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Preface

The International Conference on Business and Policy Studies (CONF-BPS) is an annual conference focusing on research areas including applied economics, enterprise management, and policy studies. It aims to establish a broad and interdisciplinary platform for experts, researchers, and students worldwide to present, exchange, and discuss the latest advance and development in business and policy studies.

This volume contains the papers of the 2nd International Conference on Business and Policy Studies (CONF-BPS 2023). Each of these papers has gained a comprehensive review by the editorial team and professional reviewers. Each paper has been examined and evaluated for its theme, structure, method, content, language, and format.

Cooperating with prestigious universities, CONF-BPS 2023 organized three workshops in Sydney, London and Cardiff. Dr. Kristle Romero Cortés chaired the workshop “Behavioral Finance Factors in Applied Finance”, which was held at UNSW Business School. Dr. Canh Thien Dang chaired the workshop “Sustainability: Latest Research in Economics, Finance, and Management” at King's College London. Prof. Arman Eshraghi chaired the workshop “Recent Advances in Behavioral Finance”, which was held at Cardiff Business School.

Besides these workshops, CONF-BPS 2023 also held an online session. Eminent professors from top universities worldwide were invited to deliver keynote speeches in this online session, including Prof. Arman Eshraghi from Cardiff Business School, Dr. Canh Thien Dang from King's College London, Dr. Kausar Abbas from Monarch Business School Switzerland, Dr. Kristle Romero Cortes from University of New South Wales, Dr. Chinny Nzekwe-Excel from University of Wolverhampton, Dr. Muhammad Abrar from GC University Faisalabad and Dr. Javier Cifuentes-Faura from University of Murcia. They have given keynote speeches on related topics of applied economics, enterprise management, and policy studies.

On behalf of the committee, we would like to give sincere gratitude to all authors and speakers who have made their contributions to CONF-BPS 2023, editors and reviewers who have guaranteed the quality of papers with their expertise, and the committee members who have devoted themselves to the success of CONF-BPS 2023.

Dr. Canh Thien Dang

General Chair of Conference Committee

Workshop

Workshop – Sydney: Behavioral Finance Factors in Applied Finance



February 3rd, 2023 (AEDT)

Business School, The University of New South Wales (UNSW)

Workshop Chair: Dr. Kristle Romero Cortés, Associate Professor in UNSW Business School

Workshop – London: Sustainability: Latest Research in Economics, Finance, and Management

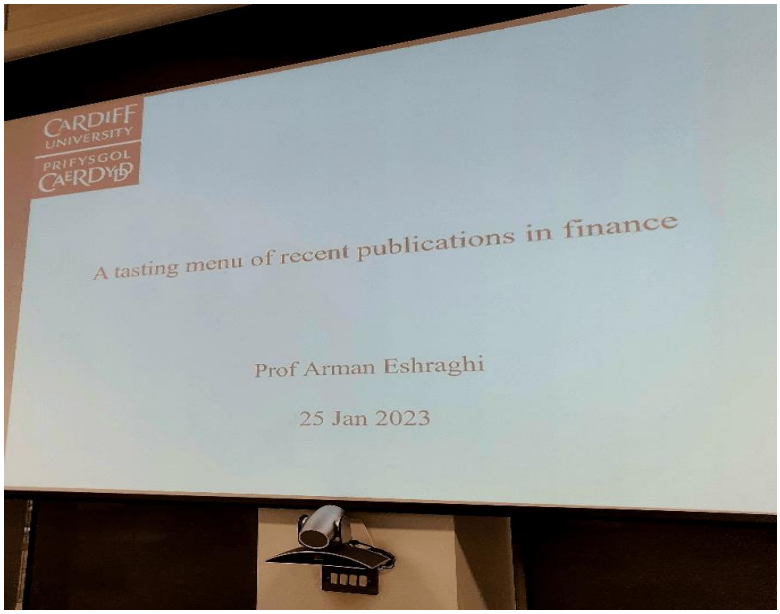


February 8th, 2023 (GMT)

Department of Economics, King's Business School, King's College London

Workshop Chair: Dr. Canh Thien Dang, Lecturer in King's College London

Workshop – Cardiff: Recent Advances in Behavioral Finance



January 25th, 2023 (GMT)

Cardiff Business School

Workshop Chair: Prof. Arman Eshraghi, Professor in Cardiff Business School

Proceedings of the 2nd International Conference on Business and Policy Studies

CONF-BPS 2023

Table of Contents

Committee Members ····

Preface ····

Workshop ····

Science Diplomacy's Contribution to and Exploitation of International Relations ···· 1
Yuntao Fang

Research on the Development of Implied Volatility in Option Pricing ···· 7
Peihang Song

An empirical Analysis of Chinese Carbon Emissions Market Trading in the First Half of 2022 ···· 14
Xiaoyu Zhu, Xiang Li, Xin Huang, Zhaoyi Lin

How Do Companies' Marketing Strategies Affect Consumers' Appearance Anxiety & Confidence and Promote Purchasing Behaviors? ···· 25
Bingheng Wu, Zhengkun Yu, Yiting Chen, Yichen Mu

Evaluating B2C and B2B Entrepreneurial Opportunities Within the Chinese Ex-Pat Relocation Market ···· 34
Wanqiu Zhang, Shiyuan Shi, Yating Li, Linfeng Cheng, Bao Li

Secondary Private Equity Funds in China ···· 44
Dan Zuo

Opportunities and Challenges for Commercial Brands under Fan Economy ···· 53
Shuchang Zhang

The Influence of Network Economy on the Marketing Strategy of FMCG Clothing Brands ··· 59
Hanrong Li

The Impact of Research Development and Innovation on Enterprise Development: Case Study of BYD and Pfizer ···· 65
Yanli Wang

A Study on the Marketing Strategy Development of Logistics Companies under COVID-19 · 71
Bowen Hua

Arbitrage Strategy Based on DHS Pricing Model ···· 76
Jiaxuan Li, Yitong Chen, Yumin Wu, Dizhao Zhang, Zhutian Gao

The Impact of the Russo-Ukraine War on US Stock Return ···· 91
Laijun Xu, Ruohan Zhao, Ancheng Wang, Jiayi Yan

Whether a Criminal is Likely to Re-offend? A Statistical Analysis Using Crimes Data from Broward County Florida ···· 104
Xinyuan Wang, Mingxin Liu, Chengran Song, Hongru Tan

Research and Solutions to Common Problems in the Workplace ····· 120
Jialin Guo
Review on Three New Value at Risk (VaR) Models ····· 128
Heying Liu
Analysis of "Green Liability" on Environmental Damage--State Responsibility in International Investment Law ····· 136
Yuexin Huang
Weighting Analysis of a Fund Portfolio of China's New Energy Vehicle Stocks ····· 145
Xinxin Ye, Jin Qin, Jiayue Lin, Ziheng Yin
Studies of the relationship between international crude oil prices and stock prices of new energy companies and investor sentiment ····· 159
Yuguang Jia, Yushan Zou, Yixuan Li, Chenrui Jiang, Haohua Zhong, Yuehe Liu
Research on the Availability Heuristic and its Application ····· 170
Ziyu Bu
The Analysis of the Impact of Covid-19 on China's Tourism Industry ····· 175
Ruiyi Yan
Electric Vehicle Industry in Three Main Regions：United States, China, and EU Countries 181
Zexuan Yan, Ruolin Zhao, Bojun Liu
Success of Nintendo Switch in 3C Marketing Model ····· 186
Jinkun Hu
SWOT Analysis of ByteDance's Business Market Environment ····· 190
Qiran Li
Sales Prediction of Big Mart based on Linear Regression, Random Forest, and Gradient Boosting ····· 200
Ruiyun Kang
Analyze of the supply chain management advantages of Tesla and the impact of the epidemic ····· 208
Leyan Lv, Chenting Zhu, Xuanyu Chen, Yifeng Lin, Tianwei Ma
Markowitz and Index Model in Capital Markets ····· 214
Junhao Shan, Bangzheng Sun, Yue Li
The Analysis of the Factors that Influence the Purchase of Sports Brands by Chinese College Students ····· 226
Jiayi Qin
A Comparison of Market Economy and Planned Economy: Based on German Democratic Republic and Federal Republic of Germany ····· 233
Baichuan Cui
Analysis of Burberry's Marketing Strategy ····· 241
Yating Yan
ESG Evaluation in Automobile Industry --Take Ford Motor Company and Tesla Company as Example ····· 246
Ruiqi Yang
Analysis of Chanel Marketing Strategies in the World Luxury Fashion Market ····· 253
Caiqing Xie
Impact of the Pandemic on Online Grocery Delivery: Taking Instacart Company as an Example ····· 260
Jiaxuan Tang
The effect of experienced regret based on gender differences in auction ····· 265
Yilan Liu

Should Apple Raise Wages? What Happens if They Immediately Raise Wages per Worker by 15%? 271
Tianyi Li
The Effect of COVID-19 on China's Real Estate Market via Different Angles 275
Jiachun Lin, Ziyu Liu, Junlin Lu, Zibo Wang
Comparative Analysis of Real Estate Financial Model: Evidence from Vanke and Evergrande 282
Yuxin Ren, Zeqing Shan, Jiawei Sun
The Impact of COVID-19 Pandemic on Singapore's Resilience in Real Estate Market 292
Guanliang Chen, Xinqi Liu, Yuxuan Yang
The Impact of Population and Fertility Policy of China on the Real Estate Market 304
Yuzun Zhang
Trust Products: An Option to Protect the Basic Needs of People with Disabilities 312
Fengni Xu
Impact of COVID-19 on the Supply Chain of Small and Medium Enterprises: Case Studies on Food, Manufacturing and Hospitality Industries 319
Yuxuan Ge
An analysis of Tsingshan Holding Group Co's Big Short Position on Nickel Futures 324
Ge Wang, Hanyi Zhao, Zixin Zhang, Shengze Wu
The Effect of Basic Education, Health, and Racial Factors on the Spatial Distribution of Poverty Rate in Los Angeles County 333
Jianrui Liu
The Governance Model Investigation of Urban Village's Commercialization Based on Cultural Insight 346
Yaru Yang
Research on Algorithmic Trading and Its Role in Pricing Efficiency in Chinese Stock Market 354
Qing Gao, Yunchang Jiang, Jiaxin Wang
A Comparative Policy Analysis for Cross-border M&A between China and Africa that Advances China's Leading Position in Mining 364
Yuting Lei
The Role of In-House Procurement According to Finnish Municipalities' Purchase Invoice Data 372
Reetta-Kaisa Ghezzi, Minnamaria Korhonen, Hannu Vilpponen, Tommi Mikkonen
Event Study: The Effect of the Passing Away of Queen Elizabeth II on the UK Stock Market 378
Xinran Li
Analysis on the Profit Recovery of China's Budget Airlines after the Epidemic -- A Case Study of Spring Airlines 393
Zichen Liu
Analysis and Suggestions on "Crude Oil Treasure" Event 401
Yucheng Ma, Lin Sun, Mingyang Liu, Entong Wang
Game Analysis on the Problem of the Pollutant Emissions in Chinese Neighboring Province 412
Ziwei Deng
Exploring the Application Value and Path of NFT in the Artwork Industry 418
Qiyue Wang
The Application of Soft Law in We Media Governance 427
Yuxin Yang

Proceedings of the 2nd International Conference on Business and Policy Studies
DOI: 10.54254/2754-1169/17/20231047

Science Diplomacy's Contribution to and Exploitation of International Relations

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Abstract: Science diplomacy is a novel academic concept. This project will analyse the positive function of science diplomacy in contemporary international relations and the use of science to achieve specific foreign policy objectives. This study aims to provide insight into the role of this science in external affairs work which analyses the impact of science diplomacy through a collection of journals, papers, news articles, and literature with the use of Document analysis. Even countries with mutually antagonistic political cultures may be able to approach international issues through concentrated scientific study due to the function of science diplomacy. Using the significance of science, the foreign service can influence or even meddle in the affairs of other nations. Therefore, scientific study diplomacy permits beneficial interactions between nations and the involvement of technologically and technologically powerful countries. The selection of science diplomacy is determined by the objectives of governments and diplomatic agencies.

Keywords: science, intergovernmental organization, diplomacy, cooperation

1. Introduction

What international affairs and science have in common is the uncertainty of the future. Scientists create new technologies without a complete comprehension of their intended applications. Otto Hann and Lise Meitner, two scientists, could not have foreseen that their 1938 discovery of nuclear fission in Berlin would result in the devastation of Hiroshima and Nagasaki seven years later. Diplomats are responsible for resolving global issues and protecting the security and interests of their respective nations. However, from the viewpoint of a diplomat, they cannot wholly forecast whether their plans and actions will address the problems facing their country. For instance, the appeasement promoted by Prime Minister Chamberlain and his Foreign Office did not result in fewer British losses during Hitler's invasion of the Nazi forces. However, the similarities between the two in the future demonstrate that science and diplomacy share features and interact. This paper will provide a rational analysis of the function of scientific diplomacy, which will proverb that science and diplomacy may complement one another, offering mutual advantages and facilitating global progress.

2. Diplomatic Connections Can Influence the Development of Science

The association of international affairs and diplomatic cooperation supports the advancement of science and technology worldwide. Scientific cooperation across borders is an essential connection

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to A Community of Shared Future for Humankind. To attain this objective in the future, the diplomatic services of each nation must take the appropriate steps to foster the growth of international scientific exchanges and advance academic achievement. Even in challenging geopolitical environments, scientists have a long history of maintaining contact with their international colleagues. With diplomatic facilities, experts from various nations may collaborate to advance research. There are historical examples of diplomacy driving scientific development. Matteo Ricci was a pioneer in the use of science as a tool of diplomacy, a model for missionaries to the Chinese Empire, and a significant influence on the development of science and technology in China. Through diplomacy in the service of science, a number of transnational cooperation organisations foster collaboration and goodwill between science and scientists from other nations. The Conseil européen pour la recherche nucléaire(CERN), also called European Organization for Nuclear Research, is an example of diplomacy in the service of science [1]. Several nations used a considerable lot of diplomacy for the advancement of research beginning in 1954, resulting in the formation of this international scientific and technology organisation [2]. A recent report shows that international relations are central to its work [3]. The Atlas is one of the most essential CERN experiments. According to the experiment's secretariat, researchers from 181 institutions and 43 nations are collaborating, making it one of the most significant scientific partnerships in the world. In the disciplines of the internet, medicine, and aerospace, CERN has aided human exploration of the planet. “Places like CERN contribute to the kind of knowledge that not only enriches humanity but also provides the wellspring of ideas that become the technologies of the future” [4]. It is impossible to deny the enormous contribution that international organisations such as CERN have made to humanity in science. However, CERN's achievement would not have been possible without the efforts of the whole European and even international diplomatic community. The success of CERN is a shred of extraordinary evidence and an example of diplomacy in the service of science.

3. The State of International Politics Restricts Scientific Advancement

However, everything is always a negative aspect, and science and diplomacy do not simply complement one another. Diplomatic limits are imposed on scientific advancement by the current global political environment. International relations may impact international scientific collaboration. At the cost of scientific objectives, diplomats prioritise so-called national interests above those of the human community. Due to the unpredictability of the future, diplomats tend to use a conservative approach to dealing with impending crises. However, conservative initiatives can guard national interests for the short term, but they are not conducive to the long-term development of science. The worldwide environment is fluid, and each country's foreign service must make decisions to protect national sovereignty and diverse economic interests. In addition to being forceful, these options also involve renunciation. These actions, which provide the appearance of global scientific collaboration, will have a significant impact on the growth of a community of human destiny and even the future of humanity. The scientific community spans boundaries and communities; scientists compete and cooperate, battling for individual and collective objectives. Due to these distinctive characteristics, science plays an exceptional role in international diplomacy and exchanges between cultural groups. In the following sections, we will examine each of the three instances in which the state impedes research and technology, political conspiracy theories impact science, and academic interchange is prohibited.

4. The Priority is the National Interest

International competition has led to a blockade of science and technology. Science and technology have become one significant indicator of the strength of comprehensive national power. Due to the

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unequal distribution of ideologies and interests, the rivalry between various nations seems to be unavoidable. Modern science and technology have a considerable impact on international relations, internal and foreign policy, as well as economic, political, educational, and cultural advancement. High technology is a critical competitive advantage, but due to the openness of scientific research, other nations can exploit it to advance their own development goals and to build their own militaries and economies. As a result, Governments and authorities naturally desire to protect science and technology since it is a crucial component of overall national power. The political issues concerning the International Space Station are an excellent example. The world's mainstream national participation in the space program has left one country out for reasons. Governments are putting new norms and constraints on international scientific collaboration, and they are contemplating themes that limit cooperation due to potential national security and defence consequences. According to James Oberg's report, the US has forbidden China from taking part in plans for the International Space Station because of concerns about Chinese rivalry in space. The US has used the issue of human rights to impede China's effort to join the space program, in contrast to the openness of the European Space Agency [5].

Political conspiracy theories frequently incorporate science and technology. Conspiracy theories even now make use of science. Science is an unambiguous target for national jockeying. When diplomacy tactics have failed to organise an adversary in order to accomplish practical results in science and technology, one strategy to impede scientific advancement is to take slow down the political conspiracy theory path. This can also be a technique to impede technological development. By implying that proponents resort to conspiracies by relying on prejudice or inadequate evidence, the public's mistrust will cause the advancement of science to slow down or even cease to exist progressively. "The importance of rigorous scientific inquiry and the engagement of scientists during health pandemics cannot be understated" [6]. During the 2019 outbreak, the US and China accused each other's virus labs of being the origin of the leak of a new coronavirus. This claim has not only dramatically enhanced the population's dread of the pandemic, but it has also gradually led to the public's mistrust of scientific institutions. According to the post from South China Moring Post: "While the world's leading scientists do not know for sure the origin of the coronavirus behind the Covid-19 pandemic, some Chinese officials and US politicians appear to know better" [7]. Evidently, officials on both sides, China and the United States, have utilised the scientific problem of the virus's origin as a weapon to attack the other government. This has deprived science of the feeling of grandeur that drives human advancement. Regardless of the position China and the United States choose on this matter, it will have a favourable impact on the virus's traceability and research.

The cessation of scientific collaboration results from the current global circumstances. International relations have an inextricable impact on international scientific organisations. Consequently, innovations that should have been developed through the partnership are destined to have an effect. A multinational coalition creates international organisations, such as CERN and other intergovernmental organisations. However, when member states of the organisation are at war, the organisation's day-to-day operations are undoubtedly affected. According to the CERN council in 2022, Russia's status as an observer state has been revoked. Russian scientific advancements were deemed "Military requirements" and excluded from studies [8]. At the same time, CERN suspended its cooperation with Joint Institute for Nuclear Research (JINR), which is a scientific organisation located in Russia [8]. By way of comparison, it is easy to see that CERN's behaviour today is inconsistent with its previous behaviour in the same historical context. During the Soviet invasions of Czechoslovakia and Afghanistan, CERN did not conduct any anti-Soviet scientific organisation campaigns. However, during the military confrontation between Russia and Ukraine, CERN took decisions comparable to those of the dignitaries of its member nations. John Ellis, a physicist who has worked at CERN for over forty years, also expressed the Council's disregard for the views of

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grassroots scientists in dealing with the Russian-Ukrainian conflict [9,10]. During the height of the Cold War, CERN maintained an open relationship with countries behind the Iron Curtain. At the same time, SESAME (Synchrotron Light for Experimental Science and Applications in the Middle East), a Jordan-based facility whose membership includes Iran, Israel, and Palestine, bridged profound political divides. It seems impossible to sustain ideal cross-border scientific collaboration in such a dynamic international environment. Compared with SESAME, "Science Diplomacy Building Bridges" is fallen [10,11].

5. Science-Academic Interaction That Takes Place Across International Borders Benefits Diplomacy

More importantly, science facilitates diplomatic contacts. Science may bridge the gap between adversarial nations through regular academic interactions. 'Nevertheless, they may become important incubators for international cooperation in a post-national world that faces ever new global problems' [12]. The required scientific collaboration will allow the regimes to establish fair diplomatic relations and build the groundwork for further future dialogue. To realise the joint growth of humanity's destiny, to maximise humanity's interests, and to give importance to the study of science, the diplomatic services of all nations must be in communication with one another, and science has, in some ways, influenced diplomacy. In a sense, science will be the beginning of diplomacy by engaging in this way. Collaboration in science to solve problems across borders and without borders, international scientific language and methods that make collaboration possible, collaboration in science to examine evidence that enables scientists to transcend ideology and build relationships, and diplomatic intervention to defuse politically explosive situations. Mt. Paektu Geoscientific Group (MPGG) The MPGG has successfully fostered research-based relationships between the regimes on the Korean peninsula. The Democratic People's Republic of Korea's consent to open a volcano on the China-DPRK border to the American Association for the Advancement of Science (AAAS) and Royal Geographical Society. The project not only "aims to understand the frequency and style of past eruptions and why a volcano of Mount Paektu's potential for cataclysmic devastation exists hundreds of kilometres west of the Ring of Fire, the Pacific Ocean–girdling seam between tectonic plates that drives much of the region's volcanism [13]", but also opening communication channels from low level to high level. The diplomatic community's participation in the programme would establish a common understanding of how to collaborate. Whether President Kim Jong Un and his counterparts will do their part to denuclearise the Korean Peninsula, the Paektu Project is an excellent beginning to connect the diplomacy between DPRK and other nations. Scientific collaboration can overcome even the most obstructive political complications. In some ways, science helps the diplomatic service to engage. The project on Mount Paektu exemplifies the value of adopting a bottom-up strategy for establishing a scientific collaboration relationship with North Korea. It is essential to recognise the scientific worth of similar initiatives and encourage and support them in order to contribute to the development of shared knowledge of how to cooperate. At the same time, larger methods should be established in order to create a framework for interdisciplinary scientific cooperation that incorporates many organizations. Expanding scientific cooperation in areas of mutual value with the DPRK would help build trust and solidify diplomatic gains. As diplomacy with the DPRK progresses, scientific collaboration should not be seen as an optional activity but as a vital feature of the expanding relationship and a consideration to be addressed by all parties when considering engagement goals. Integration of North Korean experts into the world scientific community provides substantial reciprocal advantages and should be sought with determination. There is a stage for science, and the leaders of scientific diplomacy must keep the audience interested. Just like Kistlakowsky's opinion about the scientist, who would have an important role to play in the future in the policy-making process [14].

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6. Conclusion

Foreign affairs impact the advancement of science and technology and may either advance or impede it due to the reason of national interest. Science also acts as a bridge to improve international relations. Due to its existence, communication has been able to start and grow among individuals from all walks of life worldwide. In the modern world, no single nation can solve any significant scientific challenge independently; thus, international collaboration in research and technology is essential. It is a contribution to the development and growth of all humanity. We might point to Structural Realism in International Relations Theory: International organisations have a function in non-security-related sectors, but their participation is constrained by the fact that in the field of security, Nations seek relative rather than absolute advantages, and the security conundrum cannot be addressed". The conservative behaviour of decision-makers to protect the interests of their nations is understandable. However, it is the long-term view that may make human beings' development more masculine. Above the interests of all countries is the scientific and technological development of the human community, which, this time, should be the goal that all countries protect and work together towards. In the course of human history, science has contributed far more to the advancement of human civilisation than international relations. In contrast to the result of science, which is long-lasting for the human being, international relations have been short-lived throughout human history. Diplomats' patriotism does safeguard national interests, but international relations are less significant than the growth of science as a field, considering its audience and long-term implications. Archimedes, though, was killed by the most severe kind of international relations: a total war; Archimedes' buoyancy formula has not been rendered obsolete by the evolution of international relations; it remains in use. Science has a longer-lasting effect on mankind than national interests. It is correct that diplomacy is primarily motivated by national interests. However, it is ethically untenable to disregard the millions of people in in need of improved living circumstances. The contradiction between peace promotion and the development of national strategic interests is at the core of the scientific diplomacy debate. Diplomacy and science have a symbiotic connection, and their presence should be used to promote each other rather than permitting international affairs to impede the advancement of research and so retard the continuity of human civilization. It can only be successful if scientists and science ambassadors collaborate to create partnerships with national policymakers and with public and commercial labs worldwide. Personal capacity development and science diplomacy training must foster mutual trust, respect, and comprehension. Two fields of study that at first glance seem to have nothing in common may be brought together via a skilful combination. Scientists and diplomats need to serve as each other's advisors in their respective spheres of influence. Diplomats must have a fundamental awareness of the rigours of scientific inquiry and the complexity of scientists' international affairs predicament. Collaboration between scientists and diplomats will ensure the survival of human civilisation, and scientists are truly members of the international community, often transcending national boundaries and identities.

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Research on the Development of Implied Volatility in Option Pricing

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Abstract: Option, as an important financial derivative, has received more and more attention from investors in recent years. This paper includes three parts, the first part introduces the concept of options, including the birth and history of options, the trading of options, and different types of options. Then it discusses the history of option pricing and two typical and classic option pricing models and then introduces implied volatility. The second part of this paper introduces the specific development of the option pricing models, the correction process of option pricing models, and volatility models. Different types of volatility, and their comparisons are included. And this paper also discusses the two functions of implied volatility, one is predicting the future and the other is for risk management and portfolio management. The third part concludes the first two-part and discusses the recent progress of option pricing and its volatility.

Keywords: option pricing, Black-Scholes model, implied volatility

1. Introduction

1.1. History of Option

An option is a kind of contract, which involves buyers and sellers. And the option holder has the right, but not the obligation, to buy or sell the option. According to historical records, the earliest record of option trading happened in ancient Greece. Thales of Miletus predicted the olive will have a good harvest in the coming spring. Miletus negotiated a price with the farmer for the right to use the olive oil press during the next harvest. The next year, the olive had a great harvest, Miletus then rented the right at a higher price to other farmers to make a profit [1]. Later in the 19th century, the Over the Counter (OTC) option was raised. The Chicago Board Option Exchange (CBOE) began trading stock options in 1973 [2]. Compared to the OTC market, CBOE formulated to use standardized option contracts and developed a trading system. And CBOE set up an intermediary agent company to deal with the clearing and delivery of option trading in a centralized manner, to ensure the option contracts can only be traded on guaranteed exchanges, thus providing a reliable guarantee for the trading and execution process of options. The appearance of CBOE vastly promoted the development of the option market.

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1.2. Different Types of Options

According to different criteria, options can be classified in different ways. Options can be categorized as call options or put options based on the various rights and obligations of the buyers and sellers. Depending on whether the options can be exercised before maturity, European options and American options are the two primary categories. Only on the expiration date may European options be executed, while American options, allow for exercise on any trading day prior to the expiration date. According to trading places, options have Floor Traded Options and Over the Counter Options. According to the subject matter, financial options can be divided into exchange rate options, stock options, and interest options.

1.3. History and Introduction of Option Pricing

Since option products were introduced, the issue of option pricing has been the core of options trading. Option pricing theory values option prices in the market theoretically by using variables such as stock price, strike price, volatility, interest rate, and maturity. Option pricing theory was first proposed in 1900 by Louis Bachelier, the father of modern option pricing theory. He derived a formula for European call option in his Ph.D. thesis, he assumed the stock price follows a normal distribution, and this made the probability of negative stock prices greater than zero, which is impossible [3]. Also, Bachelier's model ignores the conditions of the real stock market. Later in 1961, Sprenkle started to assume lognormal returns based on Bachelier's formula, but in Sprenkle's assumption, the degree of risk aversion and the stock price's drift rate need to be reckoned, which was quite tough [4]. Boness improved the formula [5]. The formula he derived is to discount the stock price at expiration to calculate the time value of money. After that, until 1973, many scholars improved and proposed new option pricing models. But, since some parameters in these models are subjective, none of these models had practical reference significance and were not universally accepted. In the 1970s, the proposition of the Black-Scholes Model started the revolution of the option pricing field. In 1973, Black and Scholes published *The Pricing of Options and Corporate Liabilities* and won the Nobel Economics Prize. According to the B-S option pricing model, stock prices move in a way that is geometrically Brownian and has constant volatility [6]. It also follows that：

No dividends or other profits are Markets are paid.
The option is the European option.
There are no fees associated with buying or selling stocks or options.
Prior to maturity, the risk-free rate remains constant.
There is no risk-free arbitrage opportunity.
The return follows a normal distribution.

Black-Scholes Model led a to prosperity because more and more investors were willing to invest in options. But the B-S model still has limitations. Additionally, Merton provided some thorough mathematical explanations of the Black and Scholes technique and expanded the model by taking dividend payments and strike price fluctuations into account [7]. Their extraordinary work had a huge impact on options pricing, which helped options re-establish the stellar reputation that made trading options so popular today.

Besides the most famous B-S model, another meaningful option pricing model is the Binomial Pricing Model (BOPM). BOPM was proposed by William [8]. In this model, the time to expiration is broken down into several intervals. At each small period time of interval, the stock will either go up or go down and BOPM has the following assumptions:

Transaction costs and taxes are 0.
The risk-free rate remains constant.
Shares have no dividends.

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volatility remains the same.

Borrow at a risk-free rate.

This model uses the backward tracking method to determine the original option price in reverse.

1.4. Introduction of Implied Volatility

In the option pricing model, the only unknown variable is volatility. And in the actual financial market, volatility is deterministic and cannot be observed directly. In the B-S model, the option price was determined by five variables, the current stock price, the time to expiration, the risk-free rate, the strike price of an option, and the volatility. If the option price is known, The B-S model can be inverted to determine implied volatility. In actual option trading, implied volatility is used to predict option prices and future markets. Volatility, therefore, has a major impact on the option market. In practice, there are some specific characteristics when discussing relationship between volatility, stock price, and option price:

- If all the other conditions are equal, an option with shorter maturity will have higher implied volatility [9].
- If the stock price is relatively high, the volatility, on the contrary, will be relatively low, which makes the possibility of stock upward fluctuation smaller; conversely, when the stock price is low, volatility increases and the stock is more likely to fall. Compared to the log-normal distribution, the probability distribution of real actual stock price has a higher left tail, and lower right tail.

2. Development and Literature Review

Volatility is traditionally calculated by using the standard deviation of the logarithmic returns of a security over time. For the calculation types of volatility, there are various intricate types. One is using historical information to predict future volatility, as the historical information method, which is also the time series analysis of volatility. This method includes the ARCH family of models, and the Stochastics Volatility models. The other type is based on the strike price of the option to deduce the market's expectation of future volatility, this volatility calculated is the implied volatility. The comparisons of these two types of volatility have always been concerned and discussed.

Since the introduction of the Black-Sholes model, the issue of option volatility has always attracted a lot of attention and discussion. In the classic Black-Scholes model, the volatility is assumed to be a constant number. However, empirical research shows that the volatility of an option is following a stochastic process and varies over time [10]. The strike price, time to maturity, and the current price of a stock can be observed directly from the market, the volatility is the uncertainty factor in the Black-Scholes model. The discrepancy between the actual volatility and the volatility in the B-S model has led researchers constantly revise the volatility formula based on the development and phenomenon of the financial market. Also, the B-S model cannot explain the "volatility smile", which led to an error in the option pricing [11]. The phenomenon of volatility smile skew made many researchers abandon the assumption of fixed volatility in the B-S model and they started to assume volatility as a random variable that obeys certain random processes.

In 1976, Merton produced the first option pricing models with changing variance [12]. He abandoned the hypothesis that returns obey normal distribution in the B-S model, and introduced the Poisson process, he put forward the jump-diffusion model and set jump risk as a non-system risk that obeys normal distribution. The introduction of the Poisson process improved the practicability of the classic BS model. In the same year, Black found the leverage effect. Black's leverage effect hypothesis postulated a distribution between stock returns and volatility, which is negatively correlated [13]. Later Cox & Ross & Rubinstein proposed the Binomial Option Pricing Model under a discrete time [14]. This model is simple to understand and can be used to price complicated options.

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Engle first used the autoregressive conditional heteroskedasticity (ARCH) model to characterize the autocorrelation and persistence of volatility [15]. In this non-constant volatility model, the aggregation effect of volatility is considered, and Engle won his Nobel Price. Boleslaw proposed generalized autoregressive conditional heteroscedasticity (GARCH) to improve the ARCH model, he thinks the price changes depend on both past price and past volatility [16]. Nelson considered the leverage effect of volatility and proposed an exponential generalized autoregressive conditional heteroskedasticity model (EGARCH) [17]. There are also improvements to GARCH models such as the GARCH-GH model and the GARCH-Gaussian model. These time series analysis models show that volatility responds with significant asymmetry, in the face of unexpected stock price declines, volatility is usually adjusted more than the incline of stock price.

The CIR model was proposed by Cox, Ingersoll, and Ross [18]. CIR model has the property of mean reverting, and it says that the interest rates move around an average, if they deviate from the average, they will always return to the average value. This model avoids negative interest rates. Hull and White first proposed the Stochastic Volatility (SV) model [19]. They used the Taylor expansion and derived an option pricing formula for the call option. They assumed that the stochastic volatility of stock has zero correlation with the stock price for a European call option, then the price calculated from the B-S model will be inaccurate, the price of the out-of-the-money or in-the-money option will be undervalued, which has great significance in the option pricing theory. Hull and White assumed of CIR process but did not take the relationship between expectation and variance into consideration. Stein and Stein created another Stochastics Volatility model, which used a mean-reverting process, assuming a zero correlation between returns and volatility [20]. However, Stein and Stein's model is insufficient for instantaneous volatility, and it could not avoid negative volatility.

The Heston model, put forth by Heston, is a typical and well-known stochastic volatility model [21]. The Heston model is a closed-form solution for European option pricing, and it has five parameters. It considers of leverage effect with no negative variance, and it incorporates the leverage effect. Heston's model uses the CIR process to characterize the expectation and variance respectively and assumes that the Brownian motion corresponding to the expected variance has zero correlation. Heston pointed out that volatility satisfies non-negativity and mean-reversibility and used of affine structure model to calculate a closed solution for the European option, to prevent system errors. If considering the impact of the five parameters in the Heston model on implied volatility: the mean-reverting speed is negatively correlated with the curvature of the volatility "smile", while the volatility variance is positively correlated with the curvature of the "smile". The increase of the third and fourth parameters, the long-term volatility, and the initial variance will shift the implied volatility "smile" curve moves upward, and the correlation coefficient of stock price and volatility stochastic process is related to the slope of the "smile" curve [22]. The Heston model is one of the most important models in the option pricing models in the continuous-time stochastic volatility models. It explains the "smile" and "skewness" phenomena of implied volatility. Also, the closed-form solution for the European option made the pricing process more analytical processable, and it has become a popular model. Bates combined the good aspects of the Heston model and Merton's jump model and raised jump diffusion and stochastic volatility model (SVJ).

Another important model called Local Volatility was proposed by Dupire. This Local Volatility was achieved by putting volatility as a function of time and forward price. The stochastics of volatility is entirely deduced by the asset prices. The volatility under the local volatility is not only stochastic but also retains the completeness of the market under the B-S model. Kani et al. considered local volatility to be an estimate of a random uncertainty in every instantaneous future volatility [23]. He constructed a portfolio related to index options in underlying volatility, to hedge against future changes in local volatility, reducing or to some extent, increasing volatility risks. Later Sepp.

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gave the analytical formula of local volatility based on implied volatility according to the trading habits of the financial market [24]. the Local Volatility has only one random variable, it is simpler to calculate compared to the Stochastics Volatility models. It also has the advantage that it accurately fits the market volatility data. It should be considered that the Local Volatility model is not an isolated model, Gyongy built a bridge between the two kinds of models, while also adding a local-volatility-related approach to the computation of stochastic volatility [25].

In actual option trading, implied volatility can be used to predict future options and point out the direction of adjustment to the market. Based on previous studies on volatility, Mixton constructed a multi-factor S&P 500 index model and concluded that the factor causing volatility skew was likely to be the government debt spread [26]. Chan & Cheng & Lung considered the behavior of traders and found that when the strike price was and the liquidity speed was high, the demand for the put option increased greatly. And the index option showed an asymmetric effect on the implied volatility. John Hull found that the implied volatility under risk neutrality was smaller than the lognormal distribution under the same condition [27]. Hull also explained that the increase in leverage was caused by the decline in stock prices, which reduced the risk of the company's equity assets. However, the rise of stock prices will increase the risk of the company's assets and reduce the leverage ratio, thus reducing the volatility.

Besides the above application of volatility in option pricing. Another application of implied volatility is an effective tool for risk management and portfolio management. After the appearance of the B-S model, the financial market partitioners hedged the risks in the market by construing an option, which led to the emergence and improvement of the VIX index and the study of option risk evaluation parameters. The volatility index (VIX) was launched by CBOE in 1993, this index was introduced to calculate option prices based on the B-S model and GC model, and the VIX index is a 30-days implied volatility index of S&P 500 option contract prices. In 2003 the VIX was improved. The S&P500 index was used in place of the S&P100 index by the VIX, which also obtained the S&P500's strike price, including the put and call options, to represent more market data. VIX futured by CBOE in 2004, And in 2006, CBOE began trading VIX options, which provided investors with financial products that use volatility to invest [28]. It provides a benchmark for estimating short time volatility. VIX is also known as the investor fear gauge. Whaley found that investors' greed in the market was manifested in underestimating risk and overestimating optimism [29]. The Delta value is a risk evaluation parameter [30]. The Delta parameter refers to the ratio of the change in derivative value to the change in the asset and is the slope of the relationship curve between derivative value and the underlying asset price.

3. Conclusion

In general, the option theory and its volatility calculation are constantly changing with the development of the market. In addition to the mentioned volatility model and option pricing model above, many scholars have proposed to establish relevant models. Due to the complexity of various models, the other specific development will not be included in this paper.

For the prediction of volatility, either using the historical volatility by the time series or using the implied volatility method has its own advantages. Generally speaking, the time series analysis is more theoretical by using the models, while the implied volatility is more about the extraction of real-time market information. Relatively speaking, the short-term volatility is more suitable to adopt the time series model. On the contract, the volatility forecast over one month often adopts the implied volatility method.

In order to obtain more accurate option price trends, nowadays, scholars combine machine learning to study option pricing, including the Monte Carlo simulation and neural network models. Monte Carlo relies on repeated sampling and statistical analysis for the valuation of options, and the ad-

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vantage of Monte Carlo techniques is its flexibility and Monte Carlo method could reduce the variance. Deep neural network models have the strong nonlinear fitting ability and feature capture ability and have attracted more and more attention in the field of time series analysis. But the use of the neural network pricing model alone still has disadvantages. The deficiency is manifested in the lack of interpretation of the NLSTM modelling process. In this regard, NLSTM and classical option pricing theory can be combined to make up for each other's shortcomings and do hybrid modeling. Moreover, the price of options in the market is also affected by other various external factors, such as market panic and the overall economic situation. If these factors are considered, more in-depth research is needed.

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An Empirical Analysis of Chinese Carbon Emissions Market Trading in the First Half of 2022

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Abstract: Carbon trading is increasingly being adopted as a policy tool to limit greenhouse gas emissions. This paper empirically explores the international and domestic carbon markets in the first half of 2022. International relations, climate, energy, and unexpected events can impact the Chinese carbon market. The study revealed that trading activity in the Chinese carbon market needs to be improved. Furthermore, the number of critical emitters in China's carbon market varies significantly by region.

Keywords: CER, carbon markets, carbon emission, block trading

1. Introduction

A Certified Emissions Reduction, also known as CER, is a certificate issued by the United Nations to member nations for preventing one tonne of carbon dioxide emissions calculated per tonne of carbon dioxide equivalent [1]. CERs are traded as a commodity through the carbon trading system.

In 2021, the sixth report of the IPCC (Intergovernmental Panel on Climate Change) released the following essential data: The global temperature has risen by 1.1 degrees Celsius since the Industrial Revolution. Global carbon dioxide emissions grew from 208 million tonnes in 1850 to 36.2 billion in 2019. This means that the current global atmospheric carbon dioxide concentration and surface temperatures are the highest in 2 million years and 120,000 years respectively [2].

The total value of carbon market transactions reached a record high of EUR 760 billion in 2021, representing an increase of EUR 289 billion, or 164%, compared with the same period in 2020[3]. 2021 has been a remarkable year for the EU carbon allowance (EUA) market, with prices hitting an all-time high above €90 per tonne on December 8 and allowances in South Korea and the UK also rising by 70%.

Chinese carbon market construction has experienced the following four stages: 1. Constructed the first carbon market in September 2010. 2. Launched seven pilot carbon markets in the second half of 2013 and the first half of 2014. 3. two non-pilot regional markets went online at the end of 2016. 4. Oficially launched the national carbon market based on the power industry in July 2021. According to statistics, by the end of 2020, 331 million tons of carbon dioxide and 7.336 billion yuan of carbon dioxide were traded nationwide in the eight pilot carbon markets [4].

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Regional carbon markets have become an essential means of reducing emissions. By 2021, China's pilot carbon markets will cover about 20% - 40% of the greenhouse gas emissions in each region, and the compliance rate (the proportion of enterprises that can fully pay their carbon quota in the total control and emission enterprises at the end of the period) is about 100%. Carbon markets have become an essential means of emission reduction in each region.

According to the 2021 final accounting results, the national carbon market covers about 4.5 billion tons of carbon emissions, estimated to account for about 40% of the country's total carbon emissions. In 2021, the activity of the national carbon emission trading market (referred to as the "national carbon market") increased significantly. Data show that as of December 31, 2021, the cumulative volume of carbon emission quota (CEA) in the national carbon market reached 179 million tons, accounting for 31.90% of the cumulative book in China's carbon market, and the turnover exceeded 7.6 billion yuan. Data released by the Shanghai Ring Exchange show that from the launch of July 16, 2021, to December 31, 2021, the national carbon emission permit trading market has been in operation for 114 trading days, the cumulative volume of carbon emission quota (CEA) of 179 million tons, the cumulative turnover of 7.661 billion yuan. Among them, the cumulative turnover of listing agreement transactions was 30.7746 million tons, and the cumulative turnover was 1.451 billion yuan; The cumulative turnover of bulk agreement transactions was 148.0148 million tons, and the cumulative turnover was 6.21 billion yuan. It closed at 54.22 yuan per ton on Dec 31, up 12.96% from the opening price on the first day. More than half of the critical emission units actively participate in the market [5].

2. Related Works

The transaction price of carbon emission rights can directly reflect the carbon market's relationship between supply and demand. Since 2013, each carbon emission trading pilot's trading volume has shown an upward trend in general [6]. The global carbon market is mainly concentrated in Europe, North America, and East Asia.

Prior research empirical analysis and research on the influencing factors of carbon emission rights have been made from different perspectives [7]. The macroeconomic environment, traditional energy prices, extreme weather, climate environment, carbon quota policy, and other factors will impact carbon emission trading pricing [8]. Some scholars believe that traditional energy prices, especially oil prices, positively impact carbon emission trading prices [9], while coal is negatively correlated with carbon emission trading prices [10]. At the same time, many scholars believe that extreme weather will increase energy consumption demand and affect carbon prices [11]. Among them, different regions are affected by other factors to varying degrees. For example, Jiang et al. (2022) pointed out that economic conditions and air quality in Hubei province have a significant impact on the fluctuation of local carbon emission permit prices, and energy price is an important reason for the change in carbon emission permit price in Hubei Province [12]. Other scholars pointed out that China's carbon emission trading price is bound to be affected by price fluctuations in the international carbon market [13].

Beijing Institute of Technology provides a review and prospects for China's carbon market in 2021 [5]. Yet, there are no definitive studies on the summarised analysis of carbon credits in the first half of 2022. Thus, our research is aimed to fill in the gap and focus on exploring the relationship between the two concepts. We would like to explore and analyze the carbon market in 2022 and make recommendations to enhance the trading activity of carbon market emissions.

3. Overview of the International Carbon Market (H1 2022)

As of April 2022, there were 68 carbon pricing schemes and three coming on stream, containing 37

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carbon taxes and 34 emissions trading systems [14]. Since the release of 'Carbon Pricing Status and Future Trends 2021', four new carbon pricing schemes have been implemented: one in Uruguay and others in North America (Ontario, Oregon, New Brunswick). Carbon pricing instruments control about 23% of global greenhouse gas emissions. Total greenhouse gas emissions under the carbon pricing tool increased by 1.5 % in the first half of 2022 compared to 2021 [14].

3.1. European Union Carbon Market

European Union's emissions trading system is the world's largest one; after falling sharply in early March, prices rose gradually in 2022. In July 2021, the EU released the 'Fit for 55' package. As part of the package, the EU proposed an overhaul of its carbon market to align it with the new EU 2030 climate target. The proposed reforms include adjusting emissions caps, adjusting the market Stability Reserve Mechanism to set stricter benchmarks, including the maritime transport sector, establishing a carbon border adjustment mechanism, and creating a new independent carbon market to cover fuel emissions from the construction and road transport sectors. This was one of the key factors driving the EU carbon price to a record high in 2021.

In the first half of 2022, the Russia-Ukraine war significantly affected the EU carbon market. The carbon price fell sharply from the end of February to the beginning of March (from the highest of 96.41 euros/ton to the lowest of 57.92 euros/ton), which was the most significant decline in the EU carbon price since 2014. This resulted in the European economy suffering a considerable setback since February 24, which weakened the demand for carbon allowances [15]. While international oil prices continue to hit record highs and energy prices such as natural gas, coal, and electricity continue to rise, the EU carbon price has fallen sharply. The price gradually recovered after March 7 and hovered around €80 to €85 / tonne throughout June, finally reaching €89.77 / tonne on June 30, close to the EU carbon market transaction price at the end of 2021. However, compared with a general upward trend of the carbon price in 2021, it was relatively volatile and sharply declined in the first half of 2022. Since then, carbon prices have rebounded after several months and have risen to a level similar to early 2022.

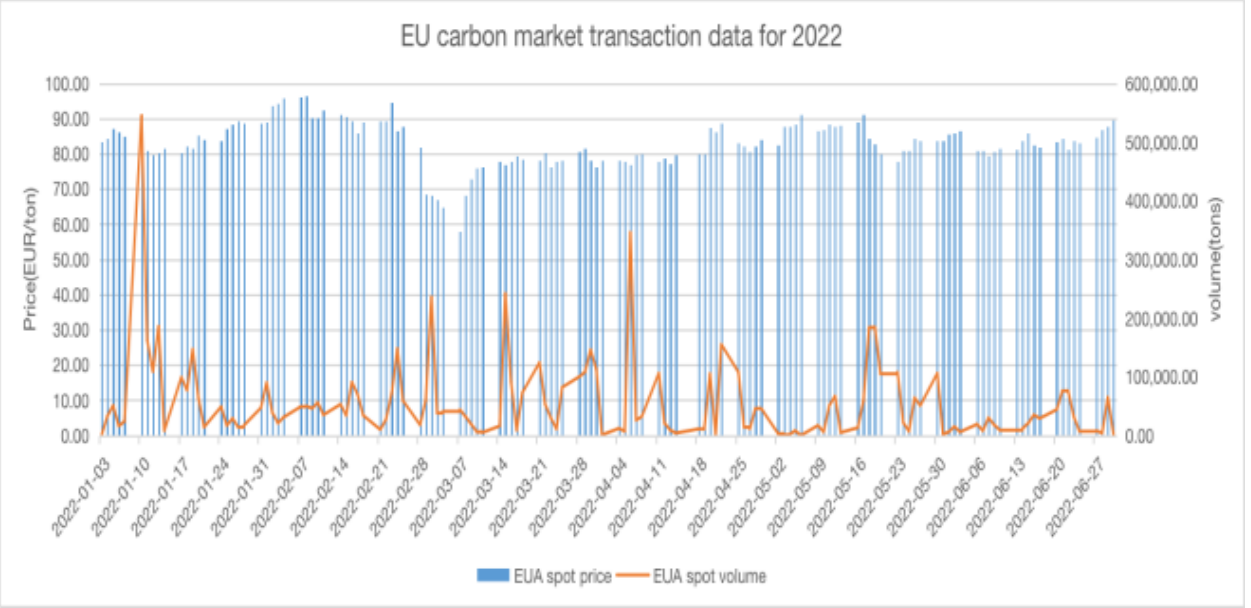


Figure 1: EU carbon market transaction data for 2022.

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3.2. South Korea's Carbon Market

Korea is the seventh largest emitter of greenhouse gases among OECD industrialised countries [16]. At the Copenhagen climate Conference held in 2009, South Korea pledged to reduce its greenhouse gas emissions by 30% in 2020 compared with the Business-as-usual scenario [17,18]. To achieve this goal, Korea has been building a national carbon market since 2009 and officially started trading in January 2015. By November 2017, about 599 companies, including five domestic airlines, had been included in South Korea's carbon market, accounting for 68% of the country's total greenhouse gas emissions. Carbon market trading in South Korea is conducted in three phases, Phase 1 (2015-2017), Phase 2 (2018-2020), and Phase 3 (2021-2025) [19,20]. The allocation of quotas has transitioned from being completely free of charge to a predominantly free allocation, supplemented by paid auctions. From the third stage, financial institutions will enter a secondary trading market based on carbon allowances to improve the market maker system in the second stage. Specifically, the Korean carbon market allowed other players, such as securities firms and individuals, to enter the secondary market; second, derivatives were introduced to enhance market functioning and ensure stability and flexibility in trading terms [21].

The average daily trading volume in South Korea rose sharply with 447.47 million tons traded on June 14, setting a new record for the country in 2022. Although trading volume rose sharply, South Korea's carbon price is still meagre, and the price recovery momentum is insufficient. On June 13, carbon prices hit the most inadequate record of $10.33/tonne. Such a significant fluctuation is mainly due to South Korea's carbon market has set an upper limit on the quota allowed to be stored, which forces market participants to sell the excess percentage. The rapid increase of quota supply in South Korea's carbon market in the short term brings downward pressure to the short-term price. The new Korean government has decided to establish and operate more than 100 local government carbon-neutral support centres by 2027 to practice carbon neutrality. Additionally, it decided to use carbon-neutral green cities as a representative model for each region. Moreover, it will follow the EU precedent of introducing nuclear power plants into the green classification system in 2023. This aimed to attract and support funding from the nuclear industry and promote complementarity in the green classification system. From 2022 until 2026, the government will provide comprehensive advice to SMEs on ESG (environmental, social and governance) management to promote green industries and technologies by expanding environmental labelling schemes and strengthening certification standards.

4. The Operation of China's National Carbon Market

4.1. The Overview of the Chinese National Carbon Market

By July 15, 2022, the first anniversary of the launch of online trading of the national carbon market, the total volume of quota trading in the national carbon market was 194 million tons, and the total turnover was nearly 8.5 billion yuan [22]. Among them, the trading volume of the listing agreement was 32.5928 million tons, and the turnover was 1.556 billion yuan; The importance of bulk agreement trading was 161 million tons, with a turnover of 6.936 billion yuan. The number of enterprises participating in the trading has exceeded half of the total number of critical emitters, and the compliance rate of market quotas has reached 99.5% [23].

4.2. The Number of Crucial Emission Companies in Each Region

Figure 2 shows the number of carbon emission companies in 16 provinces. Compared with 2021, it shows an upward trend, but there are still significant differences in the distribution among different regions. Shandong province has the most companies, while Hainan Province has the least.

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Shandong and Jiangsu provinces have more than 200 critical companies covered, which is much higher than others, while Hainan has only eight.

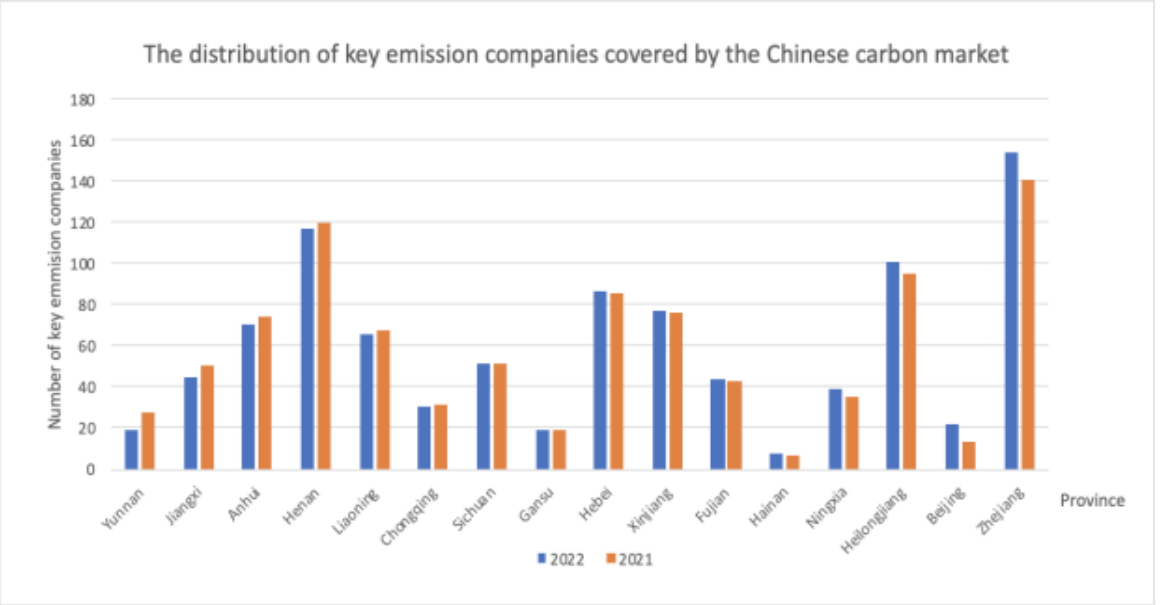


Figure 2: The distribution of crucial emission companies covered by the Chinese carbon market.

4.3. Market Trading Volume Declines, and Market Activity Drops Sharply

Figure 3 shows the fluctuations of daily trading volume in the national carbon market in the first half of 2022, screening by average daily quota. Compared to the book in December 2021, which was between 5 and 10 million tons, the volume in 2022 decreased significantly. In January, February, and March, the total volume of online listing and offline block trading was 1.352 million tons and 8.89 million tons, respectively [24].

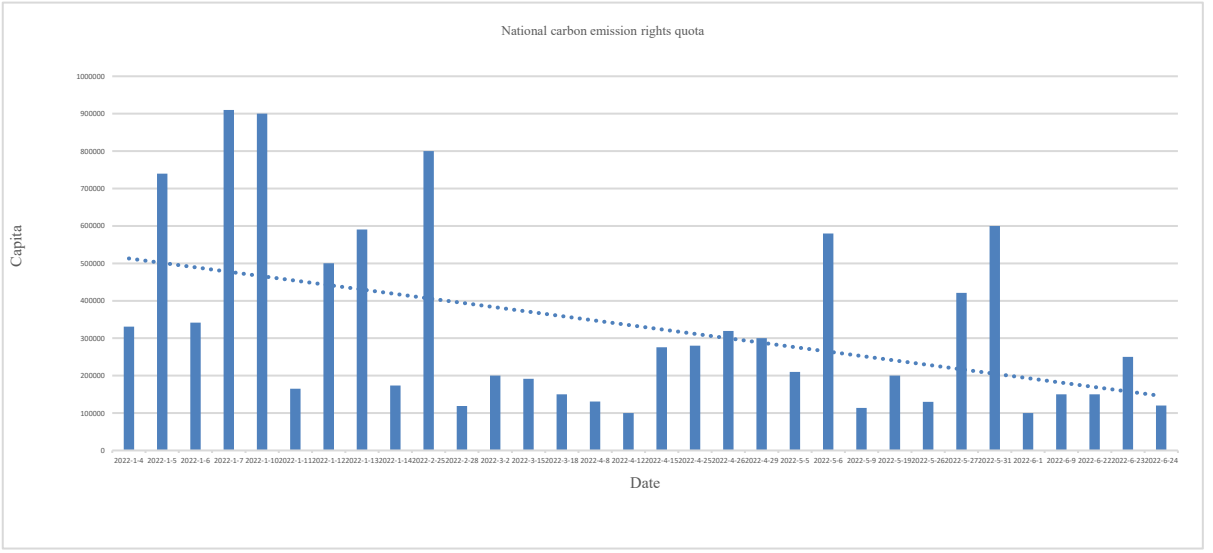


Figure 3: National carbon emission rights quota.

The enormous daily trading volume of nearly 3.2 million tonnes in the first half of 2022 came in early January, which is much higher than that in other months. From February, the book has shown

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a significant downward trend, and the average daily volume is less than 400,000 tons. Overall, the maturity of the national carbon market needs to be significantly improved.

At the same time, there was less than a 5% turnover rate in the national carbon market. Currently, the EU carbon market is the world's most actively traded carbon market. The turnover rate has increased from 417% to 500% [25]. Compared with the EU carbon market, the Chinese national carbon market is less active, and the trading atmosphere is relatively cold, so there is much room for improvement.

4.4. Daily Transaction Average Price

By the end of the first half of 2022, CEA had a cumulative turnover of 194 million tons and a turnover of 8.464 billion yuan, with an average transaction price of 43.74 yuan/ton [26]. Figure 4 shows the changing daily transaction average price trend in the national carbon market. Compared with the second half of 2021, the everyday transaction price from January to March fluctuated between 56 and 62 yuan/ton, which was significant. Although the daily transaction price fell sharply in early January, it recovered at the end of the month and reached the highest everyday transaction price in the first half of the year. Since April, the volatility gradually decreased, and at the end of May, it slowly remained stable, maintaining around 59 yuan/ton. Overall, the national carbon market daily transaction average price is regular.

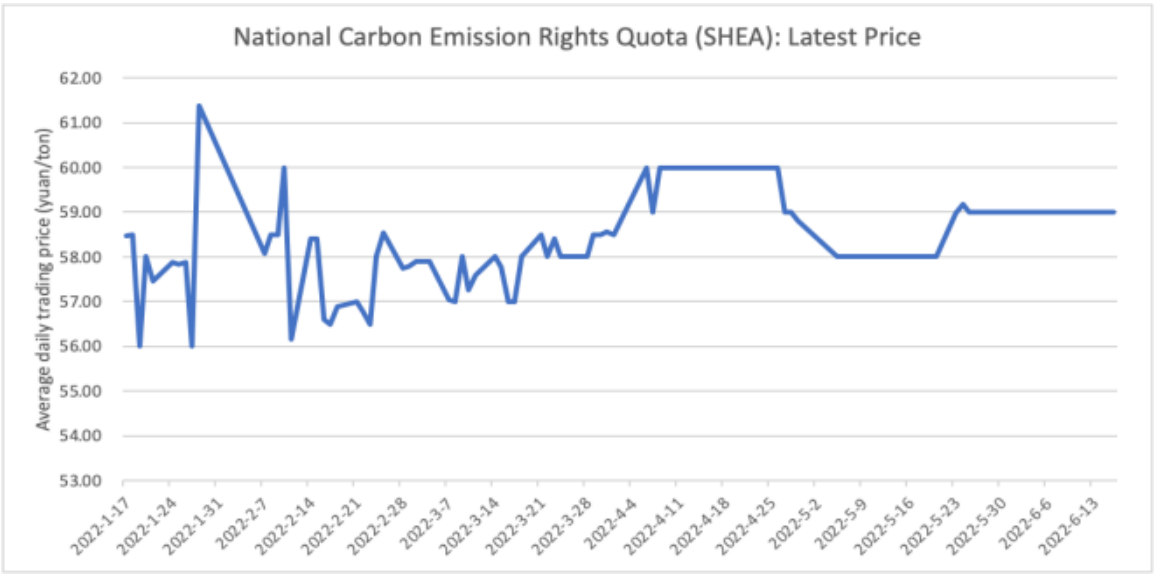


Figure 4: National carbon emission rights quota (SHEA): latest price.

4.5. Block Trading is the Primary Way to Trade

The transfer of carbon emission rights agreement includes two ways: listing transactions and block trading. The amount below 100,000 tons will be classified as a listing transaction, and the amount above 100,000 tons (including) will be concluded by block trading. Figure 5 shows the daily price and the percentage of trading volume of list transactions and block trading in the Chinese carbon market.

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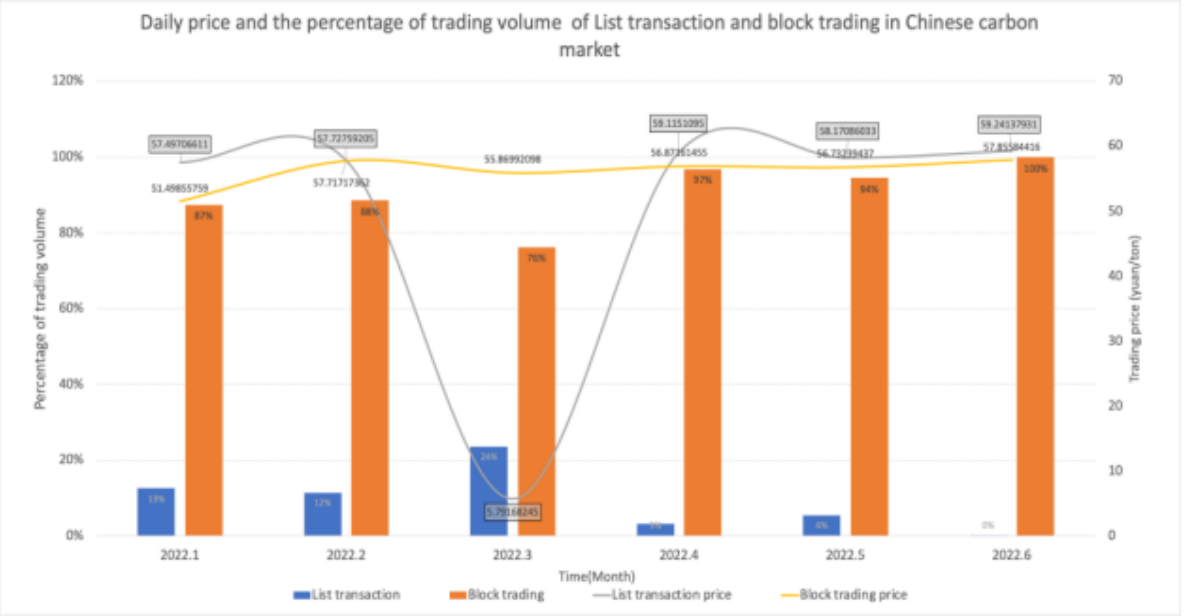


Figure 5: Daily price and the percentage of trading volume of List transaction and block trading in the Chinese carbon market.

In the first half of 2022, the cumulative volume of block trading was 1,319,4581ton, accounting for a much higher proportion than listing agreements, with 90% and 10% respectively [26]. Block trading is the primary way in the current national carbon market. The main reason is that block trading is dominated by flexible pricing, a small impact on floor trading price, high efficiency, and low trading cost. Large groups have more advantages in reducing the overall performance cost by using the limit of rising and falling block trading.

There is little difference comparing the average daily price of the National Carbon Market listing agreement with the block trading, which is maintained between 57 and 60 yuan/ton. The cost of the listing agreement is slightly higher than that of the bulk deal. In March 2022, there was a significant decline in the average daily price of listing trading, possibly due to the global carbon market changes caused by the war between Russia and Ukraine that broke out on February 24, 2022. Russia plays a vital role in the worldwide energy supply system as the world's largest gas exporter and second-largest oil exporter. In 2021, Russia exported about 230 million tons of oil and 252 billion cubic meters of natural gas, accounting for 11 percent and 16 percent of the world's total [27]. Rosneft accounts for 15% of China's crude oil imports, 8% of its liquefied natural gas imports, and 9% of its pipeline gas imports [28]. Hence, this may lead to significant changes in the national carbon market.

5. Carbon Market Outlook for the Second Half of 2022 and 2023

Carbon pricing is the basis of the EU's efforts to reduce emissions from energy-intensive sectors such as power generation and heavy industry. As one of the world's largest producers of natural gas, oil, and coal, Russia has close ties with European countries and Europe is very dependent on Russian fossil energy. Although the uncertainty of the European energy supply to Russia is high, the carbon price is inclined to be decoupled. In theory, the cost of gas and the carbon price generally correlate positively. Still, since February 23, the EU's carbon price, in contrast to the performance of the gas price, the EU carbon credits (EUA) has been down about 40% since the war between Russia and Ukraine. Gas price is rising; with the new European champions league in March 2020 outbreak, the carbon quota fell to 15 euros/ton. There are three views on the main reasons for decoupling the two prices. Qin Yan, chief power and carbon analyst at Refinitiv, and others believe

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that the market panic caused the selling. Investors reduced their exposure to euro-pegged assets and sold carbon allowances because of concerns about the European Union's economic situation. Other people such as Ingvild Sorhus, chief analyst at EU Carbon Analysis argued: “The carbon price is now decoupling from the rest of the energy complex, which has risen on Russian supply concerns [29]. Some participants may be exposed to large losses due to surging energy prices and forced to sell EUA to avoid margin calls.” High energy prices bring losses to investors. Industrial enterprises must sell carbon quotas to cash out and improve liquidity, leading to oversupply and a sharp drop in carbon prices. The final argument is that carbon prices fall because of expected demand declines. (Due to the conflict between Russia and Ukraine, energy security will become the focus of EU policy rather than climate policy in the short term, so institutional investors, including funds, are pessimistic about the carbon market in the short time [30]. Three main reasons carbon prices fell and decoupled from energy prices in March 2022. First, market panic led to technical selling; second, liquidity demand cut positions; and third, expected demand decline. But the long-term outlook is unchanged.) [30]

Putting short-term shock pressures aside, the fundamentals of the EU carbon market have not changed much. Hence, carbon prices will slowly rise. While downward economic pressures will reduce emissions and demand for allowances, high gas prices will keep coal consumption high in Europe this year, driving up power generation emissions and increasing demand for allotments. The European Parliament is still debating proposals to further strengthen carbon markets as a cornerstone of the EU's new climate strategy [30]. With excessive market speculation driving up CO2 prices to the detriment of producers, more industries are calling on the EU to postpone negotiations and review the extension of reforms to the EU ETS (emissions Trading Scheme). However, it still expects the proposal to tighten the market and support a steady rise in carbon prices. The dependence on Russian energy has made the EU more determined to accelerate the green transition; carbon market mechanisms and carbon price signals remain potent tools to promote this process. Germany, Italy, Spain, and others have all called for short-term increases in coal use to counter the risk of disruptions to Russian gas supplies. For instance, In Germany, the coalition government has proposed a carbon price of 60 euros; this could still be implemented to stabilise the carbon market and make the carbon price work as an incentive for transition.

Since February, the global energy market has suffered a second crisis. First, it is due to the influence of international relations such as the Russia-Ukraine conflict. Second, the Northern Hemisphere has been experiencing extreme heat since March. Affected by climate change and other factors, Asia, Europe, and North America have experienced a wide range of high temperatures, especially in Europe, which has led to more than 600 deaths, resulting in drought, fire, and other secondary disasters. However, the influence of the international environment, such as the conflict between Russia and Ukraine, the tight energy supply, and the sharp decline of renewable energy generation, have brought more complex and severe challenges [31]. In the high-temperature environment, power resources are affected the most. Taking Europe as a representative, many countries face the contradiction of power supply and demand. How to save electricity and reserve energy reasonably has become a big problem. To reduce carbon dioxide emissions and achieve carbon neutrality as soon as possible, European countries have been in the vanguard of energy conservation and emission reduction, having long publicly committed to phasing out coal energy. In December 2019, the European Commission proposed the "European Green Deal," which aims to make Europe climate neutral by 2050. Before this, no new coal and petrochemical projects will be added, and specific emission reduction quotas will be set for the construction, agriculture, and transportation sectors [31]. However, due to the high temperatures, many European countries are planning to restart coal power plants, which has cast a shadow of uncertainty over the currently hot "carbon neutrality" target.

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In addition to the Ukraine war and economic crisis, in 2022, a pair of gas pipe explosions also impacted the international carbon market. On June 14, America's largest natural gas export company announced that it would not be able to export gas until around the end of 2022 due to an explosion at its facility in the Gulf of Mexico, Texas and that it planned to complete the restart of part of the facility within 90 days. Since the Russia-Ukraine conflict, Europe has strongly resisted Russian gas to sanction Russia and reduce its dependence on Russian gas supplies. The two sides have gone through many rounds of tug-of-war on energy issues, leading to a significant increase in energy prices in Europe, including gas, and the risk of supply cuts, with the US promising to ease its supply gap by exporting more liquefied natural gas (LNG) to Europe [32]. On 26 September, Nord Stream 1 and Nord Stream 2, the main pipelines carrying natural gas between Russia and Europe, suffered considerable damages and underwater explosions in the leak area [33]. Firstly, the increase in energy prices due to reduced supply will exacerbate Europe's woes. The incident will also hit European norms for energy efficiency and emissions reduction. As of 30 September local time, the Norwegian Institute for Atmospheric Research said that at least 80,000 tonnes of methane gas had spread into the ocean and atmosphere after a large methane cloud formed over the area following the Nord Stream gas pipeline leak and continued to spread. Methane is a significant component of natural gas and an important greenhouse gas. The incident has also dealt a massive blow to global carbon reduction targets.

Due to the influence of international relations, climate, energy, and unexpected events, the global carbon market has undergone drastic fluctuations. Due to the uncertainty and severity of the development of these events, the carbon market has been severely hit, and the future of the international carbon market and the change in carbon price will be difficult to predict.

6. Conclusion

In conclusion, although the quota implementation rate in China's carbon market is over 99.5%, there are still large differences in the distribution of key emitters in China's carbon market among different provinces, which is related to the differences in energy consumption structure, economic development level, and government supervision. Less than 5% of the volume traded in the national carbon market changes hands. Currently, the EU carbon market is the most actively traded globally. The turnover rate has increased from 417% in 2021 to 500%. Compared with the EU carbon market, the national carbon market in China is less active, and the trading atmosphere is relatively quiet, so there is much room for improvement. At the same time, according to the article by the Beijing Institute of Technology on China's Carbon Market and Review (2022), compared with the first half of 2021, the outbreak of war between Russia and Ukraine in the first half of 2022 has a greater impact on the global carbon market [26]. It is expected that the Chinese market will continue to deepen its cooperation with the global carbon market and begin to explore the road to internationalisation. It is recommended to learn from the international carbon market development experience, coordinating the differences between China and international carbon emission trading mechanisms, and accelerating the internationalisation process of China's carbon market. At the same time, as the world's largest carbon market covering greenhouse gas emissions, China's national carbon market is expected to play a scale advantage in the construction of the global carbon market.

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Xiaoyu Zhu, Xiang Li, and Xin Huang contributed equally to this work and should be considered co-first authors.

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How Do Companies' Marketing Strategies Affect Consumers' Appearance Anxiety & Confidence and Promote Purchasing Behaviors?

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Abstract: This work analyzed how marketing strategies for businesses impacted consumers' levels of anxiety or confidence, encouraging purchasing behaviors. By conducting research on consumers who are experiencing social appearance anxiety (SAA) and analyzing two cases studies (Fenty's Body Confidence-Oriented Marketing Strategy and Brandy Melville's Controversial Appearance-Anxiety Marketing Strategy), our study concludes that social appearance anxiety-oriented marketing strategies have negative consequences on both consumers and companies. For the consumers, SAA can lead to mental/physical damage. For the businesses, the use of SAA can result in a loss of reputation. Finally, this report offers several recommendations for businesses' marketing campaigns, and these recommendations can improve profits in the long run without harming consumers or risking their standing in the market.

Keywords: social appearance anxiety & confidence, compulsive buying disorder

1. Introduction

Now appearance anxiety has become a worldwide problem (authors et al., Disordered eating: Influence of body image, sociocultural attitudes, appearance anxiety and depression - a focus on college males and a gender comparison). People are surrounded by advertisements and are more or less influenced by when they see in them. Some companies promote a single aesthetic of white and thin for profit. This controversial single aesthetic brings thought to society and makes body image anxiety a heated topic. Our research paper discusses the current trend of the market, as well as how Companies' Appearance Confidence-Oriented Marketing Strategies can Promote Customers' Purchasing Behavior.

This report is divided into the following five parts. In the background and trend of the current market section, which introduces the current situation in the market and also some specific definitions in our paper. Then the section on negative effects of appearance and body image anxiety on consumers and brands includes psychological and physical consequences.

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Then, this report applies two case analyses to analyze. Fenty Savage promotes selling by creating body positivity by generating feelings of sexiness, beauty, and empowerment towards their body, inclusivity, as well as the uniqueness of the performance. For Brandy Melville, their marketing slogan "one size fits all" was criticized, and their advertisement was controversial and was accused of creating appearance anxiety. Finally, this report gives four recommendations referring to encourage people to post pictures without photoshop to reduce appearance anxiety, explanations of negative consequences caused by appearance anxiety, standards the company should employ when choosing models, and consistency of brand value and product design

According to the definition, appearance anxiety refers to excessive attention to one's appearance, unconscious demeaning of one's appearance, imagination, and severe lack of self-confidence [1]. As one type of anxiety disorder, appearance anxiety can lead to a person's low self-esteem and dissatisfaction with themselves, exerting negative effects on people's both mental and physical health.

With the development of technology, social media has become an inseparable and important part of our daily lives. While enjoying easy and convenient access to information and advertisement, social values could also be affected by the advertisement spread by social media. In recent years, appearance anxiety has become more and more serious. When it comes to the fashion or beauty industry, the single aesthetic with the excessive pursuit of "white, young and skinny" generate appearance anxiety in society [2]. When such aesthetic or social values install in customers' ideologies, they tend to overly pursue the advertised "perfect" appearance and then transmit more anxiety to others.

In the fashion and beauty market, some companies even applied marketing strategies to connect imperfect appearance with negative evaluations such as "low ability," "lazy," "poor," or connect "hardworking ", "success" and other positive evaluations to outstanding appearance. This phenomenon subliminally creates appearance anxiety in consumers who are exposed to such advertising campaigns [3]. This phenomenon also may intensify consumers' anxiety, misleading them to consume blindly and impulsively or adversely affecting their physical psychology. In addition, the spread of appearance anxiety is fueled by false advertising and excessive publicity, driven by profit. Consumers lose their ability to judge, making it possible for these companies to take advantage [4].

Though the development of social media and the on-purpose marketing campaigns or values lead to severe appearance anxiety in society, the values of diversity, inclusiveness, and respect also become more and more popular. Comments on the Internet have a wider discussion and criticism for companies that spread body or appearance anxiety. And the call for promoting body and appearance confidence and respect for diversity is becoming more mainstream for companies marketing strategies [5].

2. Literature Review

According to previous research, Social Appearance Anxiety (SAA) is defined as people paying overmuch attention to their physical appearance. Evidence has shown that SAA has various complications, including compulsive buying disorder and depression, which are common complications generated by SAA. We also found evidence proving that the advertisement tends to create SAA, likely to lead to the complications above, which can damage their mental and physical health. Therefore, we have concluded that expressing SAA is not a suitable strategy for businesses to make profits.

Same as SAA, body positivity is a popular term and concept associated with body size or body type. Body positivity aims to challenge dominant appearance ideals, foster acceptance and respect of all bodies regardless of shape, size, and features, and focus on appreciating the functionality and health of the body rather than solely focus on its appearance. And because women are one of the groups with a high prevalence of body image anxiety, body positivity is also more often associated with female body image. When the existing "White, Thin, and Young" female aesthetic collided with "Body Positivity", advertising and capital saw the profit they could make in this game.The

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advertisements offer a superficial look into the body positivity movement and into feminist values; in fact, it offers up a much more postfeminist view, in which women are powerful through their ability to choose products [6]. While the question of whether feminism should be used to promote women to make purchases remains a fraught topic, there is no denying that body positivity can be a whole new path to advocacy.

3. Negative Effects Resulted from Appearance Anxiety Marketing

This section analyzes the adverse effects of SAA on consumers' mental health from a psychological perspective. A near equal percentage of men and women met the criteria for compulsive buying disorder (CBD), which exacerbates SAA [7, 8]. However, in recent years, marketing departments have exploited SAA in their strategies to promote their products. For example, the Brandy Melville Company is a clothing manufacturer that only designs extremely small-sized clothing. For their customers to wear their products, their body types must be practically emaciated. It is highly likely that most of these customers suffer from some form of appearance anxiety, resulting in a distorted sense of their own bodies.

The forthcoming sections show how advertisements on various social media platforms potentially make people feel anxious about their appearance. Advertisements that focus on appearance-related problems may encourage consumers with anxiety toward purchasing decisions. The next sections provide evidence that some advertising strategies may negatively impact consumer finances and mental health. Therefore, the legitimacy of deliberately using consumers' mindsets for appearance anxiety-oriented marketing strategies is controversial.

3.1. Negative Buying Behavior

Consumers who are in a chronic state of anxiety can lead to negative purchasing behavior. The research discovered that people with SAA are more likely to pay too much attention to Fear of Negative Evaluation (FNE); it refers to apprehension about others' negative evaluations. And Contingent Self-Esteem (CSE); it refers to one's self-esteem based on the approval of others or on social comparisons. FNE and CSE correlate highly with compulsive buying disorder (CBD) [10]. This disorder refers to consumers experiencing an unstoppable, chronic, and repeated impulse to go shopping and spend money.

Losing control of this activity can have crucial consequences for consumers, such as financial burdens [10]. For instance, consumers with compulsive buying behavior are likely to be in debt or inability to pay. The CBD generated by SAA makes them [WU2] pile up unmanageable debts and excess consumption. Even though sometimes they can pay off part of them, the negative cycles resulting from CBD eventually will make them deeply trapped in consumer traps [9].

3.2. Mental Health

Appearance anxiety-oriented marketing strategies also can exert negative impacts on consumers' mental states, including negative emotions and severe mental disorders. For consumers' physical health, having SAA can result in distorted judgment of their body and therefore lead to some eating disorders, which can incur some damage to themselves.

Research results found that there may be a link between SAA and disordered eating since SAA is associated with greater levels of body dissatisfaction, social anxiety, perfectionism, anorexia nervosa, and bulimia nervosa." [11]. In the eating disorder field proposed that social evaluation of appearance leads to symptoms such as disordered eating in those individuals who emphasize their physical appearance [12]. Since people are afraid of receiving negative evaluations from others about their general physical appearance, they are likely to form an incorrect judgment about their body and therefore

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get anorexia nervosa. It is an eating disorder characterized by abnormally low body weight, an intense fear of gaining weight, and a distorted perception of weight [13]. And it is a potentially life-threatening disorder with one of the highest mortality rates of mental disorders. Individuals with anorexia nervosa usually do not believe they are ill and keep trying to lose weight even if the amount of energy they take is not able to support their bodies [14]. For instance, the campaign of Brandy-Melville, a famous brand in Italy, and have stated that their clothes are only for people with a good figure. In order to be able to wear their clothes, some consumers might obsess with losing weight and therefore damage their physical health.

Meanwhile, the advertisements that imply SAA can lead to severe mental problems for consumers. For example, conducting marketing campaigns with only skinny models or promoting the 'skinny-oriented' single aesthetic in society can deliver the idea or the social values that people need to insistently pay attention to their appearance and follow the above aesthetic to make themselves more attractive. Once the ideas or the values are installed in consumers' ideology through the above marketing strategies, they eventually will feel fatigued and exhausted because they put too much energy into their appearance and worry about that. Previous research suggests fatigue is the most common syndrome in people with anxiety. Fatigue can also lead to (makes them hard to concentrate and work and even leads to sleep problems) [15]. Another syndrome is depression, which is one of the most common mental disorders in patients with SAA. Previous studies suggest a significant correlation between SAA and depression. The data in this study shows that as SAA increases, depression, anxiety, and stress levels also increase [16].

Another example is related to CBD, which can largely influence consumers' emotions before/after purchasing. Negative emotions (anxiety, boredom, self-critical thoughts, anger) were the most commonly cited before compulsive buying disorder [17]. Consumers with CBD must suffer negative emotions until they make purchases, even though they do not need those products. During the shopping, many patients state that they have experienced intense excitement briefly. Nevertheless, a sense of letdown and disappointment usually followed after they made purchases. In a word, the mood of consumers with CBD might be infatuated several times a day, significantly suffering them [18].

In conclusion, based on the studies and evidence above, the negative impacts of SAA are well supported. Creating SAA could exert negative effects on consumers' financial situations and physical and psychological health. Moreover, it will even lead to severe mental disorders. Indeed, creating SAA can make profits for businesses, helping them to attract more consumers who are willing to put effort into their appearance. However, this strategy is not suitable for long-term profits and development. It is controversial to adopt an appearance anxiety-oriented marketing strategy in terms of the above problems. Furthermore, if consumers realize that companies are trying to use SAA to wash their minds, their brand loyalty is likely to decrease and even have a bad image of those companies. Under this situation, it is tough for businesses to make profits since their reputation got ruined. Therefore, to make a long-term profit, businesses should consider other tactics for their long-term profit instead of creating SAA intentionally.

4. Case Study-Based Marketing Strategy Analysis

4.1. Case Study 1: Fenty's Body Confidence-oriented Marketing Stratgety

This paragraph describes how Rihanna's lingerie brand uses "Body Positivity" as their marketing strategy to stand out in an industry that used to drive customers to spend by creating body anxiety.

When talking about women's lingerie, what comes to mind is more "Victoria's Secret" and "Bikini" with slim waists and shapely figures. However, only defining a certain type of body as sexy for marketing purposes is biased since it is suspected of discriminating against diversity.

Rihanna, the founder of Savage Fenty said [19]: "We want to make people look good and feel

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good. We want you to feel sexy and have fun doing it." This is also the core philosophy of the Savage Fenty brand. Rihanna's fashion show includes women of all shapes, colors, and sizes, and pregnant women who cannot be seen in a regular lingerie fashion show are among the models. Grammy Award-winning, plus-size pop singer Lizzo is also one of the faces of Savage Fenty. Even Vogue's official website compared Savage Fenty to Victoria's Secret in one of their articles and supported Rihanna's foresight in ushering in a new era of lingerie shows [20]. This is not an official statement, but it is easy to see how fashion users are attracted to the brand that has "Body Positivity" as its core concept. But unfortunately, not many brands are currently using "Body Positivity" as a marketing strategy, which is a hint that this could be a new business opportunity in the future.

According to Hakeem Fenty's marketing concept allows it to be more welcomed than other brands by consumers and society in 3 different dimensions [21]:

1. Feelings of sexiness, beauty, and empowerment
2. Inclusivity
3. Uniqueness of the performance

First of all, Fenty encourages women to confront the strengths and weaknesses of their bodies, their need to use their appearance for personal expression, and to stop viewing female needs toward sex and sexuality as shameful. When women see models of their size confidently displaying themselves on stage and in front of the camera, they will feel the brand's tolerance and affirmation of their flaws. This expression of body confidence and the values conveyed in the marketing concept make consumers more confident and bring appreciation for the brand. Such positive emotional feedback could encourage customers to conduct purchase behavior more than just a one-time purchase. In addition, such feelings could also exert a positive effect on consumers' loyalty to the brand.

Besides, Savage Fenty's marketing strategy also reflects a high degree of inclusiveness. Inclusivity refers to all characteristics that represent people who are often excluded from society and it is a key concept in the body positivity movement [21]. SF's show showcased a variety of models:"Trans inclusion, queer models, disabled models, plus sized models and models in every hue were represented in this show". Such marketing strategy also received various positive comments on the social media platforms. "Victoria's Secret brand itself has waned in recent years, as customers have begun to favor bralettes and body inclusiveness over push-up bras and washboard abs" [22]. According to CNBC, Victoria's Secret sales have been shrinking every year. "Revenue in 2020 totaled $5.4 billion, compared with $7.5 billion in 2019, and $8.1 billion in 2018" [23]. Such feedback are undoubtedly the greatest support for the health-based fashion concept and the brand with "body positive" and "diversity" as its core marketing concept. It also shows the rising willingness of consumers to the products from brand and pay for their brand value.

Finally, because SF uses a wide variety of models, its fashion shows become very watchable. The models are no longer public figures on the SF stage, they become part of the show. Everyone seems to have defaulted to the fact that most of the time, the modeling industry is a very demanding industry. One often hears about models dieting for work. They have to quit the industry because of their age. Savage Fenty chooses to break this consensus and create a more diverse aesthetic opportunity for the audience. By allowing the models to act as living souls and perform as "aesthetic objects" [24], the Savage Fenty runway show was challenging the traditional objectification of runway models. This certainly makes SF's stage and fashion show scene more attractive and distinguishes SF's fashion show from others. Thus, using models of all sizes not only does not make a brand look unprofessional. On the contrary, such respect for diversity makes the show unique, which can also impress the audiences and motivate them to buy the product due to SF's uniqueness and dynamism.

In summary, Savage Fenty is a great example of how "body positivity" can drive consumer buying behavior. This psychological identity comes not only from women but also from men. By addressing 'body shame', positively promoting the value of body positivity, and encouraging customers to

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embrace their imperfections, consumers can feel the benefits beyond the brand's products themselves. With such a brand value, buyers are more likely to become regular consumers and have more than just a one-time purchasing experience. In terms of long-term benefits, using psychological cues similar to positive encouragement to prompt consumers to consume can also have a more positive impact on long-term psychosocial health impacts than creating "appearance anxiety" to make consumers engage in irrational consumption behaviors.

4.2. Case 2: Brandy Melville's Controversial Appearance-anxiety Marketing Strategy

This section analyzes a controversial marketing case about the appearance anxiety of Brandy Melville (BM). BM is a European clothing and accessories company targeting young women with items priced between $20-$50 each, which have become a popular craze in recent years, it was listed as one of the most popular clothing brands for pre-teen and teenage girls alike (Cohen & Lauren Cohen Lauren is a freshman at Penn State studying digital and print journalism. When she's not writing) [25].

BM applied controversial marketing promotion, which aims at advertising the idea of 'one size fits most. However, their clothing mainly targets x-small or small sizes [26]. "One size fits the most" was actually a misconception. The majority of items are labeled as "one size," "XS," or "small," with a few bottoms being the exception. The "one size" of the brand normally fits waists between 24 and 25 inches and is equivalent to a size zero. The normal American woman's size, however, has long been listed as a size 14 [27]. A flexible or open garment for women may be advertised as one size fits all, but it is usually a medium size (able to expand) rather than fitting small or extra-large (XL) sizes. Such a promotional slogan, in fact, conveys the subliminal message that the clothing is only intended for girls who were in small or extra small sizes and stimulated appearance anxiety in society. By offering only one size, the business purposefully excludes more girls from purchasing the items and generates young girls' appearance anxiety since they cannot fit in the "normal size" of the brand. Therefore, BM has received a great deal of criticism, such as body shaming and body discrimination, which made its marketing strategies become controversial.

By promoting a single-aesthetic value, BM's advertisement applies a controversial approach to marketing their products, which may even lead to negative effects on their customers. For example, BM creates advertising choosing models that are "tall and slender with unrealistic beauty standards" [26]. And the advertisements they posted on Instagram are these young girls wearing BM and hanging outside like on the streets or having a tea party together daily. All the images reveal a sophisticated yet relaxing atmosphere. When their target consumers---young teenagers, see this ad, they may dream of becoming the models in the ad and enjoy the sophisticated life it depicts. And when they find that their body and appearance do not match the advertisement, they will try to adopt unhealthy eating habits, such as unhealthy dieting, which may lead to eating disorders. (National Eating Disorder Association). The generated appearance anxiety could also lead to emotional purchasing.

BM also received criticism for discriminating against other body types. Their promoted single aesthetic causes appearance anxiety, especially among teenagers, which exerts negative effects on society.

Is BM making profits in the short run? In fact, yes. According to pomanda, their profit has a steady increasing trend although there may be fluctuation in between. Their profit reached its climax in December 2020. But is this marketing strategy going to work in the long run? No. BM's marketing strategy is setting a standard for beauty: young, thin, pretty whiteness. But beauty should never be defined through any standard. The brand is making profits in the short run by creating appearance anxiety, but this action actually ruins the brand's reputation. When typing out Brandy Melville on Google, you will find out most of the results are negative and attacking. There were criticized as "racism and fat shaming" [28], body shaming [29], and "racism and body shaming" [30]. If the brand continues to use this marketing strategy, eventually it may be backfired. Customers feel resentment

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toward this brand recently, but if they continue their biased and disrespectful marketing strategy, they may finally be totally rejected by the market and lose all of their consumers.

5. Recommendation

Promote authenticity by inviting consumers to send their selfies without Photoshop on social media platforms (Instagram, TikTok, Twitter) with coupons of particular brands. Sending selfies without Ps can promote the idea that people need to be who they are—assisting them to accept their body figure and grow confidence instead of living on the Internet and feeling anxiety. By sending their selfies, consumers will realize the particular brand is inclusive and form a better attitude toward it, which can help brands to gain a good reputation. In addition, sending coupons can encourage more consumers to participate in the activities and make purchases, increasing companies' total revenue.

Take corporate social responsibility, reducing the implication of social appearance anxiety. From a moral perspective, businesses should publicize diversity and inclusion in their business campaigns and advertisements and explain the negative effect of appearance anxiety on humans. Preventing consumers receive damage from appearance anxiety can help companies receive admiration and support from consumers.

Choose models of all shapes, ages, and colors to show their confidence and charisma in appearance on stage. The model group includes LBTQ+ groups, pregnant women, and people with physical disabilities. Models are also encouraged to interact with the audience on stage. Such fashion shows can be more attractive to the audience because the personal characteristics of the models become part of the show. At the same time, models of different body types can deepen the audience's memory of a specific piece of clothing or a certain design, which can help them make a quicker decision when it comes to spending money.

Align the brand designs with the values it promotes behind it. If the brand's positioning is "Fits All" then it should design clothes of different sizes, in addition, if a brand only makes clothes of size 0~2 then it should tell the public "our clothes are only suitable for slim people". This can better target customers and also help customers to find a more suitable style and positioning for themselves. More importantly, it reduces the potential negative feedback from appearance anxiety and psychological disorders, which can build a better reputation for the brand.

6. Conclusion

This report analyzes how companies' marketing strategies affect consumers' appearance anxiety, and confidence. Section two applies evidence to prove how appearance anxiety-oriented strategies could negatively affect consumers' physical and mental health from a psychological perspective. Then, by analyzing the two case studies: the success of Rihanna's Fenty, which applies appearance confidence-oriented marketing strategies, and Brandy Melville's controversial appearance anxiety-oriented marketing strategies, this report shows that marketing strategies that aim to solve people's appearance anxiety and allow consumers to gain self-confidence are the long-term solution to brand profitability. Finally, this report proposes four recommendations to help companies better address the issue of appearance confidence to conduct further marketing campaigns.

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Evaluating B2C and B2B Entrepreneurial Opportunities Within the Chinese Ex-Pat Relocation Market

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Abstract: The Chinese ex-pat relocation market is a huge and growing market with remaining problems that need to be solved. To help entrepreneurs get a better start in this golden market, this paper will disclose the best business model, B2B or B2C, that companies can choose to enter the market. Interviews, surveys, and competitive comparisons are used as methods to explore what service customers are eager for and what competitors in the market have done. After analyzing customer needs, the business model of competitors and differences between the B2B and B2C business models in the Chinese ex-pat relocation market, and with the discussion about the desirability, feasibility, and viability risks of the two business models, it is concluded that B2C is the best model to choose, because of its long-term development and revenue. Also, the B2C business model faces less risk when the whole market environment become to change.

Keywords: B2B model, B2C model, the Chinese ex-pat relocation market

1. Introduction

The number of international students has been on the rise as people focus more and more on education and cultural development. An explosion of Chinese students studying abroad has occurred in the last five years, particularly Chinese students studying in the UK. The number of Chinese students has increased by 50 per cent from 2018 to 2022, roughly 144,000 [1]. The increase in the number of Chinese students has also stimulated the UK market and economy such as tourism, healthcare, employment, and ecology. Many universities in the UK derive 10% of their total revenue (around £1.7 billion) from Chinese students, who contribute £2.55 billion to the UK economy each year in tuition fees and living costs [2].

At the same time, this growing influx of students has created a huge gap and problem in the rental market in the UK. According to Migration Advisory Committee [3], "rising numbers of students can cause pressures on the private rental market if the stock of housing is fixed in the short-term". For Chinese students, the lack of supply has amplified doubts about the reliability of overseas properties.

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They are unable to make a correct judgment on the suitability of properties because most of them live in China. For example, they are unable to judge the authenticity of a property, the layout, and the size based on a few pictures from the real estate agent. Therefore, they will hesitate to sign a contract with an agent.

In this research, the main focus is on evaluating the desirability, feasibility, and viability of a B2B and B2C business model for helping Chinese students to solve the problem of rental housing in real estate agencies. Therefore, there are three main parts to this paper. The first part is to find out what research already exists on the Chinese ex-pat relocation assistance market and to identify the gaps in our understanding of this market. The second part is to use the research methodology to compare the viability of two different B2B and B2C business models in terms of competition, customer demand, costs, and other aspects such as revenue opportunities. The third part is to discuss the findings from our research in order to identify the most compelling entrepreneurial opportunity in this market. We conclude by describing our proposed company which involves the use of VR technology when browsing properties online. It is the same model as when the tenants themselves view the properties offline. Compared to competitors, Right Move and Zoopla lack the use of technology. Therefore, the use of VR technology may help them understand the properties better.

2. Literature Review

2.1. Chinese Student Immigration Trends

The United Kingdom has seen a boom in Chinese immigration in terms of the proportion of Chinese students studying abroad, which is increasing compared to Australian and American Chinese students [4]. A rebound in the number of Chinese students occurred leading to an increase, especially after the Covid-19 period [5]. Iannelli and huang agree with Walsh's view and are showing the findings, “the UK higher education system receives the second largest number of Chinese overseas students in the world” [6]. Zhai and Cao analyze that the increase in the number of Chinese students studying in the UK may be significantly related to traditional Chinese culture, the short duration of master's programs, global competitiveness and parental influence [7].

2.2. Ex-pat Problems

Many pain points are existing in the UK rental market, for the whole picture. The UK rental market faces a chronic supply-demand imbalance that has caused rents to soar, especially as the pandemic's impact on the market slowly begins to wane. Annual rent growth this year is approaching 12.3 per cent, with the average rent rising by £115 a month, reaching a near peak [8]. Then, for the aspect of customers. They may have poor information in obtaining information inside and around the house. Customers may need to know the security situation of the surrounding area, but this part of the demand is often reluctant to disclose too much [9]. Furthermore, information asymmetry can have an impact on consumer purchase behavior. According to Wu, whether or not showing a photo of the landlord can influence consumers’ probability of buying [10]. Also, many customers face problems when they check out, such as getting their rental deposit back, being asked to repair certain items or even being evicted [11]. And if it is really necessary to take the initiative to protect rights, it is suggested that students can seek the help of the Government Grievance Ambassador or the Fair Trade Commission [12]. In addition, the quality of houses in the rental market is a problem that cannot be ignored. Christie claims that there are different risk exposures in the student housing market, for example, the quality and condition of some student housing is an issues of concern [13].

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2.3. The Existing Solutions That Attempt to Solve These Problems

Besides what customers can do above, businesses are making their efforts too. Uhomes are trying their best to solve the house rental problems international students faced. They collect foreign house resources, build domestic teams, and build platforms, hoping to create a perfect service experience and build the brand by word of mouth [14]. Although Uhomes and other websites attempt to address these issues, several challenges remain. Customers still doubt the authenticity of the houses, and need more information about the surroundings and additional services to help them get a better renting experience.

3. Methodology

In our efforts to explore entrepreneurial opportunities in the student ex-pat relocation market, we surfaced several hypotheses:

H1: There is a huge and increasing customer demand emerging in the Chinese ex-pat relocation market.

H2: Our main competitors in the Chinese ex-pat relocation market choose to form a B2C business rather than B2B.

H3: In the Chinese ex-pat relocation market, the B2C business model is better than B2B.

Methods we use: interview, survey and competitive comparison.

3.1. Method 1: Interviews

With students: We interviewed 15 students who had had the experience to rent a house in foreign countries, asking them questions about channels they used to find a house, problems they faced in the renting process, improvements they what to witness in the rental market, etc.

With education agency: We had an interview with a project manager from EIC Education, one of the biggest education agencies in China, who was especially responsible for students who want to go to the UK for further study.

3.2. Method 2: Survey

In order to achieve the objectives of the research, simple random sampling was used in probability sampling in this research. This means that it allows for more valuable and relevant information to be obtained from a large number of relevant groups. The results can be collected in a simpler, more intuitive, and objective way because each participant has the same probability of taking part in the survey [15].

The target group of this research is Chinese students studying in the UK. They can better answer the questions of this research because they have experience renting in the UK. The sample size for this research was 69. It randomly selected 10 people from each group, in 6 groups, which were all people who already or intended to live in the UK. 9 people in 1 group. This means that the results of the research are not biased because each participant had the same chance of being sampled [16].

Data collection: Online questionnaires are designed to conduct research in quantitative research, which can be used to verify the authenticity of research. For example, the application WENJUANXING is used to create questionnaires and generate links or QR codes that are widely used on social media. Using an online questionnaire format significantly saves labour costs and time costs compared to paper-based questionnaires [15], especially during covid-19. This questionnaire is closed-ended. This means that the answers obtained are easier to administer and analyse. The results obtained from the questionnaire can more strongly address the questions in the research compared to an open-ended questionnaire. Moreover, the questions in the questionnaire are all multiple-choice. It

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starts with personal information about the participants and their intention to study abroad. The most important part of the questionnaire was placed at the end to ask questions related to the B2B and B2C models. The questionnaire's questions were made more straightforward so that participants would be more likely to take part in the survey.

Data Analysis: 69 questionnaires were collected through an online questionnaire. Correlation can be used to analyse quantitative data. It is a reflection of whether the relationship between two variables affects another variable through one or more variables [15]. This means that the questionnaire can be used to further test hypotheses. Questions about participants' preference to study abroad can be used to further test hypothesis 1 or participants' choice of method of finding a property can be used to explore the relationship between B2B and B2C models. For example, the popularity of the B2C model is reflected by the fact that more people chose to find accommodation on apps rather than study abroad agency. Other data were analysed in a similar way to test the hypothesis.

3.3. Method 3: Competitive Comparison

Sample 1: Rightmove

Rightmove is a UK-based platform for sharing property information, which is the UK's largest property website. They aim to create a more efficient market and make it easier to move houses in the UK [17]. It includes almost all of the UK's properties in one website, which allows customers to access a wealth of properties anywhere else. Their main source of revenue is the monthly subscription fee paid by customers for listing their properties on Rightmove [17].

Data Collection: From its 2021 annual report, it can be seen that there are over 2.5 billion visits to Rightmove by home movers in 2021. Also, their membership is up to 18,969, which reflects the high rate of customer returns. In addition, there are over 692,000 UK residential properties listed on Rightmove, more than anywhere else in the UK [17].

Data Analysis: Rightmove's business model is b2c, which allows the company to have a large customer base after successful advertising. One outstanding advantage of Rightmove is that they are local agents, which may make customers feel more trustworthy and help them attract more customers. Another advantage is that their app is easy to use compared with other platforms, which reflects their aim 'to make home moving easier. But it also has disadvantages. They did not provide VR/AR viewing, which might be due to the fact that it functions as a link between rental agents and clients. And their orders are not fulfilled on the platform but rely on communications between the intermediary and the customer outside the platform.

Sample 2: Uhoumes

Uhomes is a global booking platform established in 2015 with the purpose of helping international students find their ideal homes. Its services include selective apartment booking, privately rental booking, conveniently rental payment, etc. In addition, they have advanced VR viewing, live broadcasts and an expert consultant that helps them find the most suitable house [18].

Data Collection: The company has more than 2.4 million high-quality apartments and has helped 130,000 foreign students find apartments. Most of their housing resource is distributed to more than 1,000 cities in 27 countries from America to Australia [18].

Data Analysis: Uhomes is a typical B2C model. So far, it has contained a large number of house resources and consumers. It means that they have more high, high-quality customers, increasing their own credibility, popularity, and reputation. More importantly, its distribution spreads widely, promoting its development toward the Chinese ex-pat relocation market.

Sample 3: Zoopla Zoopla, a popular online property portal founded in 2007, has almost as many customers as Rightmove. Running as a real estate and comparison search website, Zoopla doesn't just rely on real estate agents for revenue. It also owns other websites, uSwitch, PrimeLocation, and SmartNewHomes [19].

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Data Collection: Zoopla gets about 60 million visits a month, not as many as Rightmove, but Zoopla is still a large audience for the seller to operate. Until 2018, Zoopla has a user base of 11.2 million on their app.

Data Analysis: Zoopla is an easy-to-use rental website for people in the UK. The page Zoopla is clear and provides customers with a lot of practical information, such as geographical location and equipment in the room. At the same time, the team of Zoopla will regularly update the photos of the inside and outside of the house. Not only that, but Zoopla also has a few different lock-in housing companies, such as PrimeLocation, which is Zoopla's website for the high end of the rental market and also addresses the needs of some customers. Zoopla has become the second-largest player in the UK market.

Zoopla also has the pain point of failing to meet customers' expectations. For example, Zoopla does not provide VR house viewing, which makes it impossible for customers to observe the interior of the house in more detail. Meanwhile, Zoopla customers contact agents of real estate companies and their orders are not completed by Zoopla. The contract is mainly completed by the connection between customers and agents, which makes the overall service quality not controlled by Zoopla and also lacks contact with customers

4. Results

4.1. The Growth of Customer Demands in Chinese Ex-pat Relocation Market

Those students who we interviewed had various demands for improvements in the rental process. 93% of the students wanted to get more information about the house, including location, surroundings, etc., 73% of them needed additional services such as furniture-equipping service and repairing services, and 53% of them said that they wanted to rent a house by the help of Chinese agencies rather than directly communicating with foreign ones. Although not so many students rent a house from online platforms, they told us they were quite willing to get a house from it if there could be a reliable one. Some students told us that if their education agencies could help them find a house to rent, they will be more satisfied with their education agencies.

The questionnaire showed that 73.68% of the total number of people already living in Europe (UK and France). Chinese international students prefer to study in the USA and the UK accounting for 45.16% of each of those planning to study abroad. This means it proves that there will be a large gap in the rental market in the UK as more and more people study and live in the UK. Moreover, there is a high percentage of participants willing to find properties through Chinese-run rental app platforms (54.84%) rather than study abroad agencies (45.16%). Other direct-to-customer marketing methods are also popular, such as student accommodation official websites, foreign-run rental platforms and student subletting. This is a direct indication that the B2C model of operation is more widely accepted than the B2B model. They prefer to use the B2C approach to find out about properties. Furthermore, 96.77% of participants and their parents considered the safety of the house is the most important. The next most important aspect was the reality of the property (67.74%). They prefer to find out information themselves rather than through a study abroad agent both in function (VR technology to view the property) and properties' information. Therefore, it proves that the b2c model will be more suitable for the target audience to cater for the market.

4.2. Business Models of Main Competitors

Uhomes: Uhomes have both B2C business and B2B business.

Uhomes develops its B2B business by cooperating with education agencies. During our interview with EIC Education, the project manager of EIC told us that EIC had already cooperated with Uhomes, the biggest house rental platform which provides international students with houses to rent in the UK.

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Uhomes cooperated with project managers and teachers from EIC Education, asking them to introduce Uhomes to their student customers. The teachers would form a particular WeChat group with a salesman from Uhomes and the student, thus being paid back by about 50 to 100 pounds. Then Uhomes contacted directly with the student customers, signed contracts, and earned from additional services such as pick-up services (picking up students from airports and directly sending them to their rental houses).

Uhomes also contains a B2C model with huge financial support behind it. To be more specific, it cooperates with many Chinese overseas education institutions such as New Oriental. More importantly, they have a lot of listings, which greatly increases customer credibility. On their official website, they have VR viewing that allows customers to have a full view of the real estate as well. Besides, they also have some additional services such as airport pickup, flight booking, etc. What's more, they invite foreign students to live broadcasts, which can increase the company's credibility. They spread their product information into many well-known social medias such as microblogs, Little Red Book, and Tik Tok. Hence, through the influence of social media and personal strongly financial support, Uhomes becomes the most famous rental market in China.

Rightmove: Rightmove's business model is B2C, which allows the company to have a large customer base after successful advertising on different platforms, such as Tik Tok. Compared with the B2B business model, whose customer base is limited by the cooperating educational agency, it has a greater ability to acquire customers. Also, based on its attributes as the UK's largest property website, it is more likely to have returning customers, which enables it to generate more revenue in the way of collecting subscription fees. In addition, the properties they have are more than else where which provides huge convenience for customers and can reflect their aim 'make home moving easier. But it also has disadvantages. Compared with other B2C platforms, they did not provide VR viewing or live broadcast.

Zoopla: Zoopla's business model is B2C, which provides it with a large customer base. The real estate agents cooperating with them also have high-quality housing resources. Meanwhile, Zoopla also provides exclusive housing resources for customers with different needs, which makes Zoopla the second-largest rental platform in the UK. However, compared with other B2C rental platforms, Zoopla does not provide VR house viewing. And their communication with customers is a bit weak

4.3. Comparison Between B2B & B2C Business Model in Chinese Ex-pat Relocation Market

Brief Introduction of B2B & B2C B2B refers to business-to-business and is a transaction that takes place between a business and other businesses, while another business model is B2C, which refers to business-to-customer and takes place between a business and the final consumer.

In the aspect of B2B, the international house rental platform mainly cooperates with education agencies in China as the demand side and estate agencies in the UK as the supplement side. On one hand, education agencies in China that help Chinese students to get offers from overseas universities also help their customers to rent houses in particular areas, which provides the rental platform with stable customer currency. On the other hand, estate agencies in the UK need reliable and stable customer currency to sell out their house resources. So a golden chance has emerged.

B2C, on the other hand, its model is direct to the customers and landlord, instead of business. Furthermore, the landlord also can post their resources on the website, which means that we provide a chance that allows the landlord directly facing to customers.

Entrepreneurial Opportunities in the Chinese Ex-pat Relocation Assistance Market On the supply side, B2B and B2C sources of property information supply are highly similar. They all need to cooperate with real estate developers, agencies or student accommodations to provide more properties to tenants. In addition, according to our team's research, student accommodation and real estate agents are more willing to let their properties to companies than real estate agents. For example,

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student accommodation and real estate developers tend to offer students benefits such as local bus cards and gym cards in order to let their apartments. However, the cooperation of real estate agents varies depending on the situation. For example, some real estate agents were very willing to work with us and share resources with each other to gain benefits in our research. Other real estate agents are extremely resistant to this behaviour because they believe that there is a competitive rather than a cooperative relationship between them. Thus, theB2B and B2C models have similar sources of supply.

Differences in the B2C Business Model The B2C model is direct to the customer or landlord. The landlord can post the property for letting directly on the platform. They can use the platform to let their products directly to customers. Customers can contact customer service directly on the platform, purchase orders, and sign contracts when they find a suitable property. This means that the process of renting a product is much more streamlined compared to B2B. Moreover, it is possible to recommend relevant information based on the customer's preferences. For example, the platform can recommend more studio properties to customers when they have a high click rate for studio or one-bedroom properties.

Unlike the B2B model, B2C companies directly face customers, pursuing long-term stable sales, and hence the number of customers is more widely [20].

The larger number of customers means that the prospects of B2C are definitely better, and advertisers are more willing to cooperate with business models that have more customers and viewing. In addition, it also means that the B2C model has more revenue streams. In addition to brokerage fees, a percentage of each sale is paid as a commission. B2C can also make revenue by providing advertising services for specific products, services, or brands.

In addition, because the B2C model is a platform between customers and real estate companies, B2C can provide consumers with more services. For example, in the first place, many consumers are faced with high maintenance costs and can not get the contact number of the repair company in time. Second, after signing the contract with the real estate agent, some customers will face a slow return of the deposit and some will be charged high cleaning and depreciation fees when they check out. The reason for these pain points are due to the customer is directly connected to the real estate company, and signed the contract, it is lack regulation, the process of the B2C model can solve this problem to some extent, because, the B2C model is in a middle position, makes the B2C model can notice consumers the matters consumers need to pay attention to in the contract, makes consumer experience better.

However, the B2C model also has many disadvantages. First, the entry cost of the B2C model is very high. Without a certain number of customers, a brand-new B2C company cannot compete with the existing giants in the industry. Second, B2C needs more manpower cost to support. In addition, compared with B2B, B2C has more business activities, which makes B2C need different talents to carry out different work, which also makes the cost of B2C greater. Thirdly, it is because B2C can accommodate a larger customer group that it is difficult for B2C to generate customer loyalty. Moreover, B2C also needs more methods and channels to obtain more customers.

Differences in the B2B Business Model The biggest difference is that the B2B model relies on cooperating with education agencies in China, which benefits new set-ups in many ways.

One is that we can get stable customer flow and revenue, as education agencies have set their reputations and attracted plenty of students who are apparently our target customers. If we cooperate with those agencies, we can easily get close touch with customers and have more possibility to sell our houses. What’s more, education agencies have rather a stable customer flow, meaning our platform will have guaranteed revenue which is essential for business, especially for new set-ups. By the way, if the cooperation between our platform with education agencies is solid, we can even raise funds from them.

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The other is that we can save some basic costs. For example, we have no need to advertise online or offline to attract customers, thus saving a huge amount of money to advertise on social media or hire people to give out leaflets. Also, it is common knowledge that making a potential customer really purchase is very difficult, which requires lots of human resources and time. If we cooperate with education agencies, our customers will be those who have a very high willingness to purchase, so we do not need to hire lots of salesmen and customer service agents to persuade them to purchase.

However, cooperating with education agencies have its weaknesses.

First is that We have an additional fixed cost. Every time we get a customer from an education agency, we need to pay a commission to them, which means we ourselves will earn less in transactions we successfully make.

Then relying much on other businesses like education agencies means fragility when faced with changes or shocks. If international students gradually stop choosing education agencies to study abroad and apply for offers themselves, our customer flow cannot be guaranteed. Also, whether or not the educational agency is serious about introducing our platform to their student customers can affect our customer flow too. And it is also difficult for us to look for new customer sources, as B2B companies usually don't have much reputation among customers.

What's more, it is difficult for B2B companies to expand their business scale. And in this step, more customer sources are eagerly needed as those from education agencies are not enough. Customers are from the whole market, so our business may eventually change to a B2C model. But as mentioned before, unlike B2C companies, our company doesn't have enough reputation among customer groups, which means it cannot directly compete with B2C companies in the whole market. So a dilemma arises.

5. Discussion: Evaluating Business Model Risk Profiles

Table 1: Comparison of business model risk.

	Business Business Model	B2C Business Model
Desirability Risks	More	Less
Feasibility Risks	More	Less
Viability Risks	Depends on profits	Depends on profits

5.1. Desirability Risks

For desirability risks, the B2C business model has fewer desirability risks than the B2B business model. As for value proposition, additional services are required in both B2B and B2C business models, including VR viewing and furniture rental services and so on, which can be pursued by employing experienced staff and purchasing specialist equipment or cooperating with related companies. However, in the B2B model, cooperating with educational agencies can bring desirability risks. Due to the fact that the source of customers largely depends on educational agencies, if international students gradually stop choosing educational agencies to study abroad and do it themselves, then the customer base cannot be guaranteed. Also, whether or not the educational agency is serious about introducing the service can affect the source of customers. In addition, the market under the B2B model is smaller than that of the B2C model, the rental platform cannot reach too many target customers. While in the B2C model, the customer base is independent and the market is big enough to enable platforms to accumulate customers.

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5.2. Feasibility Risks

For feasibility risks, the B2B business model has more risks than the B2C business model. Human resources are required in both models, but B2C obviously needs more human resources in terms of advertising and attracting customers. It also requires a higher standard of human resources. Human resources are not too difficult to cultivate and acquire in today's market. The ability to raise funds is another important measurement. In the B2B model, the companies and agencies in cooperation may fund the project to become a shareholder, which means a tighter cooperating relationship. However, the B2C model has a larger market and greater potential for growth, which enables them to attract investments more easily than the B2B business model.

5.3. Viability Risks

The viability risks of the B2B and B2C business models depend on the ultimate profits. They have a similar source of revenue, which includes intermediary fees and additional service fees. However, they have different cost structures. The cost in the B2B model is the commission paid to the cooperating educational agencies. The cost in the B2C model is the advertising, it also needs more staff than the B2B model.

6. Conclusion

In summary, based on research from the interview, survey, and competitor analysis above and the result of comparing the differences between B2B and B2C and their risks, we eventually suggest that there is a greater opportunity for a new B2C solution which attempts to address the growing demand of Chinese ex-pat students for accommodation in the UK. Although research has some limitations in acquiring more detailed information about B2C companies and investigating enough data for comparing B2B and B2C exactly, as developing further into the B2B and B2C markets, we believe there will be a more comprehensive B2C solution to judge the continued growth in demand from international students living in the UK. Besides, we should constantly take the trend of Chinese ex-pat students into consideration since it greatly influences the further development of rental markets and ex-pat students.

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All the authors contributed equally to this work and should be considered as co-first author.

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Secondary Private Equity Funds in China

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Abstract: Combining the latest era background, this paper mainly focuses on the growth of secondary private equity funds in China's capital market. Starting with the current macro form and development status, it will provide an overview of the private equity market and secondary funds, followed by an introduction to the development and status of S funds in the global capital market. Following that, author will go over the history and current state of S funds in China's capital market. Analyze the advantages and characteristics of the S fund based on its theoretical essence and actual business. Finally, watch for the development of secondary private equity funds in China. As one of the few articles on secondary private equity funds and transactions, the discussion in this paper enriches the content and literature of secondary private equity investment.

Keywords: secondary funds, private equity, venture capital, Chinese capital market

1. Introduction

The new crown pneumonia epidemic and the conflict between Russia and Ukraine have added new uncertainties to the global macro situation, which have continued to have a significant impact on employment, oil and natural gas, and other fields, as well as have far-reaching and extensive joint effects on the global investment market. Investors' assumptions about the fundamental market face significant challenges in the context of an unstable circumstance and increasing uncertainty. Tracking the trends of the invested companies, as well as anticipating and preparing for possible abnormal scenarios, has become increasingly important in private equity. At the same time, many capitals have gradually withdrawn from primary private equity for the purpose of hedging, promoting the expansion of the secondary trading market of private equity.

After ten years of rapid development, the management scale of stock equity assets in China's PE market has surpassed 600 billion US dollars, with annual incremental funds of approximately 100 billion US dollars [1]. According to the usual investment period "5+3 model", Chinese private equity will usher in the first concentrated departure tide in history during the following two years. On the one hand, a large number of companies are planning and waiting for IPO, on the other hand, the fund is approaching the end of its closing term, and PE is experiencing "liquidity anxiety." It has been discovered that the current situation is pretty comparable to that of the more mature European and American private marketplaces. The rise of the private equity secondary market has effectively smoothed out the potential volatility in this market. When the stock accumulates to a particular scale, the second-hand trade market will arise as the times urge. The scale of current private equity fund management in China had reached RMB 18.99 trillion as of the end of July 2021 [2]. With such a

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huge number of assets, there must be a plethora of transaction requirements, such as liquidity, asset optimization, and exit requirements.

2. Private Equity Market and Secondary Funds

Private equity funds are frequently utilized in the private equity market to generate investment portfolios or vehicles that are backed by private equity. The full name of secondary fund is private equity secondary market fund, which is a fund product that transfers investment shares or assets of existing private equity funds and specializes in acquiring alternative asset fund shares, investment portfolios, or investment commitments from investors. Secondary transaction is a transaction in the secondary market of private equity that refers to a transaction used to transfer the main market share already held by investors or the equity interests of the invested company. The cornerstone of S fund transactions is asset succession rather than pure asset sales.

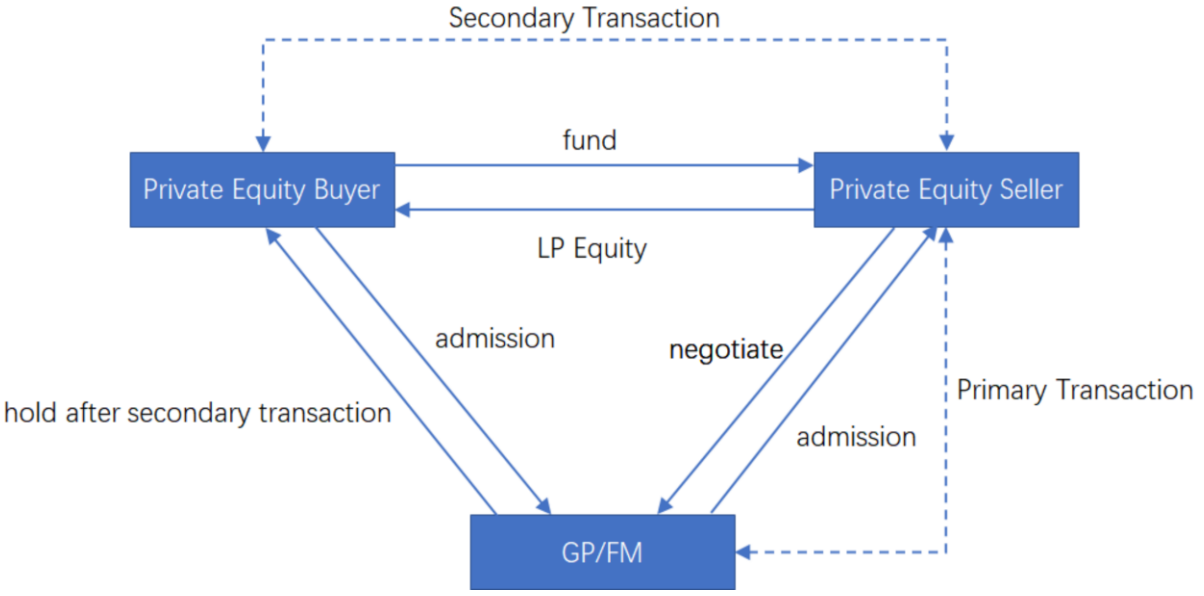


Figure 1: Secondary private equity transaction subjects and process.

S funds and S transactions enable private equity investment funds satisfy their liquidity needs, and are an important way for fund shareholders to withdraw before liquidation. There is no doubt that the expansion of the private equity market to a certain point has resulted in the birth of this emerging investment type. The original mechanism and source is that it can provide liquidity to LPs with limited capital. Since secondary trading occurs when the J-curve of equities direct investment funds bottoms out and rises, it accelerates the speed at which LPs receive returns. On the other hand, this is a niche market with few buyers and considerable seller pressure, resulting in large price discounts. Transaction method covers subscribed capital contribution, transfer of paid-in capital contribution, fund continuance and restructuring, and so forth.

3. Development and Current Situation of S Fund

3.1. On the Global Capital Market

The S fund is known as the "jewel in the crown" of the private equity market in the global capital market. VCFAG Group, founded in 1982, was the first organization to participate in private equity secondary market transactions [3]. After the Internet bubble burst in 2000, the secondary market for

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private equity began to emerge at a rapid pace. The volume of private equity transfer S-fund transactions was $7 billion in 2004, $27.5 billion in 2013, $42 billion in 2014, and $40 billion in 2015. The PE secondary market grown dramatically in 2017-2018, with the highest transaction value exceeding US$72 billion [4]. Over the last ten years, the total trading volume of worldwide S funds has increased year after year.

Since the debut of the S fund, the market has embraced this product. This is caused by a variety of factors. S-funds have an unique price advantage and can obtain private equity at a reduced cost. Furthermore, the payback is relatively short, and the S fund, which is mainly allocated to fund shares in the later stages of investing, will generate returns as early as the first year of investment, with more than half of the cost returned on average by the fifth year. Many market participants have high expectations for S funds [5]. S funds have matured as an investment strategy in the worldwide market, with approximately 30% of European and American private equity funds exiting through share transfer [6]. Pension funds, sovereign wealth funds, endowments, and foundations, to name a few, are becoming more diversified and complicated as new entrants to the secondary market. The influx of new competitors has increased competition in the entire market, lowering the discounted benefits of transactions. The advisory company role in secondary transactions has also expanded dramatically, with the advising firm now providing pricing reporting and decision-making, discovering and connecting buyers and sellers, arranging and structuring transactions, and managing databases and confidentiality. Agreements, quotation collecting, and negotiation are also aspects of services.

After ten years of consistent expansion, the amount of funds to be invested in the global capital market will hit a record high of US$3.4 trillion in 2021. Acquisitions and exits set new records, totaling US$1.1 trillion and US$957 billion, respectively [7]. The last time such a large-scale privatization transaction occurred on the worldwide market was in 2006-2007, before to the financial crisis. With the gradual rise in the acquisition price of various businesses, the emphasis of investment is shifting to specialization, particularly in the field of technology. Tracks that can achieve outstanding performance through professional technology empowerment, such as fintech, healthcare, and business services, etc.

The worldwide private equity investment market will exhibit three significant trends by 2022. The first is that investment places a greater emphasis on the ESG measurement system. More investors will consider corporate ESG factors while making investment decisions. Most private equity players have developed unique ESG investing criteria that have a substantial impact on the valuation of private equity assets, in whole or in part. If a company has ESG issues, the likelihood and amount of investment will be greatly reduced. The second point to mention is that investing in software is getting increasingly popular. In 2021, private equity deals in technology exceeded $284 billion, with 90% focused on software, providing excellent returns. Investors are predicted to favor the B2B software and technology business in the future. While technological companies are rapidly growing, they are also posing greater threats. Enterprise software companies that are mature or developing, on the other hand, have reduced risks and volatility and will become the primary investment targets of private equity. Software investments outperformed other industries, with over 60% of investments achieving 2.5x or higher returns and fewer bankruptcy liquidations than other industries. The third is to account for inflation. In various countries, inflation have occurred in 2021-2022, with the United States reaching a 40-year high [7]. The responses of the Federal Reserve and other central banks will have a significant impact on current and future transactions. In order to protect profits and future earnings, extensive research has been conducted on how to combat inflation.

In terms of private equity exits and financings, the overall value of exits has more than doubled since 2020. Special purpose acquisition companies (SPACs) were the standout performers, with deal value increasing 325% over the previous year to $158 billion. The year before, the global private equity industry raised a total of US$1.2 trillion, with buyout funds raising US$387 billion [7]. Private

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equity investors continued to generate huge gains in 2022. Buyout funds provide investors an above-market average rate of return (IRR) while minimizing volatility. According to a survey of worldwide alternative asset sector statistics, 95% of the limited partners polled met or exceeded their private equity investment returns in the previous year. In 2022, nearly 90% of respondents said they will raise or maintain the proportion of private equity investment, and up to 95% stated that they will keep this trend for a long period of time [8]. To offer liquidity to existing limited partners (LPs), more general partners (GPs) are turning to secondary partners. This allows investors in early-stage private equity firms to exit existing investments in order to meet yield and liquidity targets. This adjustment will help to attract more investors with varying time horizons, and extra time and capital will also provide additional value for investors. This new type of trading is becoming an increasingly important part of the secondary market.

3.2. In Chinese Capital Market

To acquire relatively high premiums, private equity fund managers in China have traditionally exited through IPOs or mergers and acquisitions. The primary concern of managers regarding the PE secondary market is that unjustified prices will harm the fund's investment income as well as the private fund manager's image and reputation. However, since 2017, China's IPOs have gotten increasingly restrictive, traditional exit methods have become more competitive, and A-share stock prices have declined. Because VC/PE private funds have encountered great difficulties in both raising and exiting, S funds have steadily gained the attention of the capital market. Although China has established a number of trading platforms for second-hand shares of private funds, such as the Beijing Financial Assets Exchange and the Shanghai Equity Exchange, the most important role these platforms currently play is to broaden the channels for transaction information disclosure and has not yet been implemented. The actual completion of the share transaction and the final realization of investment income are both direct driving factors. The positions and roles of professional investment institutions and intermediaries are still vitally needed. It is also an inevitable trend for China to implement the S fund model to assist private equity fund managers in exiting.

China's S-fund development is relatively late. It only appeared gradually after 2010. At present, China's private equity secondary market is in its early stages of development, with enormous potential for future growth. The S market has had substantial backing from governments at all levels, from the federal to the local. China's private equity market has grown rapidly over the last decade, progressively giving birth to the S market's development potential. Since the end of 2020, the China Securities Regulatory Commission has approved private equity fund share transfer platform pilot projects in Beijing and Shanghai. Many local governments across the country, including Beijing, Shanghai, Hainan, Shenzhen, Jiangsu, Shandong, Shaanxi, and others, have established S funds or implemented a variety of measures to encourage the development of the S market in the last year, creating a superb market for the development and construction of the S market. The support and encouragement offered by regulatory agencies and local governments for the expansion of the S market has created a favorable development environment for the S market. The existing stock structure of China's private equity market, as well as a mismatch in market demand, have also contributed to the S market's investment, which is now a Sex golden opportunity. China's secondary market has become a hot spot for numerous entities engaging in alternative investments over the last two years. The S fund trading market has the potential to significantly boost the vitality of venture capital. Many of China's leading capital firms have gradually begun to invest in second-hand assets other than primary equity, and to collaborate with local guiding funds to support the adoption of S funds. According to the "2022 China Private Equity Secondary Market White Paper," there would be 353 transactions in China's private equity secondary market in 2021, encompassing 337 funds, with a total transaction amount of 66.807

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billion yuan known. In comparison to the transaction amount of 26.445 billion yuan in 2020, there has been a 153% increase, with a compound growth rate of 47% over the last five years [9].

Table 1: Existing S fund institutions in China.

Territory	S Fund Name
Beijing	Beijing Xingyao Capital
Beijing	Beijing Vision Relay Venture Capital Fund
Beijing	Datang Yuanyi
Beijing	Hengchang Fortune
Beijing	Hengtian Zhongyan
Beijing	The Jiahao Fund of Funds
Beijing	Junshan Private Equity Fund of Funds
Beijing	Kailian Capital
Beijing	National Social Security Fund
Beijing	Zero2IPO S Fund
Beijing	Pansheng Assets
Beijing	Shanghe Capital
Beijing	Shengshi S Fund
Beijing	CITIC Construction Investment
Fujian	Borun S Multi-Strategy Fund
Fujian	Xiamen Tiandi Investment
Guangdong	Everbright Holdings
Guangdong	Guangzhou (Emerging) Fund
Guangdong	Naxin Capital
Guangdong	Shenzhen Venture Capital
Guangdong	Ying Jia Capital
Guangdong	Yuexiu S Fund
Jiangsu	Newley Capital
Jiangsu	Suzhou Fund
Jiangsu	Taikang Qianheng Equity Fund of Funds
Jiangsu	Star Naher Capital
Jiangsu	Yuan He Chenkun
Shandong	Qixin Industry and Finance S Fund
Shanghai	Pure Stone Capital
Shanghai	Gopher Assets
Shanghai	Hengxu Capital
Shanghai	Shanghai Science and Technology Innovation Fund
Shanghai	Tongji Alumni Fund
Shanghai	Yuanhai Minghua

Resource: https://zhuanlan.zhihu.com/p/501366341

Combined with the current market environment, the following factors contribute to the future development possibilities of S funds in China.

DOI: 10.54254/2754-1169/17/20231056

3.3. The Investment Target is Sufficient

During the 2014-2016 PE boom, China's private equity RMB funds experienced rapid growth. The funds established at the time entered the liquidation and redemption period after eight years of development [9]. The growth rate of stock assets is quite high due to the steeper growth curve. The current market faces structural issues. The issue of funds exiting due to maturity is urgent and serious at the end of the market. A considerable proportion of mature funds have a nearly two-year exit window. Given the large number of mature funds, it is not difficult to infer that the past two years represent a historical window of opportunity for S fund investment. For decades, China's capital and financial markets have lagged behind established global capital markets such as the United States and the United Kingdom. It is foreseeable that with the maturity of development, there will be huge potential for future private equity and secondary market transactions.

3.4. Economic Swings Create a Fantastic Opportunity for Investing

The global market climate swings dramatically against the background of the current worldwide epidemic, as well as other environmental, social, and regional catastrophes and conflicts, risk aversion is escalating. At the moment, asset price discounts are relatively substantial due to the performance of the main market. As economic growth has slowed, the demand for LP transfers has skyrocketed, and the desire for liquidity has also risen, giving S funds greater wiggle room when investing in fund LP shares. During times of economic instability, there will be more trading chances in the market for low-priced, high-quality shares of private equity funds.

3.5. Investment Opportunities Created by the Government's Withdrawal of State-owned Assets

A high proportion of LPs in China's private equity sector are state funds or government-guided funds. There will be a substantial number of state-owned LPs and government investments in the market that are ready to expire in the coming years, and exits will be considerably hastened. The adoption of the registration system and the removal of restrictions on holdings are at an inflection point in investing, and secondary private equity transactions are extremely cost-effective.

4. Benefits and Characteristics of S Funds

We discovered several intriguing traits and advantages after conducting research and analysis on S funds and S transactions in the global capital market.

4.1. The Investment Target Is Highly Transparent, Which Effectively Reduces the Risk of "Blind Pool"

When private equity funds raise funds, fund investors have a blind spot for the underlying assets that the fund will invest in in the future because the underlying assets have not yet been determined [10]. S funds, on the other hand, are regularly in the late stages of investing when they engage in it, and they typically purchase fund shares that already hold reasonably definite underlying assets. The investment portfolio corresponding to fund shares is clearer and more transparent, and underperforming assets are readily evident. By completing thorough due diligence on the funds or projects to be acquired, the S fund team may more properly price fund shares and underlying assets to achieve the projected returns of LPs.

DOI: 10.54254/2754-1169/17/20231056

4.2. Using a Decentralized Strategy to Allocate Assets, the Entry of Investors Is More Flexible

S funds frequently deploy assets more quickly than direct investment funds. LPs who invest in S funds can effectively incorporate PE assets into their investment portfolios. However, the S fund's acquisition targets are limited, and transactions are only possible when there are fund shares or underlying assets to be sold. S funds' investment strategy is rich with opportunities.

4.3. Avoid the Drawbacks of the "J-curve Effect" and Boost Fund Returns

A direct investment fund's term is typically 8 to 10 years, and its life cycle curve is commonly referred to as the "J curve" [11]. This happens because, within 4 or 5 years of the investor's contribution, the amount of the fund's external investment, management fees, and other expenses is often greater than the income generated by the investment project, resulting in a negative net cash flow, and it takes an average of 3-6 years. This takes years to break even and for LPs to start earning returns, therefore the net cash flow has a "J" shape. S funds generally enter when a company is relatively mature. Because the underlying J curve has frequently bottomed out and begun to rise at these investing points, the return period is shorter.

5. Development Prospects of Secondary Private Equity Funds in China

The IPO is currently the most significant exit route for junior private equity in China, but it has the disadvantages of taking a long time, having limited resources, and being subject to considerable unpredictability. The S fund is playing an increasingly important role as a supplementary exit channel due to its unique advantages. The S fund's primary significance is to improve the liquidity of LPs while simultaneously relieving the pressure on GPs to exit. The private equity secondary fund market has gradually increased in popularity, and general partners have begun to pay greater attention to "secondary." However, because they have a large number of project launch chores and fresh fund raising activity, the management of Chinese VC/PE institutions are still disassociated with S transactions currently. The share transfer of the previous fund is largely the replacement of funds generated by investors themselves, or the requirement for asset allocation adjustment, and there is no new capital increment, therefore lacking subjective initiative to a certain extent.

Based on the barriers to the development of S funds in China. First, the domestic S fund is still in its early stages, the scale is limited, and it has not yet become a mainstream exit method. Second, there is an information imbalance between buyers and sellers of shares, a lengthy process of altering industrial and commercial registration, and the serious shortage of intermediaries. Third, domestic S fund talent is in shortages.

Based on the opportunities for S funds to flourish and exist in China. For starters, it can meet the increased liquidity requirements of existing investors. Primary private equity investment generally lasts 7 to 10 years. The secondary market can shorten the investment return period for some investors who are eager to reach cash. Second, it offers the benefits of both risk and profit. It has been in operation for a long time since its inception for the forthcoming trade aim. The buyer has been able to better understand the state of the fund's projects and actively chose the fund with superior cash flow, which is conducive to diversifying investment and reducing risks. Third, it offers advantages in terms of establishing contacts between buyers and outstanding fund managers, which is conducive to further cooperation expansion. Fourth, as a result of the influence of geopolitics and macroeconomics, many funds established in 2014, 2015, and 2016 are under pressure to exit, due to the demand for LP liquidity and the plentiful supply of sellers. Fifth, an increasing number of roles, including buy-side and various financial institutions, are participating in the entire S fund market. The regional ecology

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has gradually improved, and the establishment of the Shanghai Stock Exchange Center and the Beijing Stock Exchange Center places S funds in a more vital position in terms of supervision and local financing. Sixth, more data suppliers, intermediary providers, legal providers, and evaluations are becoming involved in S fund intermediary services, and the entire industry chain is evolving toward ecological integrity.

S funds typically provide three benefits to general practitioners. First, for GPs, if Institution S becomes a new LP by transferring shares, it reflects market institutions' acknowledgement of the fund's performance, and the manager's reputation will also improve. Second, the new fund's contribution will provide GP with more diverse collaboration opportunities. Most institutions still use a P strategy when purchasing S. That is, to create a fund of funds that invests primarily in new funds from high-quality leading institutions. Through the S fund, GP can communicate with new LP. Third, the listing pressure on GP will be lessened. A After the S buyer enters, they usually hope to continue to extend the life cycle of the fund by keeping it for a period of time and obtaining better returns, which has the function of expanding the fund's extension term. LPs can decrease GPs' workload when making transactions and the energy that GPs must expend, such as supplying due diligence materials, to make secondary transactions more attractive with all subjects. When LPs select S funds for trading, they must keep in mind that each S fund has its unique strategy and cannot cover all sub-sectors. LPs must use caution when transacting with S funds.

The DSG approach is recommended by the asset management business of China's private equity fund of funds for how S funds identify LPs. D represents the direct investment team, S represents the S fund team, and G represents the rich GP resources [12]. The DSG deep synergy system can withstand strong competition and market cycles. This is a complex project, and the strategy calls for the S fund manager not only to have just long-term and continuous access to the market's highest-quality transfer targets. This is frequently tied to the manager's continuous ability to contribute funds and the previous positive relationship with the head GP. At the same time, it can make a swift valuation decision on the target. Finally, the scheme requires the manager to select a good target for the S fund transaction.

S funds place varying emphasis on the needs of various S assets. Different asset packages place different emphasis on distinct indicators and have diverse demands for certain assets. The essence of asset packages differs as well. The variations in many elements make evaluating the quality of the asset package according to a specific criteria problematic. Second, it should be realized that there is no clear price formula for the valuation of S assets, and that matching pricing requires evaluating the expected returns that the assets themselves can accomplish. Each link demands a great deal of trading experience, whether it is asset screening, counterparty selection, transaction structure setting, or risk control.

6. Conclusion

The development of S funds in China faces challenges and requires time and space to flourish. Promoting the growth of investment funds and capital markets is an imperative need for China. S funds have numerous characteristics and advantages, the most prominent is their investment target is more transparent, investor entry is more flexible, and they can avoid the "J-curve effect" withdrawals and boost fund returns. S funds are an indispensable part of the equity ecology. Simultaneously, a large number of private equity funds in China are progressively exiting, and the trend of state-owned funds and policies is bringing benefits. Economic performance is lackluster against a backdrop of COVID-19 and global instability, and risk aversion among investors is increasing. Secondary Private Equity Fund is an inevitable choice to follow the trend in the context of the current enormous number of exit needs.

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Opportunities and Challenges for Commercial Brands under Fan Economy

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Abstract: With the popularization of the Internet and a variety of social media, an increasing amount of investment was made in the market, and a new form of self-media marketing emerged. And as the market continues to grow and expand, some practitioners have become "celebrities" in this market, which we call an influencer. Different from the traditional celebrity or movie star. They are more engaged on the internet instead of offline activities through the "self-media" they mainly established by themselves. They gain financial benefits by advertising their own brand or endorsing other existing brands using their "celebrity" (or influencer) effect. The fan economy is booming because of this environment. Some companies have significantly improved their popularity, attracted lots of attention through the fan economy, and obtained huge profits. However, some negative content and value orientation in the fan economy may lead to threats to both companies and social stabilization. This paper will illustrate research on the "fan economy" in self-media marketing. Based on the analysis of different "self-media" platforms domestically and abroad. Demonstrating how companies should better seize the benefit and avoid the negative impact brought by this new economy in such an era.

Keywords: fan-economy, self-media marketing, internet marketing

1. Introduction

Self-media is the account that individuals used to produce personalized content and operate by themselves on social media platforms. After the individual build up a significant number of followers. They can be described as an influencer. Then the fan economy will emerge. The fan economy can be seen mainly as a system of practices of fans' material consumption of their idols' products and practices of cultural consumption, with occasional fans' production of their idols' images, products, and side products that manifest the creative dimension of fandom, apart from the commercial aspects [1]. From blogs to YouTube and TikTok. It can be seen that the technical threshold of self-media is continuously lowered, and the communication effect is enhanced. An increasing number of people chose to join the market. Thus, the fan economy develops rapidly as well and already plays a significant role in the internet economy. On the other hand, the fan economy brings negative influences such as irrational purchases and limitations on content. The normative operation of the fan economy has not yet formed systematic and effective management to avoid the negative effect. This paper will explain the reasons and behavioural logic of financial effects brought by fans in the fan economy through consumer behaviour theory. Providing a deeper understanding of the fan economy for companies to

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better seize the benefits that might be gained from this background and also provide suggestions for companies to administrate the savage development of the fan economy and minimize the harm it might bring.

2. How Influencer Became Successful and Different with Celebrity

The self-media can play such an important role in the internet industry is predictable. A variety of phenomena in the past few years can be the reason why self-media can develop rapidly. First, the increase in the number of mobile users is tremendous. According to Statista, the current number of smartphone users in the world today is 6.648 billion, meaning 83.32% of the world's population owns a smartphone. This figure is up considerably from 2016 when there were only 3.668 billion users, 49.40% of that year's global population [2]. The need for entertainment to be simple, speed, and fun has increased. The content produced by self-media has the characteristics of diversified easy understanding and attraction, which perfectly meets the needs of people in this era. Second, compared with the 90s generation, the age at which teenagers have access to the internet, mobile phones, and social media is much earlier. Teenagers not only have higher Internet proficiency than their peers in the 90s but also have a deeper understanding of self-media. According to a report conducted by morning consult, about 86% of Americans surveyed are willing to try to become an influencer on social media platforms, while 12% of young people claim they are influencers already [3]. Given such a background, it is not surprising that self-media became popular. Influencers are Individuals who accumulate a following on blogs and social media through the textual and visual narration of their personal, everyday lives. Compared with celebrities. Influencers gain their followers in a different way. People follow celebrities because they stand out in one or more areas of the entertainment industry. For example, music, sport, and movie. While influencers gain followers more from their interests and niche. They always have unique characteristics. For example, the special diet they can provide for vegans, their humorous personalities, or being strong players in video games. In addition, the reason why people want to buy products endorsed by a celebrity is different from that of an influencer. Fans are curious about a celebrity's work and life. Fans look forward to the lives that celebrities show and they want to be as close to the lives of the celebrities as possible. When a celebrity endorses a product, it provides fans with a chance to use the same product as their idols. In addition, with the background of relatively transparent information, Fans know that the best way to support their idols is to purchase the endorsed product and let the company know that this celebrity has clout and the ability to increase sales. The fans will be delighted to see their idol become more successful. On the other hand, an influencer has some knowledge and experience in the field they choose to be part of. So, their fans are more likely to be people who are either interested in the field or peers. These influencers create content to share their experiences and surveys they received from the products they endorsed and carry out our marketing activities. Moreover, most of the influencers are not mega influencers. Therefore, they are more friendly and relatable. So, fans will believe what these influencers say about a particular product. For example, if a beauty influencer recommends a foundation that he thinks works well, fans' expectations and willingness to buy this foundation will rise dramatically.

3. Opportunities Fan Economy Bring to Company

The characteristics of the fan economy have brought great business opportunities to many companies. It brings the product and high brand loyalty. Furthermore, fans volunteer to be the medium of 'advertising.' Seizing the opportunities of a fan economy can bring a company huge benefits.

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3.1. High Brand Loyalty

Brand loyalty describes a consumer's positive emotion towards a brand, and their dedication to purchasing the brand's products or services repeatedly, regardless of deficiencies, a competitor's actions, or changes in the environment. It can also be demonstrated with other behaviours such as positive recommending the brand towards others initiatively [4]. Fan economy relies on fans' positive emotions towards the influencers. At the moment, with the self-media developed. Celebrities themselves are using the media to show their personal life and activity. The distance between a celebrity and their fans is much closer than before. Therefore, it is both more convenient and easier to maintain the emotional relationship between fans and influencers, which leads to higher brand loyalty.

3.2. High Interaction and Participation

There are many new forms of media for the influencer to use to increase sales, other than filming an advertisement. For example, in recent years in China, the most popular form of live commerce is online. Since 2019, this form of marketing activity has increased dramatically from 1.5 billion RMB to 5.1 billion, more than tripling the previous year [5]. These new forms of advertising allow fans to be more interactive. Fans can use comments during the live stream to express their needs and ask questions about the product, and they will receive responses almost immediately. This way can not only reduce fans' concerns about the product but also provide them with a chance to interact with their idol. In addition, fans will post discussions on other platforms to spread the information. especially for fans of "cultivating idol". Fans even have the right to decide who will be the idol or what kind of idol they will become. Not only influencers have a variety of new forms to help businesses increase sales. Fans also have a lot of new ways to consume; these ways increase interaction. The traditional way includes buying an album and a film ticket. Nowadays, they can choose to subscribe to influencers' channels, and the platform will give influencers some money as an incentive. To watch some influencers' variety shows, membership in a video channel is often required. This amount of money is also accounted for as part of the influencers' salary. The most common way to die is by giving a life reward. The platform takes a cut, and the rest will be received by the influencer. Fans have a lot of new ways to support their idols since they want them to be a success. And all these ways are beneficial for businesses.

3.3. Fans Volunteer to be 'Media'

Belonging consumption can be defined as the sense of consumption that has strong absorption and certain exclusivity. Fans not only show off a certain product to others but also have an ambivalent attitude towards wanting too many people to own this product [6]. Fans, in this case, have more emotional needs instead of economic needs. Their belonging consumption greatly satisfies these needs. Fans witnessed their idols achieve their fantasy success. For example, some people's successes are being able to buy a villa on the beach one day and enjoy the sea breeze and quiet at nightfall, and when people were still far away from this dream, they saw their favorite idol live in a villa like this when they participated in a variety show. At that moment, their idols become the entities of their dreams. It will give fans an extremely strong attraction. with some guidance, for example, while their idol is lying on a sun chair while drinking a particular beverage. Fans will consume far more than the value of the goods themselves. These emotional feelings have attached great importance to lots of famous companies. Apple's customer experience strategy is exceptional in developing long-lasting relationships with customers [7]. It gives consumers a premium experience through the quality of its products and during making a purchase decision. However, the way Apple did it is hard to reproduce since it requires technology, superior design, and subtle user experience planning. Using influencers

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Businesses can achieve a similar effect to some extent, so businesses should pay attention towards how to use influencers to create and satisfy fans' emotional needs.

4. Challenge Fan Economy Bring to Company

The fan economy brings companies huge benefits. However, the fan economy also presents companies with challenges. The company may be dependent on the fan economy. Irrational behaviour and waste may be caused by fans' economy, which may give non-fans a negative influence.

4.1. Company's Over-reliance on Fan Economy

The company relies on the fan economy to grow and increase sales, which may over-rely on the fan economy because it will bring greater operational risk and lower stability. What fans love is the appearance presented by the influencer's self-media platform instead of the person that they really are. Fans are willing to purchase the endorsed product since there is an emotional connection between fans and influencers. They are paying for their emotional needs instead of the product itself. The loyalty brought by the fan economy is not to the brand nor the product but the influencers, which means that within the period where fans have high engagement and high loyalty towards Companies need to shift that loyalty from the influencers to the products. and these usually bring lots of trouble. First, influencers have the possibility to flop. Second, as public figures, their personal lives are highly transparent. So it increases the company's cost to maintain that persona precisely. Any behavior that does not fit the persona or what the public expects of them can be easily discovered. For example, making inappropriate comments on social media several years ago or unethical behaviour like cheating or plagiarism. Thus, the emotional connection will be broken and lead to an enormous number of fans being unfollowed, and these situations are almost unpredictable. The moment famous influencers endorse a product, causing a large increase in order numbers. while the company is preparing the product. The next day, the influencer flops because the fan cancels the payment or returns the product, so the company has no time to shift the loyalty and wastes the endorsement fee. Second, some companies underestimated the sales increase that the fan economy can bring. The company is lacking supply and this leads to fans not being able to buy the products they want in a short period of time. When they may have a negative attitude towards the company, it is hard to increase loyalty anymore. Finally, sometimes the problems and profits caused by the huge sales increase may cause the company to ignore the matter of shifting loyalty. Therefore, when the contract of the influencers ends, the company also fails to take the proper approach, resulting in a serious decline.

4.2. Irrational Behaviour and Waste

Group norms and group pressure were positively correlated with supportive behavior [8]. Under these certain rules and pressure, whether they are willing to spend money or spend more money on their idols becomes the standard of loyalty to their idols. Therefore, make an extremely irrational purchase decision. For example, last year in China. One variety show was sponsored by a milk company. One way to support the idol on the show is by buying the milk and scanning the QR code on the bottle caps. in order to see their favorite idol make their debut. Fans purchase tons of this bottled milk that they cannot consume. There are about 270 thousand unused bottles of milk. It not only wastes lots of bottled milk but also leaves non-fans with a bad impression of food waste. In addition, fans have a highly premium space for influencers. They are willing to pay more than the original price of tickets for offline activities or concerts. Thus, the possibility of scalpers greatly increased dramatically. They buy the concert tickets at the original price and sell them to fans at a much higher price, which fans are still willing to pay. These amounts of premium are not received by the businesses but are received by the scalpers. Moreover, some fanatical activities made by fans towards the influencers will also

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have a bad impact on the brand image. Some fans idolize the influencer too much. Some celebrities' fan bases may be biased towards children. For example, cartoon influencers. These people lack the ability to judge right from wrong and are easily led to extreme behaviour or high consumption. So, any negative comments about the influencers are highly unacceptable. When they see negative comments, no matter what it says Fans may engage in extreme behaviour, including cyber manhunts and even cyber violence. As the number of star fans increases, the number of such irrational fans will also increase. Others will have certain prejudices against the fan group, and when such stars endorse the company's products, others are likely to transfer these prejudices from the fan group to the company, which will lead to the brand's image getting worse.

5. Recommendation

The company should have a corporation with the social platform influencer are using. Formulate proper with influencers, Eliminate bad bootstrapping. For example, the situation mentioned above including cyber violence should be avoided. When fans saw these comments. They will form a consistent external posture within the fan base and become aggressive to all the negative comments. This behaviour is not entirely spontaneous. The guidance of the platform and the indifference of the stars themselves to such behaviour in the past contributed to this behaviour. The company should make regulation on the platform to reduce the number of group missions the platform gives fans unconscious including control evaluation and comments or making data looks great. In addition, the contract with the influencers can be mentioned in a situation like flopping. Also during the period of cooperation, anytime when influencers are trying to say something or post some words on the internet should be audited by the company. Before cooperating with an influencer, do a complete background check to see if it fits your brand image and whether the comments, they have made in the past will affect your brand image. For example, vegan influencers are not appropriate for endorsed instance meatballs. Meanwhile, Minimising antagonism between different fan groups should also be considered before the corporation. If there is existing antagonism, the company should pay more attention to the situation where the sales increased from influencers can be reduced because other fans group refuse from buying. These strategies may reduce the high risk of using endorsements and keep the effect of increasing sales.

6. Conclusion

The fan economy can bring businesses both profit and reputation as long as the company uses it properly. The company should be aware that they should not over-rely on the profit and reputation that the fan economy brings at an early stage. Check whether the influencers are appropriate for the brand and the comments the influencers have made before. Be prepared for the influencers' flop by terminating the partnership in a timely manner or issuing a public apology. The company should shift the high loyalty from influencers to the product within the period when fans have a high willingness to purchase the product. Use proper rules and regulations to avoid fans from engaging in irrational behaviour and use appropriate methods to reduce scalpers. In this way, the huge number of fans of the influencers are more likely to become fans of the product. And they will be willing to advertise these excellent products by themselves as' media'. The internet is still developing dramatically, with the advent of 5G and VR becoming increasingly mature. There will be new markets discovered and new customer bases created. The idea of a fan economy will still be important as it only changes the form. Businesses should keep the core content of the fan economy while making products and services suitable for different forms of fan economy.

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The Influence of Network Economy on the Marketing Strategy of FMCG Clothing Brands

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Abstract: This essay investigated the network economy as well as the factors that influence the marketing strategy of FMCG clothing brands. Network economy is becoming a common trend, and in the last twenty years have witnessed a huge growth in network economy. The next decade is likely to see a considerable change in the marketing strategy of FMCG clothing brands. This article aims to analyze how FMCG clothing brands have adapted to the network economy by changing their marketing strategies. It also finds out how companies are applying marketing strategies to make the network economy an opportunity for the FMCG apparel industry.

Keywords: network economy, marketing strategy, FMCG.

1. Introduction

Everyone has their own interpretation of marketing. Many people think that marketing is about selling products through advertising. In fact, this is indeed part of marketing, but marketing covers much more than that. The American Marketing Association (AMA) defines marketing as the activity, set of institutions, and process for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large [1]. Marketing has gone through four eras, which are the production era, sales era, marketing era, and relationship era [2]. A new era is rapidly approaching, the mobile internet/on demand marketing era. The growth of the internet has altered the marketing landscape and affected all facets of marketing. The network economy age has altered how businesses think about and practise marketing. At the same time, in this era, the advantages of the internet, such as fast speed, openness, intelligence, and all-weather access, are driving the sustainable development of the network economy. This essay focuses on the influence of network economy has on the FMCG clothing brands. FMCG is an abbreviation for Fast Moving Consumer Goods. It refers to the goods that have a short life cycle and are consumed quickly. Also known as PMCG, Packaged Mass Consumer Goods, as the name suggests, products are packaged into small individual units for sale, with a greater emphasis on packaging and mass merchandising. Zara and H&M are two typical examples. We can say that a networked economy broadens the scope of everything, and all the companies and businesses including FMCG clothing industry, should consider a new way of thinking.

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2. Characteristics of FMCG

Fast Moving Consumer Goods have distinct differences in the purchase decision and purchase process compared to other consumer goods. FMCG products are impulse purchases where appearance, packaging, advertising, promotion and price all play an important role in sales. FMCG clothing brands are therefore characterised by three features: convenience, visualization of products and brand loyalty.

2.1. Convenience

Customers can habitually buy close to home. Generally speaking, FMCG brands are chain stores. For example, ZARA, the fast fashion clothing shop that became popular for its fast, fashionable and low prices, has expanded its shops significantly since it opened. In 2014, ZARA even surpassed the then-celebrated Metersbonwe, with nearly 150 shops. ZARA locations are generally chosen where there is a high concentration of foot traffic. The flagship shops in the USA and Paris are rated as the most stylish shops in terms of decoration. In London, ZARA is located on Oxford Street or near Harrods. In China, ZARA can be found in famous shopping areas such as Xidan in Beijing and Nanjing Road in Shanghai. Another thing to note is that many of the nearby brands, including Burberry and Gucci, are well-known global brands. As a result, customers would psychologically believe that ZARA is also a high-end brand. Despite the high rent in certain neighbourhoods, there are significant cost savings through reduced advertising. ZARA employs the landmark effect and only spends 3% of their annual budget on advertising to establish a premium brand image.

2.2. Visualization of Products

The visualization of products is important because consumers are easily influenced by the atmosphere of the shop when making a purchase. The use of images for the goal of marketing products or promoting brands is known as "visual merchandising," which is an orientation to marketing tactics and a visual experience. Visual merchandising, to put it simply, includes shop displays and window displays. When introducing new products, ZARA's specialized visual merchandising team develops new plans. Generally speaking, visual merchandising in the clothing industry will be considered in terms of the colour scheme of the garment, the matching of items, the background, the theme and so on. There are many aspects to consider when placing the display. ZARA focuses on the lighting in their shops, with multi-point projection and metering being used to good effect. In addition, the change of lighting colours gives the whole store a vibrant and holistic feel and makes consumers want to buy. Creating an illusory dream visual experience. The whole shop reveals, reflecting the modern woman's taste for luxury and fashion in a fast-paced life.

2.3. Brand Loyalty

FMCG products generally have lower levels of brand loyalty and customers easily switch between the same product categories. The FMCG industry itself is a highly competitive industry. Manufacturers of FMCG products are at the beginning of the chain and the end customer is at the end of the chain. In the FMCG market, H&M and ZARA are two of the most familiar companies to customers. For almost all customers, the products of these two companies can be used as substitutes for each other. It is not the brand that customers are looking for, but the product that best meets their needs at the moment. As a result, customer loyalty is relatively low for H&M and ZARA, as well as for the FMCG clothing brand industry as a whole. For this reason, each company defines a different design concept to make the company's products stand out from the competition.

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3. Influences

In the Internet era, the emergence and application of the Internet, IT technology, big data, cloud computing, etc. have had a huge impact on the marketing model of enterprises. One of the fundamental changes that the Internet has brought about in the world is the elimination of the space-time gap. Statistics reveal that in the first half of 2017, China's e-commerce total increased by 27.1% year over year to reach 13.35 trillion yuan, demonstrating the country's strong e-commerce growth. For enterprises, e-commerce as a development opportunity, should seize the opportunity to actively introduce new marketing tools, make full use of the network platform, break the limitations of time and space, fully explore the potential of consumers, to provide effective strategies for enterprise marketing. First, the Internet has dismantled conventional national and regional barriers, connecting everything and transforming the world into a global "village." On the Internet, people are free to communicate and roam, regardless of race, ethnicity, country, occupation, or social status, and in this way, communicate information, and people's attachment to physical space is greatly reduced. Second, network information overcomes time constraints, allowing people's information transmission and economic transactions to be completed in less time. The network economy can run 24 hours a day, and the constraints of the network-based economic activities on the space factor are reduced to a minimum, so that the whole process of economic globalisation is greatly accelerated, and the interdependence of countries around the world is strengthened as never before. The network economy is also a speed-based economy. The network economy gathers, processes, and applies information at a speed that is very close to real time, and the pace is substantially quickened. Modern information networks may send information at the speed of light. Network economy is already helping companies provide better, more personalized customer experiences. Customized delivery capability opens up all kinds of bundling and promotional opportunities [3].

Society has entered an era of knowledge-based economy, where new technologies are constantly being updated and new products are changing rapidly, improving production efficiency, shortening the production cycle and driving the pace of economic development in the market. At present, people can find that the development, promotion, use and decline of new products are significantly shorter, which brings more pressure on the R&D team and challenges the marketing team to think about how to promote new products and gain profits in a short time, which has a great impact on the marketing of enterprises. H&M uses spring/summer and autumn/winter as the two distinct seasons that it uses to segment the fashion year. Based on information provided by sales shops situated across the world, such as the most popular products, climatic variations, and shopping preferences, sourcing activities are linked with the market orientation and are continuously changed to enhance the accuracy of fashion trends. The quality of the product has a major role in determining the lead time, which can range from two to three weeks to six months. The ideal lead time strikes a compromise between cost, lead time, and quality; a very short lead time is not always the optimum. While customers think that H&M is fast enough to bring in new products, ZARA has started to bring in new products every two weeks. Every year, ZARA stores throughout the world carry about 11,000 different styles. The success of ZARA is largely down to its supplier network. The business is always gathering fashion accessories and keeping up with the latest fashions. In just two weeks, a new release can move from conception to market. From the perspective of the supply chain, the success of fast fashion companies is largely attributable to the product supply chain's quick response. Clothing businesses are no longer competing on the basis of the product itself or the duration of the production cycle; rather, they are competing on the basis of how supply chain management dictates the production structure of businesses, which is becoming a more and more crucial factor in the growth of businesses. For ZARA, design is not only about the design team, but also about the buying team, and the introduction of the buying system has helped to reduce the time spent on design and development. Of course, ZARA doesn't just copy,

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it selects the "best" of what is popular and makes appropriate changes to the style. However, the downside of this is that ZARA pays fines of tens of millions of euros per year for infringement.

In the Internet age, competition in the market is becoming increasingly fierce, and new products are being developed and launched more and more quickly in order to improve the competitiveness of enterprises themselves. As a result, traditional marketing strategies are no longer sufficient for social development. In this regard, based on the network economy, we actively understand market demand, effectively meet the needs of different consumers, improve enterprise competitiveness, and promote enterprise marketing reform and development. Due to the development of networks, the economic organisation tends to be thin and flat. And the producers and consumers can be directly connected. The need for the traditional intermediary level to exist is reduced. This significantly reduces transaction costs and increases economic efficiency. ZARA uses consumer-oriented design, in which the customer's needs and viewpoint are taken into consideration while making decisions about design. Each ZARA shop manager has a business phone that they can use to contact corporate. The expert IT team at ZARA will conduct an analysis of the type of design that consumers in each country prefer based on the data provided by the shop manager. Additionally, offer the proper attire based on the preferences of the local clientele.

4. Applications of Network Economy in FMCG

The sudden rise of the Internet economy has made Internet technology and related Internet industries a powerful engine for the development of the contemporary world economy, and has widely covered all aspects of learning, working and living in contemporary society. According to relevant information, by March 2000, the number of people on the Internet worldwide had exceeded 300 million, and the number of web pages on the World Wide Web had exceeded one billion [4]. Such a rapid development of the Internet economy and its deepening socio-economic impact have attracted great attention from countries around the world. It has become an important theme for countries around the world to accurately grasp and adapt to the development trends and prospects of the Internet economy.

FMCG marketing has been the middle of a few of the most notorious showcasing jingles, taglines, and advertisements [5]. Usually, FMCG products are marketed through the medium of sales representatives, radio promotions, daily newspapers or banners. These mediums are mass-marketed messages. With the development of the network economy, the FMCG companies are now changing their marketing procedures and strategies. With the change in communication media, the industry is also undergoing a transformation.With the advent of e-commerce in the era of the network economy, businesses and customers have a closer interaction, saving the old marketing strategies' many intermediary links while simultaneously bringing greater benefits to consumers and safeguarding the financial gains of businesses. The extensive usage of information technology in the network era presents a chance for the growth of businesses. However, as market competition heats up, businesses must fully utilise the network and e-commerce platform to support the growth of enterprise marketing to the network if they want to stand out.

The integration of TV media and online media has achieved complementary advantages, resource sharing and profit maximisation for various industries, especially the FMCG industry [6]. With the accelerated integration of network technology, FMCG industry network marketing has been fully rolled out, the product all-round coverage of consumer groups, is the biggest advantage of integrated marketing. The advantage of all-round marketing is to better the advantages of enterprise products and consumers to buy the product to obtain a sense of satisfaction, more opportunities to interpret the product information, the dissemination of good corporate image. The integrated marketing of the media gives the company more opportunities for product placement, such as films, TV series, Internet video pre-production, mobile games, electronic publications, blogs, micro-blogs, etc. These carriers

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are integrated, three-dimensional publicity, so that FMCG companies can easily find their own consumer groups from countless Internet users. The subdivision of consumer groups, the rapid recovery of user feedback, and the precise grasp of product operation cycle, bring more business opportunities for enterprises.

The increase in the number of counterfeit products on the internet market has increased the chances of consumers being duped, and as a result, consumers are paying more and more attention to the reputation of companies. It is only when a company's brand is recognised by the public that it can achieve higher economic benefits, and it can be said that reputation has become the key to the development of enterprises. In this regard, in the era of the network economy, enterprises should ensure the quality of their products and actively use advanced technology and new materials to create high-quality products so as to gain public recognition, create a brand name effect, and promote the sustainable development of enterprises. The parent company of ZARA, Inditex, is dedicated to fostering an ecofriendly corporate culture since it has a positive effect on the company's long-term financial performance and reflects its basic values. CSR (corporate social responsibility), sustainability, environmental management, and waste water management are a few examples of areas with a heavy emphasis.

FMCG marketing is never short of challenges, in front of which each industry will develop the most suitable business development strategy according to its own development status. Multi-brand marketing, in comparison to the strong enterprise, is undoubtedly another attempt by enterprises after the saturation of a single product area. Zara's brands are Massimo Dutti, Oysho, Bershka, Stradivarius and ZARA Home. Massimo Dutti was founded in November 1985 and started as a menswear brand. After the success of the men's collection, the women's collection was launched in 1995, followed by the children's and fragrance collections. Based on a casual and sporty design philosophy while capturing the latest fashion elements, Oysho revolutionised the concept of Zara for the world of women's underwear and tights. Oysho is a youthful and dynamic brand that brings seasonal trends to all its lines. Stradivarius was acquired by the Inditex Group in 1999 and is aimed at the youth market with a young, edgy, street style. ZARA is a brand that brings the most avant-garde fashion in terms of design, fabrics and accessories to the young female segment, with unique materials and special decorative pieces, creating a sophisticated and elegant shopping environment in its boutiques, with an urban chic vibe everywhere. The company's goal is to provide customers with home furnishings that are aesthetically pleasing, functional, well-designed, and reasonably priced. To add flair and warmth to the home, the products are utilised in various settings and for various purposes. The goods' high quality and exotic design change urban living's mentality.

5. Conclusion

Information technology continues to develop and the online market is gradually becoming an important component of all markets. The borderless online world poses a great challenge to companies. For FMCG apparel brands, marketing strategies must break through the barriers of the landscape in order to create a distinctive brand. Enterprises should fully utilise the network and e-commerce platform to establish brand advantages, strengthen the marketing advantages of enterprises, and support the continued development of the economic market in order to adapt to social changes and ensure that businesses can still run healthily in the network economy. While the network economy has brought convenience to FMCG clothing brands, there are also limitations. The rapid changes in society also lead to changes in consumers. Companies need to consider a more comprehensive range of products to meet the changing needs of their customers. In general, the rapid development of network technology and the deep expansion of the network economy will undoubtedly have a significant impact on the future development of the global economy and society. But for some companies and even countries, the challenges of the online economy and its global expansion may outweigh the opportunities.

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The Impact of Research Development and Innovation on Enterprise Development: Case Study of BYD and Pfizer

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Abstract: After centuries of development, it has been proven that research and development (R&D) and innovation are the driving forces for a country to sustain its economic development and they are also essential to the development of companies. Scientific and technological innovation is strategic support to improve productivity and comprehensive national power, so companies' investment in innovation is increasing year by year. The main output of enterprises is concentrated in the fields of utility models, designs, and applied technology research and development. At the same time, national government policy has placed emphasis on the development of enterprise content and technological innovation, implementing a dual incentive system for enterprise R&D and innovation. This move has helped to energise companies in terms of entrepreneurship and innovation, while also reducing the cost of innovation and driving many new companies to invest in R&D. In this paper, the author discusses whether R&D innovation helps companies to grow by investigating the company's size, governance structure, financial report, and A-share market returns. It is found that R&D innovation is a good driver of business development and can bring advantages to companies.

Keywords: R&D, innovation, balance sheet, investors, stock market

1. Introduction

With the development and iterative renewal of high-tech industries, socio-economic development has gradually started to move to an era of digital economy. Big data, artificial intelligence, chip manufacturing, and smart sensors are becoming more and more popular all over the world. Digital products are closely related to people's lives. Companies are beginning to improve their own innovation capabilities to develop new technologies, and digital technologies are deeply integrated with corporate values. The state has paid particular attention to the development of the digital economy in recent years.

In the context of the proposed deep integration of new technologies with the real economy, some questions are supposed to be answered, for instance, whether companies will find this development trend and create an advantage in various industries, whether R&D and innovation play an important role in the development of companies, what the reaction of investors and customers is to innovative products, and how good or bad the trend of such companies is in the stock market. This paper will answer the above questions and help to clearly identify the relationship between R&D innovation and

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enterprise development. The paper also provides data and evidence for companies or new entrepreneurs in the development of innovative products and policies.

This paper compares the relevant high-tech development company and that of other industries. The proof such as asset load sheets, income, and expenditure status will be collected through data provided by the company. This paper also analyses the stock market situation of chip and new energy industries in different countries. By digging into the level of the development of high-tech industries in cities above the prefecture level to examine the advantages and impacts brought by R&D innovation, this paper enriches the proofs. Besides, the data collected in this paper helps companies to find a better direction in R&D innovation, especially for small and medium enterprises in the process of digitalization. A more adequate perspective is provided to entrepreneurial investors to help them to analyse and organise the industry market.

2. Analysis of Research Development and Innovation in BYD

Through the collection of information about the company, it is found that R&D innovation has advantages for the company. In the development of innovative technologies, the car company BYD has been gradually shedding fuel vehicles to invest in the business of electric and batteries. The scale of production of new energy vehicles has been expanded and several offline activities have been launched to support the consumption of new energy. BYD has set up a professional R&D team to update and upgrade its products, and it insists on promoting new energy vehicles with pure electric and plug-in hybrid power. BYD is also introducing more efficient vehicles to meet customer demand. Despite the impact of the COVID-19 epidemic and the downturn in the automotive industry in recent years, many companies are in a loss-making situation. However, BYD's revenue in the first half of 2022 was $390 million, an increase of $210 million over the same period of the previous year, due to technological updates in research and development [1]. In comparison to the development of many traditional companies, the high-tech industry is not prone to lose profits. This phenomenon shows that new products in R&D innovation can help companies to survive difficult times and create advantages for high-tech companies.

In the high-tech industry, electric vehicles and new energy vehicles have been widely concerned and developed among enterprises. BYD, as a giant company in the private automobile industry, is focusing more on research and development. As a car manufacturer of an independent Chinese brand, BYD has taken advantage of the technology accumulation of new energy vehicles to take a leading share of the market. In 2008, it became a long-term investment partner with BERKSHIRE HATHAWAY ENERGY, accounting for 7.86% of BYD Group's total shares. 79 million ordinary shares were issued to the public in 2011 [2]. The enterprise changed the company's production structure in 2022, stopping the production of fuel vehicles in March and focusing on helping the new energy vehicle industry. The 2022 half-yearly report of A-share shows that BYD increased its investment in technology research and development by $6.47 billion [3]. BYD has developed safer and higher energy-density batteries for use in electric vehicles. In 2022, when China's automotive industry has been hit hard, BYD's sales of new energy vehicles were around 2.65 million, achieving an increase of 1.2 times. Based on the development philosophy of technology as the king and innovation as the foundation, BYD has invested significantly in R&D innovation over a long term to ensure the safety and intelligence of its products. This has also enabled it to gain an advantage in the rapid and large-scale development of the new energy vehicle industry. In 2022, the market share of new energy vehicles rose by 24.7% in the first half of the year, becoming the global sales champion. Car sales have increased more than three times year-on-year, with a continuous increase in order intake and market recognition [1]. At the same time, the company's governance combines with national policies, and the external governance focuses more on the promotion of green travel advertising, responding to the needs of the new era and the way humans travel. BYD applies for 2,231

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patents in 2020, and BYD's electric vehicle industry chain fills the gap in China's small-capacity rail transportation technology and industry, providing an effective urban governance solution [4].

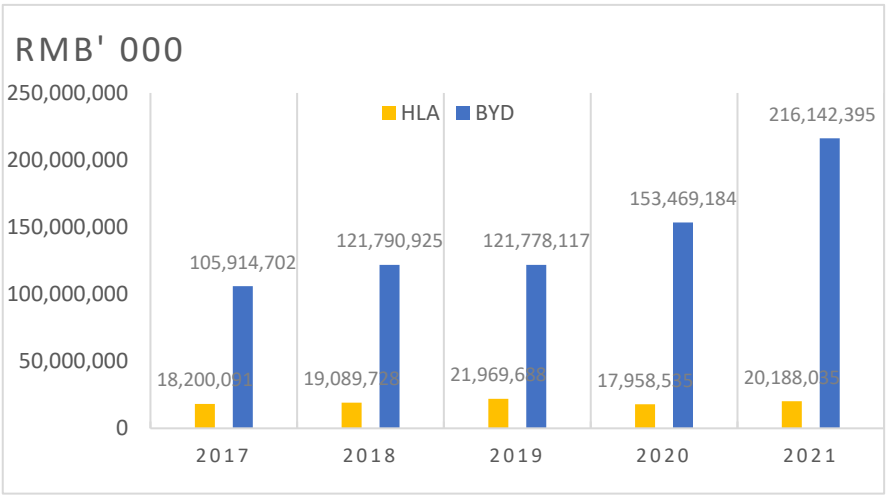


Figure 1: Profit comparison between BYD and HLA (Source: 2017~2021 BYD annual report and HLA annual report).

Figure 1 shows the amount of profits between BYD in the new energy vehicle high-tech industry and HLA in the traditional clothes industry from 2017 to 2021. During these 5 years, BYD's profitability has been on an upward trend. However, the amount of earnings of HLA has been trending down between 2019 and 2020, from $2.1 billion to $1.7 billion. The overall profitability is lower than the total value of the high-paying technology industry. 2019-2021 is a special period during the COVID-19 epidemic, due to which the overall world consumption decreases. However, in the daily consumption of food, clothing, traveling, and housing, BYD, as a new energy vehicle to solve people's travel problems, has always maintained increasing profitability.

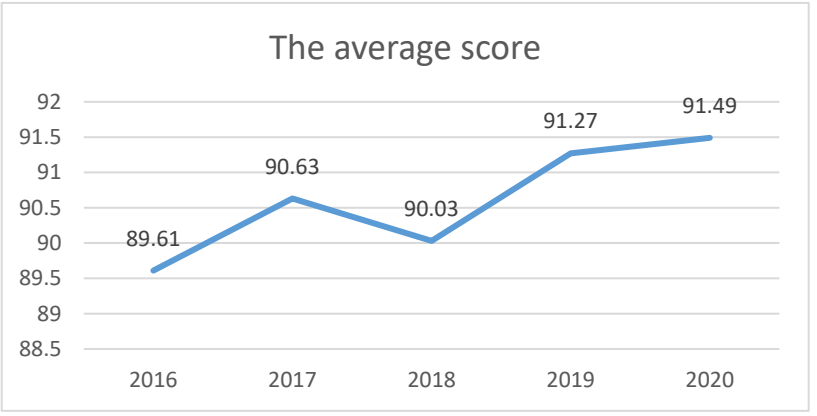


Figure 2: Customer satisfaction with the product after use (Source: BYD CRS Report).

Figure 2 shows the level of satisfaction of BYD customers after experiencing the new products developed. It can be found that BYD Sales Satisfaction Index is generally on an upward trend from 2016, from 89.61 to 91.49 points. Although it dropped to 90.03 between 2017 and 2018, it has since rebounded to 91.27. Previous studies have proven that customer satisfaction will generate high returns for companies and also influence capital flows to investors. The ability to combine product and capital markets will enable companies to obtain more business and investment capital [5]. This can enable firms to consistently outperform the market and thus make a profit.

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3. Analysis of Research Development and Innovation in Pfizer

For biopharmaceutical companies, innovation in research and development has contributed to the development of the company and has generated a lot of revenue for the company in the stock market. During the epidemic, the biopharmaceutical industry was able to generate substantial profits for a long period of time thanks to the development of medical devices and pharmaceutical products. In 2018, Pfizer added more than 180 new research and development collaborations. Pfizer has developed a state-of-the-art supercomputing centre that makes flexible use of digital technology to improve patient health. Large-scale simulations and databased analysis are conducted to predict the structure of COVID-19 oral drug candidates while improving the stability of the mRNA vaccine [6]. Pfizer made a large number of novel coronavirus vaccines and drugs in 2021, reaching an estimated 1.4 billion patients and increasing its net profit revenue by 12 million. In the same year, Pfizer also initiated 13 clinical studies and increased its investment in R&D innovation to 10.5 billion. Earnings per share increased from $3.85 to $4.42 during the year [7]. The Price/Earnings ratio to Growth (PEG) is 0.53. A PEG equal to 1 indicates that the stock's valuation adequately reflects its future growth performance; If the PEG is greater than 1, the stock is probably overvalued and should not be bought; when the PEG is less than 1, the market undervalues the stock and it is generally a suitable point to buy [8]. The estimated PEG for Pfizer since 2022 is 0.56, so it is a good option for investors. The net profit of Pfizer grows from 11 million in 2018 to 21million in 2021.

Figure 3 represents the amount of revenue of Pfizer between 2017 and 2021. The revenue drops significantly from 2019 to 2020 from 51.8 million to 41.9 million, but it then rises sharply to 81.3 million. It can be inferred that Pfizer is greatly impacted by the epidemic. In 2020, the company began to develop a vaccine against the novel coronavirus and upgraded its medical equipment. It also set up a dedicated R&D innovation team to study a wide range of diseases. The development of the vaccine is generating a huge amount of money for Pfizer. Reports suggest that the stock market is trending well for biopharmaceuticals. The biopharmaceutical industry has a long lifeline and biotech stocks can be stable in a volatile economic environment for the global sector, providing a safe haven for investors [9].

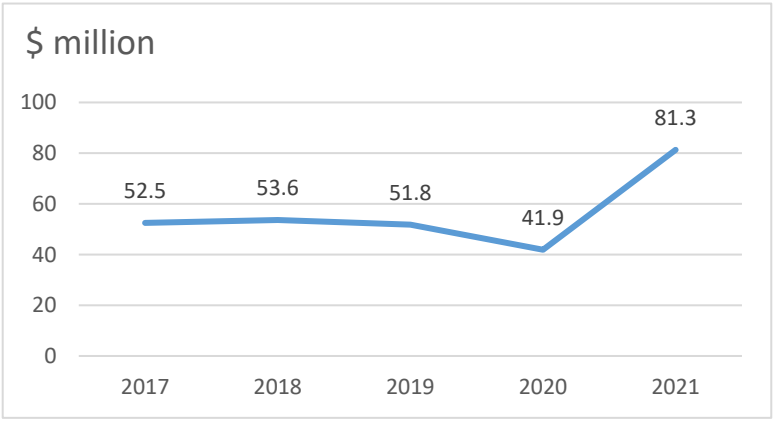


Figure 3: Pfizer's annual revenue (Source: Pfizer annual report).

Figure 4 represents an investment of $100 starting in 2017, reinvesting the company's dividend in the company's common stock. Compared to the S&P 500 index which is dominated by Europe and the US group of companies, it can be seen that the Pfizer group is in a slow decline between 2018 and 2020, but after 2020, there is a significant increase. In addition to the resumption of production, the development of new pharmaceutical products by Pfizer has also led to this significant increase.

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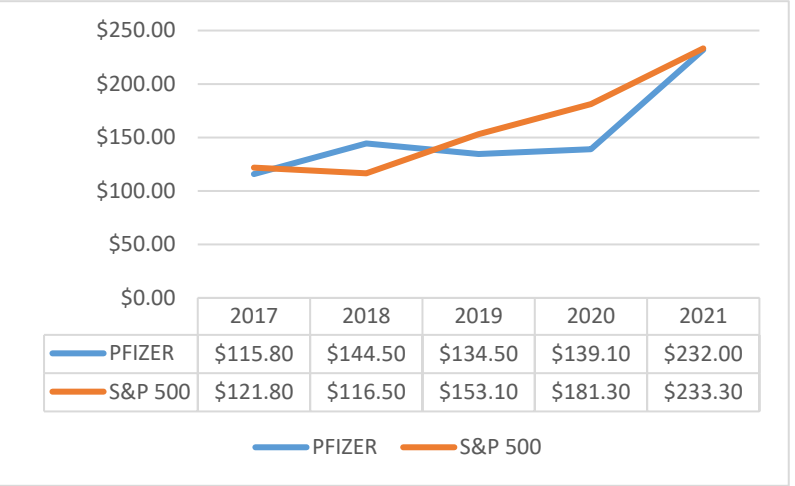


Figure 4: Chart of Pfizer and S&P 500 (Source: PFIZER PERFORMANCE DATA).

4. Suggestions for BYD and Pfizer

BYD may face the risk of having its property rights seized by its peers, high costs, and the bottleneck of not being able to get great breakthroughs in technology. Therefore, companies in the high-tech industry can strengthen their internal governance to raise their awareness of labour rights and educate their employees on intellectual property laws. In addition, companies can hire highly paid research professionals and provide them with a good working environment by subdividing each product group within the company. Companies can always collect and investigate the product preferences of investors and customers, and add personalised services and technologies for different groups of people with different needs to their research and development. This increases their competitiveness and market presence in the industry. When governing internally, companies can join forces with the government, adding financial input and policy assistance from government departments to increase publicity, thus reducing the cost of R&D and investing on a larger scale.

For Pfizer, the biggest competition in the market may be, on the one side, the pressure from peer-to-peer biopharmaceutical research and development, which needs to be constantly developed and therapeutically effective. On the other side, the same products may have been developed in other countries in global operations, which could result in the loss of a large number of foreign customers. To address these issues, Pfizer needs to accelerate its own research and development, as well as learning more about the social epidemic situation so that predictions can be done in advance according to the development and direction of the disease. In addition, there is a need for Pfizer to strengthen its legal understanding of intellectual property rights and patent more items to prevent the risk of information stealing or counterfeit goods marketing from other businesses. Companies can inform their audiences in advance of drug counterfeiting and enhance the use of logos or the uniqueness of pharmaceutical formulation. At the same time, Pfizer could initiate a takeover and merger program for small and medium enterprises in the pharmaceutical industry, reducing the number of multifaceted channels and allowing the flow of funds in a unique direction. Companies in the pharmaceutical industry could improve the reputation and customer satisfaction of the products used in their medicines, thus attracting more investors to invest in their projects.

5. Conclusion

This paper intends to examine what impacts R&D innovation has on companies and whether the impacts are all positive. From the analysis of the data of the individual companies, it is clear that

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R&D innovation can have a good revenue effect on the companies and can make the stock market have high expectations. In terms of limitations, this paper lacks the action of a separate survey on the market and uses few principles when conducting case studies, which may not be comprehensive enough in the analysis. Future studies can investigate how companies can improve their R&D innovation and how they can use it to improve their corporate governance and planning, as well as discussing what disadvantages high-tech industries have in the stock market and how companies should prevent the problems.

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A Study on the Marketing Strategy Development of Logistics Companies under COVID-19

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Abstract: Logistics involves the process of coordinating and moving resources – people, materials, inventory, and equipment from place to place. This paper focuses on the logistics market from the outbreak of COVID-19 to the present. The purpose of this research is to show logistics companies' perception of development and innovation during the COVID-19 pandemic. All findings were based on the data from specialised data research faculties and annual reports of logistics corporations, and a comparison of the company strategy applied before and during the pandemic was made. This helps to assess the companies from different aspects, such as challenges, preventive strategies, and future development. Yet, in the face of the pandemic, there was a lack of information on how logistics companies improve their business model. The results of this research suggest that the logistics company is severely impacted especially in the aviation industry, however, due to travel restrictions, companies are mainly focusing on the cargo transportation business.

Keywords: logistics, consumer habits, collaborative logistics, cold chain

1. Introduction

Logistics companies connect firms to markets by providing various services, including multimodal transportation, freight forwarding, warehousing, and inventory management [1]. During the COVID-19 pandemic, all kinds of transportation have been negatively affected. In this research paper, the strategies logistics companies implemented from the beginning of the pandemic to the time when the market gradually adapts are discussed, and the effects on the aviation industry are focused on.

The main motive of this research is to deliberate the reasons why logistics companies made such decisions to respond to the crisis. For example, what kind of efficient supply chain has the company built up, and how the company introduces the new effective logistical processes in order to reduce the costs while still maintaining company effectiveness. Meanwhile, this research also uncovers the additional advantages brought by the pandemic to logistics companies, such as a burst of demand in cold chain transportation, and analyses the logistics company from four different aspects, namely accessibility, shortage in transportation resources, changing in the demand, and rising in cost in logistics. Therefore, the significance of this research is to understand how logistics companies boost their competitiveness and change their marketing patterns.

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2. Threat and Opportunity the Logistics Company Faces under the Pandemic

2.1. Threat: Maintenance of Means of Transport

Firstly, one of the severe issues logistics companies face is the storage of means of conveyance, for example, vehicles, cargo ships, air crafts, etc.

As one of Hong Kong's flag carriers, Cathay Pacific offers passenger and cargo services to around 200 cities in Asia, Europe, North America, Africa, and Australia [2]. It has been trying to deal with the management of the rapid surge in the number of aircraft lying idle, which is caused by a decline in travel demand during the COVID-19 pandemic. As 70% of its aircraft were grounded during the outbreak of the pandemic, parking, protection, and reactivation of aircraft lying idle become the prime task.

The disbursement and costs of parking and maintenance of parked aircraft are just as much as they are for an aircraft that is flying. The loss of Cathay Pacific was US$2.79 billion in the 2020 calendar year [3]. According to Cathay Pacific Group Chairman Patrick Healy, Cathay Pacific was trying to achieve 25% of its 2019 capacity in the first six months of 2021 in operation [4]. Due to a sudden decrease in travel demands due to travel restrictions, the company decided to use long-term storage facilities in Spain and Australia. Companies needed to consider the environmental conditions of storing as the cost of maintenance and repair was considerable.

Therefore, Cathay Pacific started to pay attention to cargo transportation. “As has been the case for most of this year, our cargo business continues to be the better performer.” [5]. Figure 1 shows the traffic figures from 2020 to 2022.

CATHAY PACIFIC / CATHAY DRAGON COMBINED TRAFFIC		RPK(Revenue Passenger Kilometers)(000)	Passengers carried	Cargo and mail revenue tonne km (000)	Number of flights		RPK %Change	Passengers carried %Change	Cargo and mail revenue tonne km %Change	Number of flights %Change
	Oct 2020	210,168	38,541	709,964	1,347	Vs. OCT 2019	-98.00%	-98.60%	-30.20%	-80.10%
	Dec 2020	223,781	39,989	747,356	1,503	Vs. DEC 2019	-98.10%	-98.70%	-23.70%	-77.40%
	Jan 2021	152,055	30,410	669,496	1,258	Vs. JAN 2020	-98.70%	-99.00%	-21.70%	-81.10%
	Mar 2021	76,921	18,539	503,057	961	Vs. MAR 2020	-98.20%	-98.40%	-26.50%	-73.60%
	Apr 2021	105,830	22,404	393,333	840	Vs. APR 2020	32.60%	63.20%	-31.30%	-25.00%
	Jun 2021	233,940	40,651	661,906	1,352	Vs. JUN 2020	60.50%	50.00%	10.30%	21.80%
	Jul 2021	297,879	54,092	753,812	1,592	Vs. JUL 2020	22.60%	25.80%	17.80%	39.70%
	* AUG 2021	877,057	135,353	783,031	1,844	Vs. AUG 2020	294.10%	278.40%	20.70%	59.40%
	Sep 2021	780,461	131,774	823,088	1,996	Vs. SEP 2020	158.70%	180.00%	22.30%	55.60%
	Oct 2021	409,797	76,430	865,226	2,041	Vs. OCT 2020	95.00%	95.00%	21.00%	51.50%
	Nov 2021	393,162	70,047	858,515	2,106	Vs. NOV 2020	87.10%	85.20%	15.50%	42.40%
	Jan 2022	116,402	24,699	238,240	1,340	Vs. JAN 2021	-23.40%	-18.80%	-64.40%	6.60%
	Feb 2022	99,027	31,253	240,478	993	Vs. FEB 2021	5.20%	47.90%	-53.30%	3.60%
	Mar 2021	111,448	30,628	360,413	1,259	Vs. MAR 2021	44.90%	65.20%	-28.40%	31.10%

Figure 1: Cathay Pacific recovery in air travel.

*RPK (revenue passenger kilometers) measures the air traffic for airbus and aircraft using the formula: RPK or RPM = P*D where P is the total of revenue paying passengers and D is the distance traveled in kilometers.

**Cargo tonne-kilometres means the product obtained by multiplying the number of tonnes of revenue load carried on each flight stage by the stage distance flown measured in kilometres.

Figure 1 demonstrates the recovery in air travel and cargo transportation. However, when comparing the percentage change of Revenue Passenger Kilometers (RPK) with cargo revenue, it can be seen that although there was a decrease in cargo revenue, the influence due to travel restrictions on cargo was much smaller than on passengers traveling. The market was most severely impacted by the implementation of travel restrictions in the fourth quarter of 2020 and the first quarter of 2021.

2.2. Opportunity: An Increase in the Revenue from Cargo Transportation

The strict crew quarantine rules in Hong Kong limited overall cargo capacity, resulting in a 39.4% year-over-year decrease in capacity in March 2021. This happened in spite of the efforts to increase the number of cargo-only passenger flights and contracted freighter flights out of the subsidiary. Figure 2 demonstrates the changes in cargo and freight transportation.

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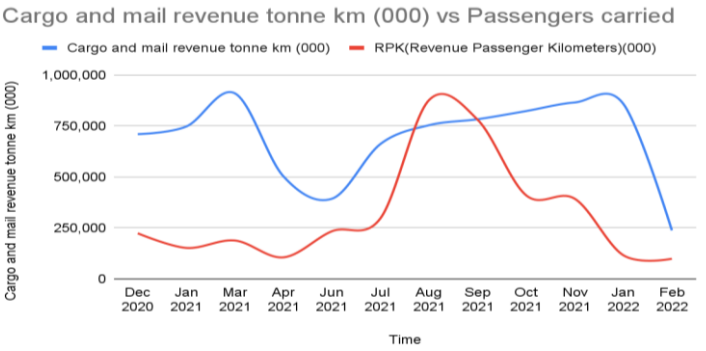


Figure 2: Cargo & mail & passenger flight.

The strategy of most logistics companies was to focus on cargo transportation due to fewer travel restrictions. In March 2021, the demand for cargo on Cathay Pacific was boosted due to the reduction in the length of the quarantine for crew members. Nevertheless, for the next few months, as shown in Figure 2, the capacity for cargo and mail remained significantly affected due to the difficulty in crew rostering lead time. The number of regularly operating cargo-only passenger flights and freighters was at the lowest level since the pandemic started. The situation started turning good after April because of increasing demand of COVID-19 vaccines. There were around 15 million vaccines being shipped by Cathay Pacific around the world. Thanks to the reduction in costs and strong cargo demand, airlines earned 79% of revenue from cargo transportation in 2021 [5].

3. Marketing Strategy Development under the Pandemic

3.1. Vaccine Transport

Since the beginning of 2021, when the promotion of vaccination started to overwhelm, the transportation of vaccines has been a challenge for logistic companies. The shipping of billions of COVID-19 vaccines around the world is being more and more difficult. Logistics companies such as DHL, FedEx, and UPS were working on distribution plans in the USA. As a consequence of observed spikes in demand for related medical and healthcare goods, companies started to focus on using all capabilities to speed up the delivery of these vital shipments.

Until December 2021, UPS, which is a logistics company offering international packages and freight transportation, surpassed one billion COVID-19 vaccine doses, since it is one of the logistic companies that are responsible for the Pfizer-BioNTech corporation's COVID-19 vaccine delivery.

The UPS network not only assisted healthcare businesses and international organizations but also participated in public-private partnerships to distribute vaccines by using the cold chain to remote areas. In order to achieve this, UPS Healthcare identified around 500 trade channels to facilitate international vaccination shipments. To accomplish this, UPS had to implement ultra-cold freeze to facilitate equitable distribution, as well as UPS Healthcare subsidiary - Marken, which UPS acquired in 2016. It played an important role since it was involved in nearly all vaccines and treatments in development today. Aviation companies, like Cathay Pacific, decided to load temperature-sensitive cargo [6]. This strategy has helped them to maintain their cargo services. Despite the fact that some of the passenger flights were grounded, this really gives them opportunities to boost and expand because passenger planes and their pilots are able to transport vaccines to regions of the world.

Along with the demand for vaccine transportation, technology innovation in each logistics company becomes the "centrepiece." Cold chain transportation became mainstream transportation during the pandemic. The cold chain refers to the transportation of temperature-sensitive products

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along a supply chain through thermal and refrigerated packaging methods and the logistical planning to protect the integrity of these shipments.

3.2. Grocery and Food Delivery

With the consumption upgrade and the new retail innovation model opening up online and offline, the consumption scenarios will be more multiple.

Therefore, not only during the transportation of vaccines but also during COVID-19 lockdowns, grocery and food deliveries have become a necessity. Waitrose, one of the major grocery stores in the UK, has developed a delivery business due to a change in customer shopping behaviour. More customers are relying on online ordering instead of going to the shop by themselves. In early 2022, Waitrose collaborated with Deliveroo, which is an online food delivery company. "It is important that we continue to evolve along with shopping behaviour to give our customers more options for how and when they want to shop with us." [7].

Being this case, logistics companies are trying to make collaborations or making acquisitions with companies that need a large amount of delivery service, which helps them in expanding their services.

3.3. Talent and Technology Management

Along with the cancellation of quarantine rules and safety measures in most countries, logistics companies no longer depend on vaccine transportation only but also on the construction of a highly synergistic and sustainable supply chain [8]. This will then lead to an increase in fitter, mechanic and technician roles, and staff gross pay in the future. However, due to the high demand in advanced technology, the use of automated and connected technology is expected to grow.

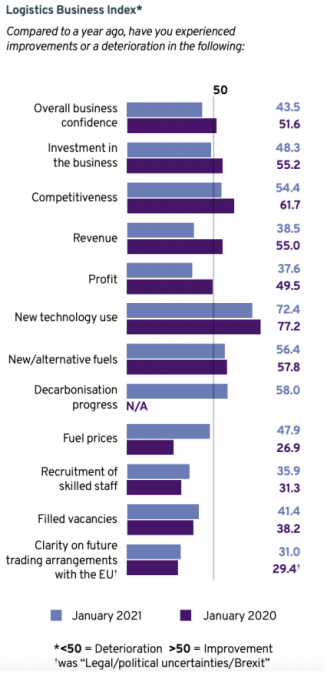


Figure 3: Change in logistics business (Source: Logistics UK Industry Survey 2020/21).

4. Conclusion

The findings in this paper show that the COVID-19 epidemic has significantly impacted the logistics industry as a result of travel restrictions, a national lockdown, and safety measures that slowed down

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the shipment process. However, when vaccine production increased, logistics companies began to take steps in that direction, such as applying for medical licenses that allow them to transport vaccines and deliver other healthcare items, to help them achieve the expansion before the competitive market was saturated [9]. Along with the pandemic is the return to normal. The logistics market will still obtain many opportunities as people gradually realise the importance of logistics. Also, with the government supporting policy, leading logistics companies with strong network operation capabilities, leading digital capabilities, and good service quality are expected to benefit from policy benefits [10].

Moreover, due to the rapid development of the logistics industry, there are many small and irregular companies that may cause market disruption [11]. However, along with the development, most small companies will choose to make alliances and cooperation. Thus, more valuable competition will then occur, and the differentiated layout of products and the improvement of service quality will be the main characteristics that consumers need.

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Arbitrage Strategy Based on DHS Pricing Model

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Abstract: The Daniel-Hirshleifer-Sun (DHS) is a three-factor model based on the investor's psychology. It supplements the market factors of the CAPM model with two behavioral factors that capture commonalities in mispricing resulting from psychological biases. The DHS method focuses on two psychological biases affecting asset prices: overconfidence and limited attention. According to Daniel, Hirshleifer, and Sun, overconfidence in the investor tends to induce commonality in long-horizon mispricing.In contrast, the inattention of the investor tends to induce commonality in short-horizon mispricing. In this strategy, assets are priced according to the DHS model, and the unexplained return generated from this model is traded. According to the back-test, the explanation power of the DHS model is limited in Chinses market. As a result, the arbitrage strategy based on this model cannot generate a decent return in the long run. However, this strategy generates a significant positive return in turbulent market conditions. During these periods, investors tend to panic, and their psychology is especially unstable, so the two behavioral factors can explain the return efficiently.

Keywords: Daniel-Hirshleifer-Sun three-factor model, arbitrage strategy, Shanghai and Shenzhen stock market

1. Introduction

1.1. Idea

This paper examines a multi-factor stock selection arbitrage strategy using the Daniel-Hirshleifer-Sun three-factor model (DHS model), which is based on CAPM and considers investors' psychology. Daniel, K. D., D. A. Hirshleifer, and L. Sun released the model in 2020 [1].

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1.2. Highlight

1.2.1. Economic Intuition

Two cognitive biases of the investor, overconfidence and limited attention, can be a reason for mis-pricing. Irrational investors are often overconfident, resulting in an insufficient response to listed companies' issuance and repurchase behavior. Besides, a large body of empirical evidence shows that stocks of companies that generate positive earnings surprises can earn higher returns in the following six to nine months compared to others with negative earnings surprises [1]. The underlying reason is that investors underreact to the latest earnings updates due to their limited attention. We will explore the Daniel-Hirshleifer-Sun multiple-factor model in this paper. Two factors, FIN and PEAD, are used to measure the bias. The two factors and the MKT factor compose the DHS model. Daily returns of the individual asset are regressed on MKT, FIN, and PEAD factors, and expected returns are then calculated. This pricing model works well in the US market. If it works well in the Chinese market, profit could be obtained from the mispricing of each asset.

1.2.2. Signal Generation

DHS model trading strategy will make regression-based FIN, PEAD, and MKT. MKT is excess return on the market portfolio. FIN captures investors' overconfident bias, and PEAD is the post-earnings announcement drift factor that captures limited investor attention [1]. Suppose the DHS model can sufficiently explain Shanghai and Shenzhen markets, as in the US market. In that case, there is no significant epsilon, stock return minus the projected return from the DHS model, in the market. Therefore, the assets with negative or positive epsilon are supposed to be mispriced. If the asset's epsilon is negatively significant, showing the asset is underpriced, we will remain the asset long. If epsilon is positively significant, showing an overpriced asset, we will short the asset.

1.2.3. Portfolio Construction

Assets are all traded in Shanghai and Shenzhen stock markets. The portfolio is rebalanced daily, and the last 20% of stocks with the most negative signal are purchased. Considering that the Chinese market has stringent regulations on short-selling and insufficient securities lending capacity, this strategy does not consider profit or loss generated from short-selling. Signal weighting will be applied for portfolio construction.

1.3. Performance Estimate

Our strategy is relatively new and has not been tested in the Chinese market. Results from testing on other similar strategies and the DHS model result based on the US market serve as performance estimations. The mere difference between Fama-French three-factor model (FF model) and the DHS model is that the DHS model uses FIN and PEAD instead of SMB (small minus big) and HML (high minus low) in the FF model. The methods used in the FF regression model and trading on epsilon are approximately the same as the DHS model.

According to Blanco [2], there is empirical evidence in favor of the Fame-French three-factor model. For example, Hu, Chen, Shao, and Wang (2019), tested the Fama-French model in the Chinese market, using data from 1995 to 2016, and got an average return of 1.23% [3]. It is also estimated that the DHS composite model outperforms the profitability-based model of Novy-Marx (2013), the five-factor model of Fama and French (2015), the q-factor model of Hou, Xue, and Zhang (2015), and the mispricing model of Stambaugh and Yuan (2017) in explaining the 34 anomalies in the US

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market [1]. A study conducted by Lian, Liu, and Shi (2021) on measuring the overreaction and underreaction quantitatively to asset pricing in China stock market shows a maximum annual sharpe ratio of 2.02 [4].

1.4. Final Result

The performance of the DHS model has been invalid in the Shanghai and Shenzhen stock markets in recent times. The DHS model can merely explain 40% of the overall market condition. The model has limited explanatory power for the market, so the arbitrage strategy cannot generate a decent return and an ideal Sharpe ratio in the long term. According to the back-test, the Sharpe ratio attained in the Chinese market from 2008-2018 is only around **0.01964**. However, this strategy works effectively during turbulent market conditions, when the psychology of investors during these periods is especially unstable, so timing is a crucial part of this strategy.

2. Specification

2.1. Analysis

2.1.1. Qualitative Analysis

The DHS model is a three-factor model based on the investor's psychology. It supplements the market factors of the CAPM model with two behavioral factors that capture commonalities in mispricing using psychological biases. The DHS method focuses on two psychological biases affecting asset prices: overconfidence and limited attention. Overconfidence in the investor tends to induce commonality in long-horizon mispricing, while the inattention of the investor tends to induce commonality in short-horizon mispricing. The economic intuition behind the Long Horizon Financing Factor is that the investor's overconfidence, which results in an insufficient response to the issuance and repurchase behaviors of listed companies, will induce commonality in longer horizon mispricing [1]. Investors can take advantage of this mispricing by predicting it and positioning our portfolio accordingly. The long-horizon financing factor exploits the information in the manager's decision to issue or repurchase equity in response to persistent mispricing. The Long-Horizon Financing Factor, FIN, reflects returns associated with mispricing that generally happen in a time horizon greater than one year [1]. The Financing Factor is based on actions that increase issuance measures, such as seasoned issues or equity-financed acquisitions.

The economic intuition behind the Short Horizon Financing Factor, PEAD, is that the investor's limited attention makes them underreact to the latest earning updates, resulting in mispricing. The short-horizon earning surprise factor is motivated by the investor's inattention and evidence of short-term underreaction, which captures short-horizon mispricing [1]. The Post-Earning Announcement Drift Factor, or PEAD, reflects returns associated with mispricing that generally happen in a time horizon that is less than one year.

2.2. Quantitative Analysis

The overall explanation power is measured by R square and adjusted R square. The daily, annual, cumulative, and Sharpe ratios are calculated to measure performance and profitability. The strategy's risks will be estimated by evaluating volatility, higher moments, tail, and drawdown. Skewness and kurtosis are measured for return distribution. The return of the Shanghai composite index serves as a benchmark. The mean and standard deviation of the regression will be used to discover whether the model is predictable. Finally, we will conduct a t-test on return, FIN, and PEAD, respectively, to test their significance.

DOI: 10.54254/2754-1169/17/20231064

3. Data

3.1. Universe

The universe of our strategy includes all the stocks listed in Shanghai and Shenzhen stock markets. The number is according to the last trading day of last year. Then, when we use Tushare to get the stock price, we can get the tradable variety for each year.

The reason for our universe choice is that Shanghai and Shenzhen stock markets are China's largest capital markets, with a wealth of trading varieties. There are nearly 4,893 stocks that can be traded since 1990. In addition, the Shanghai and Shenzhen stock markets have become more mature in recent years. Many overseas index companies are selecting stocks on the Shanghai and Shenzhen stock markets to build index portfolios, such as the MSCI A50 index and the FTSE China A50 index. Finally, stock index futures in Shanghai and Shenzhen markets are becoming more and more abundant to help investors hedge.

3.2. Data Sets

a. ROE: We get ROE to calculate one-year net share issuance (NSI) and five-year composite share issuance (CSI). Then we can calculate FIN, which is the average of one-year net-share-issuance and five-year composite-share-issuance in the log.

b. Financial Disclosure date: We get this data to calculate PEAD, which is the cumulative excess rate of return relative to the market, measured by taking a cumulative excess rate of return during two trading days before the disclosure date of the latest financial report of the listed company to one trading day after disclosure.

c. Shanghai Composite Index: We use the Shanghai Composite Index as a benchmark to calculate the information ratio, beta, and other statistics to judge the strategy's effectiveness. If hedging is needed, we need to collect the price of Shanghai 50 stock index futures (IH) or CSI 300 stock index futures (IF).

d. Adjusted daily return: We use the stock price to calculate the return, construct the portfolio and rebalance it.

e. Risk-free return: SHIBOR rate

f. Repurchase scale and issuance scale: We use the scale of repo and issuance to calculate NSI.

3.3. Data Sources

a. China Stock Market & Accounting Research Database (CSMAR)

b. CSMAR

c. Tushare in Python

d. Tushare in Python

e. CSMAR

3.4. Data Range

1/1/2008 – 6/30/2018

IS: 1/1/2008 – 12/31/2018

We chose this decade because we believe it contains bull and bear markets and presents a variety of market conditions. These include the GFC, the 2015 stock market crash in Shanghai and Shenzhen, and the 2009 and 2014 bull markets. This data will be used to optimize the parameters.

OOS: 1/1/2019 – 6/30/2022

DOI: 10.54254/2754-1169/17/20231064

The data is new enough that it is close to the current state of the market. This ensures the timeliness of our research, and this data will be used to evaluate the profitability of the optimized model.

3.5. Strategy Detail

3.5.1. Signal Generation

The general idea of our strategy is that motivated by the DHS model (2020), we try to long assets with significant negative epsilon and short the assets with significant positive epsilon. The reasons are as follows:

a. Daniel-Hirshleifer-Sun multiple-factor model is a sufficient asset pricing model where PEAD and FIN factors can generate excess returns that other models cannot explain.

b. The three-factor model proposed by DHS can explain most factors in other models.

c. Generally, Daniel-Hirshleifer-Sun multiple-factor model serves as an advanced asset pricing model.

We construct the financing factor (FIN) based on the 1-year net share issuance (NSI) and 5-year composite share issuance (CSI). We assign firms to one of the two size groups (small "S" and big "B") based on whether that firm's market equity is below or above the Shang Hai and Shen Zhen exchange market median size breakpoint. Independently, we sort firms into one of the three financing groups (low "L," middle "M," or high "H") based on 1-year NSI and 5-year CSI, respectively. The three financing groups are created based on an NSI and CSI rankings index. Specifically, we first sort firms into three CSI groups (low, middle, or high) using 20% and 80% breakpoints. Six portfolios (SL1, SM1, SH1, BL1, BM1, and BH1) are formed based on the intersections of size and financing groups; each year, the value-weighted portfolio is constructed. The FIN factor return is calculated as the average daily return of the low financing portfolios (SL1 and BL1) minus the average daily return of the high financing portfolios (SH1 and BH1), that is,

$$FIN = \frac{r_{SL1}+r_{BL1}}{2} - \frac{r_{SH1}+r_{BH1}}{2} \quad (1)$$

FIN factor return is calculated daily.

PEAD is the post-earnings announcement drift factor intended to capture limited investor attention. It is again constructed in the fashion of Fama and French (1993). Following Chan, Jegadeesh, and Lakonishok (1996), the factor is measured as the 4-day cumulative abnormal return (CAR) around the most recent quarterly earnings announcement date, which is the return of 2 days before and one day after[1]. We first assign firms to one of two size groups (small “S” or big “B”) based on whether that firm’s market equity at the end of the month is below or above the Shanghai and Shenzhen exchange market median size breakpoint. Each stock is also independently sorted into one of three earnings surprise groups (low “L,” middle “M,” or high “H”) based on Cari at the end of month $t-1$, using 20% and 80% breakpoints. Six portfolios (SL2, SM2, SH2, BL2, BM2, and BH2) are formed based on the intersections of the two groups, and a value-weighted portfolio is constructed each month. The PEAD factor return is then the average daily return of the high earnings surprise portfolios (SH2 and BH2) minus the average daily return of the low earnings surprise portfolios (SL2 and BL2), that is,

$$PEAD = \frac{r_{SH2}+r_{BH2}}{2} - \frac{r_{SL2}+r_{BL2}}{2} \quad (2)$$

PEAD factor is calculated daily.

DOI: 10.54254/2754-1169/17/20231064

We use 30-day rolling regression to regress the return of each asset on market factors MKT, FIN, and PEAD. The betas constantly generated from the previous 30 days are considered as the parameters on the current day. Then expected return is calculated as

$$E[R_{t,i}] = \beta_{[t-30,t-1],i} MKT_i + s_{[t-30,t-1],i} FIN_i + h_{[t-30,t-1],i} PEAD_i + \alpha_{[t-30,t-1],i} \quad (3)$$

The Epsilon is calculated as return minus expected return. If the Epsilon is negatively significant, we long. If Epsilon is positively significant, we are short. After regression of each asset on the three factors, we will get the formulas for each asset on each factor, where β, s, and h capture security's sensitivity to these three factors:

$$R_{t.i} = E[R_{t.i}] + e_{t.i} \quad (4)$$

($R_{t,i}$ = real return of each asset in the market, $e_{t,i}$ = error terms)

The asset's abnormal return, which indicates the difference between the expected return from the DHS model and real return in the market, should equal 0 under the hypothesized DHS pricing model if the asset is correctly priced. Otherwise, there are opportunities for profits from mispricing in the market. We use the average epsilon five days before trading day t as our signal and divide assets into five groups equally. (1-smallest epsilon, 5-biggest epsilon). We will short the assets in group five with significant positive epsilon and long the assets in group one with significant negative epsilon.

$$Signal = (e_{t-5,i} + e_{t-4,i} + e_{t-3,i} + e_{t-2,i} + e_{t-1,i})/5 \quad (5)$$

3.5.2. Portfolio Construction

Timing: According to Daniel, Hirshleifer, and Sun (2020), long-term mispricing will take a few years to correct, while short-term will take a few quarters [6]. Nevertheless, the return of each stock changes daily. The MKT, FIN, and PEAD are generated based on the daily return. Our regression and signal will thus be influenced and change daily. Therefore, we will rebalance our portfolio daily to capture the mispricing accurately.

Sizing: To increase the diversification and maximize the returns from two factors, we will long the last 20% of stocks with the slightest signal. We will trade the equities with signals calculated by epsilon in Shanghai and Shenzhen markets and use signal weighting to construct our portfolios as the signal indicating the extent of mispricing, thus leading to potential profits. We need to subtract each signal with its median to generate the signal used for portfolio construction.

Hedging & Money management: As all our assets in the portfolio are in Shanghai and Shenzhen stock markets, we need to consider market risks. To protect against downside risk in the event of any external disruptions, it would be better to short CSI 300 index future to avoid market risks.

3.5.3. Trade Execution

The Transaction Costs of the DHS strategy will include the bid-ask spread, possible slippage, latency costs, and a variety of fee costs.

Cai (2004) estimated that the Bid-Ask Spread for Shanghai A averages approximately 0.031 yuan, around 0.269 percent, while the bid-ask spread for Shenzhen A averages approximately 0.026 yuan, which is about 0.263 percent [6]. The bid-ask spread for the Shanghai A stock market is taken from an average of 492 Shanghai A stocks, while the bid-ask spread for the Shenzhen A stocks is taken from an average of 327 stocks. The percentage spread is calculated as [100*(Askit-Bidit)/Midit], where Midit is the midpoint of the bid (Bidit) and ask (Askit) quotes at the time of the transaction.

DOI: 10.54254/2754-1169/17/20231064

The borrowing fee for shorting stocks ranges from 0.3 to 3 percent. Therefore, we use 0.031 yuan as the bid-ask spread and 0.3 percent as the borrowing fee.

Slippage is also a possible transaction cost when investing in a low-cap firm since the firms listed in the Chinese stock market are generally lower in capital than the American stock markets. Latency costs will also be involved for the assets that got their signals from the short-horizon PEAD, especially for firms with low liquidity. As our trading volume is relatively low, we assume the slippage and latency cost to be 0 in the following implementation.

The Fee Costs of the order will involve the Chinese mainland taxes, Shanghai or Shenzhen exchange venue fees, and broker fees. The tax on capital gains is generally taxed at 20 percent. However, capital gains derived from Shanghai or Shenzhen stock exchanges are entitled to a 50 percent or even 100 percent tax reduction depending on the holding period. The venue fee for the Shanghai Exchange for A shares is 0.0049 percent of the trading value.

3.6. Development

3.6.1. Implementation

PnL Time Series.

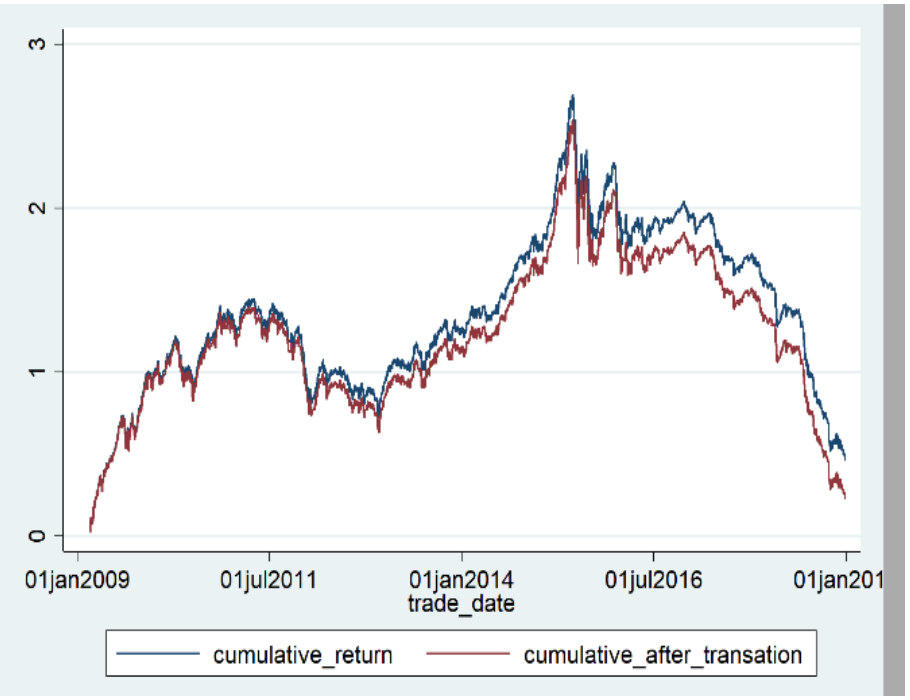


Figure 1: The cumulative return and cumulative return after transaction fee of the portfolio from 2009 to 2018.

DOI: 10.54254/2754-1169/17/20231064

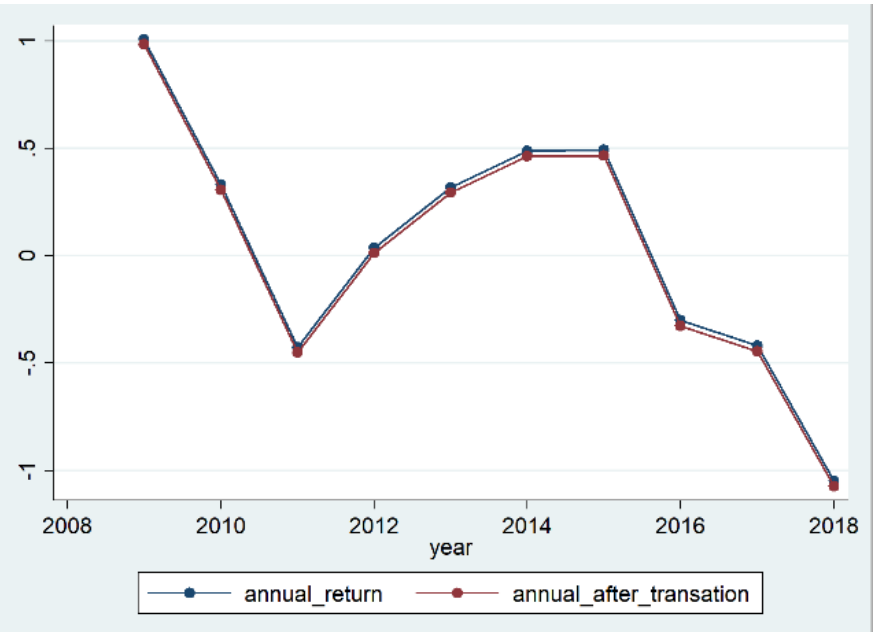


Figure 2: The annual return and annual return after transaction fee of the portfolio from 2009 to 2018.

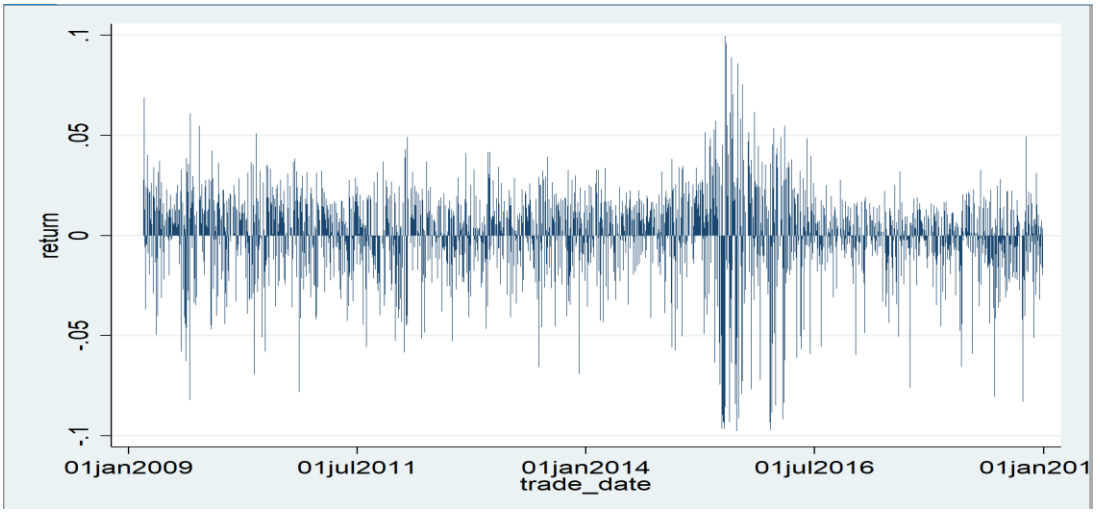


Figure 3: The portfolio returns of the daily bar chart from 2009 to 2018.

By the backtest, the cumulative return swells from 2009 to 2011 and slightly drops from 2011 to 2012. Then it began a steady climb toward its peak in 2015. A decline followed from 2016 to 2018. The bar chart of daily return clearly shows that the daily return fluctuates wildly and the extreme value achieved during 2015-2016. From the diagram of annual returns, it can be safely concluded that there were significant positive annual returns in 2009, 2014, and 2015.

The reason for large profits lies in the financial crisis in 2008 and the Chinese stock market turbulence that occurred from 2015 to 2016 with the stock market bubble popping. Enthusiastic individual investors created the stock market bubble by making massive stock purchases and borrowing funds faster than the economic development and returns of the firms they bought. As stated by Daniel, Hirshleifer, and Sun (2020), the model supplements the market factor with behavioral factors, acquiring mispricing with psychological biases, which is likely to be affected by overconfidence and limited attention [6]. The psychology of investors during these periods is especially unstable, leading to more

DOI: 10.54254/2754-1169/17/20231064

significant loadings on psychological factors and higher price fluctuations from overconfidence and limited attention. Consequently, our strategy is more profitable during these periods.

Table 1: The return summary of the portfolio.

RETURN SUMMARY (1)							
MEAN	Std. Dev.	Min	Max	Skewness	Kurtosis	Sharpe ratio	Annual-ized return
0.0001968	0.0214415	-0.0976847	0.099527	-0.8270534	6.64368	0.01964	0.0306

Table 2: The daily return summary of the portfolio.

Daily Return Summary (2)		
	Percentiles	Smallest
1%	-0.0767627	-0.0976847
5%	-0.0368519	-0.097151
10%	-0.0245652	-0.0967552
25%	-0.0087182	-0.0964489
50%	0.0024536	
75%	0.0125372	0.0888452
90%	0.0218617	0.0961361
95%	0.0285914	0.0989118
99%	0.0492646	0.099527

The distribution of return has a positive mean of around 0.02%. The skewness and kurtosis show that the return data are skewed left and have a "heavy-tailed" distribution. It could also be concluded from the return summary table (2), showing a median return of 0.24536%. The standard deviation in the table is the daily return standard deviation, and the annualized return standard deviation is 0.34037. We also annualized the cumulative return to calcite the Sharpe ratio.

```
. ttest return=0

One-sample t test

Variable |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
  return |   3,280    .0000744    .0003549    .0203274   -.0006215    .0007704

    mean = mean(return)                                     t =   0.2098
Ho: mean = 0                                 degrees of freedom =     3279

    Ha: mean < 0                 Ha: mean != 0                 Ha: mean > 0
 Pr(T < t) = 0.5831         Pr(|T| > |t|) = 0.8339          Pr(T > t) = 0.4169
```

Figure 4: The t-test conducted on daily return.

According to the t-test conducted on daily return, there is not enough evidence to reject the hypothesis that the daily return differs from zero. Moreover, our portfolio obtains a Sharpe ratio of merely 0.0196. All the statistics show that the profitability of this strategy is limited.

DOI: 10.54254/2754-1169/17/20231064

Table 3: The regression summary of the portfolio.

Regression Summary (1)					
	Obs	**Mean**	**Std. Dev.**	**Min**	**Max**
Reg_r^2	9,036,809	0.4097615	0.2128085	7.77e-06	0.9816026
Adj_reg_ r^2	9,036,809	0.3416571	0.2373633	-0.1153759	0.9794798

Table 4: The regression summary of the portfolio in two factors, FIN and PEAD.

Variable	**Mean**	**Std. Err.**	**Std. Dev.**	**95% confidence interval**	**t value**
FIN	0.0002155	0.000055	0.0031399	[0.000108, 0.000323]	3.9305
PEAD	0.0014338	0.00011	0.006297	[0.001218, 0.001649]	13.0396

Based on the regression and t-test of two factors, the DHS model has a relatively reasonable explanation of stock return as the mean of r^2 is around 0.4 without more specific factors such as industry or company performance. Some stocks even got an r^2 of 0.98, which is a perfect return projection. Besides, the t-test summary indicates that both FIN and PEAD factors can generate a significant return in the Chinese market, which indicates a promising direction for the further study of the DHS model.

```
. ttest FIN=0

One-sample t test

Variable |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
     FIN |   3,280    .0002155    .0000548    .0031399    .000108     .000323

    mean = mean(FIN)                                          t =  3.9305
Ho: mean = 0                                  degrees of freedom =    3279

    Ha: mean < 0                 Ha: mean != 0                 Ha: mean > 0
 Pr(T < t) = 1.0000         Pr(|T| > |t|) = 0.0001          Pr(T > t) = 0.0000

. ttest PEAD=0

One-sample t test

Variable |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
    PEAD |   3,280    .0014338     .00011    .0062973    .0012182    .0016494

    mean = mean(PEAD)                                         t = 13.0396
Ho: mean = 0                                  degrees of freedom =    3279

    Ha: mean < 0                 Ha: mean != 0                 Ha: mean > 0
 Pr(T < t) = 1.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 0.0000
```

Figure 5: The t-test of two factors, FIN and PEAD.

3.7. Difference from Estimations

Our strategy acquired a positive cumulative return from 2008 to 2018 and highly high returns during periods when investors are emotionally unstable. Thus, psychological factors influence more on stock returns more, and more opportunities are created. The previous strategy was tested in the US market and had a quiet, pleasant result in explaining the stock returns by Daniel, Hirshleifer, and Sun [7]. However, the market situation in the US and different from that in China. Our strategy has not been tested on the Chinese market, and no specific expected return data could be found. Therefore, we use another multi-factor stock-choosing model as a reference. As examined by Hu, Chen, Shao, and Wang (2019) tested the Fama-French model in the Chinese market, using data from 1995 to 2016 and a

DOI: 10.54254/2754-1169/17/20231064

similar trading approach except for various factors [3]. Their portfolio got an average return of 1.23%. Our portfolio obtains an average annual return of 3.06%.

According to Guo, Kun, Sun, and Qian, Investor sentiments shown by traditional exchange indicator, investigation data and internet data may be essential in stock market investment [8]. However, the lack of a short-selling mechanism, the disposal effect, and the hype preference of individual stock investors for good news may be additional considerations when trading on the DHS strategy [9].

4. Refinement

We believe that the strategy can be restored to good performance in recent times by adjusting the parameters' size and using options to hedge.

First off, we will change the window of the composite share issuance (CSI) to calculate FIN. We are now constructing the FIN based on the 1-year net share issuance (NSI) and 5-year composite share issuance (CSI). However, we do not think 5-year composite share issuance is sensitive to the market. Five years are too long for FIN to respond well to the market, so we will narrow the window for CSI to calculate the FIN. We will use 2-year CSI instead of 5-year CSI because we think 2-year CSI can better reflect the market than 5-year CSI.

4.1. Implementation

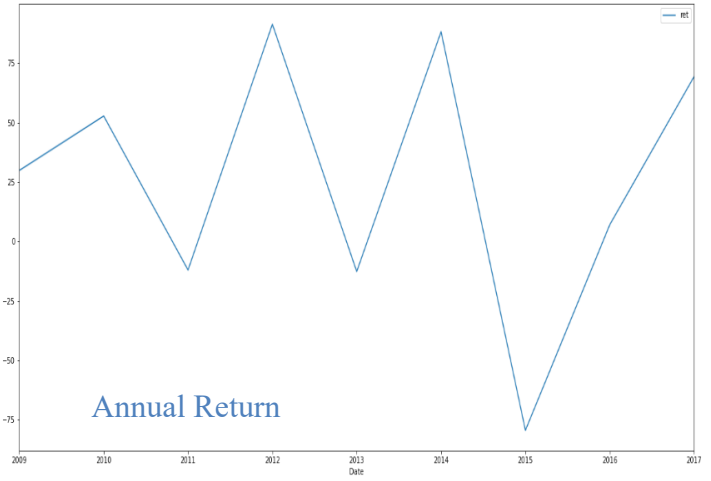


Figure 6: The annual return of the refined portfolio.



Figure 7: The cumulative daily return of the refined portfolio.

DOI: 10.54254/2754-1169/17/20231064

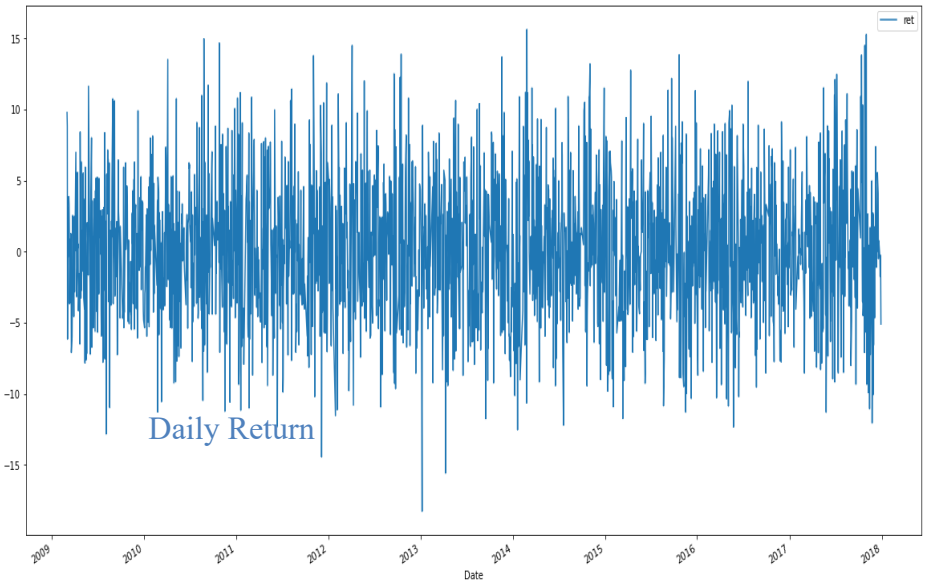


Figure 8: The return in the daily bar chart of the refined portfolio.

The above chart results from the back-test after using a 2-year CSI instead of a 5-year CSI. P.4 is the annual return. P.5 is the cumulative daily return. P.6 is a daily return. All numbers are presented in percentages.

By the backtest, the modified strategy has generally performed well, generating higher returns over ten years than the original strategy. However, there was still a massive pullback in the crash of 2015.

Table5: The return summary of the refined portfolio.

Return Summary						
Mean	**Std. Dev.**	**Min**	**Max**	**Skewness**	**Kurtosis**	**Sharpe ratio**
0.00108958	0.0494985	-0.182721	0.156378	0.109109	-0.04741	1.14969

The distribution of return has a positive mean of around 0.1089%. By the skewness and kurtosis, it can be found that the return data are skewed right and platykurtic. Sharpe's ratio also exceeds the original model. This shows that the strategy is more effective in the Shanghai and Shenzhen stock markets after modification.

4.2. Conclusion

4.2.1. Final Selection

Comparing the modified model with the original model, we find that the modified model performs better and can obtain more significant profits. 1.1 points optimized the Sharpe ratio. Therefore, we choose to use the modified model whose window of CSI is two years for an out-of-sample back-test.

DOI: 10.54254/2754-1169/17/20231064

4.2.2. Out-of-sample Back-test



Figure 9: The annual return of the modified portfolio (out of sample).

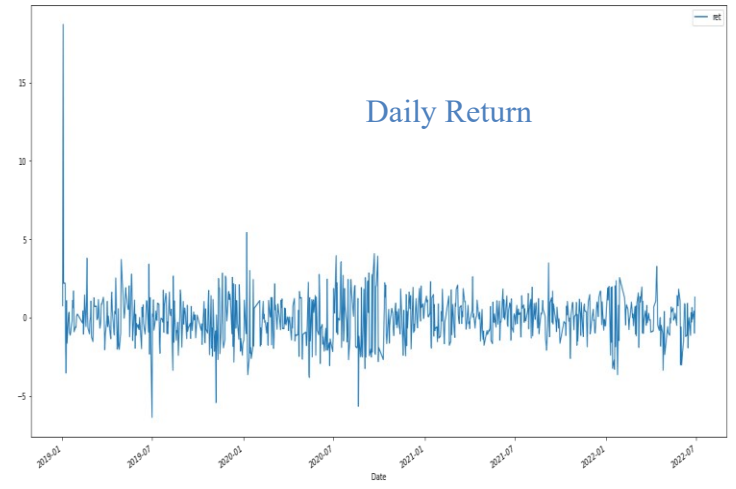


Figure 10: The return in the daily bar chart of the modified portfolio (out of sample).

The above chart results from the backtest after using 2-year CSI instead of 5-year CSI. P.9 is the annual return. P.10 is the cumulative daily return. P.11 is a daily return. All numbers are presented in percentages.

By the backtest, this strategy has not been very effective in the near term, and it has produced an enormous pullback. The global economy declined in 2019 and 2020 due to the COVID-19 pandemic. However, from April 2020, the Shanghai Composite Index showed a clear upward trend. Instead of making a profit, our revised strategy caused a drawdown of 50% in 2020. Our earnings were insignificant in 2021 and the first half of 2022. The portfolio ended up with a return of -42%. This shows that the modified model is invalid in the near term and cannot explain the market well and price each stock well.

Table 6: The return summary of the modified portfolio.

Return Summary						
Mean	**Std. Dev.**	**Min**	**Max**	**Skewness**	**Kurtosis**	**Sharpe ratio**
-0.0004977	0.0115383	-0.066377	0.186994	2.018948	25.9413	-0.6846

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The distribution of return has a negative mean of around -0.04977%. By the skewness and kurtosis, it can be found that the return data are skewed right and leptokurtic. The Sharpe ratio is negative. Although no low-frequency high losses exist, continued losses make the strategy perform poorly.

4.3. Additional Considerations

We think changing the FIN window again will make the strategy more effective. In the back-test of our strategy, the in-sample data performed well, while the out-of-sample data performed exceptionally poorly, which may be due to overfitting. We think we can change FIN's windows to 3-year CSI or 4-year CSI so that we may avoid overfitting and get a more effective strategy.

In addition, adding a few common factors may improve the model pricing ability, making the strategy more profitable. This model's factors differ from other multi-factor models like the Fama-French three-factor model because the Fama-French three factors model can well explain the expected return rate of most Shanghai and Shenzhen stocks [10]. The factors of DHS model consider investor psychology for the first time. While this may differ from traditional pricing theories, we suggest considering size or value effects to make the model more accurate.

4.4. Trading Recommendation

We strongly recommend that a trader not use this strategy without other indicators, especially in the bear market. Although DHS is a new way of pricing and stock selection, and the main trading idea is the same as arbitrage trading using Fama French's three-factor model, according to the performance of back-test, this strategy has not performed well in recent years. We suggest that if this pricing model is used for stock selection, traders should use a small window to calculate FIN or add common factors such as size or value to the model to improve its pricing ability.

With some understanding of the multi-factor stock-picking type of strategy, we can then look at this strategy. Our strategy is complemented at its base by two behavioral factors that complement the CAPM model. These two factors describe the two psychological biases of overconfidence and limited attention span of traders, respectively. If you share the same opinion about the impact of these two psychological biases on the market, then you can try this strategy in the market. However, our long-term factors found that this strategy did not respond as well as expected to the market, and its returns were not as good as we expected. This strategy usually performs better when there is panic, excitement, and other excesses among traders in the market. The historical back-test results show that this strategy performed much better in 2008, 2009, 2014, and 2015. Overall, we recommend this strategy to capture the psychological bias of traders in good market conditions to gain excess returns.

The basis of our strategy is still a multi-factor stock strategy, so if you have different ideas, you can improve the strategy by making changes to the factors on top of that strategy. Likewise, you can also optimize the strategy by changing the calculation period of the strategy's trading cycle factor, etc. to upgrade the strategy.

5. Summary

Our strategy complements the market factors of the CAPM model with two behavioral factors proposed by the DHS model and uses psychological bias to capture mispricing as a trade-off for mispricing and to correct for the differential returns among mispricing. First, we characterize the financing factor and the drift factor after short-term earnings announcements by FIN and PEAD, respectively. After this, we regress the three factors, FIN, PEAD, and the market factor. The data period of the regression is chosen to be one month, and the resulting equation is then compared to the actual market price and predicted to have possible future spreads, gaining the benefit of correcting mispricing by

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rebalancing the portfolio daily. However, the strategy can also have significant limitations under different market mechanisms; for example, the lack of a shorting mechanism and other policy restrictions in the Chinese market may result in some gains not being achieved. Also, due to the strong correlation of the strategy to investor psychological factors, it may be affected by the speculation of individual stock investors.

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The Impact of the Russo-Ukrainian War on US Stock Return

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Abstract: This paper makes an event study on the Russo-Ukrainian War effect of the stock return, including that of the S&P500, renewable energy industry, military industry, and catering industry, with a time window of 29 days (39 days for Tesla's event). This article will gain the normal and abnormal returns by using linear regression and the least square method. Then, the hypothesis test will be conducted using the Summation of the abnormal rate of return (CAR). The result will be shown by whether the cumulative abnormal return breaks the confidence interval according to the graph. Research results show that even though the war harms the economy, it does not entirely reduce the stock return. This empirical study would be helpful for the investors to make their investment strategy during the War period.

Keywords: event study methodology, summation of an abnormal rate of return, confidence interval, hypothesis test

1. Introduction

Russo Ukraine War had been launched on 24 February 2022, which not only impacted on Russia and Ukraine but also influenced the stock return of USA. This paper will analyze what the impact is in US stock return including that of S&P500, the stock return of renewable energy industry, military industry, and catering industry, as well as why the corresponding impact occurred in each of them respectively. This article will be divided into two major parts except the 'abstract, introduction, and conclusion'. In the first part, this paper will test whether Russo-Ukrainian war has influenced S&P 500, the stock return of American renewable energy like Tesla, that of US military industry especially Lockheed Martin, and that of the USA catering industry especially McDonald's. The second part of this article will analyze what the specific impact is on them, and why.

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2. Methods

2.1. Event Definition

The event study begins with the definition of the event, i.e., the event day, the estimation window, the event window must be selected. In this study, this article aims to explore the effect of the Russo-Ukrainian War on the industries of new energy, military and food. To be more specific, this paper chooses the stock market of three representative companies: Tesla, Lockheed Martin, and McDonald's.

The article defines the three terms as follows:

The Event Day

This article uses the date of the Russian invasion of Ukraine in the Russo-Ukrainian War as the event day (February 24th, 2022).

The Estimation Window

The estimation window chosen is the period from July 02nd 2018 to December 30th, 2019, which is used to calculate the expected rate of return. This paper chooses this period before the global outbreak since this article want to reduce the impact of other variables on stock prices.

However, for the S&P 500 Index, this section changed the estimation window to from September 2nd, 2019 to December 30th, 2019 (82 days in total) since for this market, this section did not intend to use the estimation window to build a linear regression model, but rather wanted to focus on the average of the market returns. Thus, a period of 82 days is sufficient time to conduct the study.

The Event Window

The event window is 14 days before and after the date of the Russian invasion of Ukraine (February 03rd 2022 – March 16th, 2022), i.e., a total of 29 days is used to observe the stock price reaction around the invasion date.

It is worth noting that, in Tesla's stock market, this paper changes the event window from 14 days before and after the date of the Russian invasion of Ukraine to 19 days before and after that event date (January 27th, 2022 – March 23rd, 2022), i.e., a total of 39 days is used. This change is made because this paper discovered that the event has little to no effect on Tesla's stock market returns when choosing to use a time length of 29 days as the event window time length. Therefore, this section extended the event window to 39 days to see if there is a more significant impact.

2.2. The Estimation of Abnormal Rate of Return (AR)

The main purpose of investment is to obtain returns, which can be divided into normal returns and abnormal returns. Normal return is the expected reasonable return that an investor can obtain under normal circumstances; while abnormal return is the portion of the investment return that exceeds the normal return. The abnormal return (AR_{it}) is equal to the actual rate of return (R_{it}) minus the expected rate of return (R'_{it}). However, in the case of the S&P 500 Index, the abnormal returns are calculated slightly different from the abnormal returns of the other three companies this article has selected. The abnormal return (AR_{mt}) for the S&P 500 Index is equal to the actual rate of return (R_{mt}) minus the average rate of return ($\bar{R}_{mt}$), where the average rate of return can be calculated from the daily market return in the estimation window.

To calculate the abnormal return (AR_{it}), this section first calculated the normal return of an individual stock market can be measured by equation:

$$R_{it} = \frac{P_{it} - P_{it-1}}{P_{it-1}} \quad (1)$$

DOI: 10.54254/2754-1169/17/20231065

where R_{it} is the return of the stock market on day t, and P_{it} , P_{it-1} are the stock prices on day t and $t-1$.

Besides, since the stock market index of all three companies selected in this paper is the S&P 500 Index, the market return R_{mt} in this article is measured by the return of the S&P 500 Index:

$$R_{mt} = \frac{P_{mt}-P_{mt-1}}{P_{mt-1}} \tag{2}$$

where R_{mt} is the market return of the S&P 500 Index on day t, and P_{mt} , P_{mt-1} are the stock prices on day t and $t-1$. Therefore, a linear regression can be conducted with the estimation window.

$$R_{it} = \alpha_i + \beta R_{mt} + \varepsilon_{it} \tag{3}$$

Using the least squares method to estimate the parameters of the market model, the abnormal return can be obtained:

$$AR_{it} = R_{it} - (\widehat{\alpha_i} + \widehat{\beta_i} R_{mt}), t \in [0, 29] \tag{4}$$

where for the case of Tesla's stock market, $t \in [0, 39]$.

2.3. Summation of Abnormal Rate of Return and Hypothesis Test

According to the abnormal rate of return, the cumulative abnormal return is:

$$CAR_t = \sum_{k=0}^{t} AR_{ik}, \tag{5}$$

where CAR_t is the cumulative abnormal rate of return from the beginning of the event window period 0 to the current period t. To observe whether the stock return has changed significantly because of the Russo-Ukrainian War, this paper conducted four hypothesis tests on the cumulative abnormal return (CAR) for the S&P 500 Index and the three companies over the event period. The hypothesis test for the cumulative abnormal returns of the S&P 500 Index is as follows:

$$H_0: \mu_1 = \mu_2$$

$$H_a: \mu_1 \neq \mu_2$$

The null hypothesis H_0 means that the average market return of the S&P 500 Index before the Russo-Ukrainian War was equal to the average market return after the war, which in other words is the event has no impact on the return of the S&P 500 Index. The change in the cumulative abnormal return of the company's share price is the result of random fluctuations. However, if the null hypothesis needs to be rejected, it indicates that the stock price changes within the event window are not random, and the war has a substantial influence on the market return.

The confidence interval conducted is:

$$(-1.96 \times \sqrt{T\sigma_\varepsilon^2}, 1.96 \times \sqrt{T\sigma_\varepsilon^2}) \tag{6}$$

Since $\sigma_\varepsilon{}^2$ is unknown, it should be estimated using the data in the estimation window:

$$\widehat{\sigma_\varepsilon{}^2} = \sum_{t \in D} \frac{(R_{mt}-\bar{R}_{mt})^2}{D-1} \tag{7}$$

DOI: 10.54254/2754-1169/17/20231065

where D is the number of days from the estimation window. As a result, if the value of CAR exceeds the confidence interval, then it can be concluded that there is 95% confidence to reject the null hypothesis. The hypothesis test for the cumulative abnormal returns of the three individual stocks is slightly different from the previous hypothesis test for the S&P 500 Index:

$$H_0: CAR_t = 0$$

$$H_a: CAR_t \neq 0$$

The null hypothesis H_0 means that the event has no effect on the stock price. The change in the cumulative abnormal return of the company's share price is the result of random fluctuations. Otherwise, if the null hypothesis has to be rejected, it demonstrates that the stock price changes within the event window are not random, and the event has a significant impact on the stock return. The confidence interval performed in the study is shown in Equation (6). Since $\sigma_\varepsilon{}^2$ is unknown, it should be estimated using the data from the estimation window:

$$\widehat{\sigma_\varepsilon{}^2} = \sum_{t \in D} \frac{\left(R_{it} - R'_{it}\right)^2}{D-1}, \tag{8}$$

where D is the number of days in the estimation window.Similarly, if the value of CAR exceeds the confidence interval, then it can be concluded that there is 95% confidence in rejecting the null hypothesis.

3. Results

3.1. S&P 500 Index

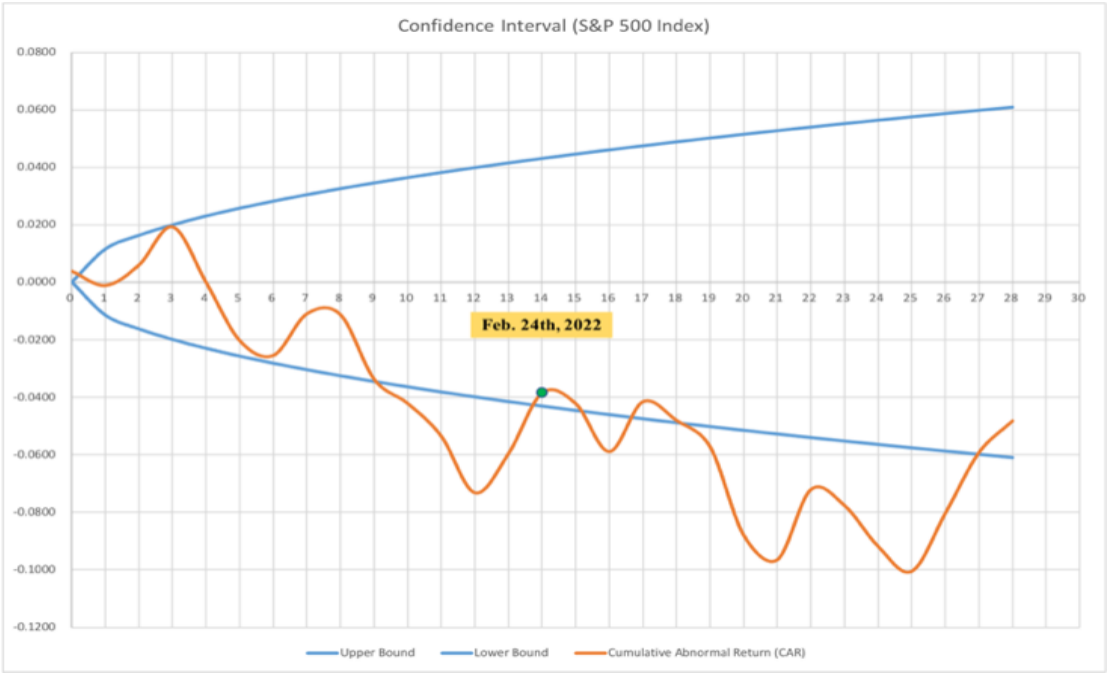


Figure 1: Confidence interval for the CAR of the S&P 500 index.

By performing the hypothesis test of the S&P 500 Index [1], Figure 1, which shows the confidence interval of the ccumulative abnormal return of the S&P 500, can be obtained. As shown in Figure 1, the line representing the cumulative abnormal return breaks the confidence interval on the 10th day. Therefore, it can be concluded that there is 95% confidence to reject the null hypothesis that the

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average market return of the S&P 500 Index was at the same level before and after the Russo-Ukrainian War. What's more, it can be observed that the stock return of S&P 500 was declining due to the Russo-Ukrainian War (see Figure 1).

3.2. Tesla

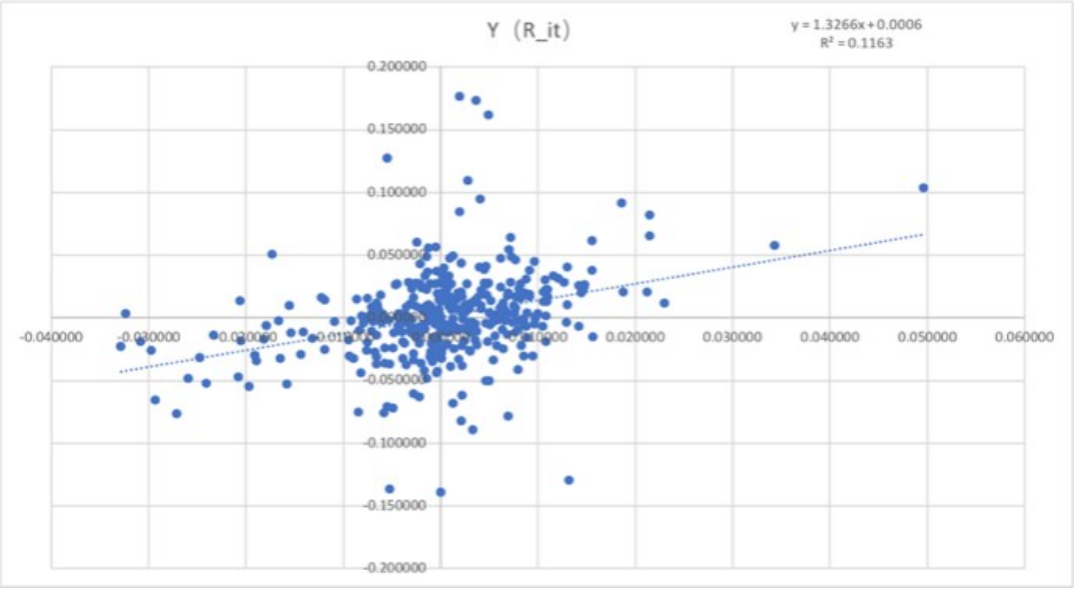


Figure 2: Linear regression model between Tesla's stock market return and the S&P 500's return.

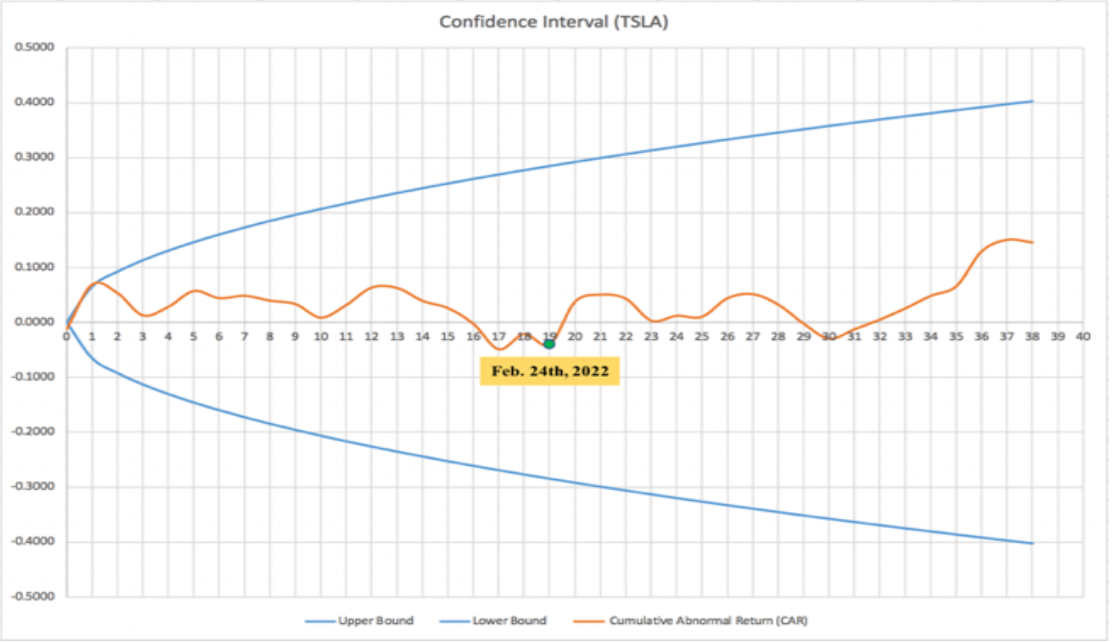


Figure 3: Confidence interval for the CAR of Tesla's stock market.

Figure 2 shows the linear relationship between the stock return of Tesla and the market return of the S&P 500 Index, which can be expressed as: $R_{it} = 1.3266R_{mt} + 0.0006$. After conducting a hypothesis test and constructing a confidence interval on Tesla's stock market, Figure 3 can be obtained. Figure 3 shows the confidence interval of the cumulative abnormal return for Tesla's stock market [2]. As shown in Figure 3, the cumulative abnormal return does not exceed the confidence interval

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throughout the whole event window. Thus, the study cannot reject the null hypothesis that the Russo-Ukrainian War has no effect on the stock price of Tesla.

3.3. Lockheed Martin

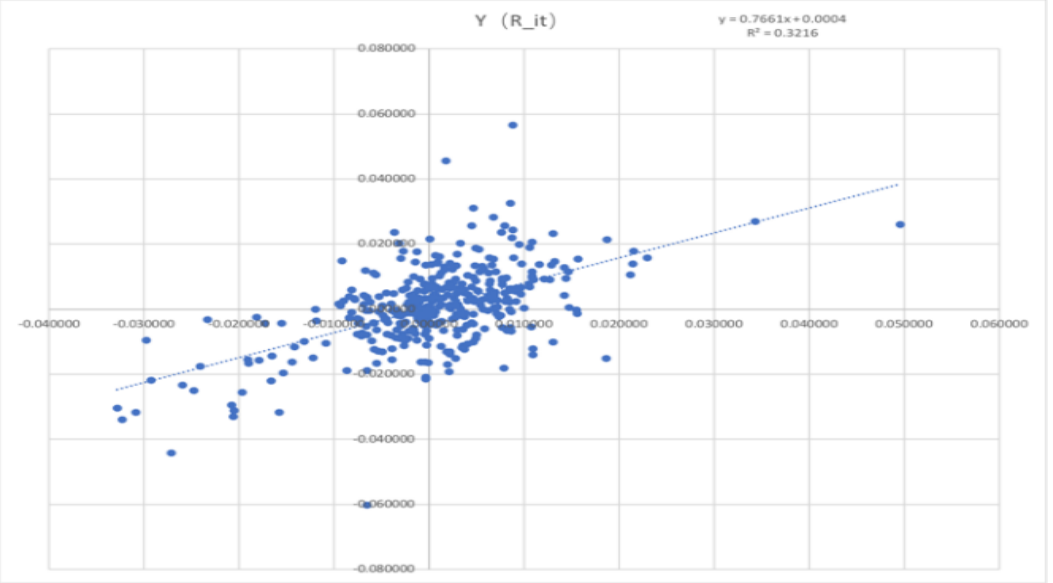


Figure 4: Linear regression model between Lockheed Martin's stock market return and the S&P 500's return.

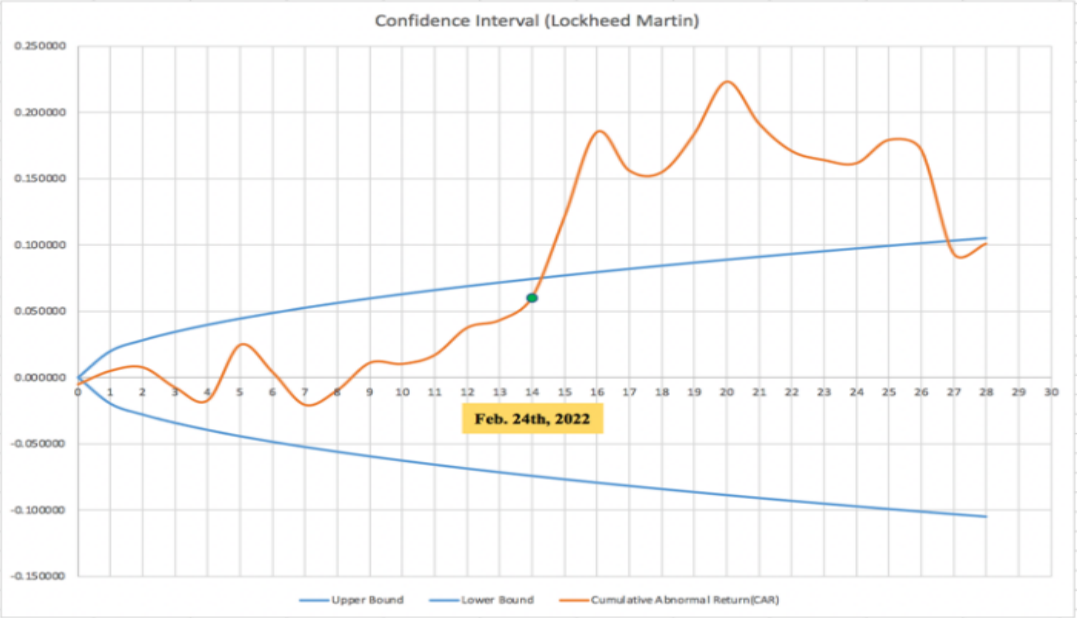


Figure 5: Confidence interval for the CAR of Lockheed Martin's stock market.

As shown in Figure 4, the linear relationship between the stock return of Lockheed Martin and the market return of the S&P 500 Index can be expressed as: $R_{it} = 0.7661R_{mt} + 0.0004$. Furthermore, the study constructed a confidence interval for the cumulative abnormal return of Lockheed Martin's stock market (see Figure 5) [3]. As can be seen from Figure 5, the line representing the cumulative abnormal return breaks the confidence interval on the 15th day. Therefore, there is 95% confidence

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to reject the null hypothesis that the Russo-Ukrainian War has no effect on the stock price of Lockheed Martin. Besides, according to Figure 5, the stock return of Lockheed Martin had generally increased due to Russo-Ukrainian War.

3.4. McDonald's

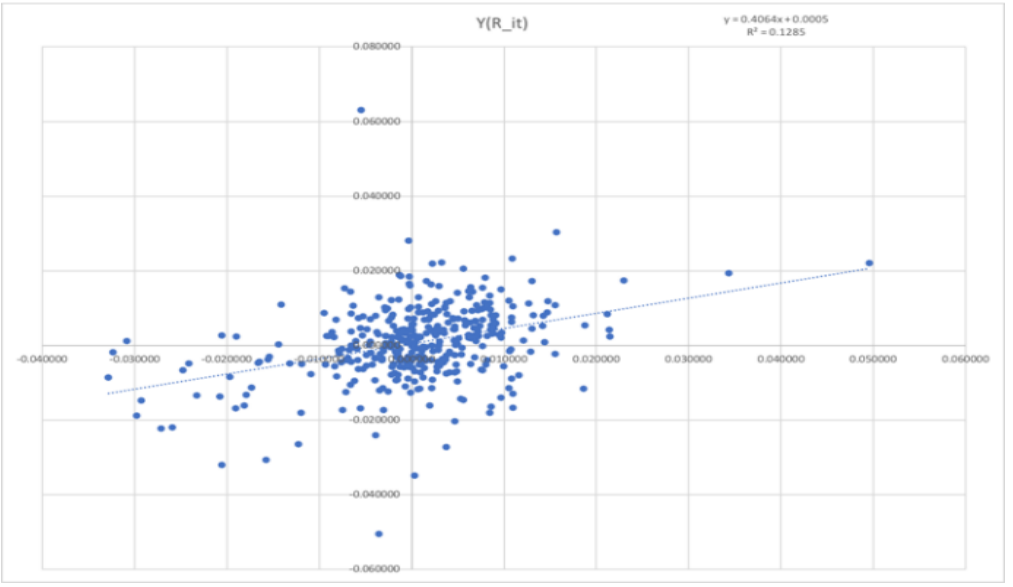


Figure 6: Linear regression model between McDonald's stock market return and the S&P 500's return.

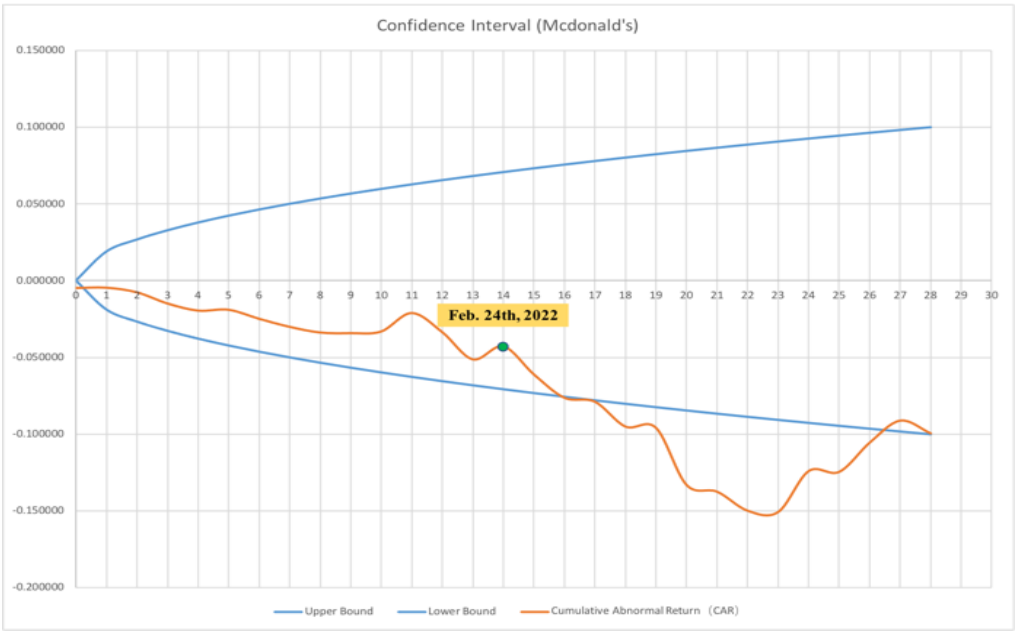


Figure 7: Confidence interval for the CAR of McDonald's stock market.

Figure 6 shows the linear regression model between the stock return of McDonald's and the market return of the S&P 500 Index[4]. The linear relationship can be expressed as: $R_{it} = 0.4064R_{mt} + 0.0005$. After performing the hypothesis test and constructing the confidence interval, Figure 7 can be gained. Figure 7 demonstrates the confidence interval of the cumulative abnormal return for

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McDonald's stock market. It can be found that the cumulative abnormal return exceeds the confidence interval on the 15th day (see Figure 7). Therefore, it can be concluded that there is 95% confidence in rejecting the null hypothesis that the Russo-Ukrainian War has no impact on the stock price of McDonald's. In addition, Figure 7 illustrates that the stock return of McDonald's was generally decreasing.

4. Discussion

Based on the investigation above, the Russo-Ukrainian War is playing no impact on Tesla. This section will address the influence of Russo-Ukrainian War on the Stock return of S&P 500, Lockheed Martin, and McDonald's respectively.

4.1. The Impact on the S&P 500 Index

The Russo-Ukrainian War had decreased the return of S&P 500. To begin with, Russo Ukraine War had increased the volatility of the natural gas price level. According to the data released by EIA [5], the Russo-Ukrainian War had increased the volatility of natural gas price: the annualized volatility of it in February 2022 had increased into 179%. However, both the supply side including industry sector, catering industry and the demand side like daily-life activities including cooking rely on natural gas to a very large extent, which means the increased volatility in natural gas price level will inevitably increase the volatility, that is, instability and risk, in both the supply side and demand side, damaging both the supply side and demand side of the USA economy by reducing the aggregate supply and aggregate demand of it. This had reduced the stock return of S&P 500 as the development of American economy had been damaged in both supply side and demand side while S&P 500 is a reflect of American economy's development to a large extent. Moreover, as the American economy's volatility has increased in both sides, the volatility had also increased in S&P 500 due to the increased volatility in American economy. Even S&P 500 Dow Jones Indices (n.d.). had illustrated in 'S&P 500 12-Month Realized Volatility Index' that the volatility of S&P 500 was constantly increasing in February [6]. This had increased the risk for investing S&P 500 in the sense that the higher the volatility the higher the risk for investment, reducing investment in S&P 500, which had in turn reduced stock return of S&P 500.

Apart from that, Russo-Ukrainian War had increased the price of oil. EIA (March 2022) had pointed out in the report 'Short-Term Energy outlook' that in the USA, the price of oil in February 2022 was 11$ per barrel (b) higher than that in January that year [7]. Nonetheless, as it has been previously mentioned in this paper, the Russo-Ukrainian War is not increasing the stock return of American renewable-energy and is therefore not promoting the development of USA renewable energy industry, and that there is a time-lag in developing renewable energy, while the current renewable energy technology in USA still cannot completely replace the use of oil. In this case, USA failed to find substitute like renewable energy to the up-priced oil to a large extent, so the USA still needed to use the oil whose price level had increased. Consequently, cost-push inflation increased because residents, firms, and enterprises there still needed to use oil when transferring products so the cost for production increased, leading to the reduced stock return of S&P 500.

4.2. The Influence on the Stock Return of Lockheed Martin

The Russo-Ukrainian War, nevertheless, is increasing the stock return of Lockheed Martin. First and foremost, Russo-Ukrainian War has stimulated the USA to supply weapons to Ukraine. As the largest military enterprise in the USA, Lockheed Martin was playing an indispensable role in suppling weapons to Ukraine, which is why this would inevitably influence the stock return of Lockheed Martin.

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Notably, the stock return of Lockheed Martin had increased sharply on 1st March 2022 as shown by the data released by the Yahoo Finance in 2022 [8], with three main different causations as follows.

First and foremost, investors anticipated that the USA would provide Ukraine with more weapons as the USA needed to do so not only for protecting Ukraine from being subjugated by Russia which is the rival country of the USA but also for preventing Russia from invading the NATO. Even the news 'Biden Sends Heavy Weapons as Ukraine Faces New Russia Offensive' reported by Bloomberg. (13 April 2022) showed that President Joe Biden was providing Ukraine with heavy weapons [9]. Nonetheless, when sending weapons to Ukraine, the USA government needed to purchase weapons from Lockheed Martin, which would expand the market demand for Lockheed Martin. This had attracted more investors to invest Lockheed Martin in the sense that increased market demand would increase profits of Lockheed Martin, resulting in the increased stock return of Lockheed Martin dramatically on 1st March 2022. Meanwhile, to meet the increased demand for military equipment caused by assisting Ukraine militarily, Lockheed Martin needed to increase the aggregate supply of its products. Selinger. M. (May. 2, 2022) had reported in the news 'Ukraine conflict: Lockheed Martin to boost production capacity for popular weapons.' that Lockheed Martin was increasing the aggregate supply of its weapons by purchasing more equipment, hiring more employees, and allocating more factory space [10]. Increased aggregate supply for meeting the market demand would help to meet market equilibrium, increasing the profits of Lockheed Martin. A volume of investors anticipated that this would happen and therefore invested Lockheed Martin by 1st March 2022, increasing the stock return of Lockheed Martin that day. Meanwhile, Lockheed Martin also needed to improve the capacity of its products, that is, weapons, by investing Research and Development (R&D) to help Ukraine defeat Russia and protect NATO from being invaded by Russia, which would improve the capacity of weapons produced by Lockheed Martin and thus shift the opportunity cost curve outward, increasing profits of Lockheed Martin. This in turn stimulated investors to increase investments in Lockheed Martin and therefore increased the stock return of it dramatically on 1st March 2022. In particular, the Eurasian Times (27 August 2022) reported in the news '6th-Gen Fighter Jet: American NGAD, British Tempest Programs Could Collaborate — Top USAF Official' that the American NGAD was inventing the 6th-Gen fighter jet with the British Tempest Programs [11]. The Breaking Defense (1 June 2022) also reported the news 'The Air Force's secret next-gen fighter has reached development phase' that the NGAD was being leaded by Lockheed Martin [12]. These news showed that the Lockheed Martin was the main role doing R&D in developing the 6th-Gen Fighter Jet that would protect both Ukraine and NATO from being invaded by Russia more efficiently. A considerable number of investors anticipated that Lockheed Martin would become the main role who invent 6th-Gen Fighter Jet hence they invested Lockheed Martin, boosting its stock return on 1st March 2022 highly rapidly. Eventually, based on all these reasons and causations, the stock return of Lockheed Martin had increased dramatically due to the massively increased investment in it that day, as a great deal number of investors anticipated that all these news would happen.

In addition, Russia was lack of performance during the Russo-Ukrainian War, which would also boost the stock return of Lockheed Martin as failing to eliminate Ukraine will reduce the confidence for Russian military industry in the market and thus stimulate more countries like India to reduce the purchase of Russian weapons while buying more American weapons instead, which would expand the market of Lockheed Martin and would therefore boost the stock return of it. Specifically, as it has been reported by New York Times (8 March 2022) in the news 'Quoting Churchill and Shakespeare, Ukraine Leader Vows No Surrender' that the Ukraine President Zelensky was not going to surrender to Russia [13]. This would expand the market for Lockheed Martin as it revealed that the military power of Russia including the capacity of its military equipment was declining and this would therefore attract more countries like India to buy less weapons from Russia while purchasing more military equipment from the USA especially that produced by Lockheed Martin. For instance, The Indian

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Express (March 4th, 2022) reported in the news 'India cancelled orders of Russian jets, weapons: US official at Senate hearing.' that India was reducing the purchase of military equipment from Russia [14]. Banerjee. V. and Tkach. B. (12 April 2022) had also pointed out in the article 'AFTER UKRAINE, WHERE WILL INDIA BUY ITS WEAPONS?' that India had been trying its best to increase the import of defense system from the USA [15]. It follows that India was purchasing less weapons from Russia while importing more military equipment from the USA, increasing the stock return of Lockheed Martin as this increases its profits due to the increased market demand for its products. A considerable number of investors anticipated that Ukraine would not surrender and therefore India would import less weapons from Russia while buying more military equipment from the USA instead, so they invested Lockheed Martin, boosting the stock return of it dramatically on 1st March 2022.

Apart from that, Sweden and Finland would join NATO to protect themselves from being invaded by Russia, which would expand the market for Lockheed Martin as countries in NATO frequently purchase weapons from the USA and these two countries need to buy weapons from the USA to prevent the invasion of Russia. For instance, The Washington Post (28 June 2022) had reported in the news 'Turkey drops opposition to Finland, Sweden joining NATO' that Turkey agreed to help Finland and Sweden to join NATO, with the aim of protecting these two countries from being invaded by Russia [16]. This would increase the market demand for the products of Lockheed Martin as these two countries needed to buy more weapons to protect themselves from being invaded by Russia. This would expand the market for Lockheed Martin as the USA allies are the main market for Lockheed Martin, which would increase the profits of this company and would thus attract more investors to invest in it. A volume of investors anticipated that these two countries would join NATO, and that the Turkey would help them join NATO. Consequently, these investors invested in Lockheed Martin, leading to a sharp increase in its stock return on 1st March 2022.

Furthermore, increasing number of investors anticipated that all these events mentioned above would happen, which stimulated more investors to invest in Lockheed Martin. This further increased the stock return of Lockheed Martin dramatically on 7th March 2022. Also, the news 'India cancelled orders of Russian jets, weapons: US official at Senate hearing.' reported by the India Express on 4th March 2022 had also showed the finance market that the India is reducing the import of Russian military equipment [17], which had also convinced more investors to expect that India would buy more American military weapons instead before long, stimulating more investors to invest in Lockheed Martin. This had also further boosted the stock return of it sharply on 7th March 2022.

4.3. The Impact on the Stock Return of McDonald's

The Russo-Ukrainian War, nonetheless, has a negative impact on the stock return of McDonald's. There are two main reasons why decreased stock return occurred in McDonald's. One of them is the increasing prime cost after the war, another is that McDonald quit the Russian stock market.

When the war began on Feb 24th, 2022, there was an immediately sharp decrease of its stock price, and that downward trend had been lasting until March 9th, 2022. From a comprehensive report of McDonald's Corporation in Aug 18th, 2022, the annual return of McDonald in 2022 is the lowest in the recent ten years and is the only negative year from 2015 to 2022 [18]. The return is -1.81%, which is quite a strike compared with 2021's 27.79% [18].

To begin with, the raw food material's price increased dramatically after the war. For example, the wheat price increased 55.7% (From 793.76 USD/Bbl. in Feb 23rd, 2022, to 1235.5 USD/Bbl. on Mar 7th, 2022) [19]. The USA was faced with skyrocketing prices in food because of the maritime embargo that Russia has enforced since the war against Ukraine, which increased the cost and risk for transferring products. Ukraine is imprisoning over 20 million tons of exporting grain. After this year's grain harvest is finished, according to Ukrainian President Zelensky, the amount could reach 75

DOI: 10.54254/2754-1169/17/20231065

million tons [20]. Up to 30% of the 86 million tons of grain that Ukraine typically produces won't be harvested, according to Laura Wellesley, a food security specialist at the British think tank Chatham House [21]. Previously, Ukraine produced 16% of the world's corn, 9% of the world's wheat, and 42% of the world's sunflower oil [22]. Additionally, Russia, the biggest exporter of wheat worldwide, had a decline in its overall export volume this year. Although Russian agriculture is not specifically mentioned in the Western sanctions on Russia, the Kremlin feels that the sanctions have raised insurance costs, disrupted payments, and thus hampered exports. The entry of Russian ships carrying agricultural goods into EU ports is not prohibited. Therefore, with the price increase of raw food material, McDonald must increase price of some products which lower its sales volume. What's more, after the war, the crude oil price also increased out of control. From the data on TRADING ECONOMICS, the crude oil price increase 34.8% from 25th 2022 to Mar 8th, 2022 [23]. Russia exports around 5 million barrels of crude oil per day, or 11% of all exports worldwide, according to data on the country's crude oil export volume over the years. Russian crude oil exports in 2020 were 4.6535 million barrels per day, coming in second only to Saudi Arabia's 6.6586 million barrels per day, which ranked second in the world. Although the major theater of the Russian-Ukrainian war is in Ukraine, and there is little chance that the Russian mainland, particularly the key regions producing crude oil, will be directly impacted by the conflict, the conflict may have an impact on producers' confidence going forward. At the same time, the UK announced it will gradually stop importing Russian oil and petroleum products by the end of 2022, while the United States formally issued an executive order banning the import of Russian energy. Since food companies need to transport fresh food material every day, the increasing crude oil price would cause the increasing transport fare, which is also a tough problem for McDonald.

Apart from the increasing transport fare of raw food material, the increased crude oil price may have some other negative effect [24]. Because of the Covid-19, many McDonald outlets only receive drive through and takeout orders. Because of the higher gasoline price, people are less willing to drive to McDonald and take the food. What's more, unfortunately, the takeout applications such as Uber Eats increased its deliver fare because of higher crude oil price. So, in short, people may consume less McDonald products because of the increased crude oil price.

In addition, McDonald's quitting Russian market caused a big loss. According to RNZ (May 17th, 2022), McDonald's has said it will permanently leave Russia for more than 30 years and has started to sell its restaurant [25]. After this news had been released on May 17th, 2022, its stock price per share has a drop sharply downward trend until May 19th, 2022. McDonald has 850 outlets within Russia, and it is worth mentioning that most of these stores are direct-sales stores, which means a much larger loss than the franchise stores counterpart. As McDonald quit the market, the market share left for local brands in Russia increased. For example, the Russia local new brand Uncle Vanya made a huge golden letter B as its logo, which is quite like McDonald's logo letter M. Their products are similar, too. Much of McDonald's market share before would be taken over by these local brands. What's more, with the development of food companies selling similar products to McDonald, these developing competitors could be threat for McDonald, either. Lastly, comparing to this uncountable loss of McDonald, the direct loss is over 100 million USD [26]. According to the corporation, McDonald's write-off from leaving Russia will range from $1.2 billion to $1.4 billion [27]. Just shutting down its eateries for the first two weeks in Russia had a major negative impact on company earnings, costing it $127 million. On the one hand, McDonald need to pay a large amount of salary even if it closed its outlets because of the employ contract. On the other hand, the food inventories of the 850 outlets are another huge cost.

DOI: 10.54254/2754-1169/17/20231065

5. Conclusion

In conclusion. Even though the war is a negative and destructive event, its impact largely varies for stock returns in different types of industries and S&P 500 in the USA. For S&P 500 and the stock return of McDonald's, the Russo-Ukrainian War is playing a negative impact on them and is reducing the stock return of them. The Russo-Ukrainian War, nevertheless, has no impact on the stock return of Tesla, and the Russo-Ukrainian War had also increased the stock value of Lockheed Martin dramatically. Moreover, it is highly significant that investors gain increased return through following things.

To begin with, when there comes to a war, investors must have a certain level of military literacy to predict and analyze the future war situation to formulate their own investment strategies based on the future war situation. For instance, investors needed to succeed in predicting that the Zelensky would not surrender, and that the USA will assist Ukraine by providing it with military equipment, so that investors can gain increased returns by investing Lockheed Martin in time. In addition, during the state of war, investors must gather enough information regarding both warring sties so that they avoid losing returns while gaining increased return. After predicting that there will be war between Russia and Ukraine, investors needed to realize that the cost for producing food would increase as Russia and Ukraine produce oil that cars carrying raw food raw materials need to use and raw material for food, after which investors needed to reduce investment in catering industry like McDonald's to avoid loss of return due to the decreased stock return in McDonald's, while investing Lockheed Martin more and thus gain more returns.

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Laijun Xu and Ruohan Zhao contributed equally to this work and should be considered co-first authors. Ancheng Wang and Jiayi Yan ontributed equally to this work and should be considered co-second authors.

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Whether a Criminal is Likely to Re-offend? A Statistical Analysis Using Crimes Data from Broward County Florida

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Abstract: Security issues have always been a significant threat to the safety of citizens in every country, and many of these re-arrested criminals have negatively impacted social security. Therefore, predicting and studying the factors of a criminal's re-entry to prison will significantly help maintain social order and improve the civil society happiness index. This study, it will show what elements are predicted to influence a criminal's return to prison and what aspects will have a higher proportion and weight based on the collected data set. In the dataset, each re-admission inmate is categorized according to gender, age range, race, records, etc. Use the Logistics model and OLS model to build a model to predict what factors most directly lead to a criminal being arrested and imprisoned again. Data research has proved that the "number of priors" is the factor that most affects the recidivism rate of criminals.

Keywords: statistics, prediction of recidivism rate, ordinary least-squared model, logistic regression model, social inequality

1. Introduction

The problem of criminals has always been the most severe social security problem in most countries. In many countries, criminals continue to disrupt public safety, so there must be some commonality among these criminals. First of all, many criminals are criminals with previous convictions, so this part is the most research oriented. So, we're going to look at what factors make some criminals more likely to re-offend and go to jail. Before the analysis, we listed some factors that may affect the crime, including the sex of the offender, the age range of the offender, the criminal record of the offender, etc. Among these factors, we defined gender as male and female, age group into three, and criminal record as yes or no. Next, we give weights to different factors and parts and use the logistic regression model to predict. In such a prediction process, it can be found that the X factor will be the most influential factor for a criminal to be caught again, and Y and Z also have a particular influence on the criminal's re-offending.

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2. Literature Review

Predicting whether a criminal will re-offend is a highly discussed topic, and many researchers have addressed the content of this topic. At Bruce Frederick, Ph.D. "Factors Contributing to Recidivism Among Youth Placed with The New York State Division For Youth" [1].

A similar study has been published in the article. In his research, he focused on what causes teens in the New York area to be imprisoned again and, at the same time, predicted their first recidivism. In such a project, Bruce Frederick first used the data of 9,477 repeat offenders. Based on their situation, he proposed the gender, race, history of alcohol and drug abuse, and whether they had received good aftercare after being released from prison., whether you have received an education, etc., as a factor to consider. At the same time, Frederick also thought all the previous crimes' recidivism. He divided them into four categories according to the reason for entering the prison and the time of detention. During the analysis process, Federick talked about the data he used and conducted a lot of chart and model analysis, among which he used a lot of bar charts and table charts to explain every single item and increase the contrast of conditions. After the establishment and analysis of the model, Frederick first thought that males would be a characteristic of the recidivist population, and secondly, whether the community environment of the recidivist was an environment conducive to the physical and mental growth of these juveniles. Whether the enlightenment and education work is completed seriously is also an important factor affecting their re-offending. Frederick's research details recidivism factors that affect youth in the New York area. The same theme is reflected in the article "The Dangers of Risk Prediction in the Criminal Justice System" by Julia Dressel and Hany Farid [2]. But the difference is that Dressel and Farid's article focuses on bias and fairness in predicting whether a criminal will re-offend. In addition, research stresses the need for court actors to consider multiple aspects of the criminal record. However, most quantitative studies of sentencing have found that the number of previous convictions or arrests affects the criminal record [3]. Other studies have shown that rehabilitation is effective in reducing recidivism. But the offender's sex, age, or level of addiction can affect recidivism [4].

This will also be a topical topic because there will be racism in the cognition of some people, so in essence, these people will think that blacks are more recidivists than whites. But the actual situation is not the case. After a large amount of data calculation and model analysis, it is confirmed that the reason for the recidivism of criminals does not have any direct relationship with people. This article made me understand and realize in great detail that any subjective speculation in the process of creating an analysis and prediction is ridiculous and contradictory to reality. Therefore, we drank 6172 data in fact in detail in our research topic and simultaneously proposed several possible reasons, using the modeling and charting to analyze and integrate the data.

3. Methodology

The logistic Regression Model is widely used for classification tasks. The model predicts the probability an object belongs to a particular group; In other words, the chances this object has a specific feature or not. **YES** is written as **1** and **NO** is written as **0** in the dataset.

Step 1: Linear regression

To begin with, we need a regression line. This line comes from linear regression.

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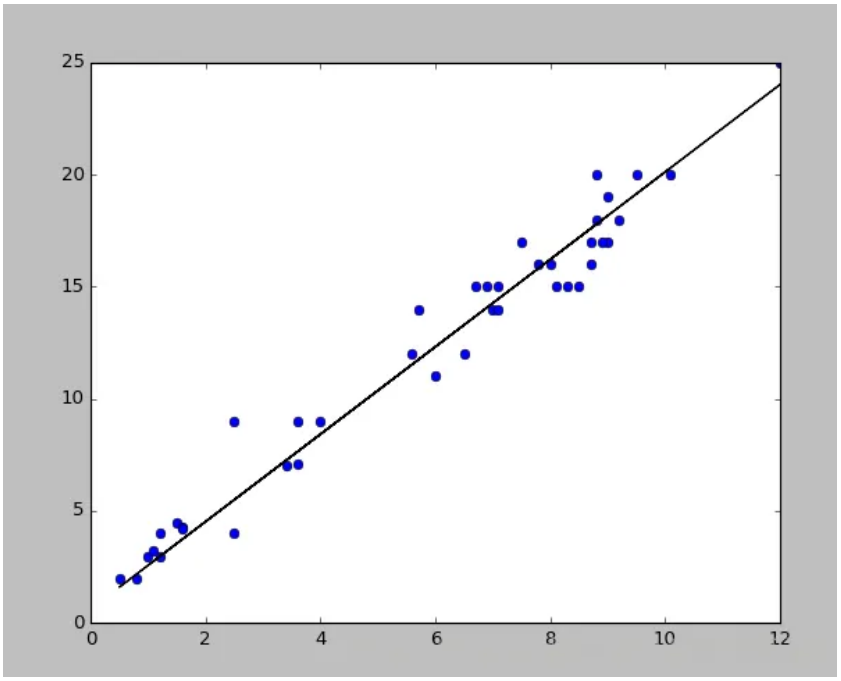


Figure 1: A common example of the linear regression line.

In this case, the line could be:

$$Y\hat{} = \beta 0 + \beta 1X1 + \beta 2X2$$

Step 2: Sigmoid function [5]
Sigmoid function is written as:

$$S(x) = \frac{1}{1 - e^{-x}}$$

S(x) value will always be between 0 and 1, no matter the x values. The graph of sigmoid function is:

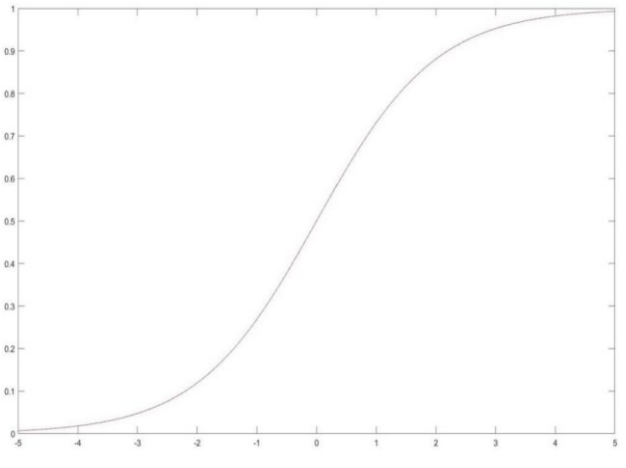


Figure 2:The graph of a sigmoid(x) function.

As shown from Fig.2., the function has two asymptotes: 1 when x approaches positive infinity; 0

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when x approaches negative infinity. The middle line of the function is x = 0, and y equals to 0.5. Usually in a logistic regression model, 0.5 is the threshold. S(x) values greater than 0.5 are considered as 1; S(x) values smaller than 0.5 are considered as 0. Hence, S(x) value is said to be the probability that S(x) belongs to 1 or 0. A S(x) values of 0.788 is considered as 1, and the probability that 0.788 equals to 1 is 78.8%.

Step 3: Application

Assuming we want to investigate whether a tumor is benign or malignant, we collect data from 1000 patients who have been through tumors before. X variables will be several indexes such as whether they are overweighted, alcoholic, young or old. Y values are either 1 or 0. (1 if the tumor is malignant, 0 if the tumor is benign). Linear regression is carried out in the data, and a regression line is obtained. Next, 1000x values are put in regression line and 1000y values are obtained. In this case, y values obtained will be the x values of sigmoid function(S(x)). 1000 S(x) values are obtained. If S(x) is greater than 0.5, label the x (y value for the regression line) as 1; If S(x) is smaller than 0.5, label the x as 0. Finally, compare the predicted 1 and 0 values with the Y values of raw data. If the precision rate is higher than 90%, the model is considered as a good model and can be used to predict the nature of a new tumor.

4. Data Analysis

4.1. Data Acquisition and Preprocessing

We use the excel data containing a sample of 6,172 individuals illustrating their basic personal information, including gender, race, age, whether they conducted crimes before, and whether the previous case is a misdemeanor or a severe one.

In Table 1, shown below, the data is all categorized as binary data given 6,172 observations, as the minimum and maximum values are always 0 and 1. Reid is an abbreviation of recidivism and is labeled as 1 if the individual we are investigating did conduct a crime again within two years; old equals 1 infers that if the age of the individual is above forty-five and young refers to those aged below twenty-five. Other variables briefly all indicate the ethnicity of the chosen individual, and if they qualified as one of the races, they are labeled as 1 under that given variable.

Table 1: OLS model summary of a given dataset.

Variable	Obs	Mean	Min	Max
recid	6,172	0.455	0	1
male	6,172	0.810	0	1
old	6,172	0.209	0	1
misdem	6,172	0.357	0	1
young	6,172	0.218	0	1
af_am	6,172	0.514	0	1
caucasian	6,172	0.341	0	1
hisp	6,172	0.082	0	1
asian	6,172	0.005	0	1
nat_am	6,172	0.002	0	1

Since we are trying to predict the possibility of whether a criminal is likely to re-offend, we introduce ordinary-least squared data analysis as it shows a direct way to establish the relationship between individual variables and the given dependent variable. As noted above, the data follows

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binary distribution; hence logistic model can also be brought up under our further analysis.

4.2. The OLS Multivariate Linear Regression Analysis

At first, as shown in Table 2, we use an ordinary least-square linear regression model to briefly illustrate the overall influence of each variable without making any changes to it [6]. We notice that with a 95% confidence interval, we need the p-value to be less than 0.05 to satisfy the condition that those predictor variables without manipulation are statistically significant towards recidivism, and from the figure below, most of the variables fit this condition. However, the p-values of the ethnicity variables, including caucasian, hisp, native American, and Asian, exceed the 5% significance level, which indicates they are not a relatively significant variable in explaining recidivism.

Table 2: OLS model numerical data result of relationship among originally given variables.

recid	Coef.	Std.Err.	t	P>|t|
Male	0.124	0.016	7.84	0.000
old	-0.127	0.016	-7.98	0.000
young	0.087	0.016	5.61	0.000
af_am	0.150	0.028	5.41	0.000
caucasian	0.051	0.028	1.81	0.070
hisp	0.008	0.034	0.25	0.805
nat_am	0.093	0.149	0.62	0.533
asian	-0.097	0.091	-1.07	0.287
_cons	0.268	0.030	8.98	0.000

Next, we want to add more possible influential variables into the OLS model, as shown in Tables 3 and 1) firstly, we focus on the effect of age and gender working together on recidivism. We see that the coefficient of the probability of being male itself causing re-offending is approximately 0.124 from Table 2 above. Still, when we combine the effect of being male and being young, the state result shows that the coefficient of the possibility of being male decreased to 0.097 instead; being male and young at the same has a p-value of 0.005 shown in step 1 column. Hence, we can conclude that being male and young simultaneously is an important factor in recidivism. 2) Moving towards the next step, we analyze whether ethnicity itself works as a significant independent factor or whether recidivism is impacted by gender and ethnicity together. Similarly from above, if an individual is an African American, he increases the possible rate of re-offending by 0.15, but if we add in the effect of being male and African American at the same time, it shows that the effect of being African American itself drops to 0.042 with a not statistically significant p-value equalling to 0.248 which says it's not the ethnicity that leads to recidivism, but gender also plays a significant role here. Being male and African American at the same time seems to be a relatively notable factor counting towards recidivism. 3) Thirdly, we add the variable male_misdemeanor into our model, it shows a similar process as the previous two steps, and we find a similar result that if a male individual conducted a comparatively small crime or mistake before, it also reflects a higher rate of re-offending [3]. The p-value of the independent variable male_misdemeanor is 0.045, which is regarded as statistically essential but not that unignorable.

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Table 3: OLS model numerical data results of different new-defined variables.

recid	**Coef.(1)**	**P>|t|**	**Coef.(2)**	**P>|t|**
male	0.097	0.000	0.038	0.086
old	-0.109	0.001	-0.123	0.000
young	-0.011	0.760	0.001	0.984
misdem	-0.093	0.000	-0.095	0.000
af_am	0.143	0.000	0.042	0.248
caucasian	0.052	0.056	0.049	0.074
hisp	0.012	0.719	0.012	0.704
nat_am	0.086	0.583	0.087	0.571
asian	-0.098	0.234	-0.092	0.264
male_young	0.112	0.005	0.099	0.010
male_old	-0.017	0.655	-	-
male_af_am	-	-	0.123	0.000
male_misdem	-	-	-	-
_cons	0.326	0.000	0.375	0.000

Table 4: Coefficients of OLS model.

recid	Coef.(3)	P>|t|
male	0.009	0.754
old	-0.123	0.000
young	0.001	0.983
misdem	-0.144	0.000
af_am	0.036	0.331
caucasian	0.049	0.072
hisp	0.013	0.688
nat_am	0.082	0.588
asian	-0.093	0.258
male_young	0.100	0.009
male_old	-	-
male_af_am	0.130	0.000
male_misdem	0.063	0.045
_cons	0.399	0.000

Throught out the process, based on Table 3, the final OLS model we generated is

Recidivism= 0.009 (male) + -0.123(old) + 0.001(young) + -0.144(misdemeanor) + 0.036(af_am) + 0.049(caucasian) + 0.013(hisp)+ 0.082(nat_am) + -0.093(asian) + 0.100(male_young) + 0.130(male_af_am) + 0.063(male_misdemeanor) as we add in those variables we considered as important.

Theoretical Reasons Why the OLS Model isn't a Good Model:

To be confident about the multivariate linear regression model we conducted, there are some classical assumptions we need to consider: 1. homoskedasticity: the variance of the residuals has to be homoscedastic or constant to make sure we have precise standard error. 2. multicollinearity: the relationship between predictor variables is not perfectly multicolinear.3. normality: residuals are normally distributed.

Homoskedasticity.

DOI: 10.54254/2754-1169/17/20231066

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of recid

         chi2(1)      =    12.58
         Prob > chi2  =   0.0004
```

Figure 3: Homoskedasticity test result of defined OLS model.

As shown in Figure 2, The Breusch-Pagan test results at the 95% confidence level show that the p-value equal to 0.0004 is less than 0.05; hence we reject the null hypothesis Ho: constant variance; thus, the residuals do not display constant variance. Our current model fails the homoskedasticity test.

Multicollinearity.

Table 5: VIF test result of multicollinearity of defined OLS model.

Variable	**VIF**	**1/VIF**
af_am	9.63	0.10
male_af_am	6.59	0.15
male_young	5.80	0.17
young	5.57	0.18
male_misdem	5.53	0.18
misdem	5.06	0.20
caucasian	4.72	0.21
male	3.03	0.33
hisp	2.28	0.44
old	1.11	0.90
asian	1.09	0.92
nat_am	1.03	0.97
Mean VIF	4.29	-

Table 5 shows that the variables we analyzed all have VIF < 10, indicating the relationship among independent variables is not perfectly multicollinear. Our model passes the multicollinearity test.

Omitted Variable Test.

```
Ramsey RESET test using powers of the fitted values of recid
      Ho:  model has no omitted variables
               F(3, 6156) =      1.60
                 Prob > F =      0.1864
```

Figure 4: Omitted variable test result of defined OLS model.

DOI: 10.54254/2754-1169/17/20231066

The null hypothesis is that the model does not have omitted-variables bias and as the p-value is higher than the usual threshold of 0.05 (95% significance), we fail to reject the null hypothesis and conclude that we do not need more variables [7]. However, we still need to consider the possibility of other independent variables influencing recidivism, including educational background, social status, etc. The problem is that those omitted factors could be indirectly related to the ones we are currently analyzing, making us fail to reject the null hypothesis.

Normality.

Our model failed the normality test as the data follows the binary distribution.

But the normality test helps us introduce the logistic regression model as the data distribution shows approximately a binomial distribution which is precisely how the logistic regression model works. Even though we could add more variables that might affect recidivism based on the current data we had concerning different predicators, there are plenty of problems within the OLS model itself. Based on those points, we wouldn't consider using OLS model to analyze our data. Hence, we introduce the logistic model.

4.3. Logistic Regression Model

The logistic regression model is used because the above OLS model cannot directly predict or obtain the probability of an individual offender reoffending. The logistic regression model is suitable because it can fit the binary variables "Yes" or "No" perfectly. In addition, it can also derive the predicted probability of reoffending from the training set. R language was used to generate the logistic regression model in the research.

4.3.1. Single Variable: Basics and Optimization

In Figure 4 shown below, the number of stars behind the p-value means the significance.

Only a tiny p-value here refers to the tremendous significance.

The p-value of Caucasians and Hispanics is equal to 0.12 and 0.905858. It is clear now that Caucasian and Hispanic people, these two explanatory variables have no significant effects on the dependent variable "recidivism". That also highly corresponded to finding in the ordinary linear model.

Deleting these two variables without significant effects on the response variable can optimize the model and let us get a more ideal one.

```
> recidivism <- glm(recid ~ number_of_priors + + misdem + af_am + young + old + caucasian
+ hisp+male, data=recidivism_data_for_project, family=binomial())
> summary(recidivism)

Call:
glm(formula = recid ~ number_of_priors + +misdem + af_am + young +
    old + caucasian + hisp + male, family = binomial(), data = recidivism_data_for_projec
t)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-2.7431  -0.9690  -0.6463   1.0857   2.0686

Coefficients:
                 Estimate Std. Error z value Pr(>|z|)
(Intercept)      -0.60641    0.13235  -4.582 4.61e-06 ***
number_of_priors  0.78533    0.03825  20.532  < 2e-16 ***
misdem           -0.21872    0.05875  -3.723 0.000197 ***
af_am             0.28386    0.11928   2.380 0.017325 *
young             0.73328    0.06893  10.638  < 2e-16 ***
old              -0.66945    0.07607  -8.800  < 2e-16 ***
caucasian         0.18798    0.12195   1.541 0.123219
hisp              0.01758    0.14864   0.118 0.905858
male              0.34771    0.07185   4.840 1.30e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 8506.4  on 6171  degrees of freedom
Residual deviance: 7577.0  on 6163  degrees of freedom
AIC: 7595

Number of Fisher Scoring iterations: 4
```

Figure 5: Summary of initial logistic model in R, single variable.

DOI: 10.54254/2754-1169/17/20231066

```
> recidivism <- glm(recid ~ number_of_priors + misdem + af_am + young + old + male, data=
recidivism_data_for_project, family=binomial())
> summary(recidivism)

Call:
glm(formula = recid ~ number_of_priors + misdem + af_am + young +
    old + male, family = binomial(), data = recidivism_data_for_project)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-2.7456  -0.9714  -0.6652   1.0875   2.0129

Coefficients:
                Estimate Std. Error z value Pr(>|z|)
(Intercept)     -0.46518    0.07857  -5.921 3.21e-09 ***
number_of_priors  0.78713    0.03828  20.563  < 2e-16 ***
misdem          -0.21938    0.05871  -3.736 0.000187 ***
af_am            0.14939    0.05694   2.624 0.008700 **
young            0.73028    0.06887  10.604  < 2e-16 ***
old             -0.66132    0.07595  -8.708  < 2e-16 ***
male             0.33946    0.07171   4.734 2.21e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 8506.4  on 6171  degrees of freedom
Residual deviance: 7581.2  on 6165  degrees of freedom
AIC: 7595.2

Number of Fisher Scoring iterations: 4
```

Figure 6: Summary of optimized logistic model in R, single variable.

As shown in Figure 6, the function of predicting recidivism probability is:

$$\text{recid} = -0.66132(\text{old}) + 0.73028(\text{young}) + 0.78713(\text{priors}) + -0.21938(\text{misdem}) + 0.14939(\text{af\_am}) + 0.33946(\text{male}).$$

The function of the logistics model with a single variable is generally similar to the part of OLS model.

Table 6: Confident interval of logistic model, single variable.

	2.5%	97.5%
Intercept	-0.62	-0.31
Number_of_priors	0.71	0.86
misdem	-0.33	-0.10
af_am	0.037	0.261
young	0.60	0.866
old	-0.81	-0.51
male	0.199	0.481

Table 7: Coefficients logistic model, single variable.

Name	Intercept	Number_of_priors	misdem	Af_am	Young	Old	male
Estimate	-0.47	0.79	-0.219	0.15	0.73	-0.661	0.34
P_value	3.21e-9	<2e-16	0.00019	0.0087	<2e-16	<2e-16	2.21e-6

As we can see from Table 6 and 7, the 95% confidence intervals of each factor, each x variable, do not include 0, indicating that each element will affect recidivism. The P-value is all small enough (p-value < 0.05). In this case, this model is optimized. It's safe for us to use.

DOI: 10.54254/2754-1169/17/20231066

4.3.2. Regression Diagnostics

When the response variable has a limited number of values (such as logistic regression, it only has the binary variables in the dataset, “Yes” or “No”), the power of the diagnostic map is much reduced. Normality can’t be checked in the logistics model because they are not linear. In this case, partial approaches are used.

1.Linear Checking

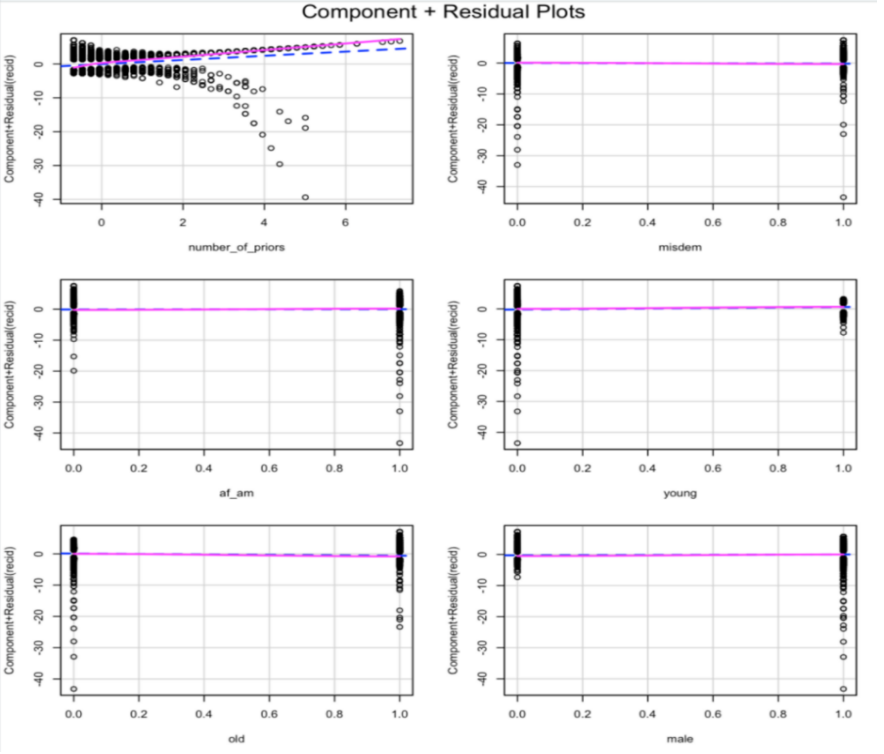


Figure 7: Linear checking.

In Figure 7, each fitted lines are close to horizontal. There is a solid linear relationship between reoffending and each independent variable.

2.Detection of Multicollinearity

```
> vif(recidivism)
number_of_priors          misdem           af_am           young
        1.140197        1.027530        1.065453        1.151107
             old            male
        1.093692        1.009400
> sqrt(vif(recidivism)) > 2 # problem?
number_of_priors          misdem           af_am           young
           FALSE           FALSE           FALSE           FALSE
             old            male
           FALSE           FALSE
```

Figure 8: Detection of multicollinearity.

They are using the variance inflation factor to check the errors of the model. The sign of the evo-

DOI: 10.54254/2754-1169/17/20231066

lution of their vif value is all lower than 2, indicating no multicollinearity problem in the logistics model.

3.Outlier Test

```
> outlierTest(recidivism)
No Studentized residuals with Bonferroni p < 0.05
Largest |rstudent|:
      rstudent unadjusted p-value Bonferroni p
5541 -2.752534         0.0059136            NA
```

Figure 9: Detection of outlier.

This function in R module determines whether there are outliers based on the significance of a single maximum (positive or negative) residual. P=0.0059136, more diminutive than 0.05, demonstrates no outliers in the data set.

4.Influence Points

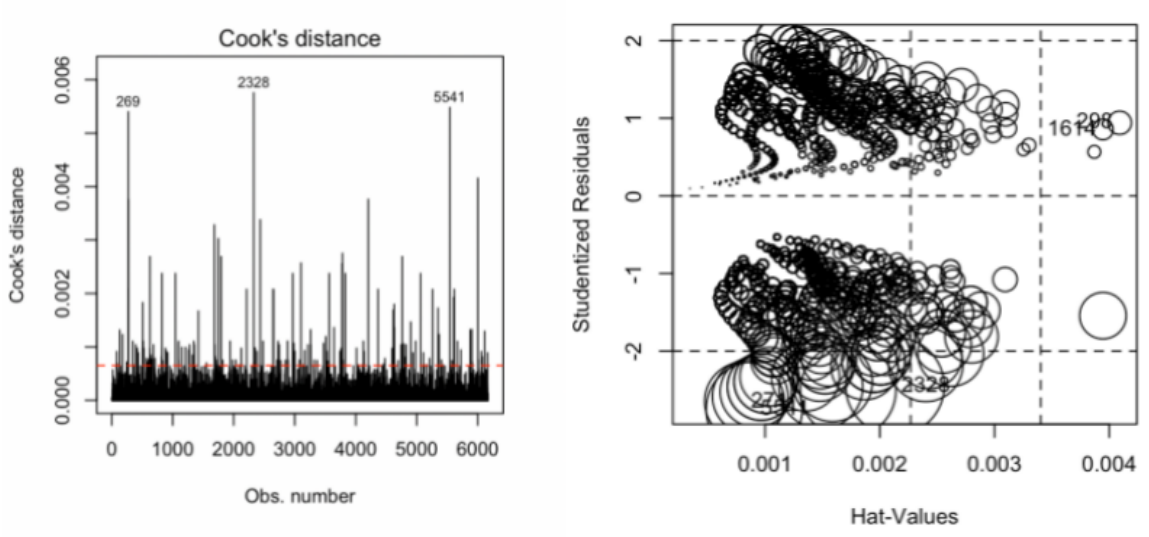


Figure 10: Influence points.

There are three influence points, 269,2328, and 5541. If one of them changes its numerical size, the pattern of the entire data set will be dramatically changed. Their leading group is nearly all within between absolute value 2 of studentized residuals, which is reasonable, and made diagnosis is relatively successful.

4.3.3. Training Data Set

From Table 8, on the contrary, for those older than 25, the probability of reoffending is multiplied by 0.5161718.

DOI: 10.54254/2754-1169/17/20231066

Table 8: Exponentiate coefficients, single variable.

	Exponentiate Coefficient of Recidivism
Intercept	0.63
Number_of_priors	2.20
Misdemeanor	0.80
Af_am	1.16
Young	2.08
Old	0.52
Male	1.40

Having the features that a criminal record, af_am, young, male parts appear in a criminal, the probability of reoffending will increase. However, the misdemeanor and old(age above 25) features appear on the offender, and the likelihood of his reoffense decreases, like the "old" variable, nearly smaller than its original two times. These factors or traits can be present in a person simultaneously, except old and young are mutually exclusive.

The predictor variable cannot be equal to 0; the intercept term has no particular meaning here.

Table 9: Prediction of recidivism probability.

	old	misdem	priors	af_am	young	male
old	1	---	---	---	---	---
misdem	---	1	---	---	---	---
priors	---	---	1	---	---	---
af_am	---	---	---	1	---	---
young	---	---	---	---	1	---
male	---	---	---	---	---	1
Tested Probability	0.33	0.42	0.65	0.48	0.60	0.47

From Table 9, it can be intuitively found that when the occurrence of each feature is 1, the recidivism probability is: number of priors > young > af_am > male > misdem > old.

The most significant factor that increases the probability of re-offending is the number of criminal priors, roughly 0.65. The more priors, the more likely the criminal is to re-offend. The second most crucial influencer is young, followed by African Americans, male, misdemeanor, and finally old, 0.3321.

The conclusion of the test dataset successfully validates the functionality of the model. Furthermore, the example of the training set is shown in Figure 11. Only the number of prior increased steadily, and all other values are controlled as its averages and unchanged.

DOI: 10.54254/2754-1169/17/20231066

Testdata_priors

Name	Af_am	Num_of_p	misdem	young	Old	male	prob
1	--	1	--	--	--	--	0.649
2	--	2	--	--	--	--	0.803
3	--	3	--	--	--	--	0.899
4	--	4	--	--	--	--	0.952
5	--	5	--	--	--	--	0.977

Figure 11: Predication of recidivism probability of "Number of Priors".

4.3.4. Interaction Variable: Model Basic Information

```
Coefficients:
                          Estimate Std. Error z value Pr(>|z|)
(Intercept)             -0.014720   0.125958  -0.117 0.906970
number_of_priors         1.199087   0.133271   8.997  < 2e-16 ***
af_am                   -0.262878   0.138182  -1.902 0.057118 .
young                    0.676515   0.190697   3.548 0.000389 ***
old                     -0.689000   0.192524  -3.579 0.000345 ***
male                    -0.173375   0.137675  -1.259 0.207921
misdem                  -0.380012   0.145021  -2.620 0.008783 **
young:male               0.456287   0.183435   2.487 0.012866 *
old:male                 0.066511   0.202503   0.328 0.742574
af_am:male               0.475552   0.150910   3.151 0.001626 **
male:misdem              0.230766   0.154945   1.489 0.136398
old:misdem              -0.002093   0.150445  -0.014 0.988899
number_of_priors:male   -0.274332   0.125420  -2.187 0.028720 *
number_of_priors:af_am  -0.216494   0.078870  -2.745 0.006052 **
number_of_priors:young   0.666613   0.197846   3.369 0.000753 ***
number_of_priors:old    -0.193219   0.077150  -2.504 0.012264 *
number_of_priors:misdem  0.047953   0.080905   0.593 0.553371
```

Figure 12: Summary of logistic model, interaction variable.

Concluding from Figure 11, the influence of many parameters on "recidivism" has changed with the addition of different interaction terms. However, the overall pattern has changed little.

Table 10: Exponentiate coefficient, interaction variable.

X Variables	Exponentiate Coefficients
priors	2.63
Young (age <25)	1.83
Old (age > 25)	0.51
Misdemeanor	0.65
Young* male	1.73
Af_am* male	1.52
Priors* af_am	0.80
Priors* young	1.97
Priors* old	0.82

DOI: 10.54254/2754-1169/17/20231066

In Table 10, it can take "prior*young" as an example. The interpretation for this chart can be if this crime has a prior conviction, they are young (the age is above 25), their recidivism probability will multiply 1.97.

1. It's similar to prior single variable logistics regression. The most significant variable is still the "number of prior convictions". The recidivism will be multiplied by 2.63. We can safely believe that if this crime has a conviction history or is recorded, he has the most significant probability of recidivism, contrasting with other features. This is the specific group that police have to pay more focus to. Similarly, older offenders are the least likely to commit again since their reoffending probability is nearly negligible twice, multiplied by 0.51.

2. Interaction variables are more convincing than single variables. Consequently, "prior*young" is the most significant explanatory variable affecting recidivism. It can say that the most likely offenders have the "criminal record and young" trait, and the probability of reoffending will be multiplied by 1.97. When "prior of conviction" meets the "old" or "af_am" trait, they will reduce the likelihood of reoffending caused by "prior of conviction", since they are predicting recidivism probability would be multiplied by 0.82 and 0.79.

3. The concluded formula:

$$recid = 2.6272(priors) + 1.8320(young) + 0.5094(old) + 0.6490(misdeem) + 1.73(young * male) + 1.52(af\_am * male) + 0.80(priors * af\_am) + 1.97(priors * young) + 0.8171(priors * old)$$

This is more honorable than the one in the single variable logistics model.

4. Racial Bias

af_am	-0.262878	0.138182	-1.902	0.057118
caucasian	0.18798	0.12195	1.541	0.123219
hisp	0.01758	0.14864	0.118	0.905858

Figure 13: The contrast between af_am with other terms.

Figure 12, it shows that racial bias is not apparent. This is because if the variables are compared, af_am has a more negligible recidivism probability than other characteristics such as "prior number" or "youth". "af_am" isn't even significant because its p-value is too large. The pattern for African Americans is similar to that for Caucasian and Hispanic.

According to what is often said in society, African Americans always commit crimes, which is a false prejudice. In terms of the model, it is not significantly biased against African Americans.

4.4. Discussion

The conclusions from the logistic regression model are credible.

The variable with the most influence is the "number of priors". The criminal's constant crime shows that his living circumstances force him. One possible reason could be speculated to be poli-

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cy. The re-offender may be influenced by social inequality, such as racial prejudice and gender inequality. After they left prison, they perceived "discrimination against criminals" by society [8]. As a result, those offenders can not find regular jobs. In this case, the offender had to turn to crime to support his livelihood. They are kind of unequal social groups. It is accessible to do some mix-method research to solve the problem in the future.

It makes sense that older criminals will re-offend less. As criminals get older, their physical fitness declines. It gets in the way of their crimes. In addition, these criminals set up their families, even take on responsibilities for caring for children or become more stable, all potential causes of lower recidivism among older offenders.

5. Limitation

5.1. The Limitation of the OLS Model

1. With R-squared being 0.0615 for the final OLS model, which means it covers only approximately 6 percent variances of the variables, it is not a convincing result to use.

2. It doesn't directly show the probability of whether an individual might re-offend, given other essential factors. In other words, the OLS model indirectly reflects the result we seek.

3. The OLS model failed some classical assumptions of being a suitable or acceptable good model.

5.2. The Limitation of the Logistics Model

1. Although scholars who support systems that predict criminal procedures argue that big data and advanced machine learning make these analyses more accurate and less biased than humans [9]. However, the main limitation of logistic regression is the assumption of linearity between dependent and independent variables [10]. Nonlinear r problems cannot be solved by logistic regression. Interaction variables must be used in many places in our data set, which may lead to inaccurate data.

2. In the future, we can expand the dataset. For example, We can collect more independent variables, like observing more traits. We can also use more diversified methods, such as decision trees.

6. Conclusion

Through Logistics and OLS models, the "number of priors" is the factor that most affects the recidivism rate of criminals. It has contributed to the increase in recidivism more than any other factor in this data set. On the contrary, "old" is the minor factor affecting the recidivism rate of criminals in the data set. The older people are, the lower the recidivism rate. In our data analysis, "Hispanic", "African_American" and "Caucasian" are not counted as influencing factors because the hypothesis test does not have enough evidence of them (p-value is too small).

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All the authors contributed equally to this work and should be considered co-first authors.

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Research and Solutions to Common Problems in the Workplace

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Abstract: This paper summarizes four common problems in the workplace through a study of the Rio Tinto workplace: sexual harassment, gender discrimination, racial discrimination, and workplace bullying. These problems not only cause personal physical and psychological distress, but also result in persistent emotional and psychological hostile treatment of employees, taking out negative emotions on people around them, customers or colleagues. This can ultimately lead to the development of disruptive behavior in the workplace, further impacting company effectiveness. In the next part of the article, this paper proposes solutions to the above problems. Specifically, it is not only the individual level that needs to make corresponding efforts to prevent suffering from similar unfair phenomena, but also the state, society and workplace need to make corresponding efforts to improve the workplace environment and further enhance the productivity of companies and the work experience of employees.

Keywords: workplace, sexual harassment, gender discrimination, racial discrimination, workplace bullying

1. Introduction

1.1. Background

After everyone has a job, work takes up a lot of time in life. In this case, whether there is a comfortable working environment is very important for employees. On the one hand, a more comfortable environment and state of mind can make employees have a higher passion for work and improve their work efficiency. On the other hand, for the enterprise, a harmonious workplace relationship will also enable it to produce higher efficiency. But inevitably, in any company in this world, there will always be various workplace problems, such as sexism, bullying, sexual harassment, racial discrimination, etc. Although these problems are prevalent in all companies, few people think about what kind of companies create these problems and how companies can manage their employees to reduce these problems. In addition to these external causes, people who are subjected to bullying or gender discrimination rarely think about how to defend their rights.

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1.2. Related Research

1.2.1. Gender Discrimination

Coffeman et.al. experimented to study whether companies discriminate against gender for candidates with the same resume. This paper found that firms were more biased towards men for candidates with the same resume. Also, it found that this is mainly due to the reluctance of firms to hire groups that are perceived in beliefs to be less capable of doing the job. In addition, it summarizes some evidence that can describe gender differences [1]. Bilan et.al. examined whether employee compensation is related to gender and whether it affects the company's revenue. This article found through the study that gender equality is not achieved in companies worldwide. Such a phenomenon is also present in developed countries, but a better breakthrough was achieved in Ukraine. In addition, the article found that gender discrimination occurs mainly among women younger than 35 years old [2]. Kobrynowicz and Branscombe investigated whether victims of sex discrimination can perceive that they have been discriminated against. Also, this article examined whether or not the characteristics of an individual could influence whether or not they were discriminated against. It found that for women, the higher the need for recognition, the less likely they were to feel discrimination. But women were more likely to feel gender discrimination if they suffered from depression [3].

1.2.2. Sexual Harassment

Maypole et.al. found that in the workplace, the main group of people who are sexually harassed are women. Furthermore, this article discusses how groups that receive sexual harassment can defend their rights through reasonable means and extends the field to the social level [4]. Cortina and Areguin examine what sexual harassment is and how it manifests itself in the workplace. This article found that what is commonly thought of as sexual harassment is forcing someone to have sex, but this is not the case; sexual harassment is more of a defiance of the opposite sex and a form of harassment of the other person's self-esteem. The article also found that sexual harassment is prevalent in the workplace and is not limited to women, but is also experienced by men [5]. Hunt et.al. specifically examines the individual and organizational causes of sexual harassment. This article suggests that sexual harassment should be avoided from the perspective of organizational training. This article suggests that sexual harassment should be avoided from the perspective of organizational training, not just from the perspective of individual enhancement or improvement of individual perceptions [6].

1.2.3. Workplace Bullying

Bartlett et.al. examined previous scientific studies and summarized them. This article found that the previous studies did not specify what workplace bullying is. However, workplace bullying does have serious effects on individuals, including negative effects on physical health and personal emotions. The effects on the individual extend to damage to the organization [7]. Rayner examined data from a 1994 survey of primarily part-time students. This article found that more than half of the endured reported experiencing workplace bullying and that there were no gender differences in this phenomenon. In addition, it found that people who are bullied in the workplace are more resistant than perceived [8].

1.2.4. Racial Discrimination

Deitch et.al. examined the issue of racial discrimination in the workplace. This article found that racial discrimination is not an emergent phenomenon, but a daily experience. People who are

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discriminated against suffer from pervasive racial discrimination over time. It also found that this discrimination affects the physical health of the discriminated people [9]. Ahmed et.al. examined the multifaceted health effects of racial discrimination in the workplace. This article found that the restriction and marginalization of the population had a significant negative impact on health of this population. The main surface of this is the development of low self-esteem in this population, which is also a sign of mental ill health [10].

1.3. Objective

In response to the various problems faced in the workplace, this paper examines the relevant papers from four aspects: gender discrimination, sexual harassment, workplace bullying, and racial discrimination. In the following analysis, we will use the workplace research report of Rio Tinto Group as an opportunity to analyze each problem in the workplace from four aspects and propose further solutions to these problems. This report will help companies to understand how to improve the environment and thus improve their productivity.

2. Problems

In 2021, Rio Tinto requested an investigation by former Australian Sex Discrimination Commissioner Elizabeth Broderick & Co. The investigation is part of Rio Tinto CEO Jakob Stausholm's efforts to reshape the company's image after the company blew up two 46,000-year-old Aboriginal cave sanctuaries in Western Australia in 2020, drawing criticism from the community. The report is an independent study of 10,000 Rio Tinto employees. The report covers a quarter of Rio Tinto's workforce and spans five years and is 85 pages long. The findings, based on one-on-one interviews, show that nearly 30 percent of women and 7 percent of men said they had been sexually harassed at work. Of those, 21 female workers also reported cases of actual or attempted rape or sexual assault. The study also revealed that nearly half of all employees who were commissioned by Rio Tinto to conduct an external review of workplace culture at the mine said they had been bullied. In addition, one anonymous employee said that he encountered racial discrimination in every corner of this company. Taken together, this report from Rio Tinto's published survey exposes sexism, sexual harassment, bullying, and racial discrimination in Rio Tinto's people management.

2.1. Gender Discrimination

Gender discrimination in the workplace is not only manifested in unequal employment opportunities but also obvious differences in employment treatment, promotion opportunities, and other aspects. Compared with explicit discrimination before employment, the latter is more insidious and more difficult to qualify and regulate. Since enterprises need to pay compensation and insurance costs for female employees who have given birth and adjust their employment arrangements, they also bear more economic expenses. Some enterprises simply do not hire women to avoid such economic expenses. These regulations, which were originally designed to protect female workers, have become a "scare" for companies that do not want to hire women. When selecting employees, companies should consider equality as the first consideration, not the gender of the employee.

2.2. Sexual Harassment

Women are the main victims of sexual harassment in the workplace. Men and supervisors make up the majority of sexual harassment perpetrators. It is clear that many women in the workplace face not only gender oppression but also resource and power oppression when they are sexually harassed. This shows that sexual harassment in the workplace is a concentrated manifestation of unequal gender and

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power relations. In addition to quid pro quo sexual harassment by superiors against subordinates, there is also hostile sexual harassment among colleagues that is unfriendly to women. Sexual harassment is a manifestation of gender discrimination and is a result of the operation of gender power relations. Whereas sexism involves the objectification of women, sexual harassment demeans and objectifies women. The harm caused to women by these acts is widespread and profound. The unequal gender power structure allows men to sexually harass women with impunity. This is the fundamental reason why sexual harassment exists.

2.3. Workplace Bullying

In the workplace, an employee is frequently in conflict with someone. But as an employee, he or she instinctively believes that conflict is normal in the workplace. Specifically, it includes abusive management from upper management: managers hurt the bully through a series of behaviors, including sabotage, harassment, bullying, neglect, humiliation, etc., which negatively affects his daily work. Workplace rejection from co-workers: Ostracism or discrimination from co-workers in the workplace, including indifference, social isolation, and avoidance of eye contact. Co-worker rejection causes employees to lose their organizational identity and the value of their presence in the organization is not perceived.

Collective isolation and rejection from subordinates to superiors: Leaders in the workplace belong to relatively strong groups and are also more likely to offend. As a result, subordinates form small groups on their own, venting their dissatisfaction with each other's leadership, and collectively excluding their superiors in their daily work activities, intentionally or unintentionally. This form of bullying is often difficult to resolve and even difficult to detect. Workplace bullying not only hurts self-esteem and affects employees' physical health, leading to a series of complications including headaches and insomnia, but also increases the risk of employees suffering from psychological and mental illness. Meanwhile, for the corporate culture, employees in a workplace bullying environment tend to form a negative corporate culture atmosphere, making employees dissatisfied and complaining mentality towards the management and development of the company, which may lead to slack work, less satisfaction, increased absenteeism, and decreased productivity.

2.4. Racial Discrimination

Racial discrimination does not only exist in society but also occurs in the management of companies. The latest Asian-Australian Leadership Report from research and consulting firm Cultural Intelligence shows that just under 5 percent of Asian Australians succeed in rising to senior management, with only 1.6 percent of executives becoming chief executives. This is due to three main reasons: cultural bias, stereotypes and institutional barriers. In terms of cultural bias, Western leadership styles place a premium on self-promotion and decisive, direct communication. This leads them to often misunderstand people who maintain a silent, humble and respectful attitude, assuming that they lack confidence. In terms of stereotypes, the exemplary image of the leader in the workplace is very 'white' and very masculine, and that is a clear 'salesman' style of leadership. This brings about direct discrimination against other people who do not fit this profile. In terms of institutional barriers, the existing leadership is more inclined to promote people of the same race, which will result in companies not selecting people based solely on their ability. And to a certain extent, it creates racial discrimination.

3. Solution

The workplace problems mentioned above are deeply rooted in the workplace, especially sexism and racial discrimination, which are not only in the workplace but also in society, and have deep cultural

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reasons behind them. Sexism and racial discrimination in the workplace are the mappings of these two problems in society. The history of human evolution is a history of industrial evolution. In the thousands of years of human civilization, patriarchal clans have dominated. Therefore the idea of male superiority over females has always existed in society. And racial discrimination is also a legacy of the history of human development. Therefore, it takes time to eradicate the workplace culture that discriminates against women and minorities, which has long been a hardcore problem rooted in the soil of society and culture. If male-dominated workplace power is unchecked and female employees are chronically disadvantaged, then discrimination is the norm and sexual harassment is inevitable.

Therefore, the solution to each problem in the workplace requires a comprehensive approach from all aspects of society.

3.1. National Initiatives

The country needs to learn from the effective legislation and practical experience of other countries around the world. Under the existing legal framework, we need to establish a legislative program that focuses on prevention and remedies to effectively address the existing problems of workplace discrimination and workplace bullying. Urge relevant industries to develop policies and measures for the fundamental prevention of workplace discrimination and workplace bullying. The state should take measures to highlight various policy systems, public education, and public opinion guidance. Severe penalties are imposed on organizations with employment discrimination in legislative provisions.

3.2. The Societal Solution

The situation of individuals is determined by the macro environment, and it is difficult to improve the situation of individuals when the macro environment is not changed. The macro-environment here, besides legal protection, focuses on the division of roles of women in society and whether it is female-friendly or not. Building a female-friendly society is not a one-day process. The key to improving the macro environment is to enhance their social power and voice and thus improve the division of labor in society as a whole. Gender discrimination in society comes not only from external groups but also from within. Many women will think of themselves as weak, insufficiently competitive, and poorly resistant to pressure, etc., and have the idea of backing off and giving up on the workplace. Women need to overcome psychological barriers and not set a fixed framework for themselves.

Likewise, it is important to emphasize cultural diversity in society, where different ethnic cultures are part of the culture. It is important to accept this diversity in an inclusive and friendly form and treat minorities equally.

Some bullying behaviors by superiors towards subordinates are aberrant behaviors such as excessive monitoring of work, loud reprimands and arranging for subordinates to take on personal matters, which are ignored as ordinary work behaviors in the eyes of the general society, but these are very common leadership bullying behaviors. Therefore, society should call for the elimination of bullying to start with these small things, so that employees can wake up and increase their awareness of self-protection.

3.3. The Way at the Company Level

The way at the company level is the main battlefield and the backbone of the company that can eliminate workplace problems. The following suggestions will be made from the company's employment process.

DOI: 10.54254/2754-1169/17/20231067

3.3.1. Selection and Recruitment

Ensure that job descriptions and requirements in job advertisements are free of gender bias, and racial bias. Take affirmative action to remove vertical and horizontal barriers based on gender and racial discrimination in the recruitment process. Ensure equal representation of men and women on hiring committees as well as ensuring the presence of ethnic minorities. Ensure that the interview and screening process is gender-sensitive and racially sensitive. Articulate the organization's commitment to gender equality and reflect gender equality in employment contracts without unfair terms for women.

3.3.2. Training and Development

Training and promotion within the company should be fair and equitable, ensuring that women and minorities have equal access to all activities. To ensure equal opportunities, an audit committee could be established to review training and promotions within the company to ensure that men and women have equal access to training and career development opportunities. Specialized institutions can also be established to provide special skills training for women, breaking the traditional skills gap between men and women. Provide women with non-traditional female positions while maintaining the company's normal operations. At the same time, instead of fixing the positions that women hold in defense, they can be rotated periodically so that women can have more job opportunities to expand their skills. In addition, provide training for managers to change their traditional mindset of non-gender-specific job assignments and increase gender sensitivity. Establish a mutual support mechanism where women can learn not only from other women but also from men. At the same time, the company has to make long-term human resource planning in which a human resource/career development plan is made for all employees.

3.3.3. Performance Evaluation

Clear performance criteria are set within the company and do not discriminate against women and minorities. The performance review process is determined by a gender-aware panel, which determines the criteria, content and structure of the review interview. These procedures need to be regularly reviewed by an established person or organization to ensure fairness and integrity.

3.3.4. Promotion System

Make adjustments to the company's current promotion system to provide more opportunities for women and minorities to advance. For example, changing job hierarchies and adding new levels; creating new promotion paths for jobs that do not have room for advancement to ensure horizontal and vertical mobility. In addition, we will provide opportunities for women and minorities in non-traditional management positions to ensure diversity in the company's management positions following the company's actual situation.

3.3.5. Salary

Adjust wage and salary rates so that there is no gender discrimination or racial discrimination, and eliminate situations where equal work is not paid equally. Ensure (1) the same pay for the same value of work (2) the same working conditions/hours for the same value of work (3) equal pay for equal work.

DOI: 10.54254/2754-1169/17/20231067

3.3.6. Work Environment

Gender-friendly infrastructure and amenities need to be installed in the company. All machines, equipment and tools in the company should be accessible to all genders. A dedicated organization or department within the company should be set up to focus and work on family crises and stresses for both men and women, such as providing the necessary counseling, flexible working hours, or other support for those who need it. Regular communication meetings are held to allow for interaction and understanding among employees within the company.

3.3.7. Prevent Sexual Harassment

Special regulations on the prevention and control of sexual harassment in the workplace should be established. The regulations should specify the specialized agency for prevention and control of sexual harassment in the workplace and its specific responsibilities, as well as the telephone number for complaints, and the obligations of the company's management to prevent and control sexual harassment in the workplace. The company shall stipulate the procedures for receiving complaints, investigating and collecting evidence, identifying and dealing with sexual harassment, as well as the penalties for sexual harassers. The rules and regulations related to sexual harassment in the workplace shall be made known to all employees in a public manner. Include prevention and control of sexual harassment in the workplace in employee induction training and management training. Without violating employees' privacy, install monitoring equipment in the office legally and without leaving "dead spots" to prevent sexual harassment and to help preserve evidence of sexual harassment. Avoid separate or overly private office spaces by using group or semi-closed offices.

3.3.8. Prevent Workplace Bullying

First, as with sexual harassment prevention, companies must establish appropriate prevention, monitoring and grievance task forces, along with clear penalties for bullies. Second, when selecting a leader within the company, the company needs to seek the evaluation of the person by other staff members within the company to prevent bullying before the staff member assumes the position. Pre-employment training is also needed before the leader takes office to prevent bullying after he or she is promoted. Finally, psychological counseling and placement measures should be done for the bully so that he or she can get out of the psychological barrier and get back to work as soon as possible.

3.3.9. Regulatory Compliance

The company will provide regular training for management so that they are familiar with all current laws and national policies regarding gender equality, workplace bullying, sexual harassment in the workplace, and racial discrimination. Also, the company has a management system in place that requires all staff to comply with and enforce relevant laws and regulations.

3.3.10. Shape a New Workplace Culture

Set up flexible activity arrangements within the company, provide employees with family time and childcare space, and offer other benefits to ease the burden on their families. Share the benefits of streamlining the size of the business by improving the working environment and conditions for employees. Design gender-equitable work models and mechanisms to ensure and encourage equal participation of women. Strive for zero tolerance of gender discrimination and cultural diversity in the workplace and workplace culture, which can also improve productivity. But the potential benefits can only be realized if organizations are intentional about creating a diverse workplace climate.

DOI: 10.54254/2754-1169/17/20231067

Companies should also develop a growth plan for the next five years, review the achievement of goals each year, and use diversity as an important indicator of a company's success.

4. Conclusion

In this paper, through the literature review and the study of the workplace research report of Rio Tinto Group, we uncovered the problems of gender discrimination, sexual harassment, workplace bullying and racial discrimination in the workplace. These problems will not only cause personal physical and psychological distress but will also cause persistent emotional and psychological hostile treatment by employees, taking out negative emotions on their surroundings, customers, or colleagues. This will eventually lead to the creation of workplace disruptive behaviors, further affecting the effectiveness of the company. Each workplace problem occurs for different reasons, but there are also commonalities. To solve these workplace problems, society, companies, and individuals need to work together, and the national government needs to enact sound laws. Society should pay attention to these workplace problems and promote the right cultural orientation to build a female-friendly society and emphasize cultural diversity. Companies need to strictly enforce laws and establish reasonable rules and regulations. Eliminate bad workplace culture from the daily processes of company operations and solve workplace problems. Individuals should resolutely defend their rights and bravely fight against workplace discrimination and workplace bullying. This article focuses more on how to prevent workplace discrimination at the company level. There is still a lack of detailed and strict protection for the national society and individual level, especially the law-making and the society. For future research, we need to further focus on how to legislate at the national level to effectively prevent workplace discrimination.

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Review on Three New Value at Risk (VaR) Models

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Abstract: The emergence of financial derivatives complicates traditional financial products and increases financial market volatility. Individuals and financial institutions are both exposed to more complex and uncontrollable risks in this environment. Because of the risk's uncertainty, we must use reasonable methods to predict and estimate it in order to achieve the goal of risk control. This paper discusses three new VaR (Value at Risk) models that have emerged in recent years based on the ARCH family model using a method of literature review. The ARMA-EGARCH model, for example, combines the ARMA model to describe constant variance time series and the EGARCH model to describe heteroscedasticity phenomena, and theoretically can better describe the fluctuations of financial time series and obtain an independent time series with the same distribution. The sequence is processed using extreme value theory, which is the ARMA-EGARCH-GPPD model, in conjunction with the GPD model. We used the ARMA-EGARCH-semi-parametric method in conjunction with the historical simulation method and the parameter method to avoid cumbersome quantile calculation because the model algorithm is more complex. The generalized EWMA risk value prediction model has more advantages for financial data with large peaks.

Keywords: VaR, ARCH series model, ARMA-EGARCH-GPPD model, generalized-EWMA model

1. Introduction

In the last century, there have been unprecedented developments in international financial markets, which are now beginning to take place. The emergence of financial derivatives is one of the most significant changes in comparison to previous financial markets. Derivatives have increased the complexity of traditional financial products, resulting in increased volatility in financial markets and an unstoppable trend toward globalization. Under such conditions, both individuals and financial institutions face more complex and uncontrollable risks, and the financial market's whims and whims will have an impact on human economic life worldwide. We must proactively manage uncontrollable and uncertain risks rather than simply avoiding them or doing nothing at all. Only through the use of proper methods and active control can investors and financial institutions reduce losses and grow more steadily. Value at risk is a risk index, statistical data, and measurement method [1]. VAR enables people to intuitively understand their maximum loss value and probability in the future, allowing them to address and manage risks. Risk is quantified by the value at risk. It is simply the proportion of assets that are at risk when market volatility is normal. This is the risky value.

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VaR is a relatively new approach of gauging financial market risk, yet it has become a research hotspot. G-30, an international private research company, originally proposed regulating risk via VaR in 1993 [2]. VaR prediction methods include historical simulation (HS), moving average (MA), and exponentially weighted moving average (EWMA) (ARCH model). Because the ARCH model depicts the fluctuation clustering of financial time series, people have promoted it, forming a general ARCH model and ARCH series model. These models have different advantages in characterizing financial time series, so scholars will choose different models according to the different needs of time series when estimating VaR, so a large number of VaR models with different manifestations. Ning Tang proposed the ARMA-EGARCH-GPPD model in 2016 [2]. Aerambamoorthy Thavaneswaran, Alex Paseka, and Julieta Frank suggested a data-driven generalized EWMA model to reduce the asymptotic variance of the volatility estimator [3]. Hemant Kumar Badaye and Jason Narsoo proposed the MC-GARCH-Copula model, which can predict VaR and ES for the next 1 min [4]. Tianyi Wang et al. introduced the GARCH-RSRK model, which determines return, realized volatility, realized skewness, and realized kurtosis [5].

Starting from the theoretical foundation of value-at-risk, this paper introduces several value-at-risk models in recent years, and compares the model's shortcomings and advantages using the method of comparison, in order to look into the future development direction of value-at-risk theory.

2. Value at Risk Theory

VaR is a statistical estimate of an asset's loss in a given risk range caused by normal market fluctuations during a holding period. VaR can be defined by financial institutions as the maximum loss of financial assets with a given probability over a given time period. In the case of normal market fluctuations, VaR is defined as the maximum loss that is expected to occur in the value of a specific financial asset or security portfolio within a specific period in the future under a given probability level (confidence level). For example, if a company has a $100,000 value at risk and a 95% confidence level, there is a 5% chance that each of the company's $1 million assets will suffer a maximum loss of $100,000 in the next 24 hours. People can make decisions based on predicted data as well as their own risk preference or aversion.

Two parameters must be determined to calculate value at risk: asset holding period and result confidence. Confidence level is loss probability interval. The likelihood increases the risk value. Higher confidence means the loss is less likely to surpass the projected value at risk. There is no hard and fast rule for determining whether a higher or lower confidence level is preferable. Because a high confidence level may overestimate the risk, a low confidence level may underestimate the risk. In general, a confidence level of 90% to 99% is appropriate. The holding period can be set to be a day, a week, a month, or a year, among other options. If the holding period is excessively long, an assumption should be made about the data, namely that the sample data are independent and identically distributed. If the data is relatively large, the holding period could be as short as one hour or as long as one minute. As a result, the holding period should be chosen based on the characteristics of the data and the needs of the users.

If x represents the return of the user's venture capital, x is a random variable and its probability density function is $f(x)$, then the value at risk with confidence level α is defined as[3]:

$$P(x \leq VaR) = \alpha \tag{2.1}$$

$$\alpha = \int_{-\infty}^{VaR} f(x)\,dx \tag{2.2}$$

3. Introduction to Several Types of VaR Estimation Models

There are three types of VAR estimation methods: non-parametric, semi-parametric, and parametric

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[6]. More computational models are derived from this, which play a role in various financial markets. This paper begins with ARCH family models, then discusses three models based on these models that have emerged in recent years, as well as their benefits and drawbacks.

3.1. ARCH Series Model

To calculate VaR, the variance and standard deviation of the return rate, i.e. its volatility, must be estimated. Because the default volatility of the return rate did not change in the early studies, the volatility of the return rate was set to a constant. However, according to additional research and reflection on practical problems, volatility is not a constant, but rather changes with time and has heap and aggregation characteristics.

3.1.1. ARCH Model

The ARCH model was first proposed by Engle [7], whose autoregressive conditional abnormal difference model can provide a better explanation and analysis of volatility. He defined $ARCH(q)$ model as:

$$y_t = u_t + \varepsilon_t (t = 1,2,\cdots,n) \tag{3.1}$$

$$\varepsilon_t = \sigma_t e_t, E(e_t) = 0, D(e_t) = 1 \tag{3.2}$$

$$\sigma_t{}^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}{}^2 + \alpha_2 \varepsilon_{t-2}{}^2 + \cdots + \alpha_q \varepsilon_{t-q}{}^2 \tag{3.3}$$

The formula (3.1) is called the mean equation of $ARCH(q)$ model. ε_t is the random perturbation term of the sequence at time t. e_t is a sequence of independent same-distribution residuals. The formula (3.3) is called the conditional equation of variance.

However, for this model, if you want to get a better fitting effect, the lag order q will be quite large, which increases the difficulty and accuracy of the model fitting. And in practice, σ_t^2 does not necessarily satisfy the linear function conditions in the equations of variance.

3.1.2. GARCH Model

To improve on both shortcomings, Bollerslav generalized the ARCH model to the generalized ARCH model (GARCH model). The definition of the $GARCH(p,q)$ model is based on the ARCH model definition, and the conditional equation of variance is changed as:

$$\sigma_t{}^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}{}^2 + \sum_{j=1}^{p} \beta_j \sigma_{t-j}{}^2 \tag{3.4}$$

where the coefficient $\alpha_0 > 0, \alpha_i \geq 0 (i = 1,2,\ldots,q), \beta_j \geq 0 (j = 1,2,\ldots,p)$. This avoids the defect of large lagging order and linear relationship on the basis of the original $ARCH(q)$.

3.1.3. TARCH Model

After a deeper examination of the GARCH model, it was discovered that the condition that the coefficient in this model was not negative was difficult to guarantee, but many financial time series had obvious leverage effects, which the model was unable to characterize, so Zakoian proposed the TARCH model in the study. The TARCH model retains the GARCH model's mean equation but replaces the variance equation to:

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q} (\alpha_i \varepsilon_{t-i}{}^2 + \varphi_i \varepsilon_{t-1}^2 I_{t-1}) + \sum_{j-1}^{p} \beta_j \sigma_{t-j}^2 \tag{3.5}$$

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Where when ε_{t-1} is not negative, $I_{t-1}=1$; when ε_{t-1} is negative, $I_{t-1}=0$. This reflects the effect of the ε_{t-1} symbol on σ_t^2.

3.1.4. EGARCH Model

By 1991, Nelson had proposed the EGARCH model, which had similar advantages to the TARCH model in terms of characterizing the volatility of financial time series. The $EGARCH(p,q)$ model is defined as:

$$y_t = u_t + \varepsilon_t (t = 1,2,\cdots,n) \tag{3.6}$$

$$\varepsilon_t = \sigma_t e_t, E(e_t) = 0, D(e_t) = 1 \tag{3.7}$$

$$log\ {\sigma_t}^2 = \alpha_0 + \sum_{i=1}^{q}(\alpha_i \left|\frac{\varepsilon_{t-i}}{\sigma_{t-i}}\right| + \varphi_i \frac{\varepsilon_{t-i}}{\sigma_{t-i}}) + \sum_{j=1}^{p} \beta_j\ log\ {\sigma_{t-j}}^2 \tag{3.8}$$

There is no requirement for positive or negative coefficients. Also, $\alpha_i \left|\frac{\varepsilon_{t-i}}{\sigma_{t-i}}\right|$ and $\varphi_i \frac{\varepsilon_{t-i}}{\sigma_{t-i}}$ reflect the magnitude of ε_{t-i} and the effect of positive and negative changes on the variance of conditions

3.1.5. ARMA-EGARCH Model

Financial time series show heteroscedasticity as a whole, but they show constant variance from the perspective of individual time periods. In practical applications we can use the ARMA model (Autoregreesive-Moving Average Model) to describe time series with constant variance. The general form of the $ARMA(p,q)$ model [8] is:

$$R_t = c_0 + \sum_{i=1}^{p} \phi_i R_{t-i} + \sum_{j=1}^{q} \theta_j \varepsilon_{t-j} \tag{3.9}$$

Where $\varepsilon_t \square WN(0,\sigma^2)$, and satisfies $\forall s < t, E(R \bullet \varepsilon_t) = 0$.

In fact, the EGARCH model can accurately describe the variance time variability and leverage effect of the majority of financial time series. As a result, the two models can be combined, first with the ARMA model to characterize the mean equation, and then with the EGARCH model to depict the residual after the ARMA model, to theoretically better describe the fluctuations of the financial time series. Combined with the general expression of the ARMA and EGARCH models, the $ARMA(p,q)-EGARCH(m,n)$ model can be expressed as:

$$R_t = u_t + \varepsilon_t, u_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i R_{i-1} + \sum_{j=1}^{q} \beta_j \varepsilon_{t-j} \tag{3.10}$$

$$\varepsilon_t = \sigma_t e_t, E(e_t) = 0, D(e_t) = 1 \quad (3.11) \tag{3.11}$$

$$log\ {\sigma_t}^2 = \phi_0 + \sum_{\kappa=1}^{m}(\phi_\kappa \left|\frac{\varepsilon_{t-\kappa}}{\sigma_{t-\kappa}}\right| + \varphi_\kappa \frac{\varepsilon_{t-\kappa}}{\sigma_{t-\kappa}}) + \sum_{\xi=1}^{n} \theta_\xi\ log\ {\sigma_{t-\xi}}^2 \tag{3.12}$$

where e_t is an independent residuals sequence with the same distribution; σ_t is the standard deviation of the sequence R_t; ε_t is a random perturbation term that enters the system at t moment, and satisfies:

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3.2. ARMA-EGARCH-GPD Model

3.2.1. Generalized Pareto Distribution

Generalized Pareto distribution (GPD) [9], is a right-skewed distribution that is generally expressed as [9]:

$$G_{\tau,\gamma}(y) = \begin{cases} 1-(1+\frac{\tau y}{\gamma})^{-\frac{1}{\tau}} & \tau \neq 0 \\ 1-e^{-\frac{y}{\gamma}} & \tau=0 \end{cases} \tag{3.14}$$

Where $y \in \begin{cases} [0, x_F - u] & \tau \geq 0 \\ [0, -\frac{y}{\tau}] & \tau<0 \end{cases}$, x_F is the right endpoint of the distribution function F.

Let the random variable X of the independent same distribution satisfy the unknown distribution as $F(X)$, and when given a determined threshold of u, if you make $y = x-u$, there is a conditional super-threshold distribution function $F_u(y) = P(x-u \leq y | x > u)$. If the threshold value u is large enough, the conditional over-threshold distribution function F_u is similar to GPD, that is $F_u(y) \approx G_{\tau,\gamma}(y)$.

From this equation (3.14) can be deformed to:

$$F_u(y) = \frac{F(x)-F(y)}{1-F(u)} \tag{3.15}$$

In the equation(3.15), with $(1-\frac{n_u}{n})$ as the estimation of $F(u)$ (where n is the total number of samples and n_u is the number of numbers in the sample whose values are greater than the threshold of u, then the tail estimation function of the distribution function $F(X)$ can be obtained:

$$\hat{F}(x) = \begin{cases} 1-\frac{n_u}{n}[1+\frac{\hat{\tau}}{\hat{\gamma}}(x-u)]^{-\frac{1}{\hat{\tau}}} & \hat{\tau} \neq 0 \\ 1-\frac{n_u}{n}e^{-\frac{x-u}{\hat{\gamma}}} & \hat{\tau} = 0 \end{cases} \tag{3.16}$$

where $\hat{\tau}, \hat{\gamma}$ are the estimation of parameter τ, γ in the GPD by the maximal likelihood method respectively. For sample $y_i (y_i = x_i - u, x_i > u)$ beyond the threshold u, the likelihood function of the generalized Pareto function is:

$$l = \begin{cases} -n_u \log\gamma + (\frac{1}{\tau}-1)\sum_{i=1}^{n_u} \log(1-\frac{\tau y_i}{\gamma}) & \tau \neq 0 \\ -n_u \log\gamma - \frac{1}{\gamma}\sum_{i=1}^{n_u} y_i & \tau = 0 \end{cases} \tag{3.17}$$

If the two formulas of the tail estimation function are equal to $1-\alpha$ (α is the significant level), the expression of the upper tail α quantile function VaR_α of the Pareto distribution can be regurgitated:

DOI: 10.54254/2754-1169/17/20231068

$$VaR_\alpha = \begin{cases} u + \frac{\hat{\gamma}}{\hat{\tau}}[(\frac{n}{n_u}\alpha)^{-\hat{\tau}} - 1] & \hat{\tau} \neq 0 \\ u - \hat{\gamma}\, ln^{\frac{n}{n_u}\alpha} & \hat{\tau}=0 \end{cases} \quad (3.18)$$

3.2.2. Introduction of ARMA-EGARCH-GPD Model

For independent time series with the same distribution, the extreme value theory can be applied to the unprocessed time series to calculate VaR. The general time series model is not independent of the same distribution, at this time it needs to be filtered by the ARCH series model, and the resulting residual sequence can meet the conditions of independent same distribution. Therefore, it is theoretically possible to combine extreme value theory and ARCH family models to study VaR. At the same time, with a large number of empirical analysis studies by scholars in recent years, the accuracy of this method in calculating VaR has also been confirmed. In the ARCH series model, the ARMA-EGARCH model has the dual advantages of ARMA model characterizing the constant variance and the EGARCH model characterizing heteroscedasticity, leverage effect, etc.

Therefore, when estimating VaR in this paper, the mean u_t, standard deviation σ_t and corresponding residual sequence $\{e_t\}$ of the t-time sequence $\{R_t\}$ are estimated by establishing an ARMA-EGARCH model for sequence $\{R_t\}$, and then use the GPD model to characterize the tail cloth of the $\{e_t\}$ sequence to obtain VaR_e, and finally get the estimate of VaR from $VaR_t = u_t + \sigma_t VaR_e$. Because this estimation model is a combination of the ARMA-EGARCH model and the GPD model, it is called the ARMA-EGARCH-GPD model [2].

3.2.3. Advantages and Disadvantages

The ARMA-EGARCH-GPD model is theoretically accurate, and no special restrictions are required for general time series to obtain more accurate VaR values. It overcomes the hypothetical linear function situation required by the ARCH model, the parameter non-negative condition required by the GARCH model, and can accurately and widely characterize the fluctuation situation and leverage effect of the sequence. The GPD model's depiction of the end of the sequence also makes the calculation of VaR more reasonable in comparison to the extreme value theory.

This method, however, is more time-consuming, and the thresholds in the GPD model cannot be too large or too small. Quantile estimation is time-consuming.

3.3. ARMA-EGARCH-semi-parametric Model

3.3.1. Introduction of ARMA-EGARCH-semi-parametric Model

ARMA-EGARCH-GPD model is more accurate in theory, but the method is more cumbersome, ARMA-EGARCH-semi-parameter methodcombines parameter method and historical simulation method on the basis of extreme value theory, avoiding cumbersome quantile calculation [2].

Similar to the previous section, we can estimate u_t and σ_t by building an ARMA-EGARCH model using parametric methods. According to VaR's general calculation formula

$$VaR_t = u_t + \sigma_t X_{1-\alpha} \quad (3.19)$$

only the $1-\alpha$ quantile $X_{1-\alpha}$ of the normalized distribution function of sequence $\{R_t\}$ is required. Inspired by the historical simulation method, we can first obtain VaR through the historical simulation

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method, and then substitute the general formula to find $X_{1-\alpha}$. The specific method is: the sequence $\{R_t\}$ is sorted from the largest to the smallest, take the sample point value corresponding to the total number of samples of $1-\alpha$ times as VaR_0, and set the standard deviation of the series to be σ_0 and the mean to be u, then:

$$X_{1-\alpha} = \frac{VaR_0 - u}{\sigma_0} \tag{3.20}$$

The estimate of $X_{1-\alpha}$ is obtained by historical simulation, and the VaR estimate is obtained by bringing u_t and σ_t obtained by the parameter method into the formula (3.19).

Because this method is to estimate VaR by using the ARMA-EGARCH model to estimate the parameter and nonparametric method to obtain quantiles, this model is called ARMA-EGARCH - semiparametric model.

3.3.2. Advantages and Disadvantages

ARMA-EGARCH-semi-parametricmodel combines the characteristics of the ARMA model to fit the constant variance and the EGARCH model to fit the heteroscedasticity effectively [10]. And instead of directly using the historical simulation method to find the quantile, but combining the parameter method on the basis of the historical simulation method, which avoids any assumptions about the distribution of the return, and can make the quantile more in line with the actual distribution. However, the method of estimating $X_{1-\alpha}$ using historical simulation is not necessarily optimal, so this model is not necessarily the optimal model for a particular sequence, and then you can study the estimation method of $X_{1-\alpha}$ to obtain the optimal model.

3.4. Generalized-EWMA Model

3.4.1. Introduction of Generalized-EWMA Model

Exponentially weighted moving average (EWMA) decreases the weighted coefficient of each value exponentially over time. The closer to the current moment, the bigger the numerical weighting coefficient. This approach does not need to save all prior data, unlike standard averaging methods. Second, the quantity of calculation has been minimized. In VaR estimation, for the square of the continuous compound return, EWMA can be used to get a prediction of conditional variance σ^2, and then take its square root to get an estimate of conditional volatility σ_p. But the square root of the variance is an inefficient estimate of volatility, so we can directly estimate volatility and get the optimal VaR prediction through a data-driven generalized EWMA model.

Because the conditional distribution of financial returns tends to be heavy tail with large peaks, and in VaR estimation, the mean of the return sequence μ is usually set to 0. By analogy with the GARCH model of conditional variance, based on the recursive form of volatility estimation

$$\hat{\sigma}_{n+1} = \frac{n}{n+1}\hat{\sigma}_n + \frac{1}{n+1}\frac{|r_{n+1}-\mu|}{\rho} \tag{3.21}$$

a data-driven generalized EWMA model of time-varying volatility is proposed [5]:

$$\hat{\sigma}_{t+1} = \alpha\hat{\sigma}_t + (1-\alpha)\frac{|r_t|}{\rho}, \alpha \in (0,1) \tag{3.22}$$

Therefore, we can predict the VaR value at the moment of t+1 with the following formula:

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$$VaR_{t+1}(p) = -\sigma_{t+1}F_R^{-1}(p) \tag{3.23}$$

3.4.2. Advantages and Disadvantages

One of the obvious advantages of generalized EWMA models is that the estimation of ρ can be used to identify t-distributions with appropriate degrees of freedom, and this method avoids false specifications of the model. When the t distribution's degrees of freedom are fewer than 4, the TGARCH model's projected variance of the conditional variance becomes infinite, hence it can't be employed. Generalized EWMA can compensate for this issue, and its estimated asymptotic variance is substantially smaller than the standard estimate, making it ideal for financial data.

4. Conclusion

In this paper, the ARMA-EGARCH-GPD model is based on the relationship between the risk value of the original sequence and the risk value of the corresponding residual sequence: $VaR_t = u_t + \sigma_t VaR_e$, the ARMA-EGARCH model is first used to estimate the σ_t and u_t of the original time series, and then the GPD model in the extreme value theory is used to fit the residual sequence and estimate the VaR_e, so as to estimate the VaR of the original sequence. The ARMA-EGARCH-semi-parametric model is based on the general calculation formula of VaR (3.19), and similarly, the ARMA-EGARCH model is used to fit the time series, estimating to σ_t and u_t, and then using the historical simulation method to obtain $X_{1-\alpha}$ inversely, and finally obtaining the estimate of VaR. For models with infinite kurtosis, VaR can be estimated using a generalized EWMA volatility model in the recursive form of volatility estimation.

As for the limitations, the model proposal in this paper is only theoretical and does not include regression testing or practical application. Because VaR is an estimate, the model that estimates VaR must be tested, with the main idea being to count the total number of times lost in the entire sample exceeds the VaR value. In future studies, authors should link specific examples to more intuitively study the advantages and disadvantages of these VaR models.

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Analysis of "Green Liability" on Environmental Damage

--State Responsibility in International Investment Law

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Abstract: Long before the birth of international environmental law, disputes over transboundary environmental damage have long existed in global trade and investment. Since the promulgation of the Rio Declaration on Environment and Development, with the arrival of the Period of Liberalization in international investment, the environmental issues involved in cross-border investment have skyrocketed, and international judicial bodies such as the International Court of Justice and the International Tribunal for the Law of the Sea have adjudicated a number of disputes over transboundary environmental damage. These "post-Rio" transboundary environmental damage disputes are characterized by complex afflictions, wide scope and serious damage. At this stage of adjudication, international judicial institutions have not developed relatively stable standards, principles and systems for *ex post facto* remedies for transboundary environmental damage. From the perspective of state responsibility, this paper analyzes the issue of transboundary environmental damage theoretically and practically, and explores the attribution, standards, and requirements of responsibility for cross-border environmental damage arising from international investment and the formation of the *ex post facto* remedy system, in order to provide reference for the establishment of a more sound and refined remedy mechanism of transboundary environmental damage in future international investment practice.

Keywords: international investment law, state responsibility, environmental damage, ARSIWA, dispute settlement

1. Introduction

Environmental Problem is one of the most significant challenges facing the international community in the new century. The conflicts and solutions between international investment behavior and environmental protection are of concern to the field of international law. How to ensure that international investment promotes economic development while avoiding pollution and environmental damage to the greatest extent is the core of the sustainable development problem in the field of international investment. While promoting their own and international economic development, multinational companies continue to reveal the harm to the environment of host countries and gradually become a global problem. In the case of climate change, for example, one-fifth of human carbon dioxide emissions come from the global supply chains of multinational enterprises [1]. As the main body of global environmental governance and regulation, how the home

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country of multinational corporations and their investment host country undertake national responsibilities in environmental issues related to international investment has become a topic that needs to be discussed.

This paper mainly analyzes the issue of transboundary environmental damage theoretically and practically, and explores the attribution, standards, and requirements of responsibility for cross-border environmental damage arising from international investment and the formation of the ex post facto remedy system, in order to provide reference for the establishment of a more sound and refined remedy mechanism of transboundary environmental damage in future international investment practice.

2. State Responsibility for Environmental Damage Caused by International Investment

When facing the risk of environmental damage caused by the international investment of its nationals and enterprises, the investing state needs not only to actively take measures from the perspective of risk prevention, but also to formulate emergency and relief mechanisms in the event of environmental damage. On the other hand, the consequences of environmental damage incurred by their own investors in the investing country during overseas investment do not necessarily lead to the investing country's national compensation liability. This needs to first analyze whether the investment conducts of domestic investors under the jurisdiction of the investing country can be attributed to their home country, and whether there have been major losses that are difficult for the operator to compensate.

2.1. Traditional Theory of State Responsibility

In modern international law, state responsibility is incurred when one State commits an internationally wrongful act [2]. To confirm whether a certain investment behavior can lead to state responsibility, it needs to be analyzed subjectively and objectively: (1) Whether there is the existence of attributable state misconduct; (2) Whether the conduct violates norms of international law.

Determining whether there are subjective elements of traditional state responsibility requires analyzing and judging whether the particular misconduct involved can be attributed to the State concerned and thus regarded as an act of the State. In accordance of Chapter 2 of ARSIWA [3], it is necessary to make analysis based on specific conditions of state's conducts.

From the perspective of objective elements, the traditional theory of state responsibility requires that the conduct of a state objectively violates its international obligations [3].

Many international investment behaviors are carried out by private commercial subjects, and there are also investment behaviors that are authorized by the state to specific subjects according to the will of the state. Most international investment behaviors generally do not directly issue in a state's breach of international obligations, but can be classified as behaviors which are not prohibited by international law. The obligation to prevent pollution of the marine environment under *Article 194* of the *United Nations Convention on the Law of the Sea* [4] may also directly lead to a state's violation of its own obligations under International Law. In such cases, supposing that the act of foreign investment is attributable to the state, it would lead to liability for breaches of international obligations.

2.2. State Responsibility for Acts Not Prohibited by International Law

Many international investment behaviors can be classified as acts not prohibited by international law. As to whether such international investment behaviors will trigger the liability of states, it is essential to learn from relevant theories of transboundary environmental damage and analyze whether international investment behaviors are not prohibited by international law. Circumstances of liability and its specific elements.

State liability for transboundary damage must meet the following requirements [5]:

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the existence of the activities of the State or the activities of operators under its jurisdiction or control, whether or not prohibited by international law, and whether or not the activities take place domestically and internally;

Whether or not the country has a common border with other countries, whether the activity has caused significant damage to the domain of other countries or their jurisdiction or control, or the environment of the public domain.

2.3. State Responsibility on Environmental Damage of Private Extra-territorial Investment

Traditionally, the assumption of international responsibility by a state is premised on its implementation of internationally wrongful act. However, in modern international investment, the situation has undergone new changes. Activities that are not prohibited by law, such as industrial production, atomic energy utilization, outer space exploration and seabed development [6], often bring damage and threats to other countries, especially the host countries. Such transboundary damage caused by acts not prohibited by international law involves not only countries but also private individuals, which is beyond the jurisdiction of traditional international law. Different from the state responsibility for private actions under the traditional liability system of international law, the situation in which the state assumes responsibility for private extraterritorial actions in the field of transboundary damage has remarkable characteristics: even if the actor causing the pollution is a private person, there is no situation that can be regarded as a state action, states also always have an obligation to protect other states from the harmful actions of individuals under their jurisdiction.

2.3.1. The Home Country's Supervisory Responsibilities for Its Multinational Subsidiaries

The control of the home country over its overseas subsidiaries can be achieved indirectly by supervising the parent company by legal means. Therefore, the responsibility of the home country to supervise the overseas operations of multinational companies is reflected in the fact that the home country has both the power and the obligation to urge multinational companies to prevent violations of the environment and human rights in the entire supply chain.

Although the international investment decisions of multinational companies largely depend on the policies and rules of the host country, more and more international investment practices show that Home Country Measures (HCMs) also have a great impact on investors' investment decisions, and they are increasingly becoming investors. Multinational corporations need the help of the home country when it comes to market access conditions and conflicts with the host country; the corporate strategy of multinational corporations will also reflect the country's policy orientation. Especially in the field of global trade and foreign investment, multinational corporations often convert corporate interests into national will, and the state then converts this will into international legal norms through participation in international legislation.

2.3.2. Host Country's Environmental Management Rights Related Responsibilities

From the environmental perspective of the international law, the appropriate management power of a state comes from its resource sovereignty. Corresponding to the host country's environmental management power, the host country has the obligation to supervise multinational companies to protect the environment. This obligation requires that when the actions of multinational corporations cause environmental damage to the host country, it shall deal with the relationship between the investment of multinational corporations and environmental protection based on the principle of not lowering environmental standards. The host country should always pay attention to the protection of the human rights and environmental health rights of the host country by multinational corporations, and should be obliged to remedy and guarantee such environmental damage in its own country; when

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the private entity lacks the ability to bear the responsibility, the state has the responsibility to compensate and make up for it.

In the absence of an explicit international legal basis for establishing direct state liability for transboundary damage of compensation, it is advisable to follow the principles of fairness and justice, the principle of loss sharing, and the principle of concentrating the liability on the state, which can be shared by States in conformity to international law and practice.

In another perspective, it will of course be more difficult for the state to assume responsibility for transboundary damage caused by private actions. Compensation for transboundary damage is mainly faced with two difficulties: first, the domestic laws of most countries deny that the state is directly responsible for private acts; second, when an injured party is a private person, the compensation from the state is likely to be due to local protection The obstructing of the doctrine will ultimately fail to guarantee the realization of the interests.

3. How to Take "Green Liability" in the Sector of International Investment

3.1. Forms of State Responsibility on Environmental Damage in International Investment

Environmental damage caused by international investment can refer to the form of responsibility of the state under the ARSIWA, including: termination of infringement, restoration to the state of origin, economic compensation and apology [3]. For the environmental damage caused by the international illegal investment behavior, the responsible country should bear the direct responsibility. For investment behaviors not prohibited by international law, the investor or its relevant operator may bear the direct responsibility, and the investor country bears the supplementary responsibility.

3.1.1. Take Emergency Relief Measures to End the Violation

In the likelihood of an accident in which a perilous activity causes or is likely to cause transboundary harm, the state of origin is obliged to take emergency measures to reduce or eliminate the transboundary harm. Principle 5 of the *Draft Principles on the Allocation of Loss* provides for emergency measures [7]. The origin state is obliged to promptly notify the affected State of the emergency and to take contingency measures to reduce the consequences of the damage. The state of origin needs to consult and take joint measures with the affected country, and if necessary, seek help from the international community.

Draft Articles on Prevention of Transboundary Harm from Hazardous Activities also stipulates the obligations of the state of origin in the event of an emergency, including the obligation of emergency preparedness [8] and the obligation of emergency notification [8], to take necessary emergency preparedness measures and promptly notify the affected persons of the relevant emergency.

It can be seen from the above Articles that in the event of an international investment project causing environmental damage or an emergency situation that may occur, the investing country should perform: (1) the obligation to notify and consult; (2) the obligation to take preventive measures and emergency measures; (3) the obligation to provide emergency assistance. The country of origin should strictly perform these obligations. If the above-mentioned obligations are not strictly performed and the loss of transboundary damage is caused or expanded, the country of origin will bear the responsibility for fault, which constitutes the state responsibility caused by the wrongful act under the traditional state responsibility law.

3.1.2. Restoration to the Original State

In the case of environmental damage caused by international investment, restitution is also an important form of responsibility to restore the environmental state before the environmental damage

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occurred. Even if the cost of environmental restoration is high and the time is long, it should not simply be without any remedies for environmental restoration. The responsible country should provide financial, resource and technical support for the environmental restoration of the affected country.

3.1.3. Compensation

The scope of compensation for environmental damage caused by international investment should include the following: (1) Personal injury and property damage, that is, environmental damage caused by international investment and thus damage to the health of residents in the relevant area, and related properties such as agricultural products, aquaculture, etc. (2) The cost of eliminating pollution and taking emergency measures and other related measures, that is, the cost of taking emergency measures and other related measures to eliminate related pollution due to environmental damage caused by international investment; (3) The cost of restoring resources and environment , that is, the cost of restoring the environmental damage caused by international investment behavior to the original healthy environment, but the environmental restoration is based on practical feasibility and the restoration measures are within a reasonable range; (4) Consequential economic losses, such as the income loss due to personal injury, reasonable profit loss due to business shutdown, and income reduction due to reasonable environmental damage [9]. Here, attention should be paid to the causal relationship between the harmful behavior and the consequential economic loss and the reasonable scope of the relevant economic loss.

In addition, if the injured state or the victim caused the damage to the international investment environment due to its actions or omissions intentionally or negligently, the compensation amount of the investor and the investing country should be reduced accordingly when considering the relevant compensation.

3.1.4. Apology

In the case of environmental damage caused by international investment, when the foreign investment behavior of the nationals of the country can be attributed to the country of origin, the country of origin can ask the affected country to make an apology. The country of origin should face up to rather than ignore the consequences of cross-border environmental damage caused by its nationals' extraterritorial investment, and may consider making an apology by expressing regret, formal apology or other appropriate means to undertake responsibility.

3.2. Responsibility Sharing Mechanism of a State for Environmental Damage in International Investment

The sharing mechanism for environmental damage caused by international investment behavior means that once international investment, which is an act not prohibited by international law, causes damage to the host country's environment, in order to enable victims to obtain appropriate compensation in a timely manner, multiple entities (including those that cause transboundary investment) will be responsible for a legal mechanism established to share the compensatory liability for the losses suffered by victims according to certain principles and order of compensation. From the perspective of the responsible party, damage compensation is not entirely borne by the state. In principle, the operator should bear the responsibility for compensation. In the event that the insurance amount of the operator is insufficient to compensate for the loss, the state shall share the compensation liability within a certain limit.

The loss-sharing mechanism discussed here is only applicable to international investment behaviors that are not prohibited by international law, and not applicable to international investment

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behaviors that are misconduct in international law. The latter should be directly held by the state in accordance with the provisions of the corresponding international law.

In the construction of a multi-layered subject loss-sharing mechanism for damage to the international investment environment, at least the following three layers should be included.

3.2.1. Investors or Their Related Entities Shall Bear the First and Major Liability on Compensation

Investors or their relevant operating entities, as direct participants and implementers of international investment, should bear direct responsibility for environmental damage caused by international investment. In order to ensure that victims are compensated in a timely manner and the environment is repaired in a timely manner, whether the investor or its relevant operating entities is at fault is not a constituent element of their liability for compensation, and a no-fault compensation liability system can be implemented. This also complies with the requirements of Principle 4 of the *Draft Principles on the Allocation of Loss* [7]. The above measures should include the operator or other entity or individual (if appropriate) assuming responsibility, and such responsibility should not require proof of fault. The above-mentioned arrangement of first-level compensation liability can be resolved at the legal level of the host country, and the host country shall, through its own legislation, stipulate that investors or their relevant operating entities shall be liable for no-fault compensation for environmental damage caused by international investment.

3.2.2. Banking Insurance and Other Relevant Financial Institutions Shall Bear the Second Layer of Compensation Liability

There is a possibility that investors or their relevant operating entities are unable to bear all the compensatory responsibilities, or will fall into operational difficulties due to assuming all compensatory responsibilities and other financial instruments, and providing a second-tier supplementary liability in addition to the amount of liability assumed by the investor or its relevant operating entities. This kind of supplementary liability can be realized through the legislation of the host country or through the legislation of the investor country. The investor country or the host country can also set up a national-level industrial compensation fund to undertake the second-level compensation liability in a targeted manner.

3.2.3. The Investing State and Other Relevant Countries Shall Bear the Last Layer of Compensation Liability

In case the first two layers of liability are still unable to fully compensate victims and restore the environment in a timely manner, it is necessary for the investor country, which has personal jurisdiction over the investor, to be the subject of the last layer of liability to ensure that additional financial resources are provided for the liability. Resource support. The implementation of responsibility at this level depends on the provisions of international law documents or the practice of customary international law. Investing countries can also take the initiative to undertake the last layer of compensation liability from the perspective of responsible investment countries, so as to prevent the victims of the host country and their environment from being unable to receive timely relief. The investor country can also work with the host country and other relevant countries to establish a national compensation liability-sharing mechanism with the participation of multiple national entities through negotiation, so as to effectively resolve major environmental risks and reduce major environmental damage.

DOI: 10.54254/2754-1169/17/20231069

3.3. The Exemption of Compensation for Environmental Damage in International Investment of State

In the theoretical system of liability for transboundary damage, the issue of immunity of state responsibility is recognized. Its parties should include state responsibility, intergovernmental international organizations, operator responsibility and multiple subjects, and the sharing of transboundary damages by multiple subjects is more conducive to protecting the interests of victims than the compensation of the single subject liability system. The establishment of the mode of multiple subjects sharing transboundary damage has transformed the compensation for transboundary damage from a single subject to multiple subjects, but this does not mean the weakening of state responsibility in international environmental protection. However, there is also a provision that the absolute responsibility of the State for damage is exempted to a certain extent, that is, the State of origin can prove that the victim is fully or partial damage, or damage caused by force majeure.

The disclaimer of state responsibility of the investing country for environmental damage in international investment is analyzed separately as follows.

3.3.1. Consent or Gross Negligence

The ARSIWA would include consent as one of the exemptions for internationally wrongful acts [3]. The liability of another State shall also be reduced or exempted if the damage is caused by gross negligence or willfulness of that State. For example, Article VI of the Convention on International Liability for Damage Caused by Space Objects exempts the launching State from absolute liability in the event of gross negligence of the requesting State [10].

For a tranboundary investment that constitutes an internationally wrongful act, with the consent of the affected country, the *ARSIWA* should be one of the defenses to reduce or exempt the wrongfulness of the overseas investment. For overseas investments that are not prohibited by international law, the consent of the host country should also exempt or reduce the host country's accountability to the investor country as an affected country. After all, the investment project is within the territorial jurisdiction of the host country and can only be constructed with the permission of the host country government. operation. If the affected country also includes other countries than the host country, the other affected countries can therefore pursue the state responsibility of the investing country.

3.3.2. Force Majeure

It is mentioned in the ARSIWA that force majeure is also an exemption for internationally wrongful acts [3]. The occurrence of force majeure is unpredictable, uncontrollable and unavoidable, such as earthquakes, floods, wars and other events. In the event of force majeure, it will be difficult for a country to continue to strictly perform its international obligations, and its violation of international law obligations will be exempted due to force majeure. However, Article 23 of the Draft Articles on State Responsibility also stipulates two situations in which a State cannot invoke force majeure as an exemption from liability [3]. The UNECE published the Convention on Transboundary Effects of Industrial Accidents in 1992, and the exemption from force majeure also echoes the relevant provisions on transboundary effects caused by industrial accidents [11].

For international investment, force majeure should also be one of the circumstances that exempts the investment behavior from causing state responsibility. In the event of force majeure, the investing country has neither fault nor legal basis to bear state responsibility for the serious consequences of overseas investment. However, if the occurrence of force majeure is caused by the behavior of the investing country alone or in combination with other factors, the investor country can hardly take force majeure as a reason for exemption in this case.

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3.3.3. Distress and Critical Situations

The circumstances precluding wrongfulness in the ARSIWA also include distress and necessity [3], and there are exceptions to each of them. When the state of origin is to protect the basic interests of its own country in a critical situation without seriously prejudicing the basic interests of the international community, it may seek immunity for misconduct under international law.

For international investment, if serious consequences occur, it may also be considered whether to invoke distress or necessity to exempt state responsibility, and attention should be paid to the exceptions in each case.

3.3.4. All Necessary and Appropriate Measures Have Been Taken

When a state has exhausted all necessary and appropriate measures, the liability shall be reduced or exempted if damage to the nationals or the environment of another State is caused by the acts of private persons belonging to that state. The International Tribunal for the Law of the Sea Advisory Opinion No. 17 also clarifies that if the investing state has taken all appropriate and necessary measures to ensure that the contractor effectively performs its obligations, the investing state can be exempted from its liability, but this exemption does not apply to the guarantee state [12].

4. Conclusion

In the field of international investment law, the state responsibilities come from two perspectives, internationally wrongful acts and investment acts that are not prohibited by international law; also, not only investing states but also hosting states could have the possibility to be responsible for the investment acts or consequences of environmental damage. As the international community attaches great importance to the environment, the impact of environmental issues in international investment is increasingly obvious, which requires international investors, investing states, and host countries to jointly take responsibility for environmental issues during investment and create a healthier and more environmentally friendly investment environment.

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Weighting Analysis of a Fund Portfolio of China's New Energy Vehicle Stocks

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Abstract: We studied the optimal weighting allocation for a portfolio of stocks in China's new energy vehicle industry, using data on circulation market value, price-to-earnings ratio P/E, growth of net profit after deductions, and institutional position share of the new energy industry for the three years 2019-2021. The return was also considered from the above four dimensions. Combining the above four dimensions, a better model for determining the weight of the new energy vehicle stock portfolio is obtained.

Keywords: circulation market value, institutional position share, net profit, P/E, portfolio, new energy vehicle

1. Introduction

In recent years, the new energy vehicle sector has become the hottest stock sector in the China's capital market, with a large number of bull stocks that have risen several times or even tens of times. At the same time, investment funds focused on the new energy vehicle sector have received huge subscriptions, reflecting investors' preference to new energy vehicle stocks. Against this backdrop, it becomes critical that fund managers with large amounts of client capital answer how to determine the optimal weighting of a portfolio in the burgeoning new energy vehicle industry. This paper presents the research results regarding sample selection and data sources, statistical analysis, and quantitative results to provide some valuable references for fund managers in China's new energy vehicle industry when choosing the weighting of their equity portfolios. Ultimately, from the data analysis of the recent 3-year bull market for new energy vehicle stocks, the fund portfolio weighting decisions for this sector can be considered in the following order: circulation market value > institutional position share > growth of net profit after deductions > P/E ratio. Furthermore, based on the multi-dimensional overlay analysis, stocks with 20-30% of institutional positions and large-cap leading stocks have the highest portfolio returns.

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2. Literature Review

We now focus on the work related to equity portfolios in China's new energy vehicle industry, which can be divided into the following categories: investment strategy, investment value, and stock value.

From an investment allocation perspective, Haiting Li proposed that the multi-factor model performed well in A-share [1]; the final five influential factors were: P/B ratio, net profit growth rate, return on net assets, gross profit rate, and prosperity. Yang Chu constructed A set of multifactor dynamic quantitative investment strategies suitable for China's A-share new energy vehicle sector [2], with a specific reference value for some investors. Hui Xu et al. proposed the fund asset allocation strategy [3]. The optimal strategy for stock investment allocation was obtained by applying the mean-variance and AHP algorithms to calculate the weighting coefficients and investment amounts of the ten stocks under maximum investment efficiency.

From the perspective of the investment value of new energy vehicles, Zepeng Chen pointed out that the new energy vehicle industry had a very bright development prospect and hidden a lot of investment opportunities [4]. At the same time, he built an investment value evaluation system for new energy vehicle-listed companies and provided suggestions for investors.

From the influence on stock price, Zhu & Lu explained that the strategy of winners with large circulation market value and losers with small circulation market value was the most pronounced and was a more significant profit pattern [5]. Wei Li explained that pre-tax and post-tax accounting earnings information positively correlated with stock prices [6]. Yingzhi Wu pointed out that the P/E ratio was an essential basis for institutional and individual investors to judge the value of stock investment [7]. Ran Liu proposed that the current P/E ratio could only be used as a reference for investment decision analysis. Only by establishing a relatively mature capital market, the P/E ratio could play a role in investment decision analysis [8]. Daping Wan suggested that an increase in the shareholding ratio of institutional investors would intensify market volatility [9]. Jun Shan believed that the higher the shareholding ratio of institutional investors, the greater the influence of the herding effect of funds on stock synchronization [10]. Wenbin Chen found that the weighted stock price can reflect the company's stock value more comprehensively and reasonably than the single P/E ratio, P/B ratio, and discounted cash flow valuation method [11].

In summary, the above literature provided a good reference in research methods and theoretical knowledge for portfolio strategy, stock value judgment, and other aspects. On this basis, this paper investigates the portfolio decision-making suggestions of mature securities staff and investors, analyzes the relevant data of new energy vehicle stocks, and lists data comparisons in four dimensions to determine the portfolio weight, which is more understandable and convenient for promotion and reference.

3. Method

3.1. Sample Selection and Data Source Section

1. Survey research method

After researching several representatives of Guotai Junan Securities practitioners and senior market participants in the capital market, this paper used professional software to extract some of the analytical data to understand the basic logic and way of thinking about stock pricing in China's capital market and identified four dimensions that could be quantitatively analyzed. Four dimensions include Circulation market value, P/E ratio, net profit and institutional position.

2. Empirical research method

This paper ranks the "new energy vehicle sector" of Great Wisdom Stock Software from four dimensions, including Circulation market value, P/E , net profit, and institutional position. It takes

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the top ten stocks in each dimension as a typical analysis sample of the new energy vehicle industry for empirical research.

3. Literature analysis

This research is based on extensive reading, sorting, and refining of relevant literature, learning and mastering relevant theories of a relevant investment portfolio, stock value, new energy vehicles, etc., enlightening methods to solve problems, and promoting the research idea and innovation of this paper.

3.2. Statistical Analysis and Quantitative Results Section

Multidimensional analysis

This paper establishes multiple data research subsets and conducts horizontal and vertical data analysis in four combinations. From the perspective of difference, it explores the influencing factors of China's new energy vehicle stock valuation, seeks the optimal solution of China's new energy vehicle stock investment weight, and draws diversified and robust research conclusions. It provides a valuable reference for fund managers in China's new energy vehicle industry to choose the weight of the stock investment portfolio.

4. Full Text

4.1. Sample Selection and Data Sources

I. Sample selection and data sources

In this paper, the top ten stocks in each dimension were ranked in the "new energy vehicle sector" of Great Wisdom stock software, which is popular in china in four dimensions, including Circulation market value, P/E Ratio, net profit, and institutional position. The stocks in the sample must be typical of the new energy vehicle industry, recognized by the public. Moreover, they must have a high percentage of revenue from new energy vehicle-related businesses to avoid the inclusion of purely thematic and conceptual stocks in the sample. Further considering the data continuity and analyzability of the existing sample, the 3-year data of the above companies from 2019-2021, were finally selected to ensure the robustness of the quantitative analysis results.

On this basis, the testing conditions were determined: the number of stocks to be included in the portfolio of this investment fund was assumed to be 10, with a single stock investment limit of 20%. In order to obtain reliable differentiated research results, the test weighting scheme will be set as follows.

1. Equal weighting (i.e. all ten stocks are weighted at 10%)

2. One band at 0.5% intervals of 12%, 11.5%, 11%, 10.5%, 10%, 10%, 9.5%, 9%, 8.5%, and 8%, respectively

3. One step at 1% intervals of 14%, 13%, 12%, 11%, 10%, 10%, 9%, 8%, 7%, 6%.

4. 2% intervals of 18%, 16%, 14%, 12%, 10%, 10%, 8%, 6%, 4% and 2% respectively.

4.2. Statistical Analysis and Quantitative Results

According to the existing research on the factors of stock valuation in China's stock market and researching several representatives of Guotai Junan Securities practitioners and senior market participants in the capital market the results of statistical analysis show that the factors which have a significant influence on stock valuation in China's stock market and can be studied by quantitative data mainly include: 1. circulation market value (circulation equity), 2 .price-to-earnings ratio P/E, 3. growth of net profit after deductions, 4. institutional position share (Note: factors that have a significant influence on stock valuation but cannot be quantified, such as event promotion and hot topics).

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Based on this, this paper uses quantitative analysis to explore the optimization path of new energy vehicle stock portfolio weight from the above four dimensions.

4.3. Circulation Market Value Dimension

At present, China's securities market is still in a period of rapid development. Early market participants are mainly retail investors. In recent years, with the increasing participation of institutional investors such as public funds, private equity funds, pension funds, insurance funds, and QFII, the market speculation atmosphere has gradually decreased, and the stock valuation system has become more and more mature. However, it is undeniable that the correlation between the valuation of stocks in China's capital market and their circulation market value (circulation equity) remains prominent. For example, the valuations of Shanghai 50 and Shanghai and Shenzhen 300, dominated by ultra-large blue-chip stocks, remain low.

On the other hand, P/E such as GEM and Science and Technology Innovation Board with smaller circulation equity are always one to two times or even higher than the former. For stocks in the same industry, the valuation of small-cap stocks is usually more than twice as high as that of large-cap stocks. According to the traditional view, stocks with smaller market value are more likely to gain more significant gains. So, does this also apply to new energy vehicle stocks?

The quantitative results of Table 1 and Table 2 show that when a higher weight is given to the new energy vehicle stocks with a more significant market value (see Table 1), the yield with the same weight (10 % for each of the ten companies) is 618 %, and the yields of other weight allocation methods are 627 %, 637 % and 655% in that order, showing an increasing trend; and if the ten stocks with the most considerable circulation market value are tested in reverse, i.e. the stocks with relatively small circulation market value are given higher weights (see Table 2), the returns are 609%, 600%, and 581% respectively, showing a decreasing trend. The maximum return difference between the two strategies is 74% for the large-cap strategy (Portfolio D in Table 1) than for the small-cap strategy (Portfolio D in Table 2).

Overall analysis:In contrast to the conventional view, a higher weighting allocation to new energy vehicle stocks with larger circulation market value can result in significant comparative returns. This may be because new energy vehicle stocks are an emerging sector, and investors are more comfortable allocating to large-cap stocks with leading sector rankings for conservative reasons. In contrast, small and mid-cap stocks are not yet sufficiently explored.

Table 1: Quantitative analysis results - circulation market value from high to low.

STOCK (CODE)	CIRCULATING-MARKET-VALUE(BNRMB)(20220621)	CLOSING-PRICE(20181231)	CLOSING-PRICE(20220621)	CUMULATIVEINCREASE(2019-2022.6)	PORTFOLIOA%	YIELDRATE	PORTFOLIOB%	YIELDRATE	PORTFOLIOC%	YIELDRATE	PORTFOLIOD%	YIELDRATE

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Table 1: (continued).

CATL (300750)	1183.7	73.2	507.85	594%	10%	59%	12.%	71%	14%	83%	18%	107%
BYD (002594)	992.7	50.48	340.9	575%	10%	58%	11.5%	66%	13%	75%	16%	92%
CXXCL (002812)	222.0	28.24	248.99	782%	10%	78%	11.00%	86%	12%	94%	14%	109%
EVEBAT-TERY (300014)	190.0	8	100.14	1152%	10%	115%	10.50%	121%	11%	127%	12%	138%
TIANQI-LITHIUM (002466)	187.0	24.43	114.39	368%	10%	37%	10.00%	37%	10%	37%	10%	37%
CHANGAN (000625)	152.0	3.26	15.36	371%	10%	37%	10.00%	37%	10%	37%	10%	37%
PUTAILAI (603659)	113.0	16.22	81.55	403%	10%	40%	9.50%	38%	9%	36%	8%	32%
TINCI(002709)	111.0	3.64	57.57	1482%	10%	148%	9.00%	133%	8%	119%	6%	89%
SSGF (600884)	57.0	8.35	26.32	215%	10%	22%	8.50%	18%	7%	15%	4%	9%
EA-SPRING(300073)	44.0	26.96	91.39	239%	10%	24%	8.00%	19%	6%	14%	2%	5%
PORTFOLIO						618%		627%		637%		655%

Table 2 Quantitative results - circulation market value from low to high.

STOCK(CODE)	CIR-CU-LAT-ING MAR-KET VALUE (BNRMB) (20220621)	CLOSING PRICE(20181231)	CLOSING PRICE(20220621)	CU-MU-LA-TIVE IN-CREASE(2019-2022.6)	PORTFOLIO A%	YIELD RATE	PORT-FO-LIO B%	YIELD RATE	PORTFOLIO C%	YIELD RATE	PORTFOLIOD%	YIELD RATE

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Table 2: (continued).

EA-SPRING (300073)	44.0	26.96	91.39	239%	10%	24%	12.00%	29%	14%	33%	18%	43%
SSGF (600884)	57.0	8.35	26.32	215%	10%	22%	11.50%	25%	13%	28%	16%	34%
TINCI (002709)	111.0	3.64	57.57	1482%	10%	148%	11.00%	163%	12%	178%	14%	207%
PU-TAILAI (603659)	113.0	16.22	81.55	403%	10%	40%	10.50%	42%	11%	44%	12%	48%
CHANGAN (000625)	152.0	3.26	15.36	371%	10%	37%	10.00%	37%	10%	37%	10%	37%
TIANQI-LITH-IUM (002466)	187.0	24.43	114.39	368%	10%	37%	10.00%	37%	10%	37%	10%	37%
EVE BAT-TERY (300014)	190.0	8	100.14	1152%	10%	115%	9.50%	109%	9%	104%	8%	92%
CXXCL (002812)	222.0	28.24	248.99	782%	10%	78%	9.00%	70%	8%	63%	6%	47%
BYD (002594)	992.7	50.48	340.9	575%	10%	58%	8.50%	49%	7%	40%	4%	23%
CATL (300750)	1183.7	73.2	507.85	594%	10%	59%	8.00%	48%	6%	36%	2%	12%
PORTR-FOLIO						618%		609%		600%		581%

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4.4. Price to Earnings Ratio Dimension

P/E ratio is an important indicator of how high or low a stock is valued. Although investors in the China's capital market have gradually begun to embrace the international investment philosophy of giving higher P/E to high-growth stocks, overall, P/E is still one of the key considerations in the decision making of the vast majority of sound investors. Therefore, the P/E ratio is a perspective that we can't avoid.

Table 3: P/E ratios from low to high.

STOCK(CODE)	P/E2018	EARNINGS2018	CLOSINGPRICE(20181231)	CLOSINGPRICE(20220621)	CU-MU-LA-TIVE IN-CREASE(2019-2022.6)	PORTFO-LIOA%	YIELDRATE	PORTFO-LIOB%	YIELDRATE	PORTFOLIOC%	YIELDRATE	PORTFO-LIOD%	YIELDRATE
SEN-IOR(300568)	22	0.23	、5.01	28.49	469%	10%	47%	12.00%	56%	14%	66%	18%	84%
EVE-BAT-TERY(300014)	35	0.23	8	100.14	1152%	10%	115%	11.50%	132%	13%	150%	16%	184%
CSECO(300035)	38	0.11	4.16	28.85	594%	10%	59%	11.00%	65%	12%	71%	14%	83%
WOLONG(600580)	38	0.15	5.7	13.4	135%	10%	14%	10.50%	14%	11%	15%	12%	16%
CAP-CHEM(300037)	42	0.3	12.53	47.03	275%	10%	28%	10.00%	28%	10%	28%	10%	28%
PUYAILAI(603659)	43	0.38	16.22	81.55	403%	10%	40%	10.00%	40%	10%	40%	10%	40%
TIANQI-LITH-IUM(002466)	54	0.45	24.43	114.39	368%	10%	37%	9.50%	35%	9%	33%	8%	29%

DOI: 10.54254/2754-1169/17/20231070

Table 3: (continued).

GEM(002340)	62	0.06	3.74	8.37	124%	10%	12%	9.00%	11%	8%	10%	6%	7%
LNFA(603315)	63	0.175	11.01	25.52	132%	10%	13%	8.50%	11%	7%	9%	4%	5%
HONGFA(600885)	101	0.15	15.15	39.11	158%	10%	16%	8.00%	13%	6%	9%	2%	3%
PORTFO-LIO							381%		406%		431%		481%

Table 3 shows that when we rank the P/E ratios from low to high and give a higher allocation weighting to low P/E outperforming stocks, the overall portfolio returns show a clear upward trend from 381% - 406% - 431% - 481%.

Overall analysis: Giving a greater weighting to low P/E outperforming stocks in the new energy vehicle sector can lead to significant comparative returns. However, in terms of absolute return values, the P/E dimension portfolio returns significantly lag behind the circulation market value dimension portfolio. It can also be seen that the portfolio returns in the P/E dimension fluctuate significantly across the weighted portfolios.

4.5. Net Profit Dimension

Table 4: Growth of net profit after deductions.

8	NET PROFIT AF-TER DE-DUCTIONS(2019-2021)	CLOSING PRICE(20181231)	CLOSING PRICE(20220621)	CU-MU-LA-TIVE IN-CREASE(2019-2022.6)	PORTFOLIO A%	YIELD RATE	PORTFOLIO B%	YIELD RATE	PORTFOLIO C%	YIELD RATE	PORTFOLIO D%	YIELD RATE
SSGF(600884)	3725%	8.35	26.32	215%	10%	22%	12.00%	26%	14%	30%	18%	39%
TINCI(002709)	2812%	3.64	57.57	1482%	10%	148%	11.50%	170%	13%	193%	16%	237%

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Table 4: (continued).

CXXCL(002812)	1189%	28.24	248.99	782%	10%	78%	11.00%	86%	12%	94%	14%	109%
AZ-URECORP(002245)	1150%	3.74	24.51	555%	10%	56%	10.50%	58%	11%	61%	12%	67%
DFD(002407)	1002%	10.32	40.26	290%	10%	29%	10%	29%	10%	29%	10%	29%
E-NEBULA(300648)	812%	16.31	37.07	127%	10%	13%	10.00%	13%	10%	13%	10%	13%
PU-TAILAI(603659)	797%	16.22	81.55	403%	10%	40%	9.50%	38%	9%	36%	8%	32%
CATL(300750)	619%	73.2	507.85	594%	10%	59%	9.00%	53%	8%	48%	6%	36%
EVEBATTERY(300014)	613%	8	100.14	1152%	10%	15%	8.50%	9%	7%	81%	4%	46%
TIANQI-LITHIUM(002466)	461%	24.43	114.39	368%	10%	7%	8.00%	29%	6%	22%	2%	7%
PORTRFOLIO						597%		601%		606%		615%

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Profit growth is the core driver of a stock's rise. The growth of net profit after non-recurring gains and losses is an essential basis for investors' valuation and is our critical analytical perspective.

As seen from Table 4, greater weight is given to stocks with significant increases in net profit after deduction, with returns showing a progressive trend from 597% - 601% - 606% - 615%.

Overall analysis: Giving higher weights to stocks with significant profit increases can lead to better yields. However, it is difficult to predict the profit increase for investors; the actual performance often deviates greatly from expected performance. Historical performance of high growth does not mean that the future could also be high growth.

4.6. Institutional Position Dimension

In the China's capital market, the proportion of institutional position in circulation is an indicator of great concern to investors. The greater the proportion of institutional positions, the more significant increase in positions, which usually means the greater chance of the stock rising. Therefore, institutional position share is also important for us to observe.

Table 5: Institutional position share.

STOCK(CODE)	PUBLIC FUNDS POSITION SHARE 20220630	CLOSING-PRICE(20181231)	CLOSING PRICE(20220621)	CUMULATIVE INCREASE（2019-2022.6)	PORTFOLIO A %	YIELD RATE	PORTFOLIO B%	YIELD RATE	PORTFOLIO C%	YIELD RATE	PORTFOLIO D %	YIELD RATE
CSECO(300035)	37.38%	4.16	28.85	594 %	10 %	59 %	12.0%	71 %	14 %	83 %	18 %	107 %
SENIOR(300568）	33.93%	5.01	28.49	469 %	10 %	47 %	11.5%	54 %	13 %	61 %	16 %	75 %
CAPCHEM(300037)	31.20%	12.53	47.03	275 %	10 %	28 %	11.0%	30 %	12 %	33 %	14 %	39 %
EVEBATTERY(300014)	29.51%	8	100.14	1152 %	10 %	115 %	10.5%	121 %	11 %	127 %	12 %	138 %

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Table 5: (continued).

EA-SPRING(300073)	26.45%	26.96	91.39	239%	10%	24%	10.0%	24%	10%	24%	10%	24%
AZ-URECORP(002245)	25.80%	3.74	24.51	555%	10%	56%	10.0%	56%	10%	56%	10%	56%
TINCI(002709)	23.67%	3.64	57.57	1482%	10%	148%	9.5%	141%	9%	133%	8%	119%
TIANQILITH-IUM(002466)	21.31%	24.43	114.39	368%	10%	37%	9.0%	33%	8%	29%	6%	22%
CXXCL(002812)	19.53%	28.24	248.99	782%	10%	78%	8.5%	66%	7%	55%	4%	31%
PU-TAILAI(603659)	17.57%	16.22	81.55	403%	10%	40%	8.0%	32%	6%	24%	2%	8%
PORTFOLIO						632%		628%		625%		618%

From Table 5, we see that the greater the weight given to stocks with a more significant proportion of institutional positions, the returns are 632% - 628% - 625% - 618%, respectively, showing a decreasing trend in steps. The larger the institutional position share is not the better, with some positions being too large and making it more challenging to upgrade positions in the future . Alternatively, a single institutional position may be too large, resulting in a pattern similar to that of a "sitting banker", which may lead to more risk. It is easier to achieve comparative returns with an institutional position of 20-30%. This view is reflected in Table 5. The top three highest-yielding stocks in Table 5 all have institutional positions in the 20-30% range. In addition, institutional positions can be increased or decreased and changed during the lifetime of the portfolio, which is not as good as known data such as circulation market value and P/E.

4.7. Multi-dimensional Overlay Analysis

From the analysis of the first four dimensions, it can be seen that the highest return is 632% for the portfolio ranked by institutional positions, followed by 618% for the portfolio ranked by circulation market value in descending order under the same weighting scenario. We, therefore, considered overlaying these two dimensions to see if there were better portfolio results. In terms of return, we found that the top three stocks had institutional positions in the range of 20%-30%, so we selected six stocks with institutional positions in the range of 20%-30%. In contrast, other stocks were selected in descending order of circulation market value, overlapping stocks were eliminated, and finally, ten stocks were selected after the two dimensions were stacked. See Table 6.

DOI: 10.54254/2754-1169/17/20231070

Table 6: Combination of public funds position share and market value.

STOCK(CODE)	PUBLICFUNDSPOSITIONSHARE20220630	CIRCULATINGMARKETVALUE20220621)	CLOSINGPRICE(20181231)	CLOSINGPRICE(20220621)	CUMULATIVEINCREASE(2019-2022.6)	PORTFOLIOA%	YIELDRATE	PORTFOLIOB%	YIELDRATE	PORTFOLIOC%	YIELDRATE	PORTFOLIOD%	YIELDRATE
EVE-BAT-TERY(300014)	29.51%	1904	8	100.14	1152%	10%	115%	12.0%	138%	14%	161%	18%	207%
EA-SPRING(300073)	26.45%	438	26.96	91.39	239%	10%	24%	11.5%	27%	13%	31%	16%	38%
AZ-URECORP(002245)	25.80%	282	3.74	24.51	555%	10%	56%	11.0%	61%	12%	67%	14%	78%
TINCI(002709)	23.67%	1108	3.64	57.57	1482%	10%	148%	10.5%	156%	11%	163%	12%	178%
TIANQI-LITH-IUM(002466)	21.31%	1877	24.43	114.39	368%	10%	37%	10.0%	37%	10%	37%	10%	37%
CXXCL(002812)	19.53%	2222	28.24	248.99	782%	10%	78%	10.0%	78%	10%	78%	10%	78%
PU-TAILAI(603659)	17.57%	1134	16.22	81.55	403%	10%	40%	9.5%	38%	9%	36%	8%	32%
BYD(002594)	15.35%	9927	50.48	340.9	575%	10%	58%	9.0%	52%	8%	46%	6%	35%

DOI: 10.54254/2754-1169/17/20231070

Table 6: (continued).

CATL(300750)	14.60%	11837	73.2	507.85	594%	10%	59%	8.5%	50%	7%	42%	4%	24%
CHANGAN(000625)	7.94%	1523	3.26	15.36	371%	10%	37%	8.0%	30%	6%	22%	2%	7%
PORT-FOLIO							652%		668%		683%		714%

As can be seen from Table 6, considering the two-dimensional factors with the highest returns stacked on top of each other, there is a substantial increase in the portfolio return, with the same weighting increasing the portfolio return to 652%, which is higher than the peak portfolio return of the first four dimensions sorted separately. Here's a bar chart that shows the difference more clearly. See Table 7.

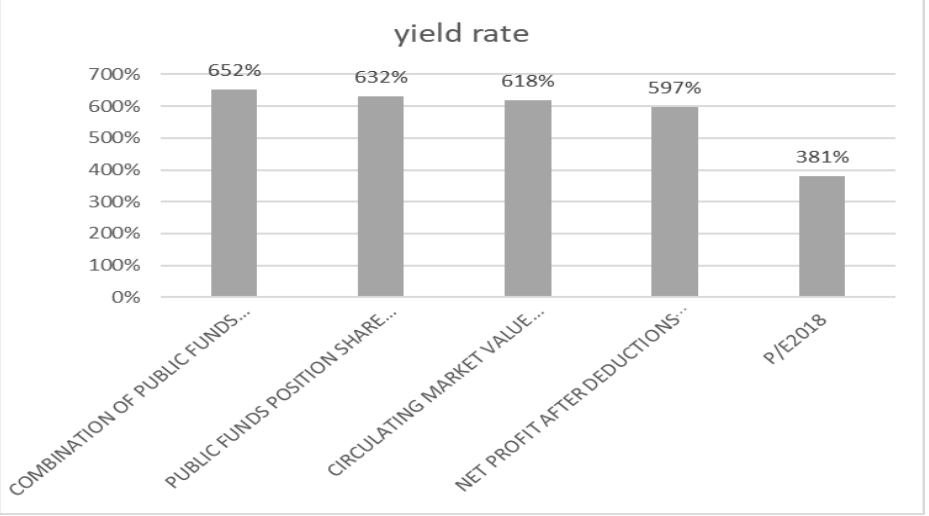


Figure 1: Yield rate of each dimension.

(Four dimensions and multi-dimension:

Combination of public fund position share and circulation market value, circulation market value, public fund position share, net profit growth, and P/E ratio.)

5. Conclusion

In this paper, through quantitative analysis of the historical data of the bull market of new energy vehicles in the past three years, the following conclusions are drawn: as a fund manager of the new energy vehicles industry, when determining the portfolio weighting, four dimensions should be paid attention to - First, select industry leaders with sizeable circulation market value and high visibility. This is because new energy vehicle stocks are an emerging industry, investors know little about smaller companies, and most capital is concentrated in large and well-known companies. At the same time, large companies have stronger R&D, capabilities are more likely to gain advantages in rapid product iteration. Therefore, the higher the popularity and the greater the circulation market value of new energy vehicle stocks, the higher the allocation weight should be;Second, consider the institutional position share. But it is not that the more significant the institutional position share is, the better

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it will be; we should focus on stocks with an institutional position share of 20%-30%. The data test in this paper shows that the institutional positions of the top three stocks with yield are all in this range.Therefore, stocks with institutional positions in the 20-30% range should be assigned a higher weighting; Third, consider the growth of net profit after deductions; the more significant the increase in net profit, the greater the allocation weighting.and here there are high requirements for the performance forecast level of sell-side investment research reports; Fourth, consider the P/E ratio, the lower the current P/E ratio, the higher the allocation weighting should be. But P/E ratio in the four dimensions of the portfolio measured, the return is significantly lower than the other three dimensions. This may be because investors in new energy vehicle stocks place more emphasis on industry leadership and enterprise size and have a higher tolerance for high P/E ratio, reflecting that the new energy vehicle industry is an emerging industry and valuation is more dependent on growth.

In conclusion, from the data analysis of the recent 3-year bull market for new energy vehicle stocks, the fund portfolio weighting decision of this sector can be considered in the following order: circulation market value > institutional position share >growth of net profit after deductions > P/E ratio. Furthermore, based on the multi-dimensional overlay analysis, stocks with 20-30% of institutional positions and large-cap leading stocks have the highest portfolio returns.

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Studies of the Relationship Between International Crude Oil Prices and Stock Prices of New Energy Companies and Investor Sentiment

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Abstract: This paper uses the daily data of the CSI Mainland New Energy Index, WTI crude oil price, and CSI 500 risk premium from January 2019 to September 2022 as samples to explore the interrelationship of the above variables using the Johansen cointegration test, Granger causality test, impulse response, and variance decomposition. The results show that in the short run, international crude oil price and risk premium have a significant effect on the share price of new energy companies; in the long run, global crude oil price cannot affect the share price of new energy companies, as well as international crude oil price and share price of new energy companies have a significant effect on the risk premium.

Keywords: CSI Mainland New Energy Index; WTI crude oil price; risk premium; investor sentiment

1. Introduction

As a non-renewable resource, crude oil plays an irreplaceable role in the political situation as well as in the standard of living of the population. However, in recent months, the international community has been less active in investing in crude oil exploration and development, which has affected crude oil production to some extent. China is amid an upswing in its manufacturing sector, with increasing industrialization and high demand for crude oil. However, China depends on global supplies for over 70% of its crude oil, which is a worrying but logical situation. Furthermore, as excessive use of fossil fuels emits harmful substances and poses a significant threat to natural disasters, people are becoming aware of the advantages of new energy sources as the concept of environmental protection spreads.

In recent years, new energy has become the focus of national strategic development and a hot stock market concept. Companies at home and abroad are going to develop new power, such as new energy vehicles, which has led to the size of the new energy market stocks being continuously expanded. It

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has been found through previous studies that crude oil and new energy can significantly affect market sentiment. However, market sentiment affects new energy stock prices and international crude oil prices, and do the original findings still hold over time? Therefore, this paper uses the CSI Mainland New Energy Theme Index (hereafter referred to as the new energy stock price proxy) from January 2019 to September 2022, the price of US West Texas light crude oil (WTI) denominated in RMB. The risk premium consists of the CSI 500 rolling P/E ratio and the 10-year Treasury yield as data samples to explore the relationship between the three and to provide an outlook for possible future research.

2. Literature Review

In recent years, with the development of the new energy securities market and the volatile rise in international crude oil prices, as well as the high level of investor concern for the new energy industry, several scholars at home and abroad have begun to focus on the relationship between new energy stock prices, international crude oil prices, unexpected events, and investor sentiment, with the following research results.

Compared to the studies on the relationship between international oil prices and the stock market, there are fewer studies discussing the relationship between global oil prices and stock market sentiment indices, and even fewer studies specifically analyzing the extent of the impact of global crude oil prices on the changes in China's stock market sentiment indices. Wang Jiayan [1] used principal component analysis to extract investor sentiment factors and subdivided the traditional sentiment variables to obtain the conclusion that there is a long-term equilibrium relationship between the volatility of international crude oil prices and Chinese stock market investor sentiment and that global crude oil prices hurt Chinese stock market investor sentiment. In the long run, the two tend to fluctuate inversely, and in the short run, they are positively correlated with each other in the initial period [1].

Based on the above study, Yi Shengkang [2] and Zhao Kun [3] introduce investor sentiment indicators, which can represent the consideration of irrational factors in the investment decision process and influence the final investment behavior of investors. It can more intuitively show the impact of international oil price fluctuations on China's stock market [2]. The latter is based on dynamic factor analysis, collecting traditional sentiment proxy variables such as network data and turnover rate to construct investor sentiment indicators [3]. The results show that investor sentiment has a positive impact on future stock market risk, and liquidity has a negative effect on future stock market risk. Thus although investor sentiment is positively related to liquidity, the two act in opposite directions. Whether investor sentiment is considered or not, international oil prices negatively impact the oil consumption sector and positively impact the new energy sector as a proxy [1-3]. Baffes points out that OPEC policy, geopolitical risk, and the strengthening of the US dollar are all strong drivers of crude oil prices, but the results are inconsistent. Zhou Minglei used the ARMAX model to obtain that unexpected events can significantly affect oil prices, and different unexpected events have other effects on oil prices [4]. Liu Qingfu et al. examined the impact effects of significant risk events on China's commodity futures market through a stochastic volatility model [5]. They found that economic circumstances, political events, and natural disasters significantly affect China's commodity futures returns and volatility. Chai et al. start from the equilibrium model of oil prices, which argues that unexpected events can break the equilibrium model of oil prices and cause significant fluctuations in oil prices.

Meanwhile, Li Zhuwei et al. findings show that changes in investor sentiment can cause fluctuations in the crude oil price index to a certain extent. However, when an external shock occurs, the shift in investor sentiment does not happen immediately, takes a reaction time, and only generates volatility in the short term, returning to its initial level in the long term. The volatility of the stock price index explains most of the changes in investor sentiment, with the USD/CNY exchange rate

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index in second place and the crude oil price index's volatility contributing the least to investor sentiment changes.

In international studies, Zhonglu Chen et al. have documented the volatility of five representative energy sources to predict assets in two energy markets by using four significant predictors simultaneously, namely VIX, GEPU, USEPU, and investor sentiment [6]. The study's results show that within-sample results indicate that the VIX significantly impacts the five energy assets. Only investor sentiment significantly positively impacts WTI oil futures and spots. Olusanya E. Olubusoye et al. conclude that each energy price is characterized by unique downward (price decline) and upward (price recovery) movements [7]. Moreover, Oluwasegun B. Adekoya showed that stock returns are more sensitive to uncertainty measures when market conditions are expected [8].

However, limited by the theoretical level, technical means, and data accuracy at the time of the paper's creation, the results derived from the final analysis may be biased. The conclusions of the research that lack timeliness may not apply to the current stock market and cannot suggest practical guidance for future generations. For example, although Wang Jiayan et al. considered the sentiment fluctuations of Chinese domestic investors in response to changes in international oil prices, the samples selected in their article are from April 2007, November 2012, and April 2015, which are outdated and cannot present the relationship between international oil prices and Chinese stock market investor sentiment today; in addition, the method used in constructing sentiment indicators is too single when collecting data, and it is too homogeneous, so the authority of the online platform is not guaranteed [2]. The statistical standards of the data are not consistent. Therefore, the limitations of the above-mentioned studies leave room for a more in-depth discussion in this paper.

This paper not only updates the data but also selects explicitly the time interval spanning the average year, the occurrence of the new crown epidemic, and the outbreak of the Russia-Ukraine war, which is more relevant and time-sensitive, and also uses Johansen co-integration test, Granger causality test, impulse response analysis, and variance decomposition in the empirical part to analyze the relationship between international crude oil prices, domestic new energy stock prices and domestic investor sentiment index. According to the observed results, China's new energy stock market has shown strong independence in recent years, and there is a relationship between active and passive influence with investor sentiment. However, chin financial trading market is unilaterally closed.

3. Empirical Method

3.1. Sample Selection and Data Description

(1) Company stock prices and international crude oil prices. Because the mainland new energy index has comprehensive coverage of the new energy industry chain, and the spot price of WTI crude oil has liquidity and high price transparency, this paper selects 000941 to measure the share price of new energy companies and the spot price of WTI crude oil as the fluctuation data of international crude oil price [9].

(2) CSI 500 rolling P/E ratio. The P/E ratio is chosen for risk premium calculation. However, the static P/E ratio reflects historical profits, and the static operating ratio will be undervalued if the company's performance declines. Rolling P/E ratios, on the other hand, are often projected based on the growth rate of profits and are more in line with investor sentiment and expectations.

(3) Ten-year Treasury bond yields. Long-term interest rates significantly impact the equity market, and their changes represent, to some extent, the risk appetite and expectations of financial market participants. There is a negative correlation between interest rates and stock prices. Investors will exit the stock market when interest rates rise and invest in the bond market instead. At the same time, interest rate changes affect a business's value through discounted cash flow valuation. A rise in interest rates will reduce a firm's valuation, and the share price will naturally fall. In the existing literature,

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Qing Zeng [10], Zhong Shi-he [9], and Moya- Martínez (2014), among others, consider the selection of long-term interest rates as one of the variables. Similarly, in this paper, the 10-year Treasury yield is chosen to measure long-term interest rates because the 10-year Treasury bond is the most liquid among medium- and long-term Treasury bonds; its yield is a better indicator of the expected trend of our economy [10].

(4) Risk premium. An indicator of the value for money of stocks and bonds is the risk premium, which measures the risk premium of stocks relative to bonds and is characterized by mean reversion. When supplies are cost-effective, investors are bullish on the stock market and, therefore, more inclined to buy stocks. Thus, the risk premium reflects a certain extent, the shift in market sentiment and investment preferences and can be seen as a benchmark for measuring investor sentiment.

(5) The exchange rate of the RMB against the USD. The spot price of WTI crude oil selected for the sample in US dollars. Foreign currencies are converted to RMB at the spot exchange rate on the same day to facilitate comparison and see its impact on domestic investment sentiment and the domestic new energy index.

All samples in this paper are selected to span the period from January 2019 to September 2022, as this period spans the years of normal, since the outbreak of the new crown epidemic and the outbreak of the Russia-Ukraine war trading situation, which better reflects the volatility of investor sentiment about the volatility of the study sample. Of these, 880 valid daily data were obtained after excluding trading days with no trading data.

As for the data sources, CSI Mainland New Energy Index and CSI 500 rolling P/E ratios were obtained from Choice Financial Terminal, while WTI crude oil spot price, RMB/USD exchange rate, and 10-year treasury yield were obtained from Investing Finance. （https://cn.investing.com/）

Table 1: Variable summary and symbol description.

Variables	Sample data	Symbols
New Energy Company Stock Price	CSI Mainland New Energy Index	NE_I
International crude oil prices	WTI Crude Oil Spot Price	WTI_P
P/E ratio	CSI 500 Rolling P/E Ratio	PE_{500}^{R}
Long-term interest rates	10-Year Treasury Yield	I_{10}^{R}
Exchange rates	RMB to US Dollar Exchange Rate	E_R
Risk premium	$\frac{1}{\text{CSI 500 Rolling P/E Ratio}} - 10 - \text{Year Treasury Yield}$	R_p

DOI: 10.54254/2754-1169/17/20231071

3.2. Variable Description

Table 2: Variable statistics and description.

Variables	Average	Median	Maximum	Minimum	SD	Skewness	Kurtosis
NE_I	2581.121	2301.460	4805.060	1177.840	1168.252	0.304	-1.446
WTI_P	412.492	404.509	821.012	55.135	116.014	0.078	-0.058
PE_{500}^{R}	19.877	19.590	27.760	13.130	3.200	0.236	-0.637
I_{10}^{R}	3.01%	3.05%	3.44%	2.50%	0.21%	-0.226	-1.042
E_R	6.723	6.719	7.206	6.308	0.259	0.035	-1.403
R_p	2.15%	2.07%	4.78%	0.46%	0.96%	-0.463	-0.602

3.3. Unit Root Test

For each time series, the rootedness was first tested using the ADF unit root test, and the results are shown in Table 3. From the unit root test findings, it was obtained that the time series constituted by the raw data of CSI Mainland New Energy Index, WTI International Crude Oil Spot Price, CSI 500 Rolling P/E Ratio, Long-term Interest Rate, Exchange Rate, and Risk Premium was unstable.

Table 3: Unit root test table.

Variables	1% thresh-old	5% thresh-old	10% thresh-old	T-Value	P-Value	Conclu-sion	Differenc-ing
NE_I	-3.438	-2.865	-2.569	-1.112	0.710	Unstable	Stable
WTI_P	-3.438	-2.865	-2.569	-1.038	0.739	Unstable	Stable
PE_{500}^{R}	-3.438	-2.865	-2.569	-1.251	0.651	Unstable	Stable
I_{10}^{R}	-3.438	-2.865	-2.569	-1.463	0.552	Unstable	Stable
E_R	-3.438	-2.865	-2.569	-0.617	0.867	Unstable	Stable
R_p	-3.438	-2.865	-2.569	-0.759	0.831	Unstable	Stable

As shown in Table 4, this paper uses a combination of the Akira Pool Information Criterion (AIC), the Schwartz Criterion (SC), the Hanan and Quinn Criterion (HQ), and the Finite Prediction Error Criterion (FPE) to determine the lag order and obtain a lag order of 1 for the variables. The validation also further reveals that taking a first-order difference for all variables shows a stable conclusion at the 1% significance level.

Table 4: Lagging order selection table.

Lagging order	AIC	SC	HQ	FPE
0	13.682	13.698	13.688	874650.772
1	-0.978	-0.912*	-0.953*	0.376
2	-0.991*	-0.877	-0.947	0.371*
3	-0.98	-0.817	-0.918	0.375
4	-0.973	-0.761	-0.892	0.378

DOI: 10.54254/2754-1169/17/20231071

3.4. Johansen Co-integration Test

After the ADF unit root test, the variables presented a stable conclusion at the first-order difference. This paper wishes to explore further the relationship between the main variables, namely the CSI New Energy Index, the international crude oil price, and the risk premium. The use of the index of the Granger causality test is an ideal tool. However, the Granger causality test requires the original series to be stationary, and the actual data time series selected for this paper does not meet this requirement. However, if the time series are cointegrated, the conditions for the Granger causality test are also met.

The Johansen cointegration test can be judged using either the 'trace statistic' or the 'maximum characteristic root,' with the 'maximum characteristic root' as the final result in this paper if the absolute value of the trace The total value of the statistic is greater than the full value of the critical value, which implies significance. If there is a presented matter, the original hypothesis is rejected, and the lag order lags are set to lag order 1.

As can be seen from table 5, for hypothesis 'None (no cointegration)': its maximum eigenvalue value is 21.024, while the 1% critical value is 18.893, implying that the idea is rejected at the 10% level, i.e., no cointegration is possible; for hypotheses 'at most 1 cointegration ' or at most 2 cointegration', its maximum eigenvalue values are 3.286 and 1.061 respectively, as well as their absolute values, are lower than the total value of each critical value, implying acceptance of the hypothesis, which suggests that at least one long-run equilibrium relationship does exist between the three main variables.

Table 5: Johansen co-integration test table (Max-Eigenvalue).

Null Hypothesis	Eigenvalue	Max-Eigenvalue	10% threshold	5% threshold	1% threshold
None	0.024	21.024	18.893	21.131	25.865
Up to 1 co-integration	0.004	3.286	12.297	14.264	18.520
Up to 2 co-integration	0.001	1.061	2.705	3.841	6.635

3.5. Granger's Causality Test

Granger causality tests study the dynamic causality between indicators. They can be used to determine whether there is a causal relationship between economic variables and the direction in which they affect each other. In this paper, in the lag order selection of the Granger causality test, the lag order lags are chosen to order 1, at which point the value of AIC is minimized, and the output is optimal.

Before conducting the Granger causality test, first observe Diagram 1: the black dots in Diagram 1 are the inverse of the roots of the AR characteristic polynomial, and all lie within the unit circle, indicating that the model is stable and confirming that Granger causality tests can be done for the three variables in this paper.

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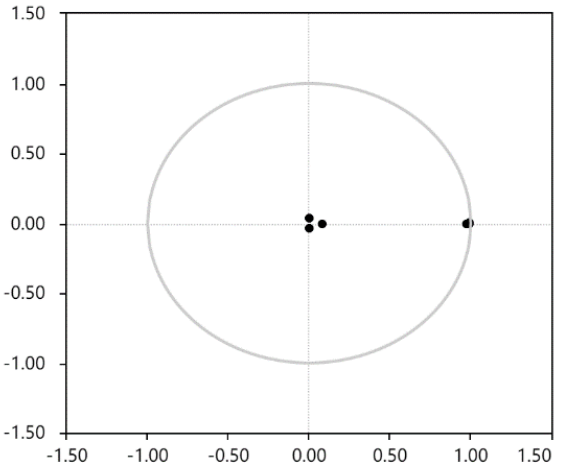


Figure 1: Inverse roots AR characteristic polynomial.

This paper's bound for the study probability is set at 0.05. Usually, a Probability less than 0.05 rejects the original hypothesis, which means that X_1 is the Granger cause of X_2； . In contrast, a Probability greater than 0.05 accepts the original hypothesis, which means that X_1 is not the Granger cause of X_2. As shown in Table 6, the domestic new energy index and global changes in crude oil prices can cause changes in risk premiums, but gl. Still, global oil prices to domestic new energy, domestic new energy index to international crude oil prices, and risk premiums to global crude oil prices and domestic new energy indexes cannot cause changes. In this paper, the bound for the study probability is set at 0.5; usually, a possibility less than 0.05 rejects the original hypothesis, which means that X_1 is the Granger cause of X_2； while a probability greater than 0.05 accepts the original hypothesis, which means that X_1, is not the Granger cause of X_2. As shown in Table 6, the domestic new energy index and international Changes in crude oil prices can cause changes in risk premiums. Still, global crude oil prices to domestic new energy, domestic new energy index to international crude oil prices, and risk premiums to global oil prices and domestic new energy indexes cannot cause changes.

Table 6: Granger's causality test table.

Null Hypothesis	F-value	Probability
NE_I does not Granger Cause WTI_P	2.877	0.090*
WTI_P does not Granger Cause NE_I	0.179	0.672
R_p does not Granger Cause WTI_P	0.003	0.955
WTI_P does not Granger Cause R_p	15.227	0.000**
R_p does not Granger Cause NE_I	0.003	0.954
NE_I does not Granger Cause R_p	8.393	0.004**

3.6. Impulse Response

The impulse response diagram shows the dynamic impact of a shock to a variable on the variable itself or other variables; if it is greater than 0, then it is a positive shock, conversely less than 0, then it is a negative shock, the larger the absolute value means the larger the shock, the closer the value to 0 means the smaller the shock.

We have obtained that the domestic new energy index is the cause of the fluctuation of the risk premium, and the international crude oil price is also the cause of the change of the risk premium.

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Therefore, further impulse response analysis was conducted to study the lags of the impact of the domestic new energy index and the international crude oil price on the risk premium. The results are shown in Diagram 2.

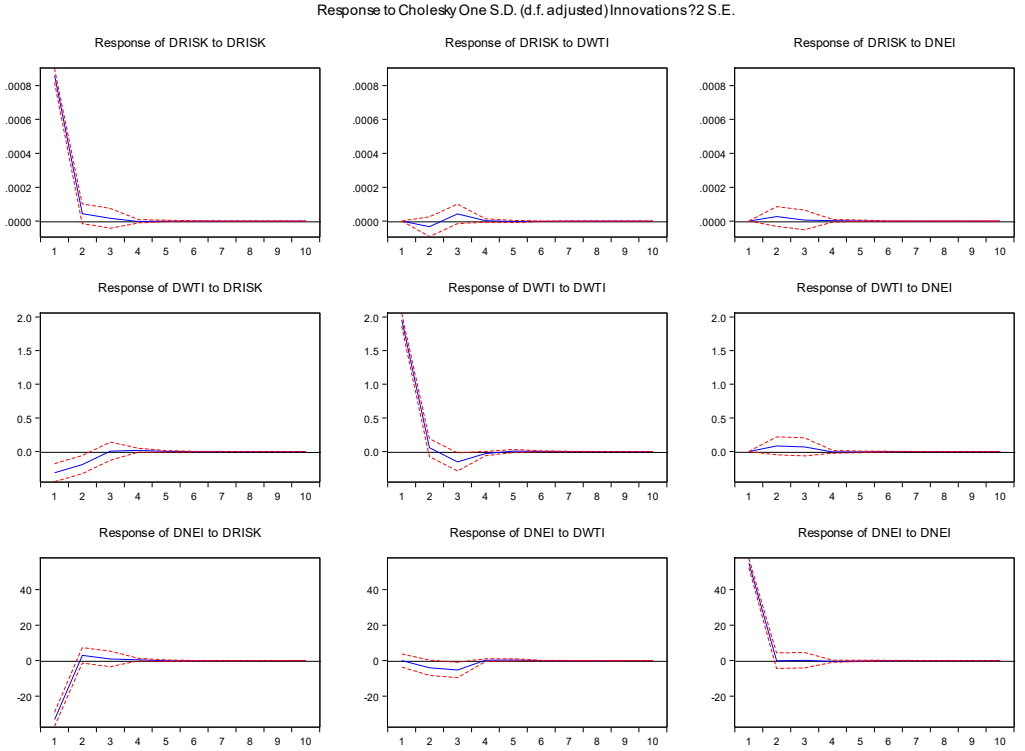


Figure 2: Impulse response diagrams of NE_I、WTI_P and R_p.

As shown in Diagram 2, when describing the impulse response, the focus is on the short-term response, the Response of B to A, i.e., one standard deviation unit of A to B, where the solid blue line is the change in B and the red dashed line is the two times normal deviation interval. As the original data series is non-stationary, the time series returns to a stationary state after making a first-order difference.

The impact of international crude oil price on risk premium is insignificant, with negative implications in the first 2 periods and positive effects in periods 3~4; the impact of the new energy share price on risk premium is also negligible, with positive impact in the first 3 periods; the result of risk premium on international crude oil is negative in the first 2~2.5 periods; the effect of the new energy share price on global crude oil price is positive in the first 3 periods; the impact of risk premium on new energy share price is very The impact of the risk premium on the share price of new energy is very significant, with a negative effect on the first 1~1.5 periods and then rapidly turning positive; the impact of the international crude oil price on the share price of new energy companies is significantly positive in the first 3 periods; development of the risk premium and the impact of the new energy share price on itself are both positive, the former is small, and the latter is significant. The impact of international crude oil price on itself is a small positive impact in the first 1 to 1.5 periods, then a small negative effect. However, all shocks are short-term, which is also determined by the characteristics of financial markets.

3.7. Variance Decomposition

Variance decomposition is the process of decomposing the variance of the forecast error of each exogenous variable in the model into components that are correlated with each endogenous variable

DOI: 10.54254/2754-1169/17/20231071

according to their causes, i.e., analyzing the contribution of each shock to the change in the endogenous variable, to understand the relative importance of each shock to the endogenous variables of the model. The critical variable chosen for this paper is the risk premium for the variance decomposition, and the results obtained are shown in Table 7.

Table 7: Variance decomposition plot of the risk premium(R_p).

Period	S.E.	WTI_P(%)	NE_I(%)	R_p(%)
1	0.001	2.151	26.024	71.825
2	0.001	2.693	25.035	72.272
3	0.001	2.754	24.705	72.541
4	0.002	2.669	24.512	72.819
5	0.002	2.534	24.366	73.1
6	0.002	2.382	24.24	73.378
7	0.002	2.228	24.124	73.648
8	0.002	2.077	24.012	73.911
9	0.002	1.935	23.9	74.164
10	0.003	1.803	23.789	74.408
11	0.003	1.684	23.675	74.642
12	0.003	1.577	23.559	74.864
13	0.003	1.484	23.44	75.076
14	0.003	1.405	23.318	75.277
15	0.003	1.341	23.193	75.466

The period is the number of periods of variance decomposition, i.e., the forecast period of risk premium, S.E. represents the standard deviation of risk premium volatility forecast, WTI_P and NE_I are the percentages of the forecast variance of risk premium volatility that are perturbed by international crude oil price and CSI New Energy Index, and R_p is the percentage of its perturbation, the sum of the three columns is 100%. The table shows that in the first period, 71.82% of the risk premium movement is due to itself, 26.02% is due to the new energy movement, and 2.15% is due to the international crude oil price movement. Over time, there was a slight increase in the proportion of own disturbances in risk premium movements and a slight decrease in the other two, which remained stable at approximately 76%, 23,% and 1% [2].

4. Conclusion and Forecast

The above empirical tests yield that in the short run, the shocks to new energy share prices from international crude oil prices and risk premiums are significant, with the former wonders consistently having significant short-run positive effects while the latter shifts from significant short-run negative effects to significant short-run positive results, which is in line with the findings of unidirectional short-run causality between oil prices and share prices of alternative energy companies obtained by Ripsy Bondia (2016). The shocks to risk premia are less pronounced for international crude oil and new energy share prices, with the former surprises turning from a short-term insignificant negative impact to a short-term negligible positive impact. At the same time, the latter has been a short-term little positive impact. Shocks to international crude oil prices are also insignificant for new energy share prices and risk premia, with the shocks being short-run insignificantly positive and the latter being short-run significant and negative.

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However, in the long run, international crude oil prices do not influence new energy share prices, which is contrary to the empirical findings of Qing Zeng [10] that global crude oil prices have a significant impact on the share prices of new energy companies, which can also reflect the fact that the new energy stock market in China has shown a high degree of independence in recent years. The fact that international crude oil can have an impact on the risk premium but not vice versa, as well as the fact that fluctuations in new energy share prices do not cause changes in international crude oil prices, suggests that China's financial trading market is still unilaterally closed, i.e., global financial derivatives price movements can most likely affect domestic derivatives financial market trading, but domestic does not affect international. In addition, trends in new energy stock prices can influence changes in risk premiums but not vice versa, suggesting an active-passive relationship in the new energy stock trading market, i.e., as the new energy sector grows, investor sentiment is high and will continue to be bullish on new energy stocks. But new energy stocks do not continue to rise or fall because of the high level of investor sentiment. The change in investor sentiment is caused by itself at 71.82%, by the shift in ne stock prices at 26.02%, and by the new energy change in global crude oil prices at 2.15%, indicating that most investors remain focused on the domestic financial trading market.

In conclusion, both the development over time and the choice of the key variables' will influence the final conclusions. The risk premium selected in this paper is only a proxy for investor sentiment and thus leads to similar or opposite conclusions to the previous empirical results i.e., the research methodology proposed in this paper for risk premium may not be the best tool to study the correlation between investor sentiment, international crude oil prices and new energy share prices. Still, both have some validity, which is subject to further research.

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Research on the Availability Heuristic and Its Application

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Abstract: The availability heuristic refers to individuals making decisions based on the availability of relevant events as a shortcut. The paper focuses on the availability heuristic and its own unique information processing mode through literature reading and analysis. According to the discussion of the application, it can be concluded that the availability heuristic affects individual risk cognition and decision-making behavior. Future research should explore the root causes, explore the relationship between the availability heuristic and other phenomena, and expand the research field of its application.

Keywords: availability, heuristic, risk, decision-making

1. Introduction

As the competitive environment becomes more and more changeable, complex, and uncertain, people increasingly realize that due to their own "bounded rationality" and the decision-making environment with incomplete information, they cannot collect all the information to make rational probability statistics and judgments. In real life, people make decisions based on the availability of relevant events as a shortcut. The paper concentrates on the availability heuristic and its own unique information processing mode by literature reading and analysis. This paper reveals the application of research accessibility heuristics to decision making, which leads to a better understanding of the decision-making mechanism to optimize decision-making behavior.

2. Introduction to Availability Heuristic

The availability heuristic refers to individuals making decisions based on the availability of relevant events as a shortcut. Individual judgment and decision outcomes are regulated by the degree of availability. Specifically, the more readily an event is perceived or recalled, the more likely an individual will perceive it to have occurred. This is known as the availability heuristic. Tversky and Kahneman first tested the existence of the availability heuristic in a series of studies, the most well-known of which was the Judgment of Word Frequency, in which people were asked to answer whether there were more words beginning with the letter K or more words with a K as the third letter in an English passage. The results found that nearly 70 percent of participants thought there were more words beginning with the letter K, even though there were far fewer of the former than the latter. In general, people can more easily recall words beginning with the letter K, such as key, keep, kill, etc., than words with the third letter K, so they will think that there are more words beginning with the letter K, leading to incorrect likelihood judgments [1].

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Previous studies have suggested that the availability heuristic usually exists in two kinds of decision tasks. One is the decision task related to the existing memory, in which the individual needs to extract the information from the memory. The other is a decision-making task that has nothing to do with existing memory. The individual needs to construct information according to the known conditions. In real-life situations, the more frequently an event occurs, the easier it is to be remembered and retrieved by an individual. Therefore, the availability heuristic is reasonable in nature, which is why researchers emphasize it as an ecologically effective decision-making strategy. However, due to the influence of various factors unrelated to event frequency, accessibility heuristic decision-making is not always reasonable and effective. The accessibility heuristic is a shortcut for cognitive decision-making with both advantages and disadvantages, which is commonly used in the possibility judgment of events and daily behavior decision-making. Therefore, the understanding and research of accessibility heuristic is of great significance.

3. The Mechanism for the Availability Heuristic

According to the definition of the availability heuristic, the individual's assessment of the degree of availability of events determines the outcome of the availability heuristic judgment decision. At present, there are two main evaluation mechanisms for availability.

According to one view, individuals evaluate the availability based on the extracted information content. The larger the number of recalled events, the higher the individual's perception of availability, and thus the more likely they are to occur in reality. Hertwig, Pachur, and Kurzenhauser found in their study of situational frequency estimation of risk that when comparing the prevalence of heart disease and gastric cancer, individuals tend to compare the prevalence of the two diseases by recalling actual instances of each disease and judging the prevalence of the two diseases in the entire population based on the number of instances. This was confirmed by Hills and Pachur [2]. Another point of view is that individuals evaluate accessibility according to their subjective feelings in the process of information extraction. The stronger the ease of feeling in the process of extraction, the higher the accessibility will be considered by individuals, resulting in the heuristic judgment result of accessibility. OSchwarz and others separated the subjective feelings of the information extraction process from the extracted information content. The subjects were asked to report 6 (easy task) or 12 (difficult task) instances of their dogmatism or non-dogmatism to induce the availability heuristic decision, after which the degree of dogmatism was self-rated. Individuals need to extract more events when recalling 12 cases than when recalling 6 cases, and the ease of the information extraction process is lower [3]. According to the first assessment mechanism, subjects who completed the difficult task of dogmatic behavior rated themselves as more dogmatic than those who completed the simple task of dogmatic behavior. When the difficulty of the information extraction process is used as the evaluation criterion of accessibility, the availability heuristic judgment will get the opposite result. That is to say, two different mechanisms of action will produce different evaluation results.

Relevant studies have confirmed that the availability heuristic is also affected by the motility, salience and recency of the event. First of all, the vividness of an event can improve its accessibility, and Keller, Siegrist and Gutscher's experiments confirm this conclusion. The study found that participants who viewed pictures of flood-affected houses rated the risk of flooding higher than those who viewed neutral pictures, which made the damage more vivid. The reason why vividness can affect the availability heuristic may be that vivid information can make events visible and concrete, which can leave a deep impression on individuals and be easy to remember, and then can be more easily extracted by individuals to affect their decisions when making decisions. Second, the prominence of the event is enough to affect the usability of the heuristic. The reason is that the familiarity of an individual depends not only on the knowledge of the event, but also on the characteristic

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points. The latter is very prominently affected by events. Finally, Tversky and Kahneman found that recent events are more readily available than previous experiences, and individuals tend to use recently acquired information to make likelihood judgments. [4]

4. Discussion of the Applications

4.1. Application 1

When people see a female driver backing up and causing a car accident, they will immediately remember that a few days ago they had a collision with a female driver. Whenever the news reports a car accident, if the driver is a woman, the media workers always specify "female driver" specifically, thus separating the female driver from the crowd of drivers. What about big data and facts?

The China Academy of Judicial Big Data released the Special Report on the Characteristics and Trends of the Crime of causing Traffic Accidents (2016.1-2019.12), which analyzed some characteristics of the crime of causing traffic accidents in China in recent years.

According to statistics, 94.60 percent of defendants in traffic accident cases are men, while 5.40 percent are women. Female drivers had an average case rate of 0.25 per 10,000 people from 2016 to 2019, while male drivers had an average case rate of 2.20 per 10,000 people, which was 8.8 times higher than female drivers.

It has been determined that men, not women, are the primary traffic offenders. The paper also mentions the male-to-female driver ratio. According to the Ministry of Public Security's 2021 motor vehicle and driver data, there were 319 million male drivers and 162 million female drivers, with a male to female driver ratio of 1.97 to 1. In other words, given the male-female driver ratio, this conclusion can be confirmed.

4.2. Application 2

When a hot stock is about to go public, the entire news media will be focused on that event. And many investors will unknowingly care about, or even buy, this stock as a result of the media bombardment.

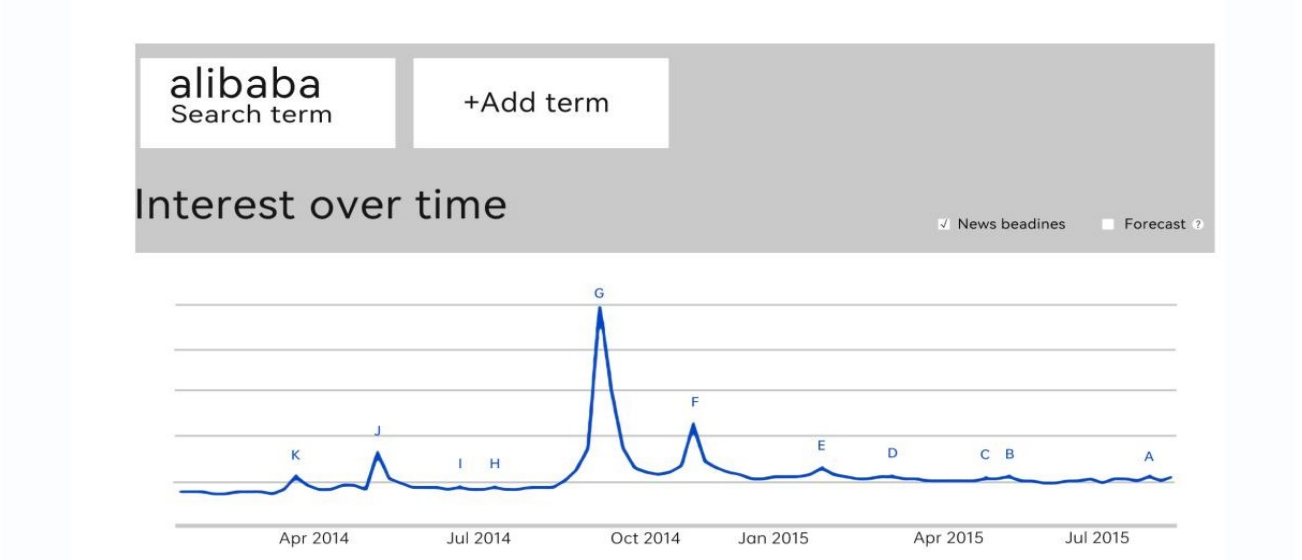


Figure 1: The number of searches for "Alibaba" on Google.

For example, Figure 1 shows the number of searches for "Alibaba" on Google. We can see that the search volume on Alibaba peaked around September 2014, which was right around the time

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Alibaba went public in the U.S. Sometimes investors even feel that what they are buying is not Alibaba's shares, but a Chinese dream with unlimited expectations of their own. As Jack Ma put it, "the dream or to have in case it comes true?"

It means that people tend to judge the possibility of an event according to the cognitive availability. For example, investors attach too much importance to the information they know or can easily get while ignoring the in-depth exploration of other information in the decision-making process, resulting in the bias of judgment.

4.3. Application 3

If Jack is the most diligent employee in the department, he gets up early and leaves work late every day and strives to make progress, and he will be recognized as the most diligent person. Just two days this month, Jack was late or left half a day early because of some small things in life, and just let everyone know. Although these two days are less than 1% of the 250 working days of the year, how many colleagues will change their impression of Jack's diligence and punctuality at this time?

If Q1 is not easy to answer, we change it to Q2: Suppose A is the manager of a team with 20 people. Jack is recognized as the "star employee". But, A made a very low-level mistake, which caused a bit of loss for the team. Will A still determine to give the only "excellent employee" to Jack in the year-end performance review?

If Q2 is to let A swing, then we can come to Q3: A is still the manager. Jack still made low-level mistakes. But at a team dinner A praised Jack in public and called on everyone to learn from Jack. In this case, what will A think about the year-end performance review?

Scene 1: "Availability Heuristic Determination" tells us that once an example is readily available in our memory, it usually tends to overgeneralize. Therefore, a diligent employee is likely to be noticeably late once or twice a month, affecting other colleagues' original favorable impression of him.

Scene 2: For the same reason as in Scenario 1, A is likely to be less determined to give the only "excellent" to Jack, even though Jack is still objectively the most valuable contributor to the team.

Scene 3: Compared to scene two, A is relatively more likely to award Jack as the only excellent employee. The reason is that people are harder to act against public.

According to the discussion of the above application, availability heuristic decisions are not always rational and effective. One way to reduce intuition and bias is to slow down our thinking, especially when people are coming to important decisions. People need to practice mobilizing their thinking patterns rather than letting the intuition make decisions. Here are seven suggestive questions to ask :

1. Why did I come up with this idea/make this judgment decision?
2. What is the evidence for this view/decision?
3. Did I come up with this idea/judgment decision quickly because there were familiar events affecting me?
4. Is it because something similar happened to me recently?
5. Is it because I have seen similar news or stories recently?
6. Is it easy? Can I find more objective data to support this view/judgment decision?

When we're done with these seven questions, you're going back to the rational thinking and decision-making for me to imagine similar results?

5. Conclusion

It is found that the availability heuristic has its own unique information processing mode. The availability heuristic affects individual risk cognition and decision-making behavior, which has important application value and theoretical value. Future research should explore the root causes, ex-

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plore the relationship between the availability heuristic and other phenomena, and expand the research field of its application.

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The Analysis of the Impact of Covid-19 on China's Tourism Industry

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Abstract: Tourism in many parts of China has been hit hard by the Covid-19 outbreak. This study provides a comprehensive analysis of the impact on the tourism industry in China before and after the epidemic, the current situation of tourism shutdown and damage, and the impact on the overall tourism market. In addition, the study analyzes the current state of the population's willingness to travel. The paper will use the tourism industry in Sanya and Daqing as case studies. In order to get rid of the impact of the epidemic as soon as possible, Chinese small and medium-sized enterprises have to come up with reasonable and effective measures to cope with it. For this reason, China should work together to fight the epidemic and make a concerted effort for the early recovery of tourism.

Keywords: China, tourism industry, recovery, Covid-19

1. Introduction

With the development of the economy and the improvement of people's living standards, the specificity of the tourism industry makes it frequently and easily affected by the external environment in the process of development. Covid-19 is more contagious and has a higher mortality rate than other prevalent infectious diseases. Because tourism is simultaneously exotic, consumptive and generative, outbreaks have a huge impact on tourism industries such as scenic spots, travel agencies, hotels, entertainment and transportation. According to statistics, more than 30,000 scenic spots and 40,000 travel agencies across the country were forced to close as a result. in 2020, the number of domestic tourists in China was 2.879 billion, down 52.1% year-on-year; domestic tourism revenue was 2.23 trillion yuan, down 61.1% year-on-year. The global figures for international tourism changed even more dramatically, with a significant drop in the number of international travelers leading to a decrease in export revenue of approximately $130 million [1]. Under the impact of the epidemic, residents avoided travel to reduce exposure to the virus due to perceived risk and fear of risk. As a result, residents' willingness to travel was significantly reduced. This paper examines the current state of China's tourism industry before and after the epidemic. The residents' willingness to travel is explored. Secondly, it also shares the current situation and damage to the tourism industry in China, and summarizes the impact of the epidemic on the Chinese tourism market. The impact of the Covid-19 epidemic on China's tourism market is summarized by referring to the data of Sanya, a famous tourist city in China. At the end of this paper, we also propose measures for small and medium-sized enterprises in the tourism industry to cope with the epidemic. The paper uses a comparative approach to compare the economic data of the tourism industry before and after the epidemic, and uses

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examples to show the "tragic situation of the tourism industry in Sanya", and graphs to give the reader a more visible comparison of the impact of Covid-19 on the Chinese tourism industry. By analyzing the impact of a series of epidemics and case studies, we hope to find ways to recover China's tourism industry as soon as possible or strategies to help China's economy recover more quickly.

2. Analysis of the Chinese Tourism Industry Before and after the Outbreak of Covid-19

2.1. Analysis of the Chinese Tourism Industry Before the Outbreak of Covid-19

As a secondary industry that greatly influences regional economic and cultural development, tourism is increasingly playing a key part in the expansion of the national economy. The "2019 Tourism Market Basic Information" published by the China Tourism Research Institute shows that in 2019, the growth rate of the tourism economy is higher than the growth of GDP, with the number of domestic tourists reaching 6.006 billion; the total number of outbound tourists is 300 million; the comprehensive contribution of tourism to GDP is 10.94 trillion yuan, accounting for 11.05% of GDP; and the number of international tourists is 300 million. China's overall tourist revenue increased from 4.13 trillion yuan in 2015 to 6.63 trillion yuan in 2019 compared to that year [2]. According to data from the Chinese Ministry of Culture and Tourist, before the pandemic broke out in late 2019, there were 28.25 million individuals working just in the tourism industry, making up 79.87 million people, or 10.31% of the country's total employed population. Thus, it can be said that the pandemic has not only impacted China's economic standing but has also made finding a job more challenging.

In 2019, China's tourist industry generated an increase of 11.7%, totaling over 5.7 trillion yuan. About 28.3 million people were directly employed by the sector in 2017. China is the third-largest nation in the world by geographical size and is home to many important historical, archaeological, and cultural monuments. Traveling both domestically and internationally is a part of Chinese tourism. Before the epidemic, around 6 billion domestic travels were conducted in 2019. Chinese visitors' favorite domestic destinations include Beijing, Shanghai, and Guangzhou. In 2019, over 32 million international visitors came to China.



Figure 1: Changes in the number and income of domestic tourists in China in the past 10 years [1].

2.2. Analysis of the Chinese Tourism Industry after the Outbreak

One of the sectors most impacted by the pandemic is tourism, a broad and very delicate business that includes food, lodging, travel, tourism, entertainment, and shopping. The following are the primary effects of the pandemic on the cultural tourist sector. Tourism comes first. The research shows that as a result, more than 30,000 picturesque locations and 40,000 tourist lodgings had to close across the nation. A total of 51.665 billion yuan in tourism income was generated during the Spring Festival in 2020, which is 89.95% less than it was at the same time in 2019 [3]. All five-star hotels discontinue

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providing catering for events including meetings, weddings, birthday parties, and family reunions. Second, the cultural sector in China experienced tens of thousands of performance events, leading to the closure of theaters, singing and dance clubs, and other entertainment places. As a result, due to a poor basis, a lack of cash flow, and dependence on social consumption of cultural products, business income plummeted. It is important to note, nonetheless, that short videos and other Internet digital culture consumption on behalf of growth attitudes have led to short videos, online with goods, becoming a current trend.

The State of Influence on the Willingness of Residents to Travel in Tourism. The epidemic is deadly and very contagious, which has led locals to cut back on their travel. There may still be a need for travel despite the outbreak's severe effects on inhabitants' confidence, desire, and capacity to travel, including Chinese government regulations that shut down cities or forbade group activities. It is generally known that people's desire and capacity to travel considerably decreased during the most recent COVID-19 epidemic in order to minimize exposure and viral transmission. Second, before planning their trip, travelers should think about the region's or destination's regulations for controlling epidemics. Whether or if they are in a high- or medium-risk location. A destination's epidemic scenario, population density, and if the nucleic acid is necessary are also taken into account. In addition, the cultural implications of the city where the epidemic is occurring or has been throughout the pandemic will have an impact on how the public perceives tourism and its reputation, which will have an impact on how and where visitors choose to travel.

Although many citizens' travel plans and patterns have altered as a result of the effective steps taken to stop and contain the pandemic, their inclination to travel has not changed. People's travel habits have altered to have "short-term, short-haul" features as a result of the epidemic. In 2020, over the eight-day National Day holiday, "the country received 637 million domestic tourists, recovering 79% year-over-year on a comparable basis, and achieved domestic tourism revenue of 466.56 billion yuan, recovering 69.9% year-over-year on a comparable basis." [4] Tourism is the desire for a better life and the pursuit of spiritual life.

Post-pandemic Tourism Status. Tourism sectors have shut down in a number of provinces and cities since the pandemic first appeared as a result of the government's response to the outbreak. Consequently, the tourist sector has suffered significant harm, it is hard to recoup company expenses, and the pandemic has been prevented from spreading, which has caused a sharp decrease in tourism demand, leaving tourism enterprises in an existential crisis with practically no income. The data center of the Ministry of Culture and Tourism estimated that "during the five days of May Day holiday in 2022, 160 million domestic tourism trips were made nationwide, a decrease of 30.2% year-on-year, recovering to 66.8% of the same period before the epidemic by comparable caliber; domestic tourism revenue was 64.68 billion yuan, a decrease of 42.9% year-on-year. 42.9%, recovering to 44.0% of the same period before the epidemic." [5] Since the government issued an emergency notice to stop the activities of tourist enterprises in late January, the hotel industry has favorably responded by putting operations on hold. Hotel sector statistics in Beijing, Shanghai, Sanya, and Hong Kong SAR declined sharply barely two months into the epidemic, according to STR Consulting data gathered from mid-to-late January to early February (Figure 2). The local hotel occupancy rate in Sanya decreased from 90% to 10%. This demonstrates the significant impact the pandemic has had on the travel and tourism sector.

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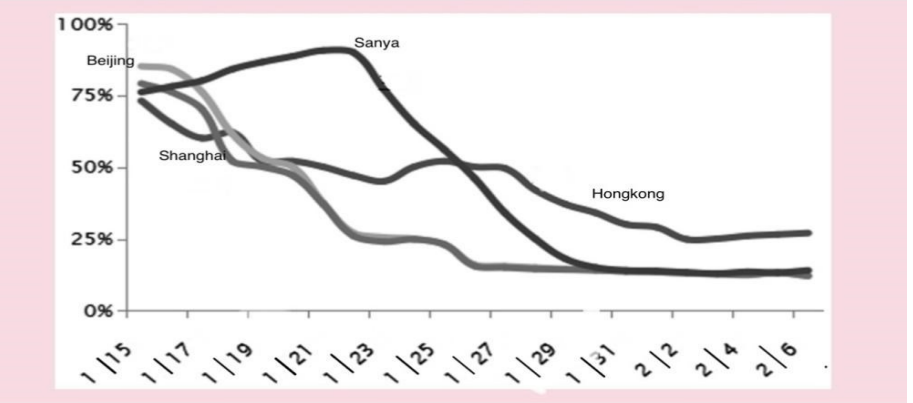


Figure 2: Data on tourism in cities affected by the Covid-19.

The Impact of the Epidemic on the Tourism Industry. The epidemic has had a significant impact on the nation's tourism industry, particularly the six key sectors that make up the sector: "food, accommodation, transportation, tourism, shopping, and entertainment." As a result, some traditional hotels and scenic locations have had to suspend operations. The tourism sector incurred more losses than other industries due to a combination of the Covid 19 outbreak and the Spring Festival's overlap. The tourism sector first experienced financial losses. The epidemic had a significant impact on the tourism industry's economy. From the tourist attractions, every Golden Week, the popular areas of tourist attractions are frequently hard to find tickets, and during the epidemic, especially during the Spring Festival and the long holidays, the tourist attractions business is dismal; from the accommodation industry, a large number of rooms idle, seriously affecting the hotel profits; from the "food" i.e. restaurant industry, a large number of restaurants closed; From the standpoint of "food," hotels associated with the catering sector either closed or rigorously limited the attendance rate in accordance with governmental standards, causing significant losses in the hotel industry. The airline business, as well as cars, trains, and other means of human transportation, are all negatively impacted from the standpoint of "travel." Airlines, cars, trains, and other modes of moving passengers were all negatively impacted from the "line" standpoint, and several airlines even filed for bankruptcy. Previously, during the peak travel season around the Spring Festival, the nation saw roughly 400 million tourists and generated 500 billion yuan in income. The epidemic disrupted the 2020 Chinese New Year Golden Week, which was anticipated to draw 450 million travelers and generate at least 520 billion yuan in tourist income [6]. The outcome is that the tourist sector will lose $500 billion as a result of the Covid 19in 2020, with essentially no income generated. This is made worse by the fact that tourist businesses must pay the wages of their staff and other required expenditures.

Case Study: Impact of Covid-19 on Tourism in Sanya. Around the 2020's Chinese New Year, the new crown epidemic will break out and spread widely. Because tourist activities are diverse and concentrated, the epidemic had a significant impact on them. Because tourism activities are diverse and concentrated, they were particularly hard hit. The pandemic caused Sanya's overall yearly tourism earnings to fall by 26.9% in 2020 compared to the previous year. Domestic income is down 20.5% from 2019 at 41.773 billion yuan, while tourism foreign exchange revenue is down 87.5% to 101.58 million USD (Sanya Tourism and Culture, Radio, Film and Sports Bureau) [7]. Second, Daqing has also been impacted by Covid 19. The total tourism income of Daqing has generally increased between 2010 and 2019, and the pattern of the change in visitor reception is similar to the trend of the change in total tourism revenue. Although the tourism economy nationwide has been severely impacted by the epidemic, the outbreak of the epidemic will accelerate the pace of change in the tourism industry for Daqing, which is in a critical period of transformation. In 2020, affected by the epidemic, the total

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tourism revenue and the tourist reception of Daqing have been significantly reduced, and the reduction ratio is close to 20%.

3. Measures Taken by Small and Medium-Sized Enterprises in the Tourism Industry to Respond to the Epidemic

The government's substantial help will be given primarily to regions with severe epidemics and regions where tourism is a significant part of the local economy. The relevant state departments, together with the governments of provinces, municipalities and autonomous regions, have introduced initiatives such as tax and fee reductions and temporary refunds of tourism service quality deposits to support tourism enterprises in tourist attractions to actively cope with the current business difficulties in order to promote China's tourism industry out of the haze of the epidemic as soon as possible. With the introduction of support programs, this perspective allows the government to respond to the impact in a more targeted and multi-programmatic manner. Considering that e-commerce was developed during the SARS pandemic, we can assume that this disease is considered to be a completely new potential. On a positive note, the emergence of covid-19 raises e-commerce and marketing strategies to another level. Companies should see covid-19 as an opportunity. E-commerce was developed during the SARS pandemic. Now, attractions and businesses can also give their customers a better viewing experience through live streaming, short films and other media, encouraging smart growth in the travel industry and modifying their strategic focus. Second, improve management and training. The tourism sector needs to adjust budgets in advance, anticipate when cash flow can be brought forward, cut costs and reduce non-essential expenditures to be able to cope with the new conditions brought about by the pneumococcal pandemic. Finally, tourism companies can develop some preferential incentive programs to keep tourists coming back. The following people can get a free year in exchange for their participation in epidemic prevention and control Medical staff, volunteers, and troopers offer reduced entrance fees, which also serves to develop brand image In addition, it helps to increase brand recognition.

4. Conclusion

To sum up, this Covid-19 fully demonstrates the vulnerability and sensitivity of the tourism industry, which can have a huge impact once it is hit. However, although the tourism industry was affected by Covid-19, many hotels or companies that rely on tourism as a source of livelihood were forced to stop operating. But we can use this time to consolidate the tourism industry's shortcomings, strengthen our own protection, and plan better and safer travel strategies. For example, today's "cloud tourism" is the new generation of travel. This paper better supports the central point of this paper by comparing the number of tourists and their willingness to travel before and after the pandemic, and even the loss of tourism in Sanya.

Through this paper, in the future, even if a major sector of the tourism industry has to temporarily shut down due to the pandemic, it can use this time to improve its business and strengthen its position. The relevant authorities also provide the necessary assistance, such as expanded tourism funding and loan programs for the relevant sectors. These strategies can help tourism businesses to get back on track after the epidemic is over and in accordance with the relevant plans. Therefore, for mutual benefit, all sectors should cooperate in the fight against Covid-19 in order to accelerate the recovery of the tourism industry.

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Electric Vehicle Industry in Three Main Regions: United States, China, and EU Countries

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Abstract: This paper will mainly focus on exploring the most significant factors affecting the sales of electric vehicles in China, the EU, and the US. After understanding the current situation of the electric vehicle market, the first step is using this information to compare and filter out important influencing factors and study them. Among many factors, electricity price, GDP, carbon dioxide emissions and the number of charging piles are the focus of this paper. Then with the help of R, some intuitive and clear conclusions are drawn during the research to help analyze the entire EV market. These conclusions not only allow people to understand the impact of certain factors on the sales of electric vehicles, but also provide a clearer and more detailed comparison of the three major electric vehicle markets.

Keywords: electronic vehicles, factors, EU, China, US, market

1. Introduction

In recent years, with the development of technology and the awakening of people's environmental awareness, the electric vehicle market has begun to flourish. Figure 1 illustrates the annual plug-in car sales evolution [1]. From 2011 to 2017, sales of plug-in vehicles had grown by leaps and bounds in three major regions, namely Europe, the US, and China. However, due to the complex international situation, different countries are facing different challenges. In some regions such as the Middle East, where oil exports are the main production capacity, it is difficult to see signs of electric vehicles on the rise. Other cases like the supply of chips required for electric vehicles are insufficient, and problems such as import difficulties also frequently appear in some countries. It seems too early to say that electric vehicles will replace traditional fuel vehicles.

Although the details vary widely, some common features are relatively obvious in the three main regions that account for more than 90% of the EV market currently. Institutional, technological, and market demand windows of opportunity emerge and interact in the industry catching up. Under the background of the overall market, it will be more meaningful to consider the influencing factors in these countries through the analysis of macro data.

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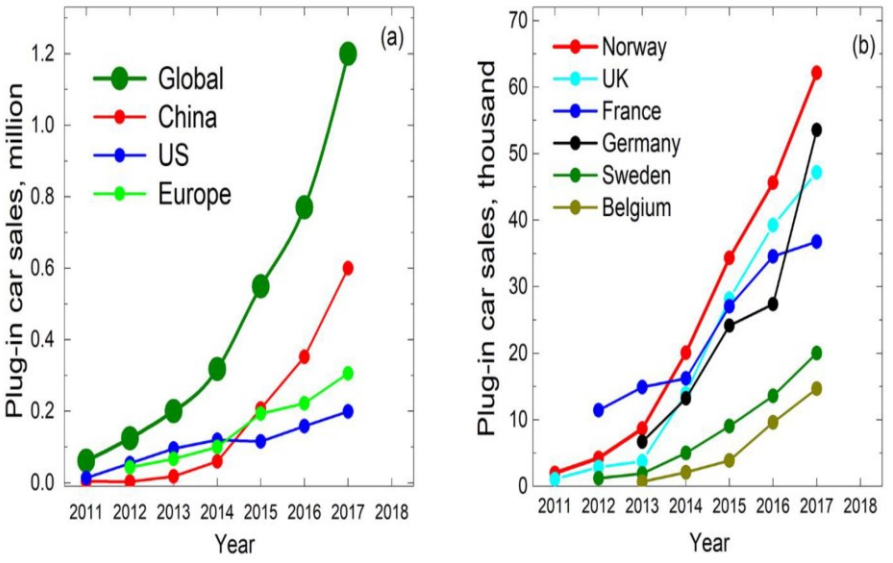


Figure 1: Annual plug-in car sales evolution: (a) worldwide, China, the United States, and Europe with (b) the specification for major European plug-in car markets [1].

2. Factors

According to previous research and intuitional suggestions, the factors affecting the sale of electric vehicles can be considered in mainly four categories: policy factors, environment factors, technological factors, economic factors. For economic factors, for example, the price of electricity and its relative price to fuel is an important factor affecting the sale of electrical vehicles because electric vehicles are the substitute commodity to fuel cars, and national GDP is also a very important factor because it measures the overall macroeconomics prosperity. For technological factors, it's considered that the number of charging facilities, driving distance and time might have a significant influence on consumer's choice [2]. For environmental factors, for example, the Paris climate agreement which has posed the restrictions and goals of carbon dioxide emission, might also be highly correlated to the electric vehicle market. For policy factors, however, it's much more complicated as it's hard to find uniformed and comparable data which means it's harder to quantify. With all the factors above, this essay is going to do a linear multiple-variable regression which chooses the sale of electric vehicles as the dependent variable and these above factors as independent variables. And it's going to be done separately by country and region. The regression model could be written as the following:

$$\text{logsales} = \beta_1 \text{electricprice} + \beta_2 \text{GDP} + \beta_3 \text{Chargingpiles} + u \quad (1)$$

Where $\beta_1, \beta_2, \beta_3$ represents the coefficients of each factor and u represents the error term.

3. EU Market

For the EU market, the company for electric vehicle selling is not very concentrated compared to the China and US market. Tesla is still the largest source but other European companies such as Volkswagen, Fiat or Peugeot also have a large share of the EV sales.

To discuss the factors affecting the EV sales, the regression based on these factors also applies. However, two regressions are necessary here, one regression is done by data from different countries in the EU within the same time period while another one is done by data from the same country of different time horizons. Because both time horizon and geographic factors are important, and it provides a broader view of two dimensions analysis.

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Firstly, the regression among 12 different EU countries should be runned (Germany, Austria, Ireland, Italy, Netherlands, Hungary, Poland, Lithuania, Estonia, Czechia, Finland, Portugal) in the second season of 2021, with the factors being electric prices, charging facilities and GDP. The regression result is shown as Table 1 below:

Table 1: Regression results with factors affecting on EV sales for EU market (1).

F (3,8)	1408.59			
Prob > F	0.0000			
R-squared	0.9981			
Adj R-squared	0.9974			
logsales	Coef.	Std.Err.	t	P > |t|
electricityprice	-1745.354	3759.043	-0.46	0.655
GDP	0.0010	0.0004	2.32	0.049
chargingpiles	0.4684	0.0207	22.61	0.000
cons	575.7472	709.7752	0.81	0.441

Secondly, the same regression ranging from January 2017 to December 2020 in Germany should be done as well, as Germany is the biggest EV market in the EU and has a significantly higher market than all other EU countries. The same regression applies, still, with these factors as the independent variables (note that CO2 emission can also be added in the regression model). The regression result is shown as Table 2 below:

Table 2: Regression results with factors affecting on EV sales for EU market (2).

F (4,43)	79.97			
Prob > F	0.0000			
R-squared	0.8851			
Adj R-squared	0.8705			
logsales	Coef.	Std.Err.	t	P > |t|
electricityprice	-68775.04	16116.62	-4.27	0.000
GDP	5356.427	1641.475	3.26	0.002
chargingpiles	7.8352	1.3992	5.60	0.000
co2emission	-109565.9	15963.15	-6.86	0.000
cons	3099795	598702.3	5.18	0.000

As it can be seen from Table 1 and Table 2, both regressions are significant by parameters and both indicate the same result: The electric sales are positively related to GDP, charging facilities and negatively related to electric price and CO2 emission. Because charging facilities measure the convenience of EV usage so the more charging facilities there are, the more people will be willing to buy them [3].

4. US Market

The U.S. is the third largest market in the global electric vehicle industry. In 2020, the U.S. sold about 260,000 EVs, ranking third in the global market after China and Europe. According to Statista, the energy demand for EVs in the U.S. will also be lower than in China and Europe in 2030[4].

The US is one of the countries that developed and used electric cars earlier in the world. However, different presidents have different policies on this industry, and the market is greatly affected by the policy. Nowadays, Biden announced a $2.3 trillion government budget, of which $174 billion would

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be devoted to developing the EV industry [5]. These greatly promote the development of this industry in the US in the future.

When building the model, based on the previous analysis, in our multiple linear regression, the dependent variable is electric vehicle sales, and the independent variables are electricity price, GDP and the number of charging piles. Since Tesla accounts for more than 60% of the market in the US, the monthly sales volume of Tesla is used as the representative of market sales. Electricity prices use average prices in U.S. cities, with data from FRED [6]. GDP uses the nominal GDP and the data is also from FRED [7]. The number of chargers uses the national total in the US, according to Statista [8]. Table 3 shows that the overall model is significant. In this model, the coefficient of electricity price is negative, while it of GDP and the number of chargers is positive. This means that sales volume is negatively correlated with electricity price, and positively correlated with GDP and the number of chargers.

Table 3: Regression results with factors affecting on EV sales for US market.

F (3,62)	51.35			
Prob > F	0.0000			
R-squared	0.7130			
Adj R-squared	0.6992			
logsales	Coef.	Std.Err.	t	P > |t|
logprice	-5.2006	2.1526	-2.42	0.019
logGDP	8.2041	1.7463	4.70	0.000
logchargers	0.2767	0.1263	2.19	0.032
cons	-85.0427	19.2727	-4.41	0.000

5. China Market

For the China market, since China accounts for the most carbon dioxide emissions globally, the government desperately needs solutions to this problem [9]. Under this circumstance, the development of EVs has become China's national strategy. From 2018 to 2021, the investment amount in electric vehicles increased year by year, ranking first in the world. In 2021, a total of 3.2 million EVs were sold in the Chinese mainland market, accounting for half of the global EV sales and 15% of all new car sales. What's more, the sales growth rate of electric vehicles also showed a significant increase In June 2022, China's electric vehicle sales increased by 132% year-on-year, far exceeding the global average [10].

Table 4: Regression results with factors affecting on EV sales for China market.

F (3,62)	71.27			
Prob > F	0.0000			
R-squared	0.7752			
Adj R-squared	0.7643			
logsales	Coef.	Std.Err.	t	P > |t|
electricityprice	-27.0394	6.4407	-4.20	0.000
GDP	0.00002	2.61e-06	6.91	0.000
chargingpiles	0.00001	2.37e-06	6.26	0.000
cons	20.0556	3.3063	6.07	0.000

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Using the same model and the same period of time, Table 4 shows the performance of influencing factors and sales in the China market. The results perform well. All three influencing factors take a vital role in sales, with a relatively high value of R-squared. Among them, electricity price and sales show a negative correlation, while the other two, GDP and the number of charging piles, show a positive correlation with sales. This is in line with the expected results.

6. Conclusion

In conclusion, initially, the EV industry is currently in the stage of rapid growth and has good development. Secondly, this industry is moving in a greener direction as a whole. In terms of market volume, from a regional perspective, China is the absolute leader now. From the perspective of car companies, Tesla has the largest market share in each region in the world. In the models of three regions, the positive or negative correlations of each independent variable with dependent variable are the same. However, the significance of t-test corresponding to each variable is different in different regions. In the case of the US, China and Germany, the GDP in the model has a large impact on sales in China and Germany, but a relatively small impact in the US. This confirms that the market environment of the electric vehicle industry in the US is not as good as that in Germany and China.

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All authors contributed equally to this work and should be considered co-first authors.

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Success of Nintendo Switch in 3C Marketing Model

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Abstract: The Nintendo Switch is a type of game console that was designed by Nintendo and offered for sale in March, 2017. Since the Nintendo Switch was on sale, it was fascinated by plenty of customers and game fans to buy it because of its unique property of its combination of home game consoles and handheld game consoles, and it became the best-selling gaming console in 10 months in North American history. Most of the success of Switch will be attributed to its subversive design. However, the uniqueness of a new product is only the start of success for a company. The marketing strategy, which was based on the 3C marketing model and implemented by Nintendo, is the key to the success of the Nintendo Switch. This research uses a comparative analysis approach and statistics analysis, studying and comparing the data of sales, groups of customers, and company's cost from Nintendo and its competitors, to arrive at the conclusion that, due to the special design for customers, efficient production for the company, and targeted strategy for competitors, the Nintendo Switch has become one of the most popular game consoles in the world.

Keywords: Nintendo, Nintendo switch, 3C model, strategy, uniqueness

1. Introduction

Nintendo is one of the largest multinational electronics and video game companies in the world, which was founded in 1889 and is headquartered in Kyoto, Japan. Since the company was established, Nintendo has designed a large number of popular consoles and game series, including "Super Mario Bros." and "Legend of Zelda," and helped them become well known around the world. In March 2017, Nintendo released the Switch, which is a console-handheld system. In handheld mode, the Switch consists of an 8x4-inch screen and two detachable, wireless controllers that hook onto the left and right side of the screen; in home console mode, the Switch will slide into a rectangular dock that connects it to a TV or external screen [1]. Two wireless controllers and a dock make the Switch have different play styles and make it easy to play anywhere. The subversive design of the Switch attracts plenty of customers and game fans to buy it. Since the Switch went on sale, Nintendo has sold 4.8 million consoles in 10 months in North America and more than 874,000 Switch consoles around the world [2]. However, the unique hybrid system could not be the only factor contributing to the success of the Nintendo Switch. With further research, Nintendo has different producing and marketing strategies aimed at their own company's production, different groups of customers, and main competitors indeed. The existing research mainly discusses the marketing strategy of Nintendo based on 4p theory or focuses on the specific strategies for particular products. However, there is no research studying the whole Nintendo company strategy. So this article will analyze Nintendo and the Switch in the 3C

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marketing model to get what marketing strategy was implemented by Nintendo to improve the efficiency of the company, solve the problems of customers and defeat the main competitors.

2. Nintendo's Strategies Based on 3C Marketing Model

2.1. The Company

When a company decides to design a product, the uniqueness of the product should be the principal factor for the company to consider. That is how the product they design could be distinguished by customers with other same-type products in the market. Therefore, the disruptive design of the Switch helped Nintendo to occupy the market. The first appearance of a hybrid system, which consists of home and handheld consoles, became the most attractive property for customers.

Furthermore, with the development of the game entertainment market and brand effect in recent years, Nintendo has gained great profits from its game software and consoles. From Figure 1, which is about the financial statement of Nintendo in the first quarter, till the end of March, 2019, the net profits of Nintendo were 1945 hundred million Japanese yuan, and at the end of March, 2020, this value reached 2586 hundred million Japanese yuan, rising by 33.3% from the previous year [3]. Such a great increase in net profits in recent years was surprisingly consistent with the surge in sales of the Switch, which could show that the Switch helped Nintendo occupy the gaming market and irradiated the company's gaming industrial chain. And more about Figure 1, the cost of sales of Nintendo in the first quarter of 2019 was 6993 million Japanese yuan, taking 58.3% of total business revenue, and that of Nintendo in the first quarter of 2020 reached 6668 million Japanese yuan, decreasing 4.6% from the previous year and taking 50.9% of total business revenue.

The decrease in the cost of sales could show that with the maturity of sales techniques of the Switch, Nintendo could save costs on hardware of game consoles and put effort into software development since more and more people had the Switch as time went by. Moreover, compared to the business revenue of Nintendo, the costs of sales of Nintendo were extremely low, especially in 2020. This phenomenon is related to Nintendo's mode of operation. In fact, in order to maximize competition and profits, Nintendo would not produce the final product in their own factory instead of designating their cooperative factories to produce the completed products [4]. In this way, Nintendo only needed to provide the core techniques and sample products to the factories in order to save on the cost of device investment [4].

Also, Nintendo did not stipulate the retirement age of staff to improve the relationship with them, making staff have deep emotions towards the company [4]. In this case, Nintendo's employees were efficient, lowering the company's labor costs. So, in the company's view, the uniqueness of the product and the method of saving labor and investment are key factors to the success of Nintendo Switch.

2.2. The Customers

Another important factor leading to the success of the Nintendo Switch is that the Switch considered the needs of different groups of customers and had a large range of targets.

First and foremost, the Nintendo Switch had a diverse gender, age, and playstyle demographic. The design of the Switch helped Nintendo reach more customers and occupy a larger part of the market. According to Figure 2 about respondents' favorite gaming platforms, home consoles were chosen by 26% of respondents, portable consoles were chosen by 6% of respondents, and hybrids were chosen by 4% of respondents. As a new handheld-home hybrid system, the Switch surely satisfied the needs of these three groups of customers, thereby amplifying their targets and market. Also, such a system was preferred by female players. From Figure 3, for computers, males' preference was obviously higher than females' preference. However, for home game consoles and hybrids, female preference was only slightly lower than males' and female players were even more preferred for portable game

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consoles than males. This shows that the Nintendo Switch certainly considered the gaming experience and playing styles of female players. Furthermore, as time passed, Nintendo released a plethora of games of various types to cater to different audiences: vivid game styles drew females and children, action games drew male players, and classic, exclusive games gave adults a reason to buy them. With such large demographics, the Nintendo Switch succeeded in attracting more targets and serving more customers.

Second, the Nintendo Switch had some peculiarities that drove people to buy it. The properties of less immersive gaming experience and short game time satisfied working adults who wanted to play video games to relieve stress from their daily lives but did not have enough time; the 349.99 $selling price was highly cost-effective for adults and affordable for student game fans [6]; and Nintendo's large number of cooperative games and portable property even improved relationships between couples and friends and social contacts between strangulated people. Therefore, the Nintendo Switch was not only a gaming console for customers but also had a little or large meaning and function in their daily lives, driving them to buy it.

Finally, Nintendo Switch noticed the different segments of the same target. For example, unlike the adults who would like to play video games to relax themselves, some of them from the preceding generation had played Nintendo's games since they were children and wanted to recall their childhood by playing the new device from Nintendo. In this case, although Nintendo introduced new techniques and hardware on the Switch, it still conserved the traditional game mode to satisfy this segment of customers [2]. Thereby, Nintendo Switch not only considered to satisfy targets as many as possible, but also considering the individuals from these groups to help them get experience more than that of game console itself.

2.3. The Competitors

The final factor in the success of Nintendo is that Nintendo fully understands its advantages and disadvantages compared to its competitors. With the development of the gaming console market in recent years, the competition between each entertainment company is becoming more and more drastic, especially between the "Big Three": PlayStation of Sony, X-Box of Microsoft and Nintendo's game consoles. For the Nintendo Switch, the main competitors are PlayStation 4 from Sony and Xbox One from Microsoft, especially PlayStation 4. According to Figure 4, about favorite gaming platforms among respondents, PlayStation 4 was chosen by most of the respondents, way ahead of other game consoles. In fact, the PlayStation 4 tries to provide a perfect home game console for game fans. Sony designed a new professional controller called "DualShock 4," which includes a touch pad and a sharing button to make players have a richer gaming experience and share screenshots of games with others online [7].

For hardware, the PlayStation 4 uses a semi-custom Accelerated Processing Unit (APU) which combines a central processing unit and a graphic processing unit, providing game fans with a more fluid playing experience and better picture quality [8]. Furthermore, the most competitive aspect of the PlayStation 4 is its exclusive games like "God of War" and "Horizon," which provide players with a completely immersive gaming experience. Such high-quality 3A games can only be operated by the hardware of the PlayStation. Overall, the PlayStation 4 has better hardware to operate its games than the Nintendo Switch and thus provides a high-quality gaming experience to players.

Known for the disadvantages of its competitors, the Nintendo Switch has a long-term marketing strategy to improve its competitiveness. In order to beat these competitors, Nintendo will adjust the price of the Switch at different stages of its product life cycle. At the beginning of the Switch, Nintendo will set a relatively high selling price. After the Switch gets mature, Nintendo will lower its price to enhance competitiveness. Finally, at the end of the Switch's lifespan, Nintendo will raise the price of the Switch, selling it as a nostalgic product [2]. Such a pricing strategy is consistent with the

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price of Nintendo Switch's competitors and its own product life cycle and is founded on the great brand image of Nintendo.

3. Conclusion

In conclusion, after analyzing the Nintendo Switch in the 3C marketing model, the success of the Switch could be summarized from 3 aspects: from the company aspect, the subversive design of the product and efficient mode of operation make the Switch occupy the market with low cost; from the aspect of customers, the functions of the Switch satisfy large ranges of customers and even implement detailed segmentation, considering the gaming experience of each individual; and from the competitor aspect, Nintendo clearly learns about the disadvantages of the Switch and makes a proper pricing adjustment strategy aiming at its competitors based on its brand image. However, besides what kind of strategy Nintendo makes, the nature of these strategies is Nintendo's humanized service. Whether from their special designs for customers or the policies for company management, Nintendo always tries its best to serve everyone related to it. In this case, humanization is the secret of the success of the Nintendo Switch. It is also the reason why Nintendo has been enduring and popular among people for such a long time. In the future, as awareness of disadvantages in hardware and game quality increases, Nintendo might mainly focus on game development, designing high quality game scenes, providing an immersive experience for customers, and acquiring comparable hardware to operate those games. Since Nintendo has been at the top of handheld consoles, the company could put more effort into the development of home consoles.

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SWOT Analysis of ByteDance's Business Market Environment

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Abstract: The short-form video industry is expanding quickly in a culture where technology is improving quickly, and life is moving more quickly. TikTok is one of the top competitors in this industry, and this study focuses on the operations of ByteDance, TikTok's parent business. It also offers a SWOT analysis of the firm's exposure to external variables such as the market environment. The results demonstrate that ByteDance is still a pioneer in its field despite several dangers. The company's drawback is that it has often been fined for displaying unsuitable content and for allegedly gathering personal data from teenagers. By looking at its worldwide market, the report also reveals the financial worth of ByteDance. Due to the numerous variables that led to the delay and the paucity of convincing data to support the debate, this report's weaknesses include the fact that ByteDance's IPO is not thoroughly examined. Future studies will continue to look closely at ByteDance's strategy and how it may succeed where other large inter-net businesses are successful.

Keywords: ByteDance, SWOT analysis, TikTok

1. Introduction

The self-publishing sector has received attention recently as technology progresses and social and entertainment habits shift. Chinese multinational mobile short-form video firm Bytespring. The platform, a pioneer in the field of modern short-form video, has had a sharp rise in usage since the introduction of COVID-19 [1]. ByteDance's company is rapidly growing, and this has several ramifications for both users and investors. This report begins with a brief analysis of ByteDance's business and financial situation, and then considers the current situation faced by ByteDance using a SWOT analysis of the business market environment in terms of Strengths, Weaknesses, Opportunities, and Threats. ByteDance and its investors are given suggestions in the report's final section.

2. Firm Description

Byte Dance is an internet technology company that operates a creative content platform, founded in 2012. As an internet company, Byte Dance chose to run a new business in the early stages of its business, with "TouTiao" as the first product available to the public [2]. TouTiao provides a personalized, high-quality content feed for each user through in-depth algorithms. While drawing a huge number of devoted users, it laid the groundwork for Byte Dance‘s subsequent fast expansion [3]. Short videos were in their early stages of growth in China at the time, and their convenience and

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fast speed are more in accordance with the demands of the public in this period of rapid development than “YouTube”, “Bili Bili”, and other video portals. In September 2016, ByteDance launched DouYin short video app, which went to life in China and quickly became a popular short video-sharing platform. As a phenomenal product, DOUYIN quickly took every city in China by storm and became one of the must-have social apps for young people. ByteDance introduced TIKTOK for markets outside of mainland China in May 2017. In the same year, ByteDance paid over $900 million for rival Musical.ly social video software and merged it with Tiktok, which previously had over 200 million users globally and a sizable following in the United States [4]. ByteDance has garnered a big number of users in international markets with the inclusion of Musical.ly, Tiktok has been downloaded more than one billion times globally, and the short video app TikTok has become the first mainland Chinese social media to go global [5]. Simultaneously, ByteDance's vision is not limited to the field of short video; with the globalization of the economy and other factors, the traditional office can no longer meet the current stage of efficient and fast work needs; in some positions, the use of an online office will gain greater benefits. ByteDance debuted its office suite Lark in Japan and Singapore in 2019, and "Feishu" in mainland China in August of the same year. The unexpected COVID-19 pandemic swept the world at the end of the year, and in the general environment, all enterprises were faced with office difficulties, and a variety of office software blossomed, with the release of Lark under ByteDance being earlier than most of the products, with better functionality and user experience, and the maximum profit brought by the general environment.

Many workers were already using cell phones and tablets to collaborate, access company information, and get work done before COVID-19 became widespread. On the other hand, as work-from-home policies are established and workers throughout the world continue to telecommute, mobile devices have become an important aspect of the workplace [6]. Moreover， Samsung Electronics is the largest information technology company in the world, and it has also been in the top 10 brands in the world for several years. In a company as large as Samsung, 82% of their IT executives say that smartphones are very important to employee productivity [7]. The report shows that in the time since the COVID-19 pandemic, smartphones have become important, not only as a guarantee of work-life balance, but also as a great way to consolidate devices, increase productivity, and reduce costs.

ByteDance has already completed 12 rounds of fundraising, totaling $940 million [8]. Kohlberg Kravis Roberts Japan, Sequoia Capital, Tiger Global Management, Morgan Stanley, Goldman Sachs, and others are among the major investors at this time.

With ByteDance in blue and the Shanghai Stock Exchange and Shenzhen Stock Exchange composite indexes in orange during the same period, the chart below clearly illustrates the trend of ByteDance's stock price over the last year.



Figure 1: Dance 2021-2022 stock gains index source: IWENCAI [9].

It is very evident that until January 2022, ByteDance's stock was in a substantial increasing trend. After that point on, the price was in a negative trend until October. The stock may fluctuate

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for a variety of reasons, including global events, national policies, etc. However, at the same time period, ByteDance's stock level has outperformed the Stock Exchange Composite Index.

3. SWOT

This study will utilize the SWOT model to analyze BtyeDance's current business condition in order to acquire a deeper view of the company's present status [10]. Albert Humphrey devised a team planning technique at the Stanford Research Institute from 1960 to 1970, which has subsequently evolved into the present SWOT (Strengths, Weaknesses, Opportunities, and Threats) analytical model. The SWOT model [11] is a situational analysis based on the internal and external competitive environment and competitive circumstances and is based on a survey that identifies the strengths, weaknesses, opportunities, and threats that Btyedance possesses by integrating them into a matrix structure. The numerous components are then linked to each other using the concept of systems analysis, and a series of conclusions are formed from them (Table 1).

Table 1: SWOT summary.

Strengths	Weaknesses
A diverse clientele from various nations, races There is a sizable user base, with a high number of daily active users. The user base is large and solid, and users rely on TIKTOK to be hard to leave behind The algorithm used to calculate video suggestions for consumers is more advanced than competitors.	Inappropriate content presentation and inadequate regulatory review The overtime culture was resisted, and most employees left.
Opportunities	**Threats**
The short video track currently holds the leading position, and the platform with its own huge traffic plays a good propaganda role in the development of other areas.	Increased competition in the industry Adverse changes in government regula-tions

3.1. Advantages

ByteDance presently has users from many nations and ethnicities, and TikTok is available in 155 countries and 75 languages as of 2019 [12]. The graph below depicts the regional distribution of TIKTOK users from 2018 to 2021.

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TikTok annual users by region 2018 to 2021 (mm)

Date	Asia Pacific	North America	Europe	LatAm	MENA
2018	62	28	21	3	4.3
2019	130	55	53	10	9
2020	198	105	98	64	33
2021	313	138	158	188	92

Figure 2: Data sources: TIKTOK 2022 report [13].

We can easily observe that the number of Tiktok users worldwide is increasing practically rapidly between 2018 and 2021. People are spending more time on their mobile phones, especially since the COVID-19 epidemic in 2019, to spend time and obtain news via social media and short video platforms. As a result, ByteDance has gained another advantage: a vast user base and a significant number of active users. TikTok has 1 billion users in the third quarter of 2021, according to Business of Apps, and is likely to reach 1.8 billion by the end of the year, as indicated in the graph below [14].

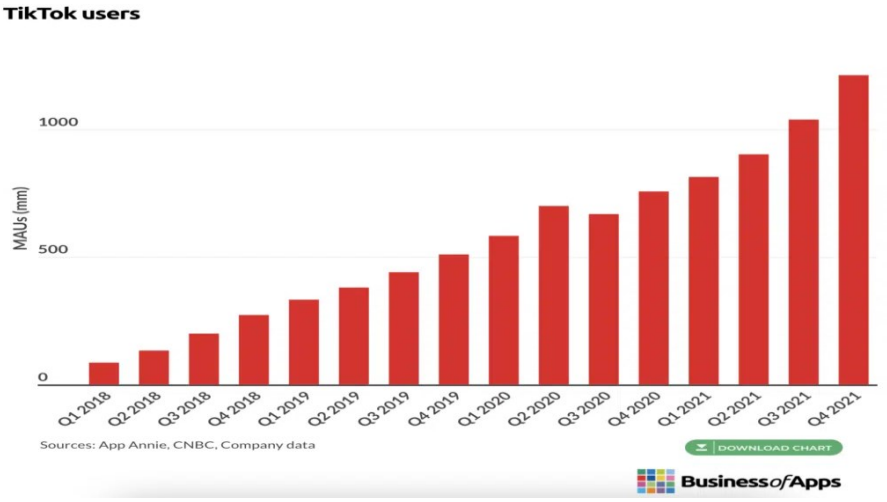


Figure 3: Monthly active TikTok users. (Source: Business of Apps [15])

Not only has the number of TikTok users increased, but the number of downloads has also increased significantly. According to Sensor Tower, as of the first half of 2021, TikTok had over 3 billion installations on the App Store and Google Play for DouYin and TikTok. This is an astounding figure. Since 2014, Facebook has had the exclusive domain of apps with more than 3 billion installations, and Tiktok is the fifth non-gaming app to join the ranks after WhatsApp, Messenger, Facebook, and Instagram, shattering what has been Facebook's industry monopoly [16]. Furthermore, TikTok was the world's number-one app in the first half of 2021, with 384.6 million downloads on both app stores. Furthermore, as indicated in the table below, the total number of TikTok downloads on the two aforementioned app stores reached 384.6 million in the first half of 2021.

DOI: 10.54254/2754-1169/17/20231093

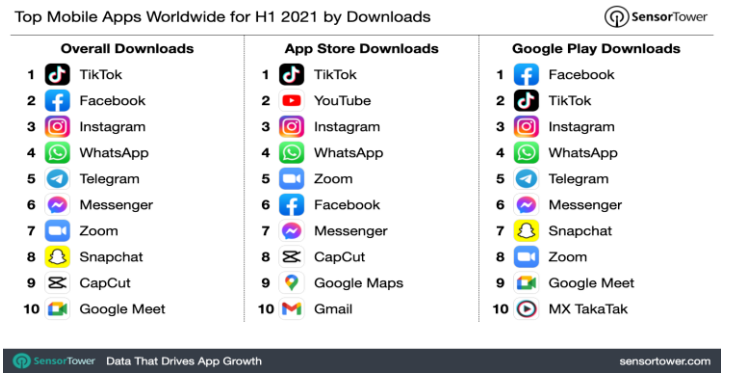


Figure 4: Top mobile apps worldwide for H1 2021 by downloads. (Source: SensorTower [17])

The data shows that TikTok captured the app market share by a clear margin, with the number of downloads in the App Store holding the top position and the number of downloads in Google Play holding the second position in that quarter, but the reason for this factor is that Google Play is unable to offer TikTok to users in the Indian region in India in this quarter of 2021. According to the BBC [18], India has banned 59 Chinese smartphone applications, including WeChat and TikTok, as a direct result of India and China's dispute in the Himalayas, which has resulted in the loss of TikTok's billion-dollar, Google Play-dominated Indian market after 2020.

TikTok's strengths are not only in the number of downloads and users but also in a large number of daily active users, which ensures a solid position. The speed of life in today's society is steadily rising, particularly in major cities and among the younger generation. People seldom spend a quiet day with a book in their hands, and instead, they use their mobile phones to get fast-paced, fragmented information to pass the time. According to Backlinko, the average time spent on TikTok by users throughout the world is 52 minutes per day, and 90% of users spend their leisure time on TikTok every day [19]. There are numerous reasons why customers appreciate the product, but ByteDance's algorithmic technique for providing films based on user preferences - "TikTok For You" - deserves a lot of praise. When users open TikTok, they have automatically pushed videos that they are interested in. This is a collection of videos that the recommendation engine has uniquely customized for each user after the user has commented on previous videos or computed based on the blogs the user follows, taking into consideration the user's assessed preferences. Although various users will view the same amazing videos, the sequence of the video push scripts is unique to each user and is based on their data [20]. Instagram, a comparable startup, employs an algorithm similar to but distinct from ByteDance. While it also tweets messages based on user data, the number of users a person follows is used to select content tweets. If the account follows a large number of users, it will vie for a spot on that user's content push list. Furthermore, if users spend less time on Instagram, they are more likely to encounter content uploaded by friends and family with whom they often communicate, making it difficult for them to engage with fresh information in the software [21]. As a result, TikTok's push material will be more relevant to consumers' preferences. As a technological business, ByteDance is more akin to a content creation company that targets consumers' interests.

3.2. Disadvantages

Since the COVID-19 epidemic, ByteDance's market has expanded in terms of users and market share, but it has also caused a number of issues for TikTok in terms of improper material display and insufficient governmental oversight. The US Federal Trade Commission penalized TikTok $5.7 million for ByteDance in February 2019 for gathering data from users under the age of 13 without

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getting permission from their parents [22]. According to the Financial Times, in 2020 US regulators again received complaints from 20 groups including Commercial-Free Childhood, the Center for Digital Democracy, and the Electronic Privacy Information Center [23]. In light of the prior sanctions, they think TikTok had not remedied the problem. Additionally, TikTok received another €750,000 in penalties from the Dutch Data Protection Authority in July of the following year [24]. The Dutch Data Protection Authority considered that because the privacy policy terms were not available in Dutch, users who did not know English would have a difficult time comprehending them. The improper content displayed on TikTok, which does not need parental verification when enrolling even though the rules of service specify that children must use it with parental approval, is another privacy concern [25]. This unavoidably leads to children downloading unsuitable video content for their age, such as pornographic, violent, and offensive material.

In addition to this, ByteDance is also experiencing an internal staff exodus. The Financial Times reports that since the opening of the TikTok Shop, at least half of TikTok's London-based e-commerce crew has departed, and the remaining employees claim they are about to do the same [26]. Employees work an average of more than 12 hours each day due to the company's need to be in touch with its Chinese headquarters, which leaves them emotionally exhausted and overburdened. In addition, ByteDance reportedly maintains a list of names, and in some cases, replacements are hired while people on the list are still in their jobs, according to sources familiar with the matter [27]. There will always be workers who cannot handle this high-pressure environment and willingly quit, which is precisely what the management wants to happen. This hostile work climate is like a knife hanging over the heads of employees. China, where ByteDance's parent firm is based, has a slightly different position than other nations in that it has a huge population and a rising percentage of higher education, both of which make it harder and more stressful for young people to find jobs. According to the Chinese website Xinhua, 240 million people have received higher education in China to date [28]. Due to the intense rivalry for employment and workplaces, the notorious 996 work system was born. But after a Pinduoduo employee passed away suddenly at 1:30 a.m. in his workplace, the government intervened to change the absurd overtime arrangement, and a number of significant Chinese internet businesses followed suit [29]. According to a ByteDance China internal document, which Bloomberg has seen, staff in China are only permitted to work from 10 am to 7 pm, Monday through Friday [30]. Employees are only permitted to request overtime on their own initiative, and they will also be paid more for working over their regular shifts. However, as yet, ByteDance has not found a satisfactory way of working for its employees in the UK.

3.3. Opportunities

ByteDance already ranks among the top Internet firms on the planet, and the traffic generated by its large user base will help the company expand into new markets. The company's popularity will also affect the amount of traffic that is directed to its operations in other industries. According to Bloomberg, ByteDance paid around US$1.5 billion to purchase Amcare, one of the biggest private hospital chains in China [31]. It also shows that ByteDance is prepared for formal entry into the healthcare industry since, Amcare runs a prestigious children's and women's hospital in China, where its private maternity rooms are well-liked by the elite and wealthy. ByteDance's entry into the healthcare industry began with the acquisition of a mass-market firm in 2020 that provided health information to the general population. This was followed by more substantial investments in a drug research company and a DNA synthesis company [32]. This is only one of ByteDance's numerous businesses; it also operates an AI company and an advertising agency. As a result of the enormous traffic-generating capacity that well-known apps like TikTok and TouTiao provide, the firm is able to include promotional adverts in its own short-video software and entice users away

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from established platforms and onto emerging ones. Additionally, businesses may significantly improve both the number of prospective consumers and their exposure by employing big data to analyze which people require these services.

3.4. Threats

As the market for short videos grows, more and more businesses are jumping on board. They include well-known social media sites like Facebook, Instagram, and WeChat. They are using their own user traffic to create their own short video platforms. The parent company of Facebook, Instagram, and WhatsApp, Meta, imitated this by releasing its own short-form video format, dubbed Reels, while Tencent created its own short-form video platform, WeChat, employing its two main social media applications, QQ, and WeChat. Due to the increased industry rivalry, TIKTOK is in danger of losing its market share. The market share of TikTok has been substantially impacted by the advent of large corporations, but BtyeDance has maintained its market dominance in the short-form video industry, and Tencent and Meta's replication plan has failed. As the short-video platform struggles to get subscribers in a local market more dominated by Jitterbug and Crypto, Tencent Holdings announced it will refocus the “WeSee” app to focus on film and TV content [33]. Because Reels were highlighted on Facebook's home screen and forced users to search for photos and videos of their family and friends on a separate display page if they wanted to see them, the same Meta's imitation of TikTok was referred to by users as plagiarism. This serious caused user community dissatisfaction. Social media star Kylie Jenner and her sister Kim Kardashian commented in an Instagram post "Stop trying to be TikTok. I just want to see pictures of my friends." [34]

Kuaishou, a short video platform supported by Tencent, began with the primary purpose of engaging a grassroots audience with a limited understanding of video production skills. ByteDance and Kuaishou are intense competitors in the Chinese industry. And the emergence of TikTok has broken the industry monopoly that Kuaishou had been enjoying. According to founder Yang, "We were at the top of the rankings and overnight fell to number two." [35] ByteDance was made aware that, without the prior advantages amassed in a short period of time, the market share might have been divided among the major players and their position in the short video field. TikTok's irreplaceable position in users' minds and its well-established software system allowed them to retain its leading market position. ByteDance's market share is probably going to be split amongst the big companies, and it'll probably lose its position in the short-form video industry.

Government regulation and policy are the main influence on ByteDance's operations, as opposed to competition, with unfavorable changes in government rules creating a threat that ByteDance cannot foresee or manage. An excellent illustration of this is how ByteDance purchased Shanghai-based developer Moonton Technologies this year as it prepared to join the gaming sector in order to compete with China's biggest gaming giant, Tencent, and get access to the video game market [36]. However, a governmental crackdown in 2022, extended approval delays for new games, and restrictions on underage gaming time have hurt China's whole video game sector, causing a fall in total revenue for the first time in 14 years [37]. ByteDance was forced to curtail its nascent gaming industry as a consequence, and according to the South China Morning Post, has already let go of hundreds of staff members in its gaming section and shut down the majority of its studios [38].

ByteDance has seen a similar policy crackdown in foreign markets. A ban on downloading the video app TikTok was imposed by US President Donald Trump in 2020 due to worries that it may be used to gather personal information about Americans [39]. Additionally, Donald Trump has stated his desire to sell TikTok to a US corporation directly. ByteDance would have lost the whole US market if it had objected to the US government's crystal-clear request. Zhang Yiming, the creator of ByteDance, reportedly made the decision to work with Oracle Corp. rather than allow Microsoft to purchase TikTok's US operations, according to Reuters [40]. There are many similar examples,

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such as the Chinese government's modification of the data regulatory framework, which led to the delay of ByteDance's IPO [41], which will not be listed in this report. It is evident that private businesses cannot compete with the enormous power of the government as a result.

4. Conclusion

ByteDance, an online technology business running a creative content platform, is now a leader in the short-form video industry in this period of quick technological advancement and internet domination. The company's advantages over other businesses in the sector, according to this report's SWOT analysis of the present market environment faced by ByteDance, are its sizable user base, high level of active users, and its more sophisticated algorithms that boost the popularity of its product TikTok. The company's drawback is that it has often been fined for displaying unsuitable content and for allegedly gathering personal data from teenagers. Additionally, the demanding workplace has caused overwork and personnel turnover. Second, at this point, ByteDance has the chance to invest in other industries and leverage the significant user traffic on its platform to promote new initiatives by employing big data analytics to draw people to relevant content. Finally, ByteDance faces both market rivalry and the possibility of government regulation. Even though it faced intense competition from other large Internet firms, it managed to maintain its position as an industry leader by relying more on the benefits of being an early investor. ByteDance is able to vary in terms of geographical areas and industry verticals, distributing risk and lessening the adverse effects of regulations. ByteDance is experiencing certain challenges for investors, such as getting caught up in international politics, but the company's strength is still evident to everybody, especially given its sizable and devoted customer base. ByteDance is still a great investment as a result. Due to the numerous variables that led to the delay and the paucity of convincing data to support the debate, this report's weaknesses include the fact that ByteDance's IPO is not thoroughly examined. Future studies will continue to look closely at ByteDance's strategy and how it may succeed where other large internet businesses are successful.

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Sales Prediction of Big Mart Based on Linear Regression, Random Forest, and Gradient Boosting

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Abstract: With rapid development of machine learning and data science approaches, many retailers are employing sales prediction to aid in strategy formulation and profit growth. However, it is challenging for some small merchants to access vast volumes of data for analysis. This paper investigates the viability of predict sales in a small-scale retail supermarket, and evaluates the performance of linear regression, random forest, and gradient boosting method in the corresponding limited dataset. The selected metrics for analysis are RMSE, MAE, and R^2 score. Experiment results indicate that the linear regression model has a relatively large error and suffers from underfitting. The two decision-tree based models, random forest, and gradient boosting, perform similarly, with gradient boosting model outperforms by a small margin. This study illustrates that it is feasible to perform sales forecasting by machine learning techniques on a small collection of data. It also identifies the issues in this process and suggests potential fixed, giving small retailers a guideline for making effective sales predictions.

Keywords: sales prediction, machine learning, linear regression, random forest, gradient boosting

1. Introduction

In the age of data technology, data acquisition and analysis are getting more and more important. As one of the core applications of data science, forecasting has become an indispensable tool in all industries. Decades ago, a survey of businessmen showed that 92% of the respondents regarded sales forecasting as being of great significance [1]. Additionally, among these merchants, the group of retailers expressed the most interest in and concern over this topic [1]. For the retail industry, accurate sales forecasting means capture of market trends in advance, better inventory, and pricing decisions, and maximized profits. In early days, small and medium-sized retailers might not have been able to make as good sales forecasts as large companies and banks due to a variety of constraints. However, decreased expenses and the development of numerical prediction methods have enabled even individual retailers to benefit from this amazing technique.

Various studies on sales forecasting through machine learning have been conducted, which yield many in-depth conclusions. Scholars examine the relationship between weather and food retailers' sales, and develop a deep-learning based model that uses LSTM and a stacked denoising autoencoder network [2]. Based on the model, they predict the sales of a Japanese chain supermarket and achieve an outcome superior than many conventional machine learning methods. Other researches carry out

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sales forecasting on Amazon's book sales using a variety of modeling techniques, such as regression, decision tree, and artificial neural network [3]. Features from multiple perspectives, including prices, sentiments and their interactions, are used in training and are shown to have various degrees of importance in different models. The result provides a guideline for online venders to precisely forecast their sales. In addition, other study discusses a concern that is frequently disregarded when predicting house selling prices through the random forest model [4]. By conducting analysis on the house sales data on Fairfax County, Virgina, they confirm the efficacy of variables related to the spatial correlation of houses, and therefore refine the random forest model. The research presented in Ref. [5] examines the significance of the ARIMA model and introduces a deep learning model built on top of it. The authors demonstrate the viability of this ARIMA-based model by analyzing five-year sales data from several stores and achieve a high accuracy. Other research introduces ForeXGBoost, which is a method based on XGBoost and takes the first place in a competition for machine learning models. ForeXGBoost model combines XGBoost, time series analysis, one-hot encoding techniques, and missing value filling [6]. Despite being specifically designed for the vehicle sales data used in the competition, the model also performs well in other sales forecasting scenarios, particularly when it comes to time series and data anomalies. Some of the scholars discuss a potential solution to the issue of some merchants not having enough data for sales forecasting [7]. They analyze short time-series data through neural network and utilize a multilayer-perceptron to do prediction, eventually demonstrating the adaptability of neural networks in sales prediction with small datasets.

The aim of this paper is to investigate the feasibility of machine learning for sales prediction in a small-scale retail supermarket, Big Mart, and to compare the performance of models used. The rest part of the paper is organized as follows. Section 2 presents the data source and its processing procedure, introduces the models and metrics, and outlines how the experiment was conducted. Section 3 introduces and analyzes the results. Section 4 examines potential limitations of this research and offers suggestions for improvement. Eventually, Section 5, summarizes the experiment and discusses its implication.

2. Data & Methods

2.1. Data

The dataset examined in this research was from the Kaggle stage and contains information about Big Mart, which was a supermarket brand with more than 60 stores currently operating in Nepal. It comprised sales data for 1559 products across 10 stores in different areas in 2013 and provided detailed information about the product, outlet information where the product was purchased, and its sales value. The provided train set that had 8523 observations was used to build and test the model. The dependent variable to be predicted was the sales of each product at an outlet with characteristics. There were 11 independent variables in total. Seven of them were categorical variables, including product ID, fat content, product type, outlet ID, outlet size, location type, and outlet type, while weight, visibility, maximum retail price (MRP), and year of establishment were the remaining 4 numerical variables. Some data had missing values in weight and outlet size, which needed to be fixed before model training.

2.2. Data Processing

Generally, four steps were taken during data processing: train-test split, handling missing values, consolidating redundant categories in each variable, and converting categorical variables into indicator variables. First, the training set provided was randomly divided into a new training set which comprised 80% of the 8523 data points, and a test set that contained the remaining 20%. Subseuqently, data cleaning and transformation were performed in these two sets, respectively. Missing

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values were found in two independent variables: weight and outlet size. For weight, the average of existing values was used to fill the gap. For outlet size, a more precise method was applied. The outlet size was found to have a relatively strong correlation (0.56) with outlet types, so the mode of outlet sizes in each outlet type was calculated first, and then the corresponding mode was filled in according to the outlet type of the missing data. Afterwards, redundant categories in the variable fat content were solved: duplicate labels such as “low fat”, “LF”, and “reg” were combined into “Low Fat” and “Regular” in respective. Lastly, all the categorical variables were converted into indicator variables by using the built-in function *get_dummies* in the Pandas library in Python.

2.3. Models and Metrics

Three determining models were chosen to fit the data: Linear Regression, Random Forest, and Gradient Boosting. Other methods such as Stochastic Gradient Descent were also scrutinized, but the results, probably due to the small training set size, were impractical, so they were not considered here. All models came from scikit-learn library in Python and were executed in Python 3.9. The metrics used to determine the performance of models were Root Mean Square Error (RMSE), Mean Absolute Error (MAE), and the coefficient of determination (R^2).

$$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2} \tag{1}$$

$$MAE = \frac{1}{n}\sum_{i=1}^{n}|x_i - \bar{x}| \tag{2}$$

$$R^2 = 1 - \frac{\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}{\sum_{i=1}^{n}(y_i - \bar{y})^2} \tag{3}$$

Linear regression model with ordinary least squares (OLS) method was used. This model assumes that the relationship between the dependent variable y and the independent variable x is linear, and generates the set of coefficients β_i’s which minimizes the residual sum of squares between the observed values in dataset and the targets predicted by the model. Here, the intercept term was included to achieve better result. The formular is as following:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \cdots \tag{4}$$

Random Forest is an ensemble learning method that operates by building a number of decision trees at training time and uses averaging to improve prediction accuracy and reduce overfitting. For regression tasks, the average predicted values of individual trees are returned. In this experiment, n_estimator, the parameter that determined the number of trees in the forest, was set to 200 and the function that measured the quality of splits was selected to be mean squared error.

Gradient Boosting is a method of combining several simple models, which are typically decision trees, into a composite model. It has a forward stage-wise fashion since simple models are added one by one and each new model takes a step in the direction minimizing the prediction error. As more simple models are combined, the final completed model gets stronger. This algorithm uses gradient descent to minimize losses, which is where the term "gradient" comes from. When training the model, learning rate and the number of boosting stages were set to 0.1 and 100, respectively.

2.4. Procedure

After data processing and model selection, the next steps were to choose appropriate features and train the models. Features were selected based on their correlation with the target variable. In the calculation of correlation coefficients, Cramér’s V (also known as Cramér’s φ), the statistic that measured the association between nominal variables [8], was used as the criterion of measurement. In

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addition, the dython library in Python was applied for the calculation. Furthermore, different hyperparameters were tried during the learning process, and the final selection was shown in the previous section. When the training was completed, their results were compared and analyzed.

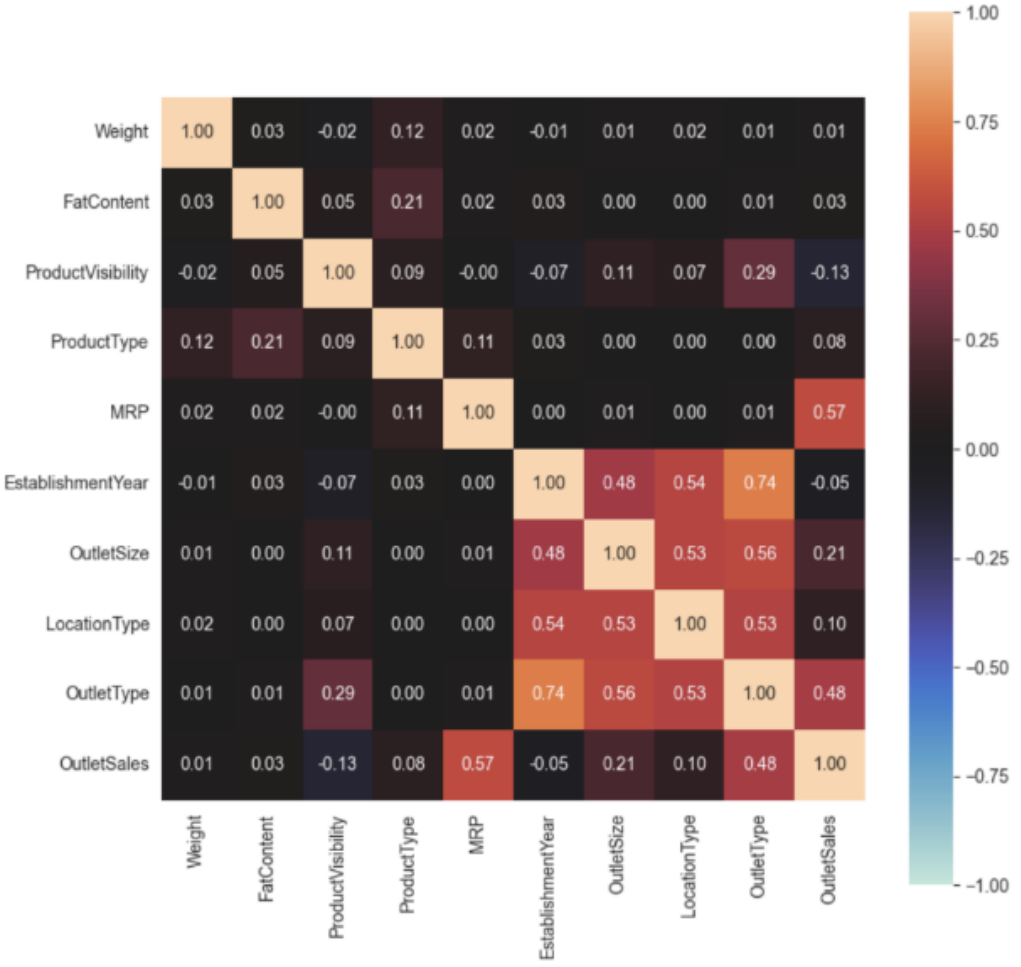


Figure 1: Heatmap of correlation coefficients.

3. Results

3.1. Correlation

The heatmap that displayed the correlation between each variable was generated by the function *nominal.association()* from python library. It should be noted that the product ID and outlet ID, the two features used for identification, were not considered because they were not relevant to the objective of this study. The correlation was presented in Fig. 1. Except for MRP and outlet type, most of the features had a low correlation with the target variable, outlet sales. The relatively high correlation (0.21) between outlet size and outlet sales was, to some extent, due to their high correlation with outlet type. Based on the obtained correlation coefficients, the three least correlated features - weight (0.01), fat content (0.03), and year of establishment (-0.05) - were tested during model training to decide whether to be applied. Test results showed that both fat content and the year of establishment had a positive effect on the accuracy of the model. Thus, excluding weight, the remaining 8 features were used in model training.

DOI: 10.54254/2754-1169/17/20231094

3.2. Model Performance

For each model, scatter plots with observed values on x-axis and predicted values on y-axis were used to illustrate the performance. Ideally, the model should have a high R^2 score, which meant that the arrangement of the scatter points should be close to a straight line with a slope of 1.



Figure 2: Scatter plots for results of linear regression.

The results of the linear regression model (seen in Fig. 2) did not appear to be linear. Instead, it was more like a curve with a positive but decreasing slope, which gave an upper limit that was around 6000 to predicted values. In addition, for part of the data with observed values less than 1000, the model's predictions were less than 0, which was inaccurate because the value of sales would never be negative. The reason for the unsatisfactory results might be related to the nature of the features used. Most of the features involved in training were categorical variables, which were not well suited for linear regression in the case of low correlation.

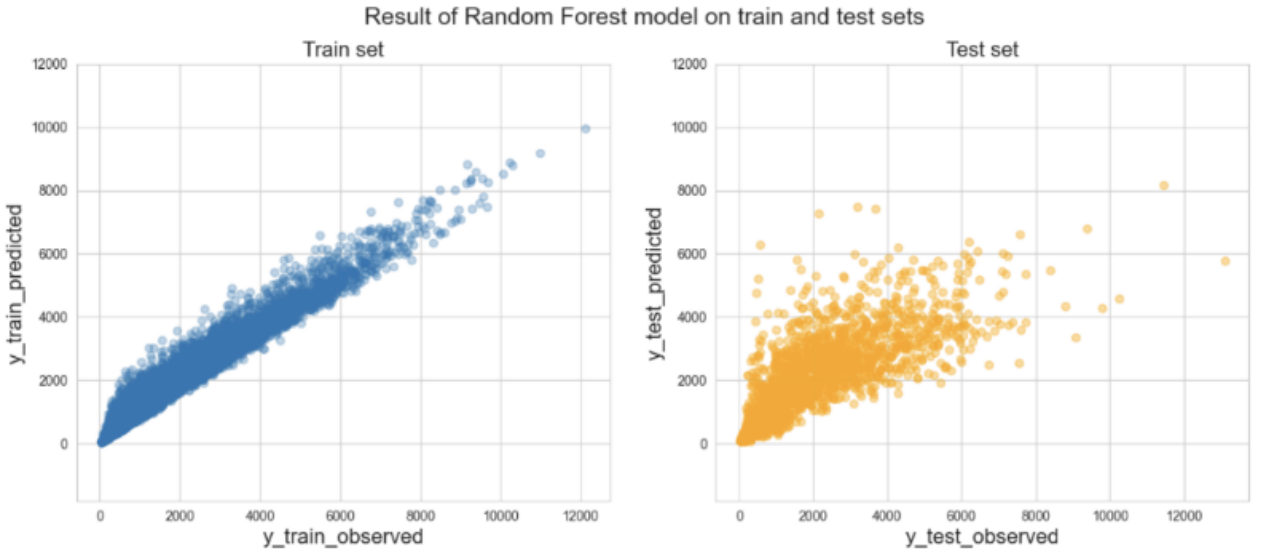


Figure 3: Scatter plots for results of random forest.

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As presented in Fig. 3, the result of Random Forest was more reasonable than that of the linear regression model. The model performed very well in the training set due to the characteristics of decision trees and was therefore not informative, while the result for test set was not as perfect, but a linear trend still existed. From the density of data points, it could be seen that the random forest model performed better for data with observed sales between 0 and 6000, and it had a large error for data that had sale values greater than 6000. A possible reason for this phenomenon was that most of the samples used for training were concentrated between 0 and 6000, which made the model unable to effectively classify data beyond this interval.

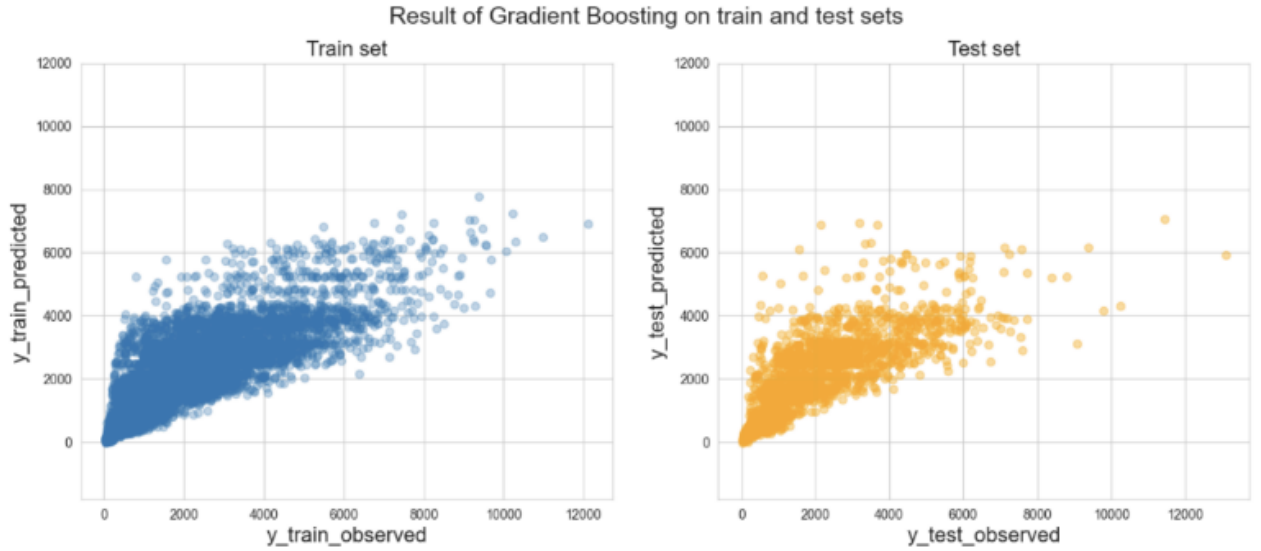


Figure 4: Scatter plots for results of gradient boosting.

The results of Gradient Boosting were illustrated in Fig. 4. Also based on decision trees, Gradient Boosting performed worse than Random Forest in fitting the training set due to its additive nature. However, its performance in the test set was slightly better, i.e., the linear trend of data points was more obvious. The predicted values obtained from this model were lower than the true values. Besides, the same issue in the prediction for data with true values larger than 6000 existed as well. The errors and R2 scores of different models were generally consistent with the trends exhibited by the scatter plots, as presented in Table. 1.

Table 1: Errors and R^2 scores of models.

	Linear Regression	Random Forest	Gradient Boosting
RMSE_train	1124.926	425.269	1029.046
MAE_train	834.714	293.638	727.225
R2_train	0.562	0.937	0.633
RMSE_test	1142.004	1133.550	1086.291
MAE_test	840.730	790.548	753.112
R2_test	0.567	0.574	0.609

Overall, Gradient Boosting performed the best among the three models. It had the highest R2 score and lowest errors in testing. Random Forests performed slightly worse than Gradient Boosting, which

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was consistent with the fact that gradient-boosted trees generally outperform random forests [9]. The linear regression model had relatively the worst accuracy, which could be determined by both the RMSE and MAE. Its RMSE was close to that of the other two models because there were more outliers in the results of them, which was because of the lack of accuracy in their prediction of data with large values.

3.3. Interpretation

The results demonstrated that the sales prediction by machine learning techniques was feasible but ineffective for the chosen small retail markets. In machine learning, though it was not always true that the more training data used, the better the resulting model would be. But it was obvious that the data collected from a small retail market, such as Big Mart, was insufficient to train a model that performs well. This was due to the characteristics of small markets, i.e., low retail traffic, a narrow range of available goods, and a limited number of data categories. This experiment suggested that for small volume sales data, doing sales prediction only by machine learning was not a good approach. Such sales forecasting was not particularly informative and could only be considered as an aid for small retailers to make decisions.

4. Limitation & Future Enhancement

While this experiment met the study's aim, it was not perfect and the outcomes still had some flaws. In general, the lack of training data put all three models at risk of underfitting. In particular, the underfitting of linear regression model was more severe, as shown in Fig. 2, possibly because of the data's predominance in categorical variables that had low correlation. In contrast, the overfitting was also reflected in the random forest model to some extent. Additionally, the limitations in terms of the dataset were not only reflected in the insufficient amount. The lack of different aspects of dependent variables was also a major factor. As Armstrong mentioned in the research, factors such as the environment, customers, market conditions, and competitors could all cause changes in sales [10]. The data utilized in this experiment were all regarding the products and the stores and no external factors were included, which constrained the accuracy of the models. In future studies, when dealing with small-volume and less informative datasets, a smart strategy is to make judgmental extrapolations, as suggested by Armstrong [10].

This experiment also had space for improvements in terms of model selection and evaluation criteria. Models based on decision tree, like random forest and gradient boosting, did not work well for predicting new data beyond the existing data range. While the commonly used method for prediction, linear regression model, showed rather substantial underfitting. Therefore, experimenting with other hybrid models, such as linear model trees, might produce better results. Moreover, if the data is viable, incorporating time series analysis or using more complex models like LSTM were potential ways for improvement in future researches.

5. Conclusion

In summary, this paper investigated the feasibility of using machine learning approaches to forecast sales of each product in Big Mart. Based on correlation coefficients, appropriate features were selected and used to train three models – linear regression, random forests, and gradient boosting. Among these models, gradient boosting outperformed the other two models in terms of accuracy and R^2 score. According to the result, sales forecasting was moderately predictive and could serve as an aid for decision making. However, this experiment several data and model restrictions, and thus the most ideal outcomes were not obtained. For future studies, alternative hybrid models, such as the linear model tree, or time series models (e.g., the LSTM) would be good attempts for better sales

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forecasting models. Moreover, for small-volume and uninformative datasets, judgmental extrapolations based on knowledge about the products and the market would be a good strategy to increase the accuracy of sales forecasting. Overall, these results offered a guideline for small retailers to make sales prediction through machine learning with restricted datasets, and pointed to potential issues within the process.

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Analysis of the Supply Chain Management Advantages of Tesla and the Impact of the Epidemic

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Abstract: In contemporary society, where the energy crisis is becoming more and more serious, the energy transition of automobiles is imminent. By studying the background of Tesla, its production strategy, battery technology, supply chain, marketing network, and operation mode under the epidemic, combined with the comparison of traditional car companies, this paper hopes to provide relevant suggestions and improvement methods to the energy transition of traditional car companies, which can make the electric vehicle industry develop more rapidly.

Keywords: Tesla, car industry, strategy, battery technology, supply chain, marketing

1. Introduction

Tesla Inc. is an American electric car and sustainable energy business based in Palo Alto, California. Its mission statement states that the company aims to "accelerate the world's transition to sustainable energy." Elon Musk is the company's current CEO and previous chairman.
In this academic paper, Tesla's supply chain management is the focus of the study. The study will focus on four aspects of Tesla's battery, logistics management, and retailers. Ultimately, the study will analyze how Tesla has been affected by the pandemic, especially in the supply chain.

2. Background of Research

In recent years, countries around the world have enacted many policies on emissions based on the importance of environmental protection. For example, one California policy predicts a 1 billion tons reduction in CO2 emissions by 2045 [1].

As international oil prices continue to rise, the cost of using fuel cars rises. In this condition, the electric car consumer base continues to grow.

As the leading electric car brand, Tesla holds a significant market share. A report says that in the United States, Tesla has even caught up with BMW in luxury car sales [2]. In addition, Tesla is reported to be the fastest-growing brand in the world in 2021. That is why the case of Tesla's supply

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chain management deserves to be researched.

3. Production Strategy

In order to study Tesla's supply chain management, the first step is to analyze its production strategy. Three levels of strategy are presented below: Vertical integration, Product development, and Technology-driven.

Vertical integration. Unlike other car companies that typically outsource 80% of their components to suppliers and focus only on engine manufacturing and final vehicle assembly, Tesla's product strategy can integrate vertically, including product components and the placement of charging equipment. This integrated approach to operations leverages sales margins and effectively manages the supply chain.

Product development. Tesla has a well-established growth strategy for product development. It has gradually developed from a single product line of Roadster to the current four product lines of model 3, model Y, Model X, and Model S, which cover different price ranges. In addition, Musk claimed that in 2023, Tesla would open two new factories to start new products such as the Semi, Roadster 2, and Cybertruck [3]. Tesla also has many product developments in areas other than cars, such as solar charging panels and EV charging stations [4]. Tesla can make huge profits through the development and iterative update of these products.

Technology-driven. As a high-tech company, Tesla is mainly focused on technological innovation. This is reflected in both autonomous driving and battery technology. Take Autopilot, for example; Tesla develops much of its assisted driving technology, while Toyota prefers to outsource (using Mobileye or ZF's technology). By April 24, 2020, Tesla released a software upgrade that indicates that Tesla will have complete autopilot. It means that cars will no longer need to be controlled by humans in the future.

4. The Suppliers of Tesla Batteries

In the beginning, Panasonic was Tesla's battery supplier, distributed in the United States & China& Japan. LG battery became one of the suppliers in 2019; the main business is distributed in Europe. In 2022 CATL and BYD will become its battery supplier, responsible for most of the battery supply in China, and the blade battery provided by BYD will be used for the first time in the Tesla model Y.

The Diversity of New Energy Vehicle Batteries and the Uniqueness of Tesla. In terms of electric cores, only cylindrical cores are designed with a safety valve; the gas produced by the cores, when working, the safety valve can be opened to release when the air pressure is too high, so it is safer. The other two types of cells（square complex shell cell & soft pack cell） are not designed with safety valves.

The battery cell can be understood as the core component of the battery. However, it is only a separate component and cannot be directly said to be the battery; some brands of the battery warranty are the warranty of the battery cell rather than the battery pack. After all, the battery cell is a semi-finished product and cannot be used directly as a battery. It needs to be coordinated by the internal circuitry and shell of the battery to work properly. The electrolyte inside the battery works when the cell plays the role of the top and bottom; without the power cell, there is no way for the battery to complete the internal electrode reaction. Round cell volume and capacity are not large, but the battery's high energy density is the advantage. Because of this advantage, the design of retaining round cells was passed down in Tesla. Tesla's own 4680 battery is the latest single-cell cylindrical battery. 4680 battery is Tesla's new generation of cylindrical battery with a diameter of 46mm and a height of 80mm. Compared to the 2170 battery, energy increased by five times, power increased by five times, and range increased by 16%, while the cost was reduced by 14%.

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Although the 4680 batteries have been produced by Tesla, it does not meet its batteries demand and still need to be provided by external suppliers. Indeed, the proliferation of battery systems in response to decarbonization across a range of industries and spaces is transforming economic relations all along the production network, raising several areas of public and policy concern: from the availability of mineral raw materials such as lithium, nickel, and cobalt, to bottlenecks in LiB manufacturing capacity [5]. Since 2021, Tesla has searched worldwide for enough nickel and has reached purchase agreements with several nickel suppliers. In addition, the company continues pushing for advances in raw material processing and battery manufacturing methods. For example, in January, Tesla said it would buy 75,000 tons of nickel concentrate from a project developed by Toronto-listed Talon Metals. Earlier, Tesla agreed with BHP Billiton, the world's largest integrated mining company, to buy material from its operations in Australia. Tesla also agreed to buy nickel from a mine in New Caledonia, which commodities trader Trafigura partly owns.(Martins, Livia Salles.)

5. Supercharger

Tesla's charging pile and charging technology is also its core technology, the cooling technology in the charging cable can ensure that it will not overheat during the charging process, which is a very significant point compared to other new energy vehicles. You can fully charge the car with the Supercharger within 50-80 minutes, this charging speed is far superior to other new energy vehicles, and Tesla Supercharger is widely distributed， which means no worry about mileage. The charging power is inversely proportional to the remaining energy of the battery.

6. Tesla Logistics Management Versus Traditional Car Companies'

Tesla adopts a unique supply chain and logistics management approach compared to traditional car companies. Tesla has a reliance on in-house expertise to produce selected parts for the manufacturing process and direct selling to the consumers.

By contrast, the model used by traditional car companies includes the reliance on suppliers to produce critical components for the manufacturing process and the use of franchised dealers to sell to customers.

Tesla uses in-house expertise for the manufacturing of car components. In the traditional supply chain model, automakers rely on suppliers to deliver the needed components [6], including parts critical to the production system. However, the in-house manufacturing of electric cars has enabled Tesla to retain control over the production of components. As a result, traditional car companies might stall their operations in the event of unforeseen component problems.

If a problem in the supply chain happens to critical components used in car manufacturing, this will affect the delivery time of finished products to customers.

The major companies using the traditional supply chain model suffered due to the shortage. However, Tesla used its in-house production strategy to maintain operations and build its competitiveness in the industry [7,8]. Thus, using in-house expertise to improve manufacturing efficiency emerges as Tesla moves from the traditional supply chain model.

Tesla's direct selling model. Tesla uses direct selling to the customers, which is a change in the supply chain model used by traditional car companies. Tesla can quickly get customer feedback, which is considered to be Tesla's most significant advantage over its competitors. Consumers, Tesla's direct sales model also has the opportunity to reduce the purchase cost for consumers because it eliminates franchised dealerships, shortens intermediate links, and simplifies the purchase process. Hence, Tesla's move of selling directly to the customer emerges as a way of moving from traditional supply chain operations.

Traditional car companies produce components for car manufacturing. Supplier dependence in

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the supply chain model leaves the companies dependent on suppliers to deliver critical components that facilitate the manufacturing process [6]. If a supplier delays delivering the needed parts, there is likely to be a delay in delivering the products to waiting customers. Thus, the dependence on suppliers for car manufacturing parts remains a significant aspect of traditional car companies' supply chain and logistics management.

Traditional car companies sell models. Traditional car companies sell car units to customers through franchised dealerships. This approach avoids selling directly to the customers [7]. The result of indirect selling to the customers is limited contact between the manufacturer and the customer, where customer feedback reaches the manufacturer at a slower pace. The manufacturer depends on the dealerships as an intermediary in communicating with the customers. The choice of selling through dealerships further includes higher costs than selling directly to customers. The choice of partnering with franchised dealerships adds to the complexity of the supply chain and increases the costs of delivering the products to the target customers.

7. Retail Network

Direct sales. Tesla sells directly to consumers. Unlike other traditional car companies,

Tesla does not use a franchised dealer model but owns all of its stores, giving carmakers more leeway than most to manage their retail approach. It has built an international network of company-owned showrooms, mainly in urban centers. More importantly, it creates a better customer buying experience. “Unlike car dealerships, Tesla showrooms have no potential conflicts of interest. Customers deal only with sales and service staff hired by Tesla”(Kristina). [9].

Online sales. In addition to its stores, Tesla has transformed the traditional auto dealer network. "It has created a new multi-channel model for buying cars, including online and Apple-like retail stores" [10]. Online stores offer potential customers the opportunity to buy cars directly online. Tesla takes orders through its website and sells cars directly to customers. They do not have a storefront, so they do not have to go to a dealership. You do not have to go anywhere when there is a Tesla you order online. Tesla pays the same price online as it does in stores. You can order and submit all essential documents offline from home. Customers are assigned a Tesla consultant at a local store to help manage the pre-shipment process. Some Tesla advisors will work at the central virtual store, helping online buyers in specific markets without being assigned to physical stores. Instead of renting expensive space in malls and shopping districts, Tesla rents space in parking lots, warehouses, and other locations to manage its test-drive fleet and distribution centers. This streamlining of the transaction process eliminates the expensive rent Tesla has to pay to set up shops in malls.

Home service. “In some areas, Tesla has hired mobile service support, mobile technicians who make house calls. In some cases, services are delivered remotely” [11]. For example, a new way to fix cars is to wirelessly upload data so technicians can see and fix the problem without touching the car. In some cases, services are delivered remotely. For example, suppose they cannot fix the car online. Tesla has Tesla Troopers. Tesla Rangers are a team of remote technicians who end up at your location -- home, business, coffee shop, or wherever -- and fix your car there.

Ford sales. Ford's retail network compared to Tesla's retail network. Ford differs from Tesla in allowing franchised stores, where Ford sells cars to customers through franchised dealers, just as traditional car companies do. This approach avoids selling directly to customers. Trust Ford is the largest Ford dealership group in the world, but it is interesting to note that Trust Ford is part of the Ford Retail Group and is wholly owned by Ford Motor Company. Ford is also beginning to change its retail network due to Tesla. Ford wants to start selling electric cars directly at a fixed price. Online sales will have a fixed price, eliminating the usual price negotiations and dealer discounts - which, like Tesla's direct sales of electric cars, are also moving to the Internet. However, Ford was still willing to keep dealers," We bet on Dealers," Ford CEO Jim Farley told dealers. We will not negotiate

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directly, "he told reporters after the meeting. Some explanation is in order.

8. COVID's Effect

Covid has deeply attracted people's attention as a synonym of this era. It has changed people's lives and affected many companies' operations, especially in their supply chain management. Respectively the increasing demand for microchips, difficulties met in demand forecasting, and adverse effects on importing and exporting.

Covid's Effects on Chips. Two main factors that lead to the shortage of microchips are the increasing demand for chips and the insufficient production capacity of microchip manufacturing. From the beginning to the end of the pandemic, the population of home working has quadrupled, from initially 5% to 20% at present [12]. Research shows that this has increased computer demand [13]. As a result, the sales of computers boosted the demand for microchips because chips are one of the most important parts of computers. It so happens that electric cars also need chips because each electric car is a giant computer. Therefore, to meet the chip demand for computers, the number of chips available for electric cars is much reduced.

During the pandemic, many factories worldwide have been restricted in working times. This leads to a limit on manufacturing, resulting in a lack of productivity [14]. For example, in China, Many factories can operate only three days a week. This is fatal, especially in a period of increasing demand. It makes the manufacturing of electric cars very limited.

Tesla - because of its unified, centralized supply chain management- found an appropriate and effective way to control its usage of microchips and successfully managed to grow profits despite chip manufacturing restrictions. When they learned of the shortage, they immediately told the production line to remove all the chips scheduled to be installed in the waist function of cars' front seats to save microchips. Later, when the number of chips is sufficient, some canceled functions will be reinstalled. Compared to Volkswagen, Tesla is doing very well. However, VW does not manage its supply chain in a unified way, and the production line and design cannot be updated in time, so Volkswagen has to stop production [15].

Covid's Effects on Demand Forecasting. The marketing strategy of the automobile industry is mainly offline marketing. The auto 4S stores were significantly affected when the pandemic broke out because most people chose to stay home instead of going out. This has caused many car companies to lose customers for weeks or even days. Due to the drop in transaction volume in a short time, it is difficult for the supplier to predict the transaction volume in the next stage, so it is difficult to accurately predict transactions from customers to the upstream of the supply chain. From downstream to upstream, the impact will become gradually larger and larger. This is called the Bullwhip Effect.

However, Tesla is an exception. Because of its unique retailer model: Online Transactions, they can still receive orders like usual. This can give them sufficient data support to help them get a more accurate forecast of the subsequent stage of sales and production plan.

Covid's Effects on Importing and Exporting. Covid has dramatically affected the transportation of international trade. Many countries close their board to prevent COVID-19 from entering their countries.

Tesla imports raw materials from countries all over the world. For example, it imports a vast of graphite from China [16]. Unfortunately, when the coronavirus was discovered in China, the Chinese board was closed imminently. This is an unexpected situation for Tesla because approximately 55 percent of its graphite is imported from China. This disturbs their production plan because of the lack of raw materials. Moreover, the shipment fee during the pandemic also increased, meaning more money is spent on it, and less is left for the R&D department.

DOI: 10.54254/2754-1169/17/20231098

9. Conclusion

This article discusses Tesla's production methods, battery design, logistics chain, retail methods, and the epidemic's impact on Tesla's supply chain. In each section, we compare and contrast Tesla with traditional car companies. Tesla, as the leader in new energy vehicles, has a unique way of doing business and a robust supply chain that is an example for all major car companies, and in the era of the increasingly urgent energy transition, all major car companies should learn from Tesla's strengths combine their advantages to create more competitive products for us.

Acknowledgment

Leyan Lv, Chenting Zhu, Xuanyu Chen, Yifeng Lin and Tianwei Ma contributed equally to this work and should be considered co-first authors.

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Markowitz and Index Model in Capital Markets

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Abstract: Investment has become an essential subject in this age, and the Markowitz Model is one of the most classical theories. However, after this, a new model is based on it borne. Nevertheless, it is similar to the Markowitz, so we want to figure out why this new model is better than M. In this work, we use excel to make two models called Markowitz and Index and displaying them. As a result, we found that the Index Model does better than the M because of the higher slope. With this conclusion, investors can use them to choose their best combination.

Keywords: markowitz, index, minvar, maxsharpe, CAL

1. Introduction

The return and risk of investments have always been an essential part of the financial investment markets and an important reference point for decision-makers. As the economy continues to grow and new financial instruments are created, capital markets have become central to the U.S. financial market. In 1952, Harry Markowitz published his infamous "Portfolio Selection." There are three parts to Markowitz's Portfolio Selection: 1. To determine the permissible portfolios region using the risky investments available, which in particular includes determining the minimum variance frontier of allowed combinations of risk and return 2. To determine the optimal risky portfolio, and 3. Select a suitable complete portfolio by mixing the optimal risky portfolio with the risk-free asset maximizing the investor's utility function, given the level of the investor's risk-aversion. Modern portfolio theory, therefore, is a risk-reducing approach to portfolio management that achieves a certain level of portfolio's expected return subject to some possible additional constraints by optimally diversifying across all given investment options. However, Markowitz's theory requires comprehensive estimation of various expected quantities (returns, standard deviations, and correlation coefficients), and the model does not specify how to estimate them; the estimates obtained by historical data sample averaging may not be reliable. Despite these shortcomings of the Markowitz model, it is undeniable that the field of finance has undergone a revolutionary change before it and after it as a result. To remedy some of these shortcomings, a simplified model of optimal portfolio allocation was proposed and instantly became widely used in the financial industry is; the Index model developed by William Sharpe about ten years after the Markowitz publication in 1963. This model simplifies the measurement of individual security and portfolio risk

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and return. It enhances the analysis of expected returns and allows measuring the risk of a given portfolio, in addition to simplifying the estimation of covariance matrix problems.

Our research here focuses on ten well-known stocks using their historical daily total return data over the last twenty years. We then aggregate the daily total return data into the monthly total return data and use the Markowitz Model and Index Model to calculate all the required model estimates based on the monthly total return data running the models with those estimates; we find the efficient frontiers, the global minimum risk portfolio, the optimal risky portfolio, and the minimum return portfolio frontiers for our portfolio.

#	Group #4	Full Name	Sector (Yahoo!finance)
1	QCOM	QUALCOMM Incorporated	Technology
2	AKAM	Akamai Technologies, Inc.	Technology
3	ORCL	Oracle Corporation	Technology
4	MSFT	Microsoft Corporation	Technology
5	CVX	Chevron Corporation	Energy
6	XOM	Exxon Mobil Corporation	Energy
7	IMO	Imperial Oil Limited	Energy
8	KO	The Coca-Cola Company	Consumer Defensive
9	PEP	PepsiCo, Inc.	Consumer Defensive
10	MCD	McDonald's Corporation	Consumer Cyclical

Figure 1: The company that we choose.

The Markowitz Method formulas we used are as follows.

The Markowitz Model (MM) expected portfolio return:

$$r_p = \vec{w} * \vec{\mu}^T \tag{1}$$

Markowitz Model (MM) investment portfolio expected standard deviation:

$$\sigma_p = \sqrt{\vec{v} P \vec{v}^T} \tag{2}$$

The Index Model (IM) formulas we used are as follows.

The expected portfolio return following the Index Model:

$$r_p = \vec{w} * \vec{\mu}^T \tag{3}$$

The Index Model investment portfolio expected standard deviation:

$$\sigma_p = \sqrt{(\sigma_M \beta_p)^2 + \sum_{i=1}^{n} w_i^2 \sigma^2(\varepsilon_i)}, \beta_p = \vec{w} * \vec{\beta}^T \tag{4}$$

Some of the shortcomings of the Markowitz Model are 1. For large portfolios, the number of estimates required is large, which effectively prohibits the application of MM to large portfolios. 2. The MM does not tell exactly where to get the expected estimates; if one naively assumes that we need to get them from historical data estimation, this introduces a dependency on the sample size and sampling frequency. None of this is discussed in the original MM. This is why the IM has made such progress and become popular with users.

2. Markowitz Model's Description

We define $\vec{\mu} = \{ \mu 1, \mu 2, \mu 3, \ldots\ldots \mu n \}^T$ is the set of instruments' average returns; $\vec{w} = \{w1,w2,w2,\ldots..wn \}^T$ is the unknown set of instruments' weights; $\vec{\sigma} = \{\sigma 1, \sigma 2, \sigma 3, \ldots \ldots \sigma n \}^T$ is the set of instruments' standard deviations; $\vec{\beta} = \{\beta 1, \beta 2, \beta 3, \ldots . \beta n \}^T$ is the set of instruments' betas; $\{\sigma(\varepsilon 1), \sigma(\varepsilon 2), \sigma(\varepsilon 3), \ldots . . \sigma(\varepsilon n) \}^T$ is the set of the residuals' standard

DOI: 10.54254/2754-1169/17/20231099

deviations; $\vec{v}=\{\overrightarrow{v1},\overrightarrow{v2},\overrightarrow{v3},\ldots\ldots\overrightarrow{vn}\}^T$ is an auxiliary vector; and $\begin{cases}\rho11 & \rho12 & \ldots. & \rho1n \\ \rho21 & \rho22 & \ldots\ldots & \rho2n\end{cases}$ $\rho n1\ \rho n2\ \ldots\ldots.\ \rho nn$ is the matrix of instruments' cross-correlation coefficients.

The Markowitz Model can be used in the practical applications of asset allocation. By obtaining the optimal asset portfolio, the investment proportion of securities can be changed so that the portfolio can diversify the investment risk and achieve the objective of maximizing the investment utility. Moreover, such a model implies a unique property: the risk reduction due to diversification by choosing the assets in a portfolio with low correlation.

3. Data Processing Steps

Step1:

First, we choose data for all these ten companies. Then we copy them into our specific model, which can run a particular procedure to help us calculate our outputs. We need to get the results of Markowitz's global MinVar and MaxsSharpe. For Minvar, we chose this data.

Table 1: Variant data.

	SPX	QCOM	AKAM	ORCL	MSFT	CVX	XOM	IMO	KO	PEP	MCD	Return	StDev	Sharpe	20.0%	Dummy Variable	
MM	173.4%	-17.8%	-11.2%	-15.1%	-33.5%	-46.0%	71.9%	-27.3%	32.7%	21.4%	-48.5%	-4.2%	20.0%	-0.21	498.9%	With Regularization	
IM	0.0%	10.9%	20.3%	8.2%	44.6%	-12.7%	-57.8%	3.8%	-16.3%	5.2%	93.8%	22.0%	28.0%	0.79	273.7%	Without Regularization	
	173.4%	17.8%	11.2%	15.1%	33.5%	46.0%	71.9%	27.3%	32.7%	21.4%	48.5%						

Moreover, we use an Excel tool called Solver; we choose the range of weights from SPX to PEP, then click "min" and then click ok; after a few minutes, the results will show off. The MaxSharpe is similar to the global Minver, but the difference is that we used the minimum for the global Minvar and the maximum for the Maxsharpe, as the exhibits below show.

DOI: 10.54254/2754-1169/17/20231099

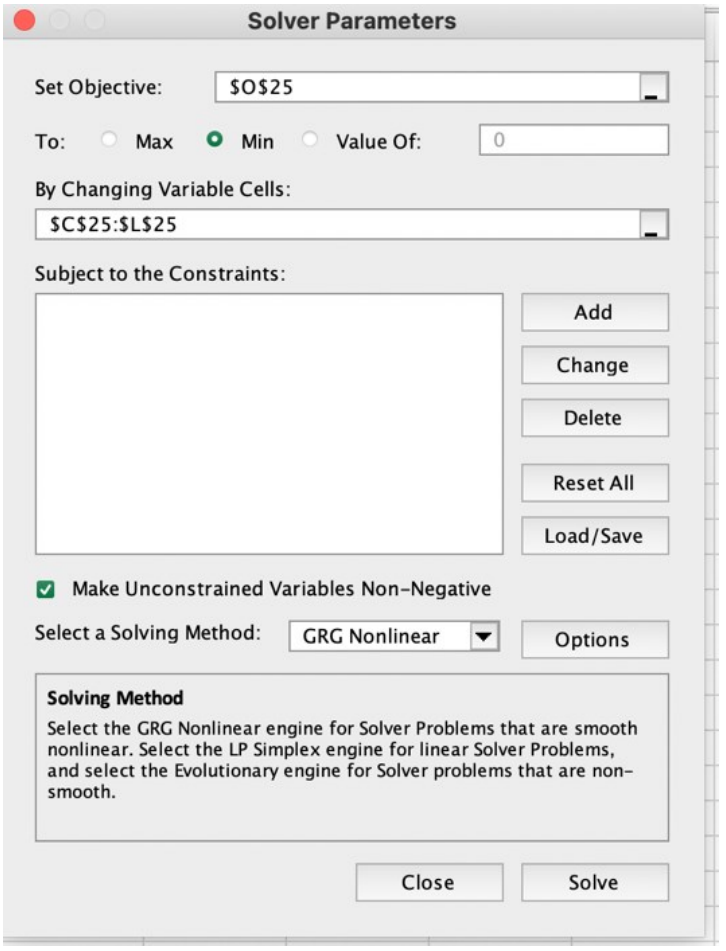


Figure 2: Markowitz's global Minvar(constra1).

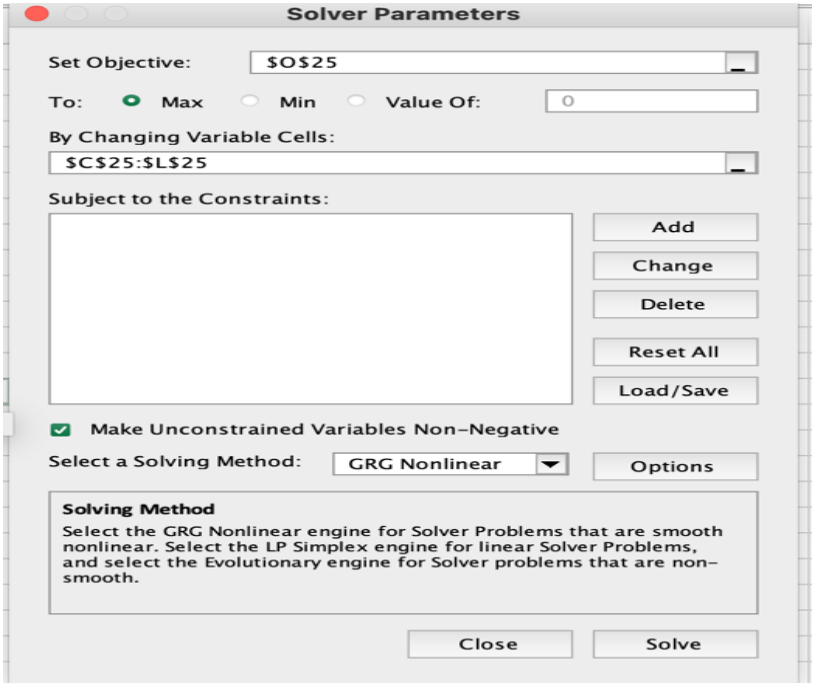


Figure 3: Markowitz's global MaxsSharpe(constra1).

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However, these are just MM; hawse also needs to estimate the IM - Index Model, and the Index Model's global Minvar and MaxSharpe points can be different from Markowitz Model ones. We want to get to know why IM is better than MM. So firstly, we made a model similar to the MM to find their differences.

The target function is now different, the weights are different, and the standard deviation is also different. So the target function needs to be changed into IM's standard deviation, and the weights need to be changed into the ones on the line corresponding to the IM.

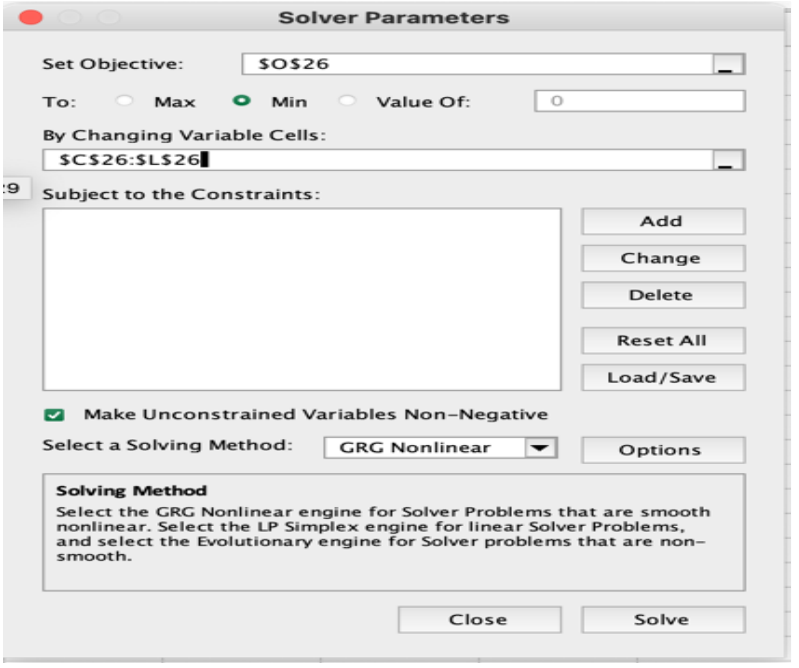


Figure 4: Index model Minvar(constra1).

These two results also do not require any constraints.

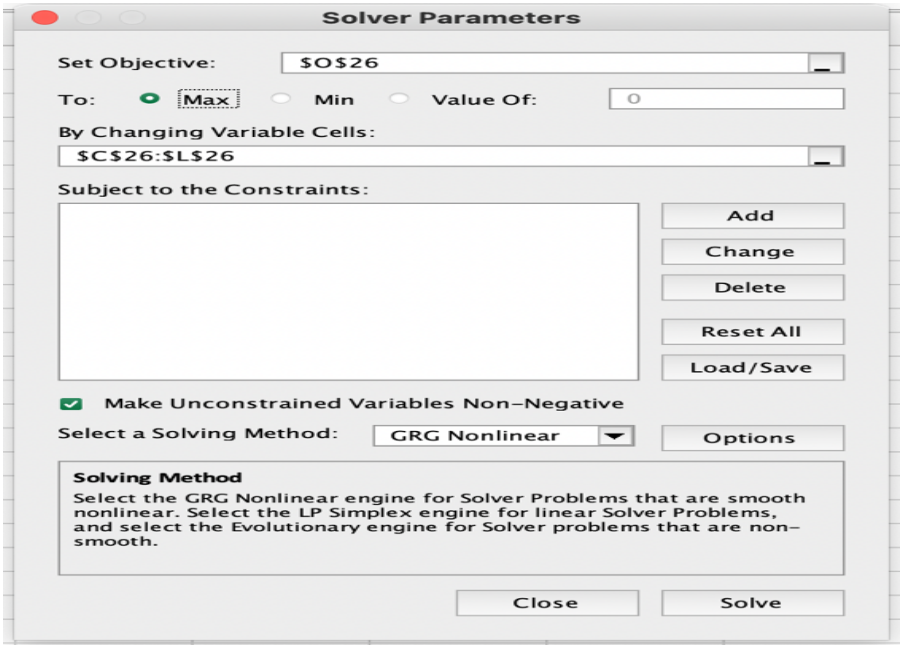


Figure 5: Index model MaxsSharp.

DOI: 10.54254/2754-1169/17/20231099

As a part of this project, we also need to make similar calculations with an additional constraint, MM constr2, and IM constr2. The additional constraint, which we call constr2, corresponds to the weight of SPX being equal to zero, and everything else remains the same as described above for constr1. Once we set up all these models, we run the other Excel tool called SolverTable, which allows up to run the Solver recursively multiple times. For that, we need to make some additional steps before we run the SolverTable. For MM constr1, we add a new limit: making the standard deviation equal to the Dummy Variable and changing the target function to the Expected Return, after which we must save the Excel spreadsheet.

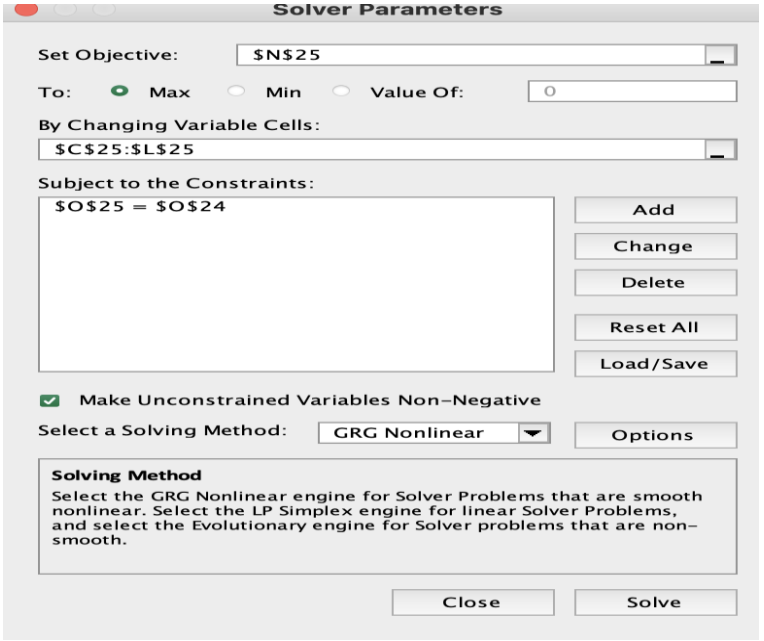


Figure 6: Markowitz model MaxsSharpe(constra2).

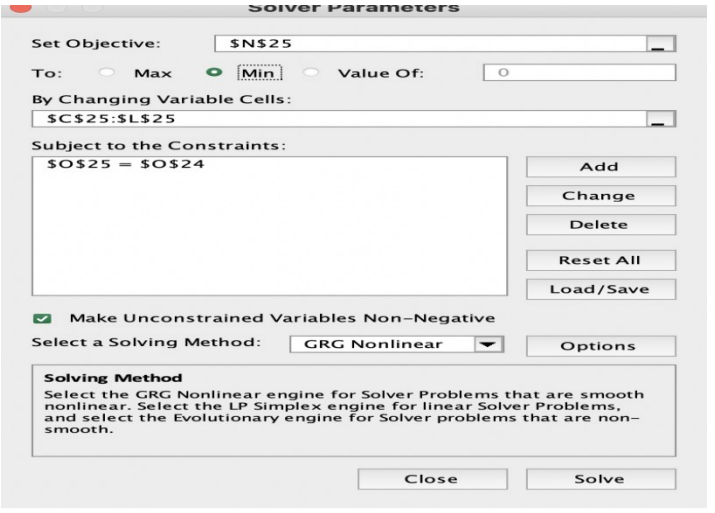


Figure 7: Markowitz model Minvar.

Once we have set up all these steps, we can run the SolverTable, and we need to pass on the Dummy Variable to it and set up the output range from the SPX to the Sharpe. Once these steps are done, we click ok, and once it shows us the last menu, we must click no because if we press yes, it will go into an infinite loop. So as the result of running the SolverTable, we calculate the MM

DOI: 10.54254/2754-1169/17/20231099

Efficient Frontier constr1, and if we changed the target into the expected return and the weights into the IM, when we again run the SolverTable, and we produce the inefficient frontier for the MM with constr1. Moreover, we can produce the MM Minimal Variance Frontier with constr1 similarly to the efficient frontier above, with the only difference between them being that the variance frontier's minimum value is -0.1. Moreover, this is how we obtain three constr1 results.

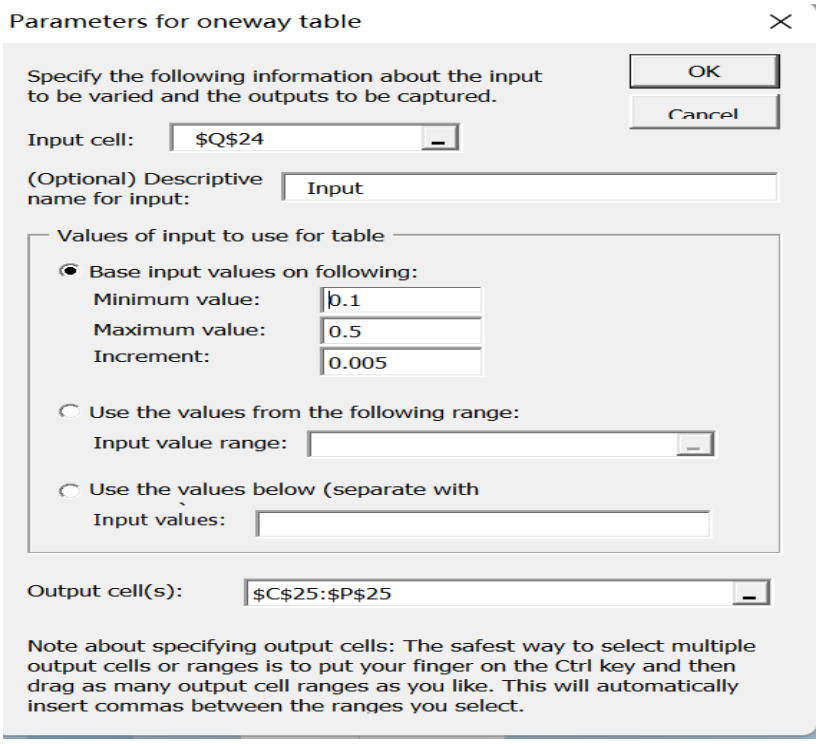


Figure 8: Solvertable.

The setup for constr2 is very similar to the setup for constr1, but we need to add a new constraint to make SPX weight equal to 0. However, after we ran the SolverTable with this setup, the results did not converge well, so we changed our Dummy Variable's value and reran the SolverTable to produce the well convergent results after this change. The next step is to implement the IM for constr1 and constr2. The target function and the weights for constr2 need to be changed into IM's, and the constraint also needs to be changed into IM's. Moreover, constr2 is the same as cosnstr1; one just needs to change its data into IM's data. We are almost finished. What remains is to make two charts of frontiers the Markowitz model and the Index model. We use points and lines to show our data and distinguish different frontiers. Finally, we added a new part called Monte-Carlo, for which we used about 50,000 randomly generated instrument weights using an Excel function similar to (RAND()-0.5)*CH1. Moreover, we have also used the Excel formula SUMPRODUCT() for the Index model.

DOI: 10.54254/2754-1169/17/20231099

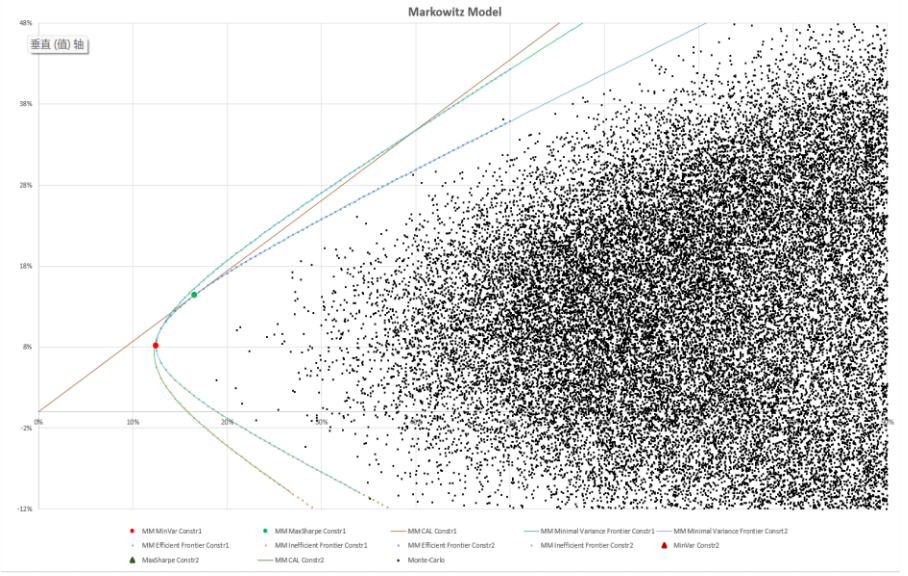


Figure 9: Markowitz model's results.

As a result of calculating the models, we found that IM and MM results have different limits, which obviously indicates differences between their results. The meaning of the Markowitz Model is that although the individual asset's risk is entirely determined by its standard deviation, the portfolio risk, in addition to being determined by the individual assets' standard deviations, is also determined by the asset's cross-correlations. According to the Markowitz Model, the best investment portfolios lie on the Efficient Frontier in the two-dimensional space of risk and return. The Efficient Frontier of the investment opportunity set in the two-dimensional space of "mean-standard deviation" is given below [1]. The Index Model was proposed as a simplification of the Markowitz Model, which is supposed to produce results close enough to the Markowitz Model, and it remedies several significant drawbacks of the Markowitz Model, such as a too large number of estimates required for its calculation for large portfolios [2]. Moreover, the Index Model has found widespread use for practical portfolio optimization in all countries. However, this is only at the theoretical level; for our specific comparisons, we put the two results in a graph together to compare our findings:

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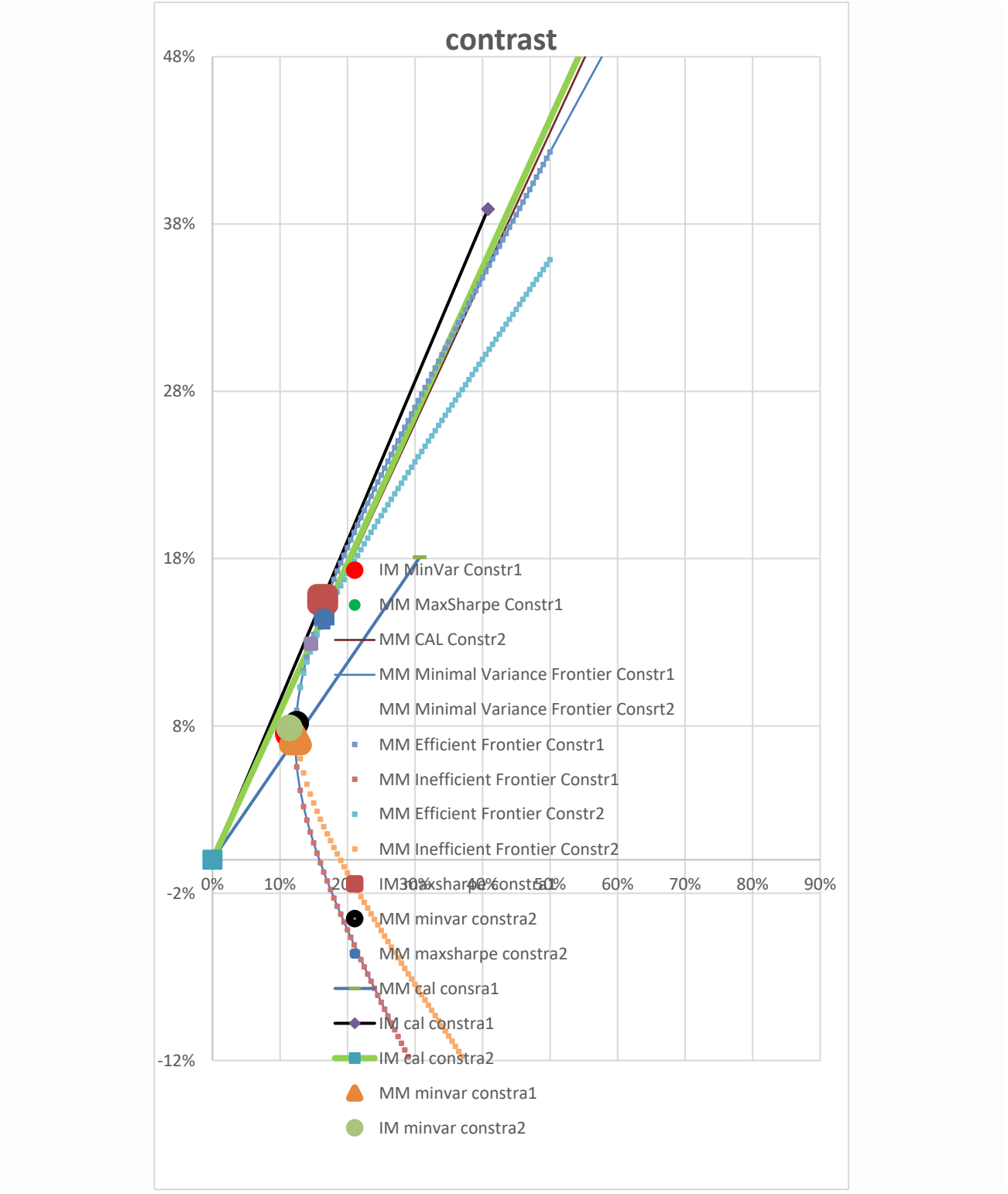


Figure 10: The result.

As one can see from this chart, whether we are trying to resolve the global minvar or maxsharpe points, with constr1 or constr2, the Index Model's performance is better than Markowitz Model's. Moreover, if we compare the CALs, we can see that the Index Model's CAL, whether with constr1

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or with constr2, has a higher slope than that for the Markowitz Model's capital allocation lines. Therefore, we need to add the riskless asset to the mix to form a complete portfolio.

Let us denote the risk-free rate of return as RF, and since its risk (standard deviation) is zero, the riskless asset corresponds to a point located on the vertical axis. It can be shown that point Y corresponds to the maximal utility, where the riskless asset F is combined with the optimal risky portfolio P laying on the Efficient Frontier located between P and F [3]. The CAL line describes all possible allocations between the optimal risky portfolio and the riskless asset [3]. The slope of the CAL line is the Sharpe Ratio, which means that the portfolio risk premium is measured in terms of the risk such portfolio is bearing. The CAL line reflects the linear relationship between expected return and risk [1][3]. The higher the slope (or the higher the Sharpe Ratio is), the higher the expected return for a given level of risk, or the better the investment is [4]. These two results show that Index Model is doing better than Markowitz Model in our specific case. In addition to the Markowitz model and the Index model, various similar in-spirit models involve more factors than just one – the broad index – multi-factor models that are also widely used in practice. However, these two models are the basis of the portfolio optimization theory and still have much practical use.

4. Conclusion

In 1952, Markowitz, an American economist, wrote in his seminal academic paper "Portfolio Selection“: "In Effective Diversification, two quantitative indexes, mean and variance of portfolio returns, are applied for the first time to define investors' preferences mathematically, explain the principle of investment diversification mathematically, and systematically elaborate the problem of portfolio and selection," which marks the beginning of the Modern Portfolio Theory. The theory is that combining individual securities into portfolios reduces unsystematic risk (https://baike.baidu.com/item/). The theory of, Markowitz is instrumental in helping investors make investment choices. In Markowitz's time, people bought stocks based on broker recommendations or other non-systematic reasons. Markowitz uses variance (or standard deviation) as the only risk measure to help investors make more rational choices. Before Markowitz, there was some recognition that diversification could reduce investment risk， but it has not been systematized in theory。

Every model has its area of applicability and assumptions, is not perfect, and the Markowitz model is not an exception – it has some drawbacks. It is well known that in the Markowitz model, we need to calculate the variance and covariance of all the stocks, so if we have multiple stocks, the process of estimation of the model calculation may be prohibitively extensive to the extent that the model cannot be used. For example, even in our case of the 11-asset portfolio, we had to do many calculations before we ultimately got the result. It is a long process that quickly gets ever more complicated for more extensive portfolios, so some people do not want to use the Markowitz model. One another drawback of the Markowitz model is that the standard deviation does not reflect all the risks well. For example, if we take two stocks or securities and calculate their standard variances, and they turn out to be the same in the Markowitz world, their risk is the same. However, one can quickly come up with an example where one of these stocks is a riskier investment than the other, even though they have precisely the same standard deviations. One company may be actually near default because it owes too much debt, which it cannot pay the interest on. Such investments may have a slight standard variance but very high actual risk. However, the advantage of the Markowitz model is straightforward: if your estimation is accurate, then your Markowitz model is more accurate than the other models. The Markowitz model is relatively straightforward. If you have calculated all the required estimates, you run the model, and you obtain the allocations into each

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stock, and you can judge if the proposed portfolio is meaningful. I can bring a good example from my personal life illustrating this.

My brother was ready to invest, but he had difficulty choosing among several stocks. He used this Markowitz method to calculate the variance and standard deviation of the stocks. Although he had to spend some time estimating the model, the results it produced were beneficial to him, allowing him to correctly select the correct stocks and amounts to invest in. Not all investors know how to use the Markowitz model to invest in stocks. In reality, we can say that the Markowitz model has already played a role in China's stock market. It has helped some investors analyze investment returns and risks and promoted the development of the stock market. However, we should not rely on it entirely in the applications and let it just be one of the tools that assist us in rationalizing our investments. In summary, the Markowitz model quantified risk for the first time and greatly contributed to portfolio management and risk management.

After the Markowitz model was introduced and its drawbacks and limitations were understood, the Index model was introduced. The advantages and disadvantages of the Index model from an investment perspective, as well as its practical application, will be attempted to analyze in this work. The single Index model has an obvious advantage when we come to investing. Its application leads to a significant reduction in the number of estimates needed for portfolio optimization, which makes optimizing large portfolios possible. When we use a single Index model, it is simply not as computationally intensive. This is an obvious advantage. The above analysis shows that the Index model divides the risk premium of individual securities into the market and non-market parts, which significantly simplifies the investment analysis. The simplification of the Index model is significant for analysts to do securities analysis. It is challenging for security analysts to estimate security covariances across industries. In our view, the Index model gives an easier way to calculate the covariance because the covariance of the security is derived from the influence of the same market index. Of course, everything has its advantages and disadvantages. Let us analyze the disadvantages of this model. When applying the Index model to investment analysis, this model has the limitation of asset return uncertainty structure. For example, we did not consider industry factors in our investment analysis. For example, they will affect some industries linked to world events and politics. In reality, the Index model has been used extensively in hedge fund portfolios to help investors maximize returns and minimize risks; it helps investors correctly grasp the direction of obtaining better returns or reducing risk. After the above analysis, we can conclude this. The Markowitz model and the Index model have a strong connection; these two models have their characteristics, advantages, and disadvantages. The Markowitz model is challenging to calculate, and all the stocks' variance and covariance need to be calculated. This disadvantage makes the Markowitz model not widely used in practical applications. The advantage of the Markowitz model is that it is straightforward, and if you get your estimates right, it is pretty accurate. Compared with the Index model, the Markowitz model does not ignore some seemingly unimportant factors; the Markowitz model can give better results than the Index model. Compared with the Markowitz model, the Index model requires less computation under the same conditions; it can be used more in actual applications for large portfolios. The results from the Index model may not be as accurate as those from the Markowitz model. However, it is much easier to calculate, and the Markowitz model gave accurate results, but a large amount of data caused estimation errors that may offset the accuracy benefit. Both models are good models with their advantages. In daily investment, other methods can also be integrated for investment analysis.

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The Analysis of the Factors That Influence the Purchase of Sports Brands by Chinese College Students

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Abstract: Sports have been thriving in China since the two Olympic Games were held in Beijing, notably with the growing prominence of Chinese college students in the global sports consumption market. Currently, there is still a dearth of research on the factors that affect consumption in this population. This study investigated the classic international sports brands represented by Nike and the local new sports brands represented by Li-Ning. The author uses the 4P, STP, and SWOT analysis methods in management to clarify the purchase motives of Chinese college students for sports brands. The results of the interviews revealed that Chinese college students take many factors into consideration when choosing sports brands, such as cost performance, comfort, style design, brand effect, celebrity endorsement, etc; most of the students thought that cost performance and comfort were the key factors; Chinese brand Li-Ning and American brand Nike were widely welcomed among Chinese college students due to their high-cost performance, higher comfort, superior appearance design and other advantages.

Keywords: sports brand, Chinese college students, consumer market, Nike, Li-Ning

1. Introduction

College students have gradually become major consumers in the sports market due to the acceleration of globalization and the market economy, the emergence of different sports brands and the overall improvement in consumption ability. Clarifying the drivers influencing the group's consumption from the perspective of users is conducive to the timely adjustment of the market positioning of sports brands and the growth of college students' participation in the sports market. Firstly, the author analyzed the current situation of sports brand consumption and brand preference of Chinese college students as well as developed hypotheses through existing materials and information. Secondly, the author interviewed 10 Chinese college students to explore the potential driving forces behind their purchases of sports brands. The study aims to advance pertinent studies of the sports brand consumer market, and provide a reference for sports brand marketing initiatives.

2. China's Sports Consumption Market

Driven by the upsurge of nationwide fitness programs and the Healthy China Initiative, the population of sports fitness in China has soared in recent years, and the consumer demand has increased. The

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Chinese sports consumption market has been growing, with the young Chinese group represented by college students being the major consumer group today.

2.1. Hot-selling Sports Brands

China's sports consumption market is now witnessing a diversified development trend. On the one hand, products of international first-line consumer brands represented by Nike and Adidas are popular all over the world with a massive production scale, including clothing, footwear, sports equipment, etc [1]. On the other hand, some well-known local sports brands represented by Li-Ning, Anta and Tebu, have already built a huge retail distribution channel market and supply chain management system and developed e-commerce with excellent brand marketing design, manufacturing, distribution and sales capabilities, despite having a relatively short history of development. The international popularity of domestic sports brands has been further enhanced since the Beijing Olympic Games [2].

The author investigated the popular sports brands Nike (America) and Li-Ning (China) using 4P and SWOT analysis methods in this part.

Table 1: The comparison between Nike and Li-Ning through the 4Ps analysis.

Brand	Product	Price	Promotion	Place
Nike	Cutting-edge sports products Sports shoes patent [3] Fashionable appearance Diversified products	Be more expensive in China or other countries Be affordable in America	Grow to the mass market for ordinary consumers from the athlete-exclusive shoe market Foster brand loyalty via idol worship Utilize animation and computer games to approach teenagers and children Emphasize self-awareness and value to win women's heart	Be not directly engaged in retail and wholesale Product business online and offline selling
Li-Ning	Fantastic look Wide usability	Excellent cost performance The best choice among products at the same price	Sponsor events Collaborate with online celebrity players and professional athletes to jointly design products	Online shopping Stores at home and abroad Different purchasing methods for online and offline shopping

The series that Nike introduced has its own distinctive features. Nike is more expensive than Li-Ning, and its marketing tactics are more diversified. Both use the online and offline modes simultaneously. Overall, Nike's product marketing strategy is more mature.

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Table 2: The comparison between Nike and Li-Ning through the SWOT analysis.

Brand	Strengths	Weaknesses	Opportunities	Threats
Nike	High brand awareness; High customer loyalty; High market response capacity; Great financial position; Strong R & D team; Good corporate image; Powerful marketing network;	The diversified operation started late; Lack women's clothing, sandals and slippers; Product factories in the far east region suffering from disasters and the impact of the financial crisis;	The rise of people's health consciousness; Income increases in populous countries and regions, such as Asia;	Intense domestic and foreign business rivalry The US economy has seen slow growth, a recession, and the threat of war; Changes in the consumer preferences of the young; Fluctuations in foreign currency exchange rates and interest rates; Inflation and the financial crisis in Asia and the far east; The adverse effects of import and export regulations;
Li-Ning	Excellent resources and brand awareness; Ideal management system; High cost-effectiveness; Sponsor of sporting events and teams; relatively localized supply chain	Inaccurate market positioning; cheap products are very impressive; poor brand promotion;	Enhance the communication between consumers and the company; Assume social responsibility;	Vigorous development of existing international and domestic sports brands; The updated public relations policy;

Nike made a $400 million investment in R&D as early as 1981 [4]. Nike has unrivaled advantages in terms of consumer loyalty and market reaction due to its patented revolutionary goods. With the rise of people's health consciousness and the increase of per capita income in Asia and other countries and regions, Nike still has great development potential in the future. The fierce competition from similar brands at home and abroad, fluctuations in foreign currency rates, price inflation in Asian factories, and financial crises are the greatest threats to Nike. For instance, Nike's extensive supply chain in various nations entails more external risks than Li-Ning's relatively local and stable supply chain.

2.2. Popular Sports Brands

The author investigated the consumer market for the hot-selling sports brands Nike (US) and Li-Ning (China) using the STP analysis method in this part.

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Table 3:The comparison between Nike and Li-Ning through the STP analysis.

Brand	Segmenting	Targeting	Positioning
Nike	Young people who love sports and pursue fashion; White-collar workers with incomes; Sports enthusiasts with different incomes, from different groups and at different professional levels;	Young people who have a passion for sports and fashion; Middle-and high-income people keen on sports	Nike's advantage lies in its R&D investment and brand recognition in terms of the positioning of its core competitive advantage;
Li-Ning	Male students between the ages of 14-25 years old	Sports brand for the youth;	The company occupies a significant position in the middle and high-end Chinese sports goods market, and is progressively entering the high-end market.

The average price of Nike is around RMB 1,000, which has a specific threshold for consumers. Li-Ning is more appropriate for young people, whereas Nike's customer groups often have greater requirements for products. Additionally, Nike enjoys more advantages and popularity in the international market than Li-Ning.

3. The Influencing Factors of the Purchase

3.1. Consumer Group Characteristics of Chinese College Students

As a major consumer group in the sports market, Chinese college students' consumption behavior is influenced by the emerging online consumption culture [5]. According to a survey released by iiMedia Research in July 2021, the annual consumption scale of Chinese college students is anticipated to exceed RMB 700 billion in 2021, with enormous consumption potential [6].

High price-sensitive consumption. Chinese college students prioritize quality and are relatively sensitive to price, and they tend to choose cost-effective products and consumption methods. More than 60% of the surveyed college students by iiMedia Research mainly prioritize quality and price when shopping, while more than 40% will focus on promotional activities and brand recognition [5].

Premature consumption. Excessive consumption is the primary factor causing campus loans, as well as one of the fundamental factors affecting consumption habits [7]. With the popularity of various small loan services such as Huabei on the Alipay platform, college students' excessive consumption is becoming increasingly prevalent today. According to iiMedia Research, 54.9% of college students prefer premature consumption, and 11.9% of them have the habit of excessive consumption. Nearly 40% of the college students who engage in excessive consumption spend RMB 500-1,000 impulsively per month.

Image consumption. The consumption concept of college students has evolved with the change in the social environment over time, and the current consumption behavior often highlights their personality and self-pursuit[8], thus the image consumption of many college students has increased significantly. One survey of iiMedia Research demonstrates that more than 70% of the college students spend more than RMB 500 on clothing every semester, of which "RMB 500-1,000" accounts for 37.1%, and "more than RMB 5,000" accounts for only 1% [5].

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3.2. The Factors That Influence Chinese College Students' Purchase of Sports Brands

3.2.1. Research Method

The research adopted the interview and the purposive sampling method with a sample of Chinese college students. The author recruited interviewees in the community on September 17, 2022, and examined the influencing factors of their purchase of sports brands through interviews.

There are 10 participants in total, including 5 males and 5 females (listed in numerical order, beginning with "A"). See Table 4 for details.

Table 4: Basic information of respondents.

Number	Gender	Grade	Is your major related to sports	Monthly living expenses range	Frequency of buying sports products
A1	male	sophomore	yes	1,000-2,000	3-4 months
A2	male	junior	no	3,000	1 month to 2 months
A3	female	sophomore	yes	2,000	6 months
A4	male	freshman	yes	2,000	4-5 months
A5	female	sophomore	no	2,500-3,000	2 months
A6	female	senior	no	20,000-40,000	2-3 months
A7	female	sophomore	yes	3,000	5 months
A8	male	junior	yes	4,000-5,000	5-6 months
A9	male	sophomore	yes	10,000-20,000	1 month to 2 months
A10	female	freshman	no	5,000	5-6 months

3.2.2. Research Design

Based on a review and summary of the available literature, the author designed the interview questions as follows:

What is your gender?
What is your grade?
Is your major related to sports?
What is your monthly living expenses range?
Which kind of sports brands—domestic or foreign—do you prefer? Why?
List your top three favorite sports brands. Why do you like them?
What channels do you usually use to get information about sports brands?
How often do you buy sports brand products? Why?
What price range do you purchase sports brand products in?
What factor will you prioritize when you buy a sports brand product? Why?
Which of the following features of sports brand products most appeals to you: cost performance, comfort, style design, brand effect and celebrity endorsement? Why?
When do you usually buy sports products? Why?

The author prepared 12 questions in advance for the interview. Due to the constraints of face-to-face contact in the context of COVID-19, the author's interviews were all conducted through one-to-one chat through the voice or text chat function of the online instant chat tools QQ and WeChat. After obtaining the consent of the interviewees, the author recorded or typed the whole chat content. Following the interview, the author sorted out and summarized the chat texts and audio recordings to offer concise and accurate responses to all the questions.

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4. Conclusion

The main results were as follows:

Most of the participants believe that cost performance and comfort are the most important considerations, one possible explanation for this is that the interviewees are college students, with monthly living expenses ranging from RMB 2,000-3,000 (or RMB 10,000 for a few students). With the majority of sports brands being used for exercise (mostly in class or occasionally exercise), as well as the average purchase frequency of 3-4 months, cost performance and comfort are their top priorities.

Chinese brand Li-Ning is popular among Chinese male college students because of its high-cost performance and certain comfort advantages. Additionally, Li-Ning has also experienced a rapid rise in recent years due to its use of web celebrities' selling goods, and endorsements, as well as new technologies in its products, such as "Li-Ning bow", "Cushion" and other core technologies [9]. Furthermore, it has opened up a significant number of offline stores and online purchase channels. Li-Ning has emphasized ingenious design, incorporates a variety of cultures to increase the buyer's cultural identity, and combined with the public's preference to increase the buyer's sense of affinity in terms of the appearance and interior. The Nike brand in the United States relies more on its strong brand influence, celebrity endorsement, and its new and updated technology and superior appearance [10]. However, due to its relatively high price in China, and its products' poor compatibility with Chinese body size/foot type, the purchase rate was relatively low among the male participants. The female respondents were more willing to pay for brands, celebrity endorsements and appearance, and they prefer brands like Lululemon, Nike, and FILA. These brands focus on the development of women's sports groups as well as diversified designs. Combined with women's sports style and needs, they try to design popular sports products for women according to women's body shape (foot type) and women's consumer psychology, taking into account the star effect simultaneously. There are both similarities and differences when comparing male and female respondents. Future sports brands are suggested to take into account a better combination of the two for the market of Chinese college students.

Chinese college students would take several factors into account when buying sports brands including high-cost performance, the comfort level of sports products (fabric material, performance, etc.), appearance design, celebrity endorsement, and brand effect. The influencing factors are more in the product itself. At the same time, the research in this paper also has some limitations. Only 10 college students were randomly selected as samples in this interview, and the investigation intensity and coverage are not large. In future research, we can also increase the number of samples and interview questions and increase the scope of data and the accuracy of research to a greater extent.

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A Comparison of Market Economy and Planned Economy: Based on German Democratic Republic and Federal Republic of Germany

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Abstract: The economic confrontation between East and West Germany is one of the key topics. Researchers have reached a consensus that the market economy of the Federal Republic of Germany (FRG) is more superior and more realistic than the planned economy in German Democratic Republic (GDR). However, the research still lacks a persuasive explanation about the deep and essential reason why market economy is better than command economy. Also, there are debates about the practical application and future extension of two economic formats. Thus, the study allocates and compares the international relations, important statistic and divergent economy systems of two Germanies, attempting to address these research gaps based on the fait accompli in GDR and FRG. The research outcomes illustrate that in all three domains did market economy in FRG overwhelmed planned economy in GDR, while the command economy also showed strength in particular areas. The outcome of the research indicates that market economy is more superiors and more functional in a macroscopic aspect than planned economy. To be specific, market economy obtains the strengths of developed productivity, a free market with countless chances, the opportunities to compete freely with high rewards and the ability of continuingly creating wealth to the society, while planned economy protects and promotes the equivalence of the distribution of social wealth. Based on it, the emergence of a highly integrated economy is forecasted, which is a combination of market economy and command economy but the main part is market economy.

Keywords: international relations, important statistic, divergent economy systems, GDR, FRG, market economy, planned economy, practical application, future extension

1. Introduction

In 1989, the Berlin Wall collapsed, which nominally symbolic the re-unite of Germany. Until today, the debates and arguments about GDR and FRG are continuing, as these two Germanies represented two diverse political camps and two divergent economic systems, which is still meaningful to the politically ideological confrontation nowadays, the socialism versus capitalism or the market economy versus the planned economy didn't flee with the end of the cold war. On the opposite, the direct confrontation transformed to integration of two economic systems, where the confliction is that

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whether market economy or planned economy should dominant the whole system with its opposite to play an assisting role. Considering the empirical fact of GDR and FRG, in 1989, the failure of GDR in economy seemed to be unstoppable. As the most economic successful country in socialism camp, with highly support by Soviet Union directly, the speed of development in economy of GDR was still far behind FRG. Furthermore, from 1980 onwards, there was a clear economic fatigue in East Germany, with a declining trend of individuals' standards of living. Based on the fact, researchers conclude that market economy is more superior than planned economy. However, the conclusion is too subjective as the international background and economic basis of two countries are quite different, which are two decisive factors to impose impacts on the outcome. How to prove that market economy should be the dominant drive of the economy? What can we conclude and apply to the modern international relations? What progress might be achieved on the future economy? To address the research blanks, the study concentrates and compare the economy with the background in three dimensions. In respect of international relations, the study compared the policies of US to FRG and the policies of Soviet Union to GDR, as the confrontation of East and West Germany was essentially the confrontation of socialism camp versus capitalism camp. Some vital statistic about the economic foundations of two Germanies were also given in the study. Particularly, the study concentrates on the comparisons of economic systems, which is extended by revealing the fact that two economies are not purely single economic system. The ultimate objection of the study is to prove the unassailable superiority of market economy over planned economy currently, which could bring out some ideas and thoughts about the future economic system as an evolved integration of market economy and planned economy. Particularly, the outcome of the study reflects that the integrating economy is a combination, while the dominant part is still market economy.

2. Description of Planned Economy in GDR

2.1. International Relation

With the failure of Nazi in WWII, Germany was divided into two countries, representing two opposite ideological camps respectively. On October 7, 1949, German Democratic Republic was established on the occupation land of Soviet Union. As the Iron Curtain speech given by Churchill, the temporary cooperation between Soviet Union and western capitalist camps collapsed, with ideological confrontation replacing by. As a satellite country of Soviet Union and vanguard of cold war, East Germany was bond to the responsibility to construct a developed economy to prove the legitimacy and incontrovertible correctness of planned economy. Consequently, the international relation of GDR was restricted to only socialism camp, which leaded to the exhausting place of the GDR economy at the ending period of its regime. The trade with western capitalism camp was halted, with clear orders and supplies from Soviet Union and the socialism camp. Former flexibility of the industrial structure was blocked by the western world, which brought out the falling of technologies to some point.

However, the critical geographic position of GDR didn't turn out as a bargaining chip for better treatment as a defeated country. Since Soviet Union was drastically damaged in WWII, the claim policy from it is correlative to the ethnic hatred correspondingly. It claimed a compensation of more than 10 billion dollars from Germany, (mostly from East Germany and partly from West Berlin). It is estimated that Russians removed about 1,300 industrial factors and more than 4,500 kilometers of railway, which considerably attacked the basis of industry and economy in GDR. It is stated that at the beginning of the cold war, individuals in GDR were imposed on debts about 2,500 marks per capita [1].

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2.2. Important Statistics

The area of GDR is 41,828 mi², with a population from about 18.3 million in 1950 to 16.7 million in 1980 [2]. The personal income per capita of GDR is 6,000 dollars, with the rate of personal owned cars being less than 50%. It is given that in 1971, the average height of men in GDR went on 173 cm of female was 165 cm [3].

2.3. Planned Economy

Similar to the economic system of Soviet Union and the socialism camp, GDR had a command economy (planned economy), which means that decisions made on investments, production, distribution and pricing are from the order of government or an authority [4]. The establishment of planned economy sincerely contributed to the recovery of the economic structure in GDR. From 1950s to 1960s, the economy in East Germany maintained a stable increasing rate of 7% each year, which is not lasting as the authority neglected the significance of the Light industry and handicraft industry. After abolishing the rationing system, the economic development in GDR became slower. From 1950 to 1980, GDP per capita in East Germany increased from 2,500 dollars to 9,000 dollars, while it reached a plateau from 1980 onwards, at about 9,000 dollars.

3. Description of Market Economy in FRG

3.1. International Relation

As a response to the socialism camp, Federal Republic of Germany, on behalf of the capitalism camp, was established on May 23, 1949. It rose on the occupational land of France, UK and USA. As a result, it plays the role of the vanguard between socialism and capitalism. The original intension of America was to build a so-called high fence halting the potential ideological invasion from Soviet Union. But how is that possible in a defeated country with numerous debts to be paid? The most necessary affair is to recover the economy in west Germany in order that it is capable to play the political role and economic role, which is to defeat Soviet Union along with the socialism world by proving the correctness and the priority of market economy and capitalism. In a word, the restore of an economically developed FRG is the key to win the cold war.

Accordingly, Marshall Plan was promulgated by US, which considerably release the economic burden of FRG. It is estimated that FRG received about 1.5 billion dollars in total and precious technological aid through this plan and the economic trade with countries in the capitalism camp. The industrial foundation was recovered miraculously in a few years after the WWII. It is also claimed that at the beginning of the cold war, individuals in FRG obtained approximately 140 marks per capita [1].

3.2. Important Statistics

West Germany was integrated by the occupational lands from US, France and UK, accordingly the area of it went on 96,030 mi², the population was approximately from 50.9 million in 1950 to 61.4 million in 1980, which shown an upward trend. In 1983, the personal income per capita of FRG is 8,000 dollars. It is estimated that in 100 persons in FRG, the ratio of personal owned cars reached more than 90% [2]. Another research showed the biological standard of living in FRG [3]. In 1971, the average height of men was 175 cm, with female on 167 cm.

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3.3. Market Economy

With aid from external trade and proper inner policies, FRG fulfilled Wirtschaftswunder (economic miracle) on the ashes of WWII by instituting its unique social market economy. The GDP per capita soared continuingly at 5,000 dollars in 1950 to 22,500 dollars in 1989 as a reflect. In particular, the social market economy must be distinguished with the traditional pure market economy. The broad definition of market economy is that the decisions on production, investment, and distribution are taken according to the market forces [4]. Compared to it, the social market economy in FRG mixed with ingredient of planned economy, which means that the capitalism in FRG has more direct regulations from government, along with the bigger proportion of stated-owned economy in the markets. With the regulation from the authority and the self-pushed market system, economy in West Germany is lasting till the reunification of Germany.

4. Comparison of GDR and FRG

GDR is radically opposite to FRG in almost every aspect delivered. Diverse international relations, distinct initial conditions, various kinds of economy and different agricultural strategies. Compared to GDR, FRG had a much better initial conditions in economy and industry. Soviet Union destroyed the industrial base in GDR while US and its allied countries aided FRG to restore its industry rapidly. GDR's international trade was limited while FRG could freely have transactions with the most developed countries in the world. Also, when every citizen in GDR had to pay a debt for 2,500 marks per capita, individuals in FRG acquired a supplement of 140 marks per capita from the Marshall Plan.

The basic statistics of two Germanies are diverse. Compared to East Germany's area of 41,828 mi^2, West Germany owned 96,030 mi^2 of land. From the comparison of the population quantity from 1950 to 1980 in each country, it is concluded that FRG was experiencing a period of moderate increasing in population, while in GDR, the population declined in 30 years. Also, from the research, it is clearly stated that the biological standard of living of FRG is better than GDR both in men and female as the figures of FRG's average height is higher than in GDR.

GDR and FRG were established in different background with diverse economic system. GDR had a typical planned economy on the structure of Stalin's mode, while a unique social market economy was promulgated in FRG, which correspondingly brought out comparative outcomes. At the very beginning, panned economy in GDR drew market economy in FRG as both two classifications of economy achieved a rapid economic development. Nevertheless, the increasing speed in GDR got slower and slower while the market economy in FRG continued to maintain a significant speed. The figure 1 and figure 2 show that from 1950 to 1980, the GDP per capita in FRG served as a leading role, being ahead of GDR about 2,500 dollars in 1950 to 13,500 dollars in 1980. In particular, both market economy in FRG and planned economy in GDR were integrated, as the economy in West Germany concluded a mare part of regulation from government instead of market itself. By contrast, East Germany also abolish the rationing system, which was a main part of planned economy.

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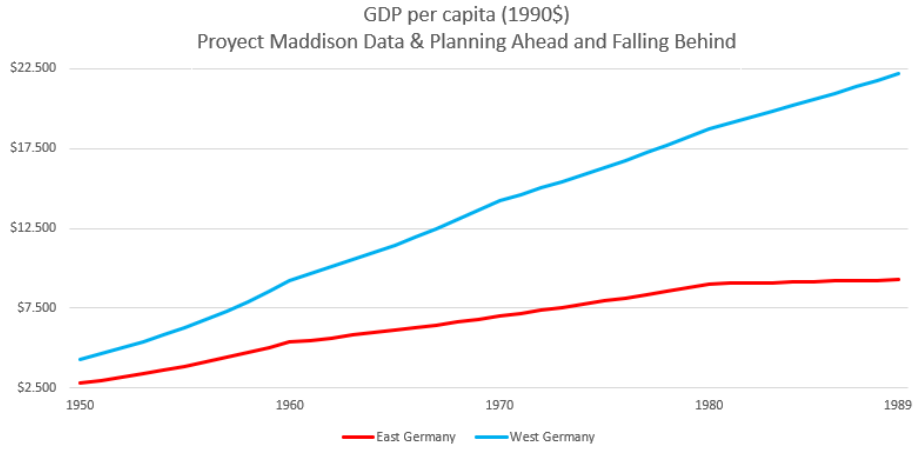


Figure 1: GDP per capita [5].

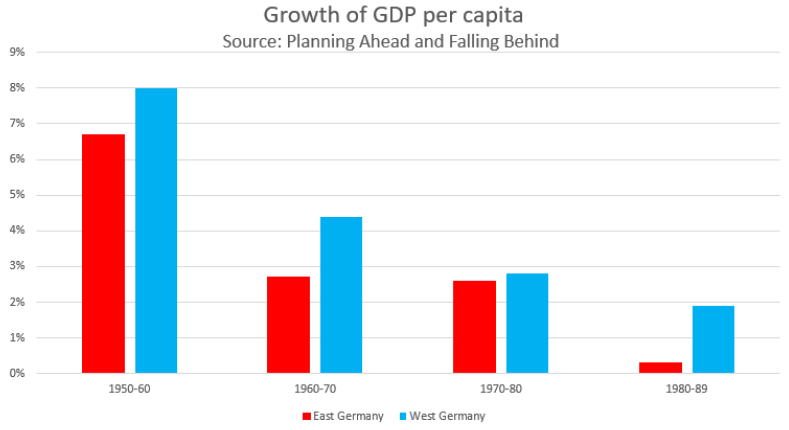


Figure 2: Growth of GDP per capita [6].

To sum up, in 1949, the initial conditions of FRG including industry, economy and external trade position in the world were much more superior than GDR, which is sincerely attributed to the completely divergent policies from the capitalism camp and socialism camp and their different roles in cold war. To prove the priority and correctness of the economic systems respectively, ideological confrontation pitted social market economy in FRG representing the ideology of capitalism versus command economy in GDR representing the ideology of socialism. Looking back to the competition these days, we can conclude that the social market economy defeated its opponent in every respect, as the economic road implemented in FRG is a sustainable way to drive the economy, with the improvement of the standards of living of individuals. It should be emphasized that the planned economy in GDR is far from useless as it also recovered economy in an extremely difficult situation, while the problem is that the fully controlled economy by government could hardly ever lead to the achievement of economic targets, as it would fail in deciding the consumer preference, surplus, and shortages in the market. As a consequence, the GDR's government ignored the importance of the light industry and handicraft industry, being far behind of FRG in economy.

Such empirical example leads to a theoretical conclusion: Is it not persuasive to conclude that the mainly planned economy is less correct and less scientific compared to the mainly market economy since the initial condition of two countries were divergent? What is the enlightening significance and influence of the economic confrontation between East and West Germany? Is it possible to combine

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the strengths of the market economy with the strengths of the planned economy and merge and coexist to create a new economic system in the future?

The first question is posted since it seems not unassailable based on the fact of GDR and FRG as FGR had a more superior conditions to rebuild economy, which imposed a vital impact on the outcome. However, the resources at the binning could not the dominant factor in modern economy. As proofs, Singapore, Japan and South Korea achieved economic miracles respectively, with a fact that they are all small countries lacking raw materials and other economic basis. The starting conditions of these countries were similar to GDR, while the outcomes were completely different. At a more macroscopic level, market economy versus planned economy can be concluded as objective truth versus subjective willingness. The reason is that planned economy operates according to plans drawn in advance by the state or an authority, while market economy operates on the market forces, which is based on demand and supply. Then there is an obvious problem about planned economy, how to ensure the correctness of the so-called plans from the authority? In another words, the problem of planned economy is "planned" itself. Economy is not a game that can be foreseen the steps and the roads, only following the scientific objective truth can lead to the success of economy, which means that the planned economy could not be the dominant economic factor, or it would unavoidably lead to failure at last. To sum up, the mainly market economy is more superior to mainly planned economy in a scientific aspect through the comparison of GDR and FRG.

Of research two typical economic classifications is significant to modern economy and globalization nowadays. From the success of FRG and the failure of GDR, we can conclude that the economy dominated by market economy is the current best way to develop economy, with two main reasons to prove the thesis. First, the nature of market economy is open and comprehensive as market economy requires a free market. The wider scale of the market, the bigger interest would be generated by a dominant market economy, conforming to the trend of globalization. On the opposite, the planned economy naturally tends to be conservative and tends to have blocked internal economic circulation, which is worse in 2020s. For instance, North Korea blocked itself with external world with a highly backward planned economy, it subjectively missed the boat of development of economic globalization. With a free and open market, it would be common to have more opportunities to succeed. Consequently, there would be ample human resources to guarantee the productivity of the economy. It is stated that from 1949 to 1965, there were about 3 million immigrants from GDR to FRG [7]. Moreover, the open policies in West Germany also attracted more than 1 million workers from Western European countries. Particularly, the human resources sincerely affected the outcomes of two Germanies.

Second, market economy has a strength of protecting and promoting the equal chance of competition. At a macroscopic level, market economy strengthened the cooperation of countries and the benign competitions. It is emphasized by a research with statistic of a few countries in Western Europe that the productivity of FRG make considerable progress through the competition with its adjacent countries [8]. At a microscopic level, the establishment of a free market would also induce the competition of individuals, which would push the general economy in return. It is compared that in GDR [9], the dispersion of the wages of people was smaller than in FRG, most citizens share the same standards of living in GDR, lacking the competition on a free market. It is hard to find an extreme example of radical poverty, while it is also hard to obtain a high income in GDR. In FRG, the income dispersion is large, while it should be mentioned that with the general economic development, the lowest income in FRG was continuingly increasing from 1950 to 1989. In GDR, the propaganda of planned economy is to allocate the wealth equally, while it is hard to maintain a general economy without a free market, which could also reflect the downward trend of economy in GDR since 1980 and correspondingly the declining standards of living of citizens. In a word, there isn't progress without competition, there isn't wealth without a free market.

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As mentioned, the market economy is better at chance of competition, the ability to create wealth and construct an open and comprehensive atmosphere in society, while it is worse in the aspect of allocate wealth. Compared to it, planned economy acted better at centralizing the state power to focus on single economic objection and has a more average allocation system, while it lacks the indispensable vigour of economy to maintain its sustainable development. Therefore, it is necessary to merge a new economic system, with the strength of both market economy and planned economy. The social market economy of FRG could be a form of the "new economy". As mentioned, "The market economy's distribution via price, and social policy's distribution by means of state allocation, can be contrasted to each other as patterns of primary and secondary distribution" [10]. With a free market regulated by government in a restrained way, the wealth would be created, and the monopoly would be banned by the authority to prevent the inequivalence of the distribution of the social income. It is also mentioned that market economy is capable of continually producing and reproducing a surplus economy that concludes the entire economy, in the opposite, the planned economy is capable of continually producing and reproducing a shortage economy that concludes the entire economy [11]. These theories argue that both capitalism and socialism are essential in the drive of economy. Actually, they are complementary in economy. Nowadays, most countries in the world have a more or less economic form of combination of both two economy. Considering France, US and UK as entirely free market economies, they have relatively large numbers of state-owned enterprises, banks, and insurance companies. Social market economy with numerous private firms are existing in China, which is a socialism country. The tendency in the whole world is to combine market economy and planned economy to acquire the highest productivity and incomes. To sum up, the future new economy is predicted to be a combination of market economy and planned economy, while market economy would still be the dominant factor.

5. Conclusion

From the practical example of GDR and FRG, it is concluded that from a scientific and modern point of view, market economy has unassailable strengths compared to planned economy. First, market economy conform to the trend of globalization as the nature of market is the factor of openness and comprehension. Globalization is a entirely enhancement of market economy, while market economy is the essential condition of globalization. Market economy essentially is a form to obey the objective rule, which is the reason why it could boost the development of economy. By contrast, planned economy is more subjective as the nature of it is "plan", which is often proved false and not lasting. The fact is, the reality is always changing, it is impossible to make proper plan or so-called command in advance. The history has proved many times (including GDR versus FRG), that economy dominated by plans couldn't last to create wealth or promoting the productivity. Also, market economy entitles individuals to own various opportunities to compete and make fortune, which would incite and enlarge the scale of economy, increasing the standards of living of the entire society or country. In comparison, planned economy lacks the capability of competition, while it could address the problem of distribution in an equivalent way.

History is spiraling to upgrade and evolve. The experience of ideological confrontation in the past is likely to boost a new economy, which is dominated by a free market and assisted by regulations of plans from authority on the aspect of distribution.

The study addresses the research gaps on the controversies of the superiority of market economy and planned economy based on the empirical fact of GDR and FRG from a more comprehensive and more persuasive aspect. Moreover, the study focusses on the current enlightening significance of two economic systems and predicts the emergence of the new economy in future.

However, the study is defective as the argument of the future economy should be dominated by market economy lacks the practical and persuasive examples. There are still many successful

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countries with a economy dominated by plans from governments. In China, the social market economy is sincerely affected by the regulations and commands from the party, while it can still maintain the rapid economic growth for about 40 years. Therefore, future research in this topic should be based on the international outlines and use more specific and direct examples to prove and access the ultimate arguments.

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Analysis of Burberry's Marketing Strategy

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Abstract: Over the past decade, digital marketing has become essential to an organization's marketing strategy. As a leader in the luxury market, Burberry's digital marketing is the core part of its operation. It has successfully adopted digital marketing strategies to attract the younger generation. As a form of online marketing, it has enabled Burberry to build its brand image and revolutionize the marketing industry. The brand's digital marketing is reflected in its product design, campaign videos, creative content, and choice of marketing channels. This paper analyzes Burberry's digital marketing strategy and provides suggestions for the luxury industry based on Burberry's analysis.

Keywords: Burberry, digital marketing, growth strategy, brand image, co-branding

1. Introduction

Since the 21st century, most developed countries have entered the digital age. The time people spend online has become the new social paradigm, and the time people spend in virtual space has gradually erased the boundary between real and virtual life, accelerating the trend of entertainment life and business branding into the digital age. A company's image can be strengthened or shattered overnight in the digital age. The Internet allows companies and consumers to achieve more direct communication, and establishing a particular connection with a wide range of users through online platforms is just a new starting point for marketing [1]. Many brands have concluded that they should take advantage of the marketing prospects in the meta-universe and thus have started experimenting with brand marketing. Brands like Nike, Disney, Snapchat, and Facebook are building virtual communities and providing virtual content to expose people to the fashion and art world.

As one of the industries most concerned with brand image, the luxury industry is now also moving towards digital marketing. Burberry is one of the first luxury brands to join the digital trend. While digital is gradually becoming a growth driver, digital marketing expands the brand's reach and attempts to capture the attention of its audience [2]. Extensive digitalization is affecting and changing the entire value chain of luxury brands. The attitude of luxury brands towards digital transformation has changed from "hesitant" to "fully embracing," and they are constantly iterating their services and online service experience. AR, 3D, and other digital technologies are also becoming increasingly popular in the interaction between luxury products and new audiences online [3]. It is convenient to buy luxury goods online without losing the sense of prestige so that people can get almost the same exclusive services and standards as offline brands. Currently, consumers in the luxury industry are iterating generation after generation, providing new growth drivers. Meanwhile, digital transformation has accelerated recently, and e-commerce and NFTS continue to grow. This

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paper will analyze Burberry's digital marketing strategy and provide further suggestions for developing digital marketing in the luxury industry.

2. Analysis of Burberry's Digital Marketing

2.1. Overview of Burberry Company

Burberry was founded in England by Thomas Burberry at the age of 21. The founder's original intention was to design clothing that would protect people from the dreary British weather. As a result, Burberry is a symbol of classic upper-class British style. Perhaps the most iconic of Burberry's products is British leather, whose iconic checkered print helps define the brand's image in popular culture. Burberry applied for a registered trademark for the classic check pattern in 1921, and the design has been closely associated with the brand. The check consists of a beige background with interlocking black, white and red stripes, and today the design is one of the most recognizable patterns in the world [4].

With 421 stores worldwide, Burberry is present on all except Antarctica's continents and has a significant following in Europe and Asia. Their stores are designed to provide a luxury store experience while improving customer service. Over the years, Burberry has mainly focused on self-promotion through digital channels. The company regularly launches new campaigns and uses various types of promotions. For example, they placed ads in premium magazines, TV, billboards, and other places to target specific demographics. Burberry also recognizes the importance of social media marketing and has signed up national brand ambassadors and several celebrities, including Kate Moss and Agnes Dane, to promote their products [5]. The use of digital technology was a critical factor in the success of the promotion.

Throughout the digital channel, Burberry's goals are consistent. People can now buy online, pick up in-store, place orders in-store via Burberry.com, and access a unified shopping cart on mobile and desktop devices. In addition, with synchronized channels, Burberry can more easily access new markets, including Japan and Korea, and use social media platforms for online shopping.

2.2. Product Digitization (Virtual Products)

The intersection of the real and the virtual has been the most important social phenomenon in recent years. The virtual world is becoming a part of the consumer's life scenario, and the fashion industry has been picking up on this trend for a long time. In 2021, Burberry and the popular game "Glory of Kings" launched two skins of the famous hero character "Yao," using the classic Burberry check pattern that is well known in the market, which generated much attention in social media. This is the first time that "King of Glory" has jointly launched hero skins with a luxury brand, both designed by Burberry's creative director Riccardo Tisici.

From Burberry's perspective, this collaboration is not about selling more game skins for profit but essentially a marketing campaign to build the brand's image in the Chinese market, clearly targeting the wide range of young users in the local Chinese market who may not be loyal users of luxury fashion brands but are interested in fashion elements and topics. As a result, Burberry succeeded in mobilizing the interest of this segment of consumers.

2.3. Digitalization to Open up Marketing Channels

At present, luxury brands have substantial control over all aspects, from design, production to sales, and the proportion of direct sales channels is expanding. In addition, the epidemic has driven the transformation of channels in the luxury industry, and online channels have become the new frontier for brand marketing, bringing new customer increments. As a result, luxury e-commerce has

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made significant progress in the past two years.

The primary luxury goods market is mainly divided into online and offline channels, among which offline channels include travel retail, department stores, specialty retail, and single-brand stores. However, the offline channel was severely hindered by the impact of COVID-19. However, the online channels in the primary market were not affected by the epidemic, mainly including sales on the official website and self-operated, franchised, and wholesale e-commerce platforms.

Burberry has a strong digital team, with content shared on platforms and mobile devices created in-house. Burberry was the first brand to use Snapchat to promote its men's fragrance and beauty line, Mr. Burberry. In addition, Burberry launched its Facebook page in 2009 and was one of the first luxury brands to use the social network to promote itself. Facebook is Burberry's most popular account and has attracted 17 million followers. They use Facebook's live streaming feature to share product events, backstage content, runway clips, announcements, and store openings. They even have a solid online presence on YouTube, Instagram, and Twitter [6].

Last year, Burberry created the official Twitter account @BurberryService to provide customer consultation services, and Burberry also ran a Twitter buy button at the 2014 fashion show to make mobile purchases instant. The Twitter account has also been rolled out to several different international locations.

YouTube has worked remarkably well in its digital marketing. For example, Burberry posts videos of different products, events, and behind-the-scenes footage on YouTube, and Burberry has created some great unique content. With over 100,000 followers and hundreds of thousands of plays, it continues to grow in popularity.

2.4. Digital Interaction to Enhance Brand Promotion

Burberry has created an outstanding online consumer experience through social media and its website. Moreover, he has been innovative in his approach to digital, building a fashion website that includes digital content and drives e-commerce. Burberry has also designed unique digital content that allows consumers to interact with the brand, offering customization opportunities to match the tastes of younger customers. Burberry has also created Art of the Trench, a community where users can upload photos of themselves in their daily lives wearing Burberry trench coats; the company invites photographers and trench coat owners to participate, putting the consumer at the center of the brand and then adding the best-submitted photos to the site. Users can then comment and share the photos, attracting thousands of users [7].

3. Some Suggestions for the Luxury Industry Based on Burberry's Analysis

3.1. Combined with Digital to Vigorously Develop Co-branded Products

Every luxury brand has strong brand potential and a high-quality raw material origin. There is also a brand history of more than 100 years, family handcrafted, craft heritage, texture optimization, etc. The strong brand power makes it a great luxury brand. Each luxury brand has its brand strengths, categories, and different commercial spaces. The brand alliance of joint promotion product customization has become an essential form of luxury brand promotion. Brands' mutual excavation and joint operation have become an essential form of "brand potential promotion."Luxury brands should continue building strong brand potential, illuminating industry-level brand promotion, and effectively combining brand promotion methods.

3.2. Utilize Social Marketing to Improve User Cognition

Popular in social marketing, many industrial-level brand planning and marketing have influenced

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industry brand management. The consumer value represented by sensation and consumer evaluation trial as a touch point amplifies the characteristics of luxury brands. As a result, social marketing will be more distinctive and fulfilling. Social marketing planning not only lights up the perception of luxury brands and enhances the visual feeling and experience resonance of users but also makes more users feel the brand value through text push and video feeling and makes more users feel the product features and brand sedimentation through audio communication and community activities [7]. In short, it is urgent to ignite brand social content, improve the accuracy of luxury content pushing and fully light up the user feeling in social marketing [4].

3.3. Use Digital Technology to Drive Brand Experience

The application of digital technology enhances users' consumption experience, enabling them to deeply perceive the quality of luxury goods and feel the fabrics, artistry, and characteristic craftsmanship of luxury goods with a high-quality touch. It also makes sense of the value of luxury brand planning more prominent and gives a firmer grip on the marketing planning of the luxury industry. In addition, better fabric experience, value presentation, product features, etc., give users more brand awareness [5]. The application of digital technology makes luxury brands more intimate and attentive.

In short, it is urgent to continuously integrate into the wave of digital technology iteration, innovate digital brand experience, and strive to enhance the digital interactive perception of luxury goods. The high-quality brand value refreshes the user's perception and makes the brand interaction more valuable to the industry [1].

4. Conclusion

Burberry is a fantastic brand with a strong presence in the luxury fashion market, and Burberry's continued focus on digital has seen its sales soar. This brand blurs the line between online and brick-and-mortar shopping and expects digital partnerships to be a key source of future growth for the luxury industry. Across the digital landscape, Burberry is investing in building an omnichannel presence, the Burberry app, and using data and analytics to help the brand thrive in the new digital ecosystem. In addition, the brand will curate product and merchandise assortments that allow customers the flexibility to choose their preferred payment and delivery options, enabling them to switch seamlessly between physical and digital distribution channels. The brand will also create product categories that vividly illustrate the digital shopping experience through compelling product stories. In the future, it is hoped that Burberry will use digital to drive the brand experience, leverage social marketing to increase user awareness, and integrate with digital to develop a solid co-branded offering.

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ESG Evaluation in Automobile Industry

--Take Ford Motor Company and Tesla Company as Example

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Abstract: With the outbreak of natural disasters and extreme weather, people are paying more and more attention to protecting the environment and society. This society is gradually demanding more and more from companies. In this context, the new concept of ESG has emerged under the call of the United Nations. This article details MSCI's ESG scoring system and what it covers. Through the ESC scoring system of MSCI, this paper analyzes Ford Motor Company, represented by gasoline cars, and Tesla Company, represented by electric cars, to reflect the current development of environment, society, and governance in the American automobile industry. We found that the overall ESG development of the American automotive industry still needs to be improved. Companies should also strengthen the development of management social aspects and corporate governance while considering the development of environmentally friendly products.

Keywords: ESG, Tesla Company, Ford Motor Company, MSCI

1. Introduction

With natural disasters and global warming occurring more frequently around the world, more and more people are becoming aware of the importance of protecting the environment. The Intergovernmental Panel on Climate Change (IPCC) and more than 1,300 scientists from around the world predicted in 2016 that future temperatures would rise by 2.5 to 10 degrees Fahrenheit over the next century [1]. In 2004, the United Nations Environment Programme (UNEP) first introduced the concept of ESG investing, which focuses on the environmental, social, and governance aspects of business investment. In addition, other countries such as China, Germany, and the United States are experiencing an alarming increase in industrial volumes to meet the growing demand for consumer goods worldwide, accelerating the depletion of global oil reserves. Given the unsustainability of oil-dependent economic development, the rapid depletion of oil increases the call for renewable and diversified energy sources [1]. Then, the government begins to strongly encourage the emergence of environmentally friendly products such as bicycle sharing and new energy cars instead of gasoline cars.

In response to the government's initiative, ESG has gradually become an emerging investment idea and corporate action guide in financial circles in recent years. Compared to the original traditional investment philosophy, investors now consider not only the factors that generally influence investment decisions, such as the company's financial statements, market share, and growth prospects, but

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also the ESG aspects of the company, such as whether the company's products are environmentally friendly, whether the company contributes anything to society, and whether there is corruption in the company's management class. Another reason investors have started to focus on investments in ESG companies is that according to the report, during the Great Recession, the stock of companies with higher ESG ratings had higher returns, lower return volatilities, and higher trading volumes than that of companies with lower ESG rating [2]. Therefore, investors want to add the higher ESG investment option to diversify their portfolio risk and earn more return.

Driven by this trend, more and more companies in different industries are also focusing on their environmental, social, and corporate governance aspects development. As a result, the automotive industry's development is also receiving much attention. This article will analyze the differences in the ESG scoring system between new energy vehicle companies represented by Tesla Inc. and gasoline vehicle companies represented by Ford Inc. in the U.S. automotive industry and point out several possible directions for the future development of the (new energy) automobile manufacturing industry.

2. MSCI's ESG Rating System

This article uses the ESG rating system from MSCI Company to evaluate the ESG rating from the new energy automobile industry and the fuel automobile industry in the United States. MSCI is a US-based indexing company headquartered in New York City. It is a global provider of ESG equity, fixed income, hedge fund, and equity market indices. MSCI indices are among the most used benchmark indices by portfolio managers worldwide.

Based on the ESG rating system from MSCI Inc., A company's ESG rating can be categorized into seven levels, from high to low, AAA, AA, A, BBB, BB, B, CCC. The AAA and B levels represent the company's leadership in managing ESG risks and opportunities compared to other companies in the industry. Secondly, the grades of A, BBB, BB represent the company's mediocre performance in managing ESG risks with its peers in the industry. Finally, ESG ratings of CCC and B mean that the company is lagging far behind its peers in managing this risk.

MSCI's ESG scoring system covers ten themes and 35 key risk questions. The Environmental aspects are mainly considered from the four themes of climate change, natural capital, pollution & waste, and environmental opportunity. The Social aspect focuses on human capital, product liability, stakeholder opposition, and social opportunity. Finally, corporate governance and behavior are the two main topics evaluated in the Governance pillar.

Table 1: MSCI ESG environment evaluation framework.

Environment Pillar			
Climate Change	Natural Capital	Pollution & Waste	Environment Opportunities
Carbon emission	Water stress	Toxic emission & waste	Clean tech.
Financing environmental impact	Biodiversity & Land use	Packaging material & waste	Green building
Product carbon footprint	Raw material sourcing	Electronic waste	Renewable energy
Climate change vulnerability			

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Table 2: MSCI ESG social evaluation framework.

Social Pillar			
Human Capital	Product Liability	Stakeholder Opposition	Social Opportunities
Labor management	Product safety & quality	Controversial sourcing	Access to communication
Health & Safety	Chemical safety	Community relations	Access to finance
Human capital development	Consumer financial protection		Access to health care
Supply chain labor standards	Privacy & Data security		Opportunities in nutrition and health
	Responsible investment		
	Insuring health & demographic risk		

Table 3: MSCI ESG governance evaluation framework.

Governance	
Corporate Governance	Corporate Behaviour
Board	Business ethics
Pay	Tax transparency
Ownership	
Accounting	

3. ESG Evaluation and Comparison of Tesla and Ford Company

3.1. Overview of Tesla Inc. & Ford Motor Company

Tesla Incorporation is an American multinational electric vehicle and clean energy company headquartered in Austin, Texas. The company's major product businesses focus on three segments: electric vehicles, solar panels, and energy storage devices. According to the MSCI ESG scoring system, Tesla company is evaluated as A among 42 companies in the automobile industry.

Ford Motor Company is a famous American automobile company headquartered in Dearborn, Michigan. Ford is one of the world's top 500 companies. The company's core business includes designing, manufacturing, and selling high-quality cars, SUVs, trucks, and electric models. Based on the data from MSCI ESG scoring system, Ford Motor Company is evaluated as B among 42 companies in the automobiles industry.

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3.2. Evaluation of Environment Pillar

Tesla Inc. plays a leadership role in both Climate Change and Environment Opportunities. According to Tesla Inc.'s 2021 Impact report, Tesla achieved a cumulative 8.4 million tons of CO2-equivalent emissions reductions from using its cars and solar panels worldwide in 2021, equivalent to the carbon sink generated by more than 3,400 acres of forest in one year. Tesla is trying to reduce its carbon footprint by constantly improving its factories and products. In terms of factory improvements, for example, at the Gigafactory in Texas, Tesla chose to use highly efficient, insulated, low-radiation Windows to reduce the building's heating and cooling needs. On the other hand, Tesla has designed all its new factories to be covered in solar panels. By the end of 2021, the company had installed 21,405 kilowatts of solar panels [3]. On the product side, as an electric vehicle company, battery upgrades are certainly at the core of Tesla's research. Hence, the company manufacturer unveiled a new way to produce battery sheets using a dry electrode process at Tesla Battery Day 2020. According to the company's latest analysis, the new process allows a direct transition from cathode or anode powder to electrode film, reducing energy consumption by more than 70 percent throughout the battery manufacturing step [3].

In contrast to Tesla Inc., Ford Motor Company is lagging behind the rest of its industry in the environment pillar. According to Ford's ESG Data Book, Ford Motor Company has improved its global greenhouse gas emissions in this area, dropping from 2.96 million in 2020 to 2.59 million in 2021. However, the data from his ESG Data Book shows that CO2 emissions per passenger car are increasing in all countries. For example, in 2021, Ford's CO2 emissions per light commercial vehicle in the EU rise from 166g/km in 2020 to 202.16g/km. On the bright side, Ford has embarked on developing and researching new energy vehicles. In addition, they plan to increase their electrification investment to over $22 billion in 2025. In 2021, Ford sold almost 30,000 electric vehicles worldwide, and they are committed to selling all passenger cars in Europe as electric vehicles by 2030. Although Ford's 2022 Sustainability report states that they will achieve a 76% reduction in greenhouse gas emissions in Scope 1 and Scope 2 by 2035, as well as carbon neutrality by 2050, current data shows that Ford still ranks in the top three of all U.S. autos companies in terms of greenhouse gas emissions. It still has a long way to go in terms of sustainability.

3.3. Evaluation of Social Pillar

In the social pillar, Tesla is in the middle of its industry. On the bright side, according to Tesla's 2021 Impact report, Tesla Inc. will provide very comprehensive benefits for its employees. For example, they offer free medical, dental, and vision plan contributions for employees and their family members. In addition, their company has a rich ethnic diversity of employees and has directly created nearly 100,000 jobs in 10 years. For society, based on the news, Elon Musk, the CEO of Tesla Inc., donated nearly $ 6 million in Tesla shares to the charity in November 2021. On the other hand, Tesla has at least two issues with its labor management and product safety and quality. First, during COVID-19, Tesla President Elon Musk said employees could stay home if they feel uncomfortable. Two of its employees chose to stay home for two days for the safety of their families, after which they received termination reports from Tesla. The two employees claimed that Tesla did not establish any protective measures and disinfection in its factories, nor did it inform employees of the hazards of COVID-19, and did not consider the health and safety of its employees first [4]. Second, according to news reports, Tesla recalls nearly 500,000 Model S and Model 3 electric cars for safety issues. Its main problems come from the rearview camera and the trunk, which increase the crash risk. For example, NHTSA says, "The rearview camera harness in the Model 3 sedan can be damaged by the opening and closing of the trunk lid, which prevents the rearview camera image from being displayed [5]."

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So, if Tesla wants to achieve a high rating in this area of society, they have much room for improvement.

For employees, Ford also provides employees with basic health insurance, retirement insurance, accident insurance, vacation, and so on. Like Tesla, Ford has done a lot for society. First, they have branches in 43 countries and solve the job problems of nearly 183,000 people. Second, in Ford's 2022 sustainability report, they donated 1.3 billion to disaster relief efforts around the world and 120 million masks to at-risk communities in all 50 U.S. states in response to COVID-19. Engineers at Ford and Tesla assembled different versions of the ventilator using parts from their respective models to relieve the pressure on the hospital ventilator caused by COVID-19 [6]. Ford has also donated $74.4 million to communities worldwide to improve their quality of life or living environment. However, Ford Motor Co. still has some hidden product safety concerns. According to news reports, Ford recalled 39,000 vehicles in May 2022 after five more fires were reported due to 16 fire reports. Ford then announced another recall of 27,000 U.S. vehicles to address the risk of under-the-hood fires in the 2021 Ford Expedition and Lincoln Navigator SUV [7]. Additionally, in terms of labor management, in 2022, Ford laid off about 3,000 employees and contract workers, especially at Ford in the United States, Canada, and India [8]. Thus, while Ford has made many contributions to society, social issues cannot be ignored, leading him to be in the middle of the pack among the American car companies in his industry.

3.4. Evaluation of Governance Pillar

In the governance pillar, based on the evaluation of MSCI, Tesla Inc. becomes better in corporate behavior than corporate governance. The most significant issue from corporate governance is related to Tesla's board of directors. First, Tesla was also fined by investors for having too few independent directors on its board [9]. Shareholders believe that having too few independent directors makes them make investment decisions that are not necessarily made with the best interests of investors in mind. For example, in 2016, Musk acquired his cousin's company, SolarCity, which was in a severe financial crisis. Many investors believed that Musk made this decision for the sake of kinship rather than putting the interests of investors first. Second, in 2018, Tesla's board approved an unusual compensation package for CEO Elon Musk. If all goals are met, Musk will receive $55 billion in equity value, the highest compensation for any CEO in the history of corporate America. On the other hand, Musk uses a corporate structure that reduces the friction of hierarchy and creates an organizational culture that encourages flexibility and fluid communication to get the job done. Based on Tesla's income statement, as shown in Figure1, we can also see that the company's profitability has been increasing yearly, which shows that the company's top management has set the right strategic development direction.

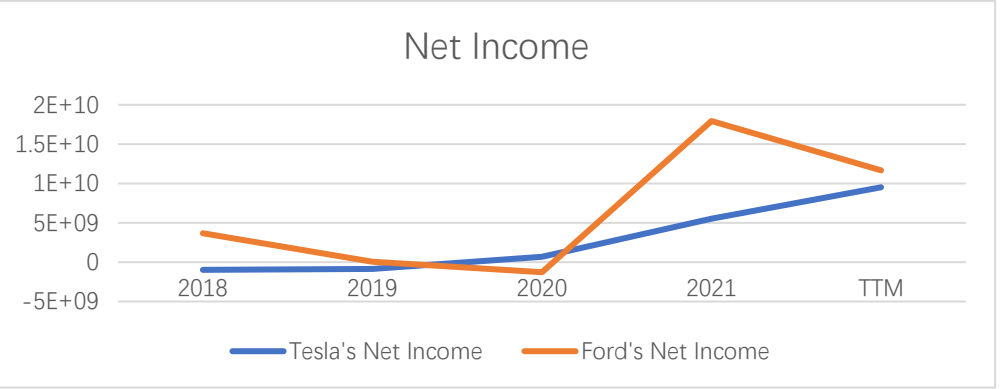


Figure 1: Net income from Tesla Inc. and Ford Motor company (https://finance.yahoo.com/quote/F?p=F).

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Ford Motor Company is in the middle of the industry in both corporate behavior and governance performance, representing that Ford still needs to figure out some problems in the governance pillar. First, Ford had some problems with business ethics. According to news reports, Ford needs to pay a $19.2 million fine to settle allegations that the company falsely advertised the fuel economy of some of its hybrid vehicles and the payload capacity of some of its pickup trucks. Ford exaggerated to consumers the distance they could travel on a single tank of gas, claiming that driving differently would not affect the actual fuel economy of the vehicles [10]. Third, Ford's financial situation looks more 'anxious' than Tesla's. Based on Ford's net income for 2018, Ford's profits have fluctuated a lot which is not a good signal for the company. Even in 2020, net income is surprisingly negative. This can show that when it comes to corporate governance to set strategic goals, Ford's top management does not have the same strategic goals that Tesla's top management has set to better suit their company's growth. Ford needs to pay more attention to corporate governance, and many aspects need to improve.

4. Conclusion

In general, U.S. electric car companies led by Tesla are doing better than U.S. gasoline cars led by Ford Motor Company in terms of ESG development. The U.S. auto industry also shows a trend of developing electric vehicles and reducing gasoline vehicle production. Based on the ESG analysis of Tesla and Ford, we found that the auto industry is currently focusing on developing environmental aspects while neglecting improving society and governance. Even though Tesla is already the ESG leader in the U.S. auto industry, many social and corporate governance issues exist, such as product safety issues and board 'dictatorship'**.** As for the environment, although the current trend of the overall automotive industry is to develop new energy sources, at the same time, automotive companies need to avoid pollution other than greenhouse gases, such as water pollution and pollution from hazardous chemicals. However, these issues in the automotive industry, while still present, are overall progressing toward high ESG scoring standards.

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Analysis of Chanel Marketing Strategies in the World Luxury Fashion Market

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Abstract: The luxury market is a unique fashion market that provides more than necessary products to satisfy people in the wealthiest class. Chanel is a French luxury fashion brand that was founded in 1910 in Paris by Coco Chanel. This paper uses 4Ps marketing theories to analyze the reasons for Chanel's outstanding marketing performance worldwide, especially in China. The conclusion shows that Chanel keeps its unique personality to attract more demands from young people and also insists on the consumer base of wealthy people.

Keywords: marketing strategies, 4 Ps, luxury market, Chanel

1. Introduction

In its root sense, luxury comes from the Latin word "Luxus", which means an overly rich, extravagant way of life or a desire to satisfy more than the necessary needs. Luxury has long been synonymous with high fashion, a model essentially based on tailoring. The designers of luxury are those of the wealthiest class aesthetic tradition. They designed each piece of clothing tailored for the aristocracy to be unique, representing a celebration of the power and prestige of the aristocracy. As times progressed, however, this tradition of fashion and approach to tailoring began to change [1]. For example, in the 1920s, designer Coco Chanel revolutionized the look of traditional clothing design, preaching a more modern and dynamic approach to fashion. In addition, Chanel revolutionized the style of the suit, making it comfortable and practical.

In contrast to the traditional wealthy consumers from the 19th century, such as landowners and business people, who are the leading luxury group, many consumers of luxury today are young people - Generation Z and Millennials. Investopedia has coined the term HENRY to describe them, meaning "High Earners, Not Rich Yet", who are driving the growth of luxury globally.

By 2025, Chinese luxury consumers will reportedly account for 50% of global luxury spending. On the other hand, luxury spending in the United States, Japan, France, and Italy has also rebounded significantly [2]. This shows that Chinese consumers have always dominated the luxury market, which stimulates more and more luxury products designed with Chinese elements, such as launching "Asia Only", "Tanabata Only", and " 520 limited" products to attract Chinese consumers. The report also shows that Chanel, Louis Vuitton, Dior, Gucci, and Hermes are the most popular among women, while for men, Louis Vuitton, Rolex, Chanel, Armani, and Gucci are the most popular [2].

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As the world's top luxury brand, Chanel has been one of the most preferred luxury brands by Chinese consumers. This paper presents a comprehensive analysis of Chanel's marketing strategy through the 4Ps theory to reveal the reasons for its outstanding marketing performance.

2. Theory

In this research, the 4Ps of marketing will be mainly used. The 4Ps were first formally introduced by E. Jerome McCarthy in 1960. McKinsey simplified the concept into the four “P”-product, place, price, and promotion. The 4Ps can help marketers design programs appropriate to their times' dynamic social and political realities and target markets. The 4Ps are often referred to as the marketing mix. Included in these "P' s" are a series of factors to consider when marketing the product, such as the location of the store, pricing strategies, brand awareness in the world, consumer demand for the brand and product, strengths and weaknesses compared to competitors, and suggestions for how the production company can interact with customers.

3. Overview of Chanel Company

3.1. Chanel Introduction

Founded in 1910 in Paris by Coco Chanel, Chanel is a French luxury fashion brand known worldwide for its timeless designs, iconic suits, and little black dresses. In addition, Chanel specializes in women's ready-to-wear, luxury goods, and accessories. Chanel revolutionized haute couture and garments by replacing structured, corseted silhouettes with more practical garments. Instead of striving for beauty that binds women to their achievements, couture made clothes that were more comfortable for women to show their freedom. To this day, women are still very fond of Chanel clothes.

3.2. Chanel Financial Statement

According to Figure 1 from the financial result of Chanel, financial results for 2021 were driven by solid demand from the local customer base for all product lines, highlighting the desirability of Chanel's creations. Total revenues for 2021 were $15.6 billion, up 49.6% compared to 2020 and up 22.9% to 2019. Operating profit of $5,461 million, up 170.6% compared to 2020 and 57.5% compared to 2019. a positive net cash balance at the end of 2021, reflecting Chanel's strong performance and financial discipline and the free cash flow of $4,540 million in 2021[3]. Chanel's huge finances are also, as Philippe (2019), Chanel's Chief Financial Officer, said, "This financial statement shows that our financial position is very sound and we can maintain our position as a private, independent company for centuries to come.", meaning that Chanel can still maintain its independent position in the fashion world under the pressure of being annexed by Kering and LVMH [4].

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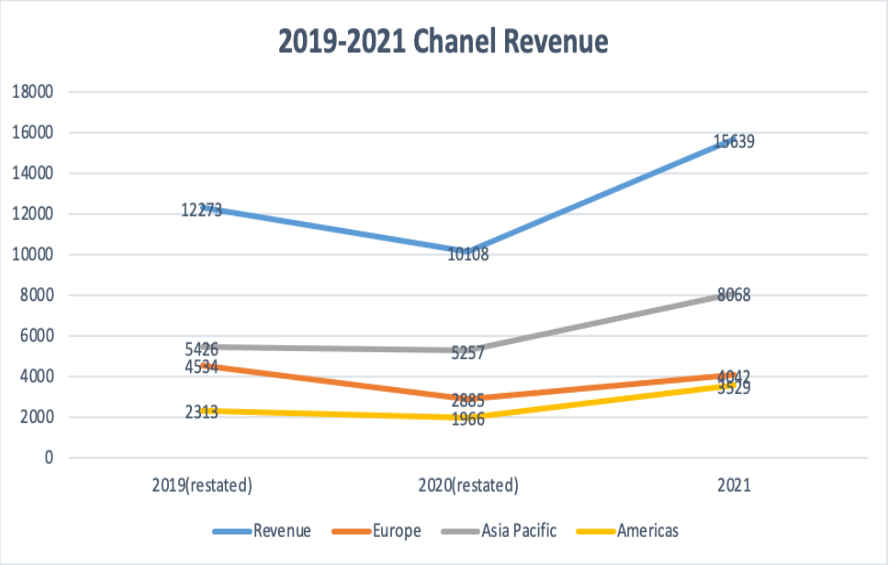


Figure 1: Chanel revenue.

4. Analysis of Chanel's Marketing Strategies

4.1. Product

Chanel is one of the world's leading luxury fashion brands catering to an elite clientele, and it offers a wide range of fashion products as a high-end luxury brand. Chanel's products are mainly aimed at women's clothing, accessories, shoes and bags, and makeup, but it also has a range of colognes and fragrances for men.

4.1.1. Chanel's Unique Design

The first product advantage is that Coco Chanel has constructed brand recognition with her unique designs and has given Chanel so many distinctive products, such as the classic "little black dress", the tweed jacket, and numerous iconic representations such as CHANEL N°5 perfume. None of these products can be considered separately from the brand, meaning that Chanel has converted its products into its most iconic symbols. Furthermore, unlike luxury products such as Louis Vuitton, which constantly introduces novelties in new seasons, Chanel releases new collections that still stick to the most popular bag models and follow the brand's traditional designs, such as the Chanel 19 and Chanel Leboy. This has helped Chanel cement long-term customer loyalty.

4.1.2. Chanel's Excellent Quality

In addition to the persistence in product design, Chanel's product quality has always been highly guaranteed. Chanel does not carry out mass production, only launching limited edition products, especially fashion clothing and fine jewelry. Chanel Haute Couture is equal to the highest level of modern fashion. The Chanel workshop first makes an exclusive mannequin for the customer, then designs and makes the clothes based on the mannequin. After completing the first draft, Chanel will take the sample clothes and specifically fly to the customer's city to help the customer try it on, then continue adjusting according to the actual situation. At least three months later, exclusive to the customer's name and a number of the world's unique Chanel Haute Couture will come into the customer's hands. The most conspicuous thing is that the few remaining high-fashion brands all have machine-made parts, but only Chanel's Haute Coutures are all made from start to finish in a high-

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class handicraft workshop in Paris. Also, any supplier of delicate fabrics will prioritize Chanel for their traditional fabrics, and Chanel will buy out the rights to use such fabrics to build their unique branded products. It also perfectly matches the psychology of high-fashion customers seeking unique quality and attracts more consumers through exquisite but rare products.

4.2. Place

The locations of Chanel stores are chosen in high-end luxury malls catering to the high aristocracy or in the terminals of international airports, as this is where most potential customers travel. To cater to its target clientele, Chanel even opens boutiques in the lobbies of some five-star luxury hotels, such as the Bellagio in Las Vegas, where Chanel boutiques have been opened in the commercial streets of the hotel, where spending has become the most significant pastime for tourists in a paper-drenched urban atmosphere. The research from the MBA Skool Team (2022) showed that "The Chanel boutiques are located around the world including cities like New York, Boston, Amsterdam, São Paulo, Sydney, Hamburg, Cannes, Miami, Bangkok, Geneva, Tokyo, Saint Tropez, Moscow, Los Angeles, Paris, Dubai and London- which is the biggest in the world. It has around 300 Chanel boutiques, out of which 120 are in North America, 90 in Asia, and 70 in Europe. In addition, its fragrance and skincare counters are available across high-end luxury malls [5]."

As the world's largest consumer of luxury goods, Chinese consumers are highly valued by Chanel. Chanel seized the opportunity to enter the Chinese market in the 1990s, a critical period for the booming Chinese economy, and today has opened more than a dozen Chanel stores in first-tier cities such as Beijing and Shanghai. In this critical era of rapid economic growth, the needs of Chinese consumers began to change, and more wealthy people turned their attention to the luxury market. In 1999, Chanel opened their first store in Beijing on the Wangfu Peninsula. Until now, Chanel has over fifteen stores in China, which is growing with the demand of Chinese luxury consumers [6]. Most Chanel stores are located in first-tier cities or traveling cities' most luxury shopping centers since this can match the shopping malls where Chinese target customers are often found.

From Chanel's place strategy, we can see that Chanel has a clear plan for the brand's market positioning, and its presence in high-end malls also allows them to maximize its chances of attracting target customers. Chanel also provides customers with a unique brand experience in its stores. Consumers have a different experience when buying luxury goods than they usually do. Chanel's offline stores offer one-on-one service, elegant and bright store design, and attentive sales staff that make Chanel stand out from its competitors. Many online celebrities post photos of themselves in Chanel stores on social media platforms, which invariably promotes Chanel.

4.3. Price

4.3.1. Worldwide Chanel Pricing Strategy

All worldwide Chanel products' prices follow a premium pricing strategy since Chanel's pricing has consistently met the fashion needs of upper-class aristocrats and satisfied the human appetite for beautiful things. Because of the high quality and rarity of the raw materials used in Chanel products, the elegance of the products, and willing payment from the wealthy target group, it still makes everyone line up in stores to buy, even with its exorbitant pricing. Upper-middle-class people are also willing to pay for Chanel products because Chanel products can improve their social status. In order to attract different wealthy levels of consumers, Chanel has various pricing strategies. For example, Haute Couture is priced at the very high end, from $50,000 to $100,000 or even higher than $400,000 a piece, attracting many wealthy people. Also, most everyday clothes, shoes, and bags for the upper middle class are between $1,000 and $50,000.

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Chanel has raised its costs four times in one year since its big hit. According to CBN Data, the price of the 2.55 medium mouth cap bag has increased by more than 65% in just two and a half years. Chanel's price increases reflect a brand's popularity and reinforce its exclusivity. More specifically, Chanel's constant price increases can boost the brand's sales. In addition, because the price continues to rise, it captures the psychology of consumers who are worried about the price going up again, attracting many consumers who are still hesitant to buy now.

4.3.2. Particular Pricing Strategy in the Chinese Market

Surprisingly, Chanel has a unique pricing strategy in China - lowering the price of its products in China since 2015[6]. As the second largest market for luxury consumption, Chinese consumers have responded positively to this unique pricing strategy. Since it is unusual for luxury brands to lower prices in China, most brands tend to raise their goods' prices to make them more exclusive. This pricing strategy has reinforced Chanel's good brand image in China and attracted more potential customers.

Although the price in China is lower, Chanel still insists on the strategies of raising its price at the same time around the whole world, including China. The price increase will make Chanel unaffordable to more middle- and upper-class people, so when the resistance to obtaining Chanel becomes greater, consumers' desire to buy will also increase, even if purchasing Chanel's goods is a small short-term goal to motivate money. This is an important reason to explain that even with a high premium and price increase pricing strategy, Chanel still tops the 2021 survey of Chinese high-net-worth consumers as their favorite luxury brand.

4.4. Promotion

4.4.1. Chanel Basic Promotion

Chanel has invested in promotion in a variety of ways. Firstly, Chanel will place advertisements for its products in high-end fashion magazines such as Vogue and Elle to attract a high-end customer base. Among those advertisements, watches, perfumes, and makeup are the most popular since they can bring Chanel the most significant revenue. A $42 Chanel lipstick is more likely to attract more consumers than a Chanel bag which costs $6,000 or more.

Secondly, Chanel also uses elegant store layouts and creative mannequins to display goods in the windows of boutiques to attract customers, even making some Chanel stores become places where many people take pictures. Then, Chanel also hired supermodels and Hollywood actors to model for their brand and invited them to wear or carry Chanel products on the red carpet. Chanel used the fame of models or celebrities to get much promotion and let people enjoy Chanel fashion on famous social occasions.

Moreover, Chanel's biannual new release shows attract much attention from the media and fashion industry, allowing its new release products to get many clicks and views on social media. Chanel also shows perfectly illustrates its elegant and premium brand positioning. For example, for the Spring/Summer 2019 show, the theme of the launching products was beach resort style. Chanel set up the Grand Palais in Paris as a beautiful and serene golden beach. Throughout the show, models wearing Chanel's new season clothing and barefoot walking across the beach. The whole show creates the scene of a cozy beach holiday for the aristocratic ladies of high society, and it is also one of the marketing strategies that Chanel wants to present in front of the public. When people start to imagine this perfect scenario, they will also have higher psychological expectations of Chanel's garments products, which is conducive to improving the perceived value of the Chanel brand itself.

Finally, with the development of data, Chanel has also expanded its marketing channels to social media. With 23.6 million followers on Facebook and 52.65 million followers on Instagram, Chanel

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has the most followers of others luxury brands' social accounts. This large fan base has effectively helped Chanel promote their new merchandise and multiple product lines on social media, such as fragrances and beauty [7].

4.4.2. Chanel Promotion in the Chinese Market

Chanel's promotional tools in China are also very targeted. As a first point, Chanel appointed celebrities known in China, such as Jennie of Blackpink and supermodel Liu Wen, as ambassadors for Asia. Specifically, Jennie has over 11.3 million followers, and her posts about Chanel products have had a significant impact on China's youth, where star-studded culture is prevalent, raising brand awareness among the younger generation and driving sales from a large number of fans.

Furthermore, Chanel launched exciting offline events to attract customers, such as the brand expo in Beijing in 2011, the electro party about the new watch launch in Chengdu, and the "Sense Chanel" fragrance exhibition in Shanghai in 2021. The primary purpose of these events was to gather mass attention to promote the brand's various product lines and let people know that Chanel has products for the middle class in addition to its expensive fashion [6].

Lastly, Chanel has created an official Chinese website for Chinese policy reasons to help Chinese people know more about the brand. In 2019, Chanel officially reached an agreement with Tmall to sell some cosmetics and toiletries on its website. Despite the rapid development of online shopping in China, Chanel insists that customers come to its offline stores to buy clothes, shoes, and bags to ensure the brand's quality. Due to Chanel's digital strategy, Chinese luxury consumers are not only buying Chanel beauty and perfume but also buying Haute Couture clothes now.

5. Conclusion

Luxury goods are nowadays more and more favored by contemporary people, especially the young group, and the luxury goods market shows an increasingly prosperous economic phenomenon. Even though there are many luxury brands, such as Louis Vuitton, Gucci, and Dior, Chanel's product range is still prevalent in most of the fashion market, from clothing, leather goods, watches, jewelry, and shoes to fragrances, skincare, and beauty. This paper analyzes its marketing strategy in detail through the 4P theory. Chanel's high-end products are combined with a careful selection of boutique locations in the world's major cities and various promotions covering social media platforms, data markets, and global advertising campaigns to achieve Chanel's brilliant status today. Chanel maintains a conservative and cautious approach to traditional luxury on many levels. For example, Chanel has always protected its traditional classic designs but added different elements to each season's new collection. Particularly in Chanel's core ready-to-wear and handbag business, Chanel has also tried to adhere to the traditional definition of luxury by building a differentiated brand strategy, which is, selling one-of-a-kind products to satisfy the desires of the wealthy beyond their actual needs. As mentioned in the previous discussion of Chanel's pricing strategy, unlike other luxury goods that have been replenished to meet consumer demand, Chanel has been accelerating the frequency of price increases to maintain the scarcity of its core products to ensure product quality, stimulate consumers' desire to buy, and meet the demands of the highest tier of the pyramid, price-insensitive high net worth consumers "Unique". Even though Chanel has premium pricing strategies, it still cannot resist the increasing demand of consumers. Besides the top-of-the-line Haute Couture collection, Chanel's other products are attracting the attention of young working people, reflecting Chanel's success in capturing the market of young consumers once again. In the future, we will consider comparing and analyzing the marketing strategies of Chanel and other companies to improve the knowledge of the whole industry market.

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Author's Contributions

In the whole process, the author researches, organizes, writes, revises to complete this article.

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Impact of the Pandemic on Online Grocery Delivery: Taking Instacart Company as an Example

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Abstract: The Pandemic has had an unprecedented impact on online grocery shopping; the worldwide lockdown has made online grocery shopping a rigid demand for citizens. During the global pandemic, many online grocery shopping companies grew up rapidly to the enormous demand. Especially Instacart, the most developed company in online grocery shopping, gained huge success in late 2019. This article analyzes Instacart's strengths, such as the three algorithms, its weaknesses, and how it can grow sustainably after Covid-19.

Keywords: online grocery shopping, Instacart, Covid-19, intelligence algorithm

1. Introduction

Since the first case of Covid-19 was diagnosed in late 2019, the global pandemic has been unstoppable. The virus spread and mutated at a breakneck pace, and soon, people worldwide started to realize the seriousness of this big spread and started shopping online [1]. As a result, the coronavirus has been a significant driver of online grocery shopping. While stores remain the critical channel for most grocers, online grew dramatically during the pandemic, with many retailers adjusting their offerings and operations to meet consumer demand. According to the statistics, Online Grocery Sales in the US Annualized Market Size Growth 2017–2022 is 17.6% [2], and the size of the online grocery of the US market reached a staggering $32.7 billion [3].

Additionally, the most surprising thing is that between 2019 and 2020, the first year of the epidemic, online grocery shopping grew from $66.5 billion to $109 billion, more than fifty percent growth [4]. Online grocery shopping reminds people of one company called Instacart. Instacart was founded in 2012 by Apoorva Mehta. He saw the need for an app that headed only to grocery shopping. The great turning point came with the COVID-19 pandemic, which increased online grocery shopping demand [5]. This article will focus on Instacart's Intelligence algorithm and how it has been successful.

2. Changes in Online Shopping before and after the Covid-19

Before Covid-19, although E-commerce was growing at an average pace, not most people liked to use this new method to purchase groceries. Some citizens love shopping in-store, which can relieve their pressure. The Covid-19 forces changed everyone's shopping habits, both for online and in-store shopping person; the pandemic altered many ways, especially for groceries. The most important thing people need at home is daily necessities; as people hurried to stock up on toilet paper and cleaning

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goods amid the global lockdown, grocery store inventories were swiftly depleted. As the lockdown wore on, supply chains tightened, cleaning materials became increasingly scarce, and everyone scrambled for basic food staples and requirements [6]. Online grocery shopping sales in the U.S. exploded from $66.5 billion in 2019 to $122.39 billion in 2021, as shown in figure 1; the online grocery market nearly doubled in two years, which shows the pandemic effect this industry a lot [7].

3. Advantages of Instacart

Instacart is convenient because it is not limited to regions and works with many warehouses so that most people can use it for their convenience. This section will analyze the reasons for its remarkable success during the pandemic.

3.1. Cooperation with Warehouse

Instacart has a relationship with dozens of stores, such as Aldi, Costco, CVS, Wegmans, and so on, and people can buy anything they want in those stores. There are 4,000 cities, and work with more than 15,000 stores around the United States and Canada work with Instacart. With those vast networks, Instacart has become the quickest grocery delivery service, and goods are delivered in less than two hours or picked up at local shops. However, looking at the main competitor of Instacart: Amazon fresh, it only services the city with Whole foods in a metropolis like New York City, Baltimore, Philadelphia, Boston, etc. Therefore, Instacart is more convenient for consumers than Amazon Fresh. Therefore, Instacart gives almost every user unfettered access to the convenience of the software.

3.2. Shopper Reward System

Instacart has a reward system for shoppers, which motivates the shopper's enthusiasm and efficiency. The shopper will get ten points when they finish the order, and those points can get discounts on the price of gas, which means they can make more money when they finish more orders. In addition, Instacart also made a policy of tips protection; they can receive extra money, which is tips, after they finish the order whether the customer gives them or not. Therefore, the shoppers get more encouraged to complete the orders on time, which is a win-win policy for both the shoppers and customers.

3.3. Making Use of Intelligence Algorithms to Improve the Effectiveness

Instacart uses intelligence algorithms like data algorithm, matching algorithm, and routing algorithm, as shown in figure 2, intelligence algorithm of Instacart. First, the data algorithm improves the accuracy of the warehouse stock and helps the customers' experiences. Customers only consider browsing the commodities they want and finding, paying for, and receiving them. However, those transaction seems easy, but behind these steps, the data algorithm helps a lot. Instacart has a relationship with more than 500 grocers and almost 40,000 physical shop locations in the United States and Canada. In addition, the pandemic brought explosive growth in orders and users, from 200,000 in March 2019 to 500,000 in late 2019. The Instacart company has a huge challenge to track billions of data points from 40,000 physical stores. Therefore, Instacart must forecast how many more than 50,000 customers will be online and accessible to work at any given time and location; they also must batch many orders from various consumers so that the authorized shopper can swiftly choose, pack, and transport them. Users will inevitably run into a situation when an item is sold out. To avoid this problem, Instacart collects product data from various sources and sorts it using automated, rule-based algorithms. Many shops offer us inventory data once every day, including pricing and item availability, but others submit updates every few minutes. For some users who book items, predicting the

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inventory of goods has become an essential thing because Instacart does not own or run its stores; they do not have a complete picture of what is on the shelves of any one store at any given time, let alone what will be there later that day or several days later [8]. Instead, we must make well-informed projections when we fill our virtual shelves. Data algorithms focus on shoppers' purchase history and how often a customer orders one commodity the most. For every product, Instacart will calculate a score between 0.0 to 1.0; a score of 0.7 means the shopper has 70 percent to find this product [9].

Furthermore, Instacart will update those scores in real time to help customers and shoppers match the possibility of finding the items. Due to this score, consumers will decrease the chance to purchase items that cannot find by shoppers [10]. On the other hand, when a product is sold out, it will no longer show the store and prevent the customer from adding it to the cart.

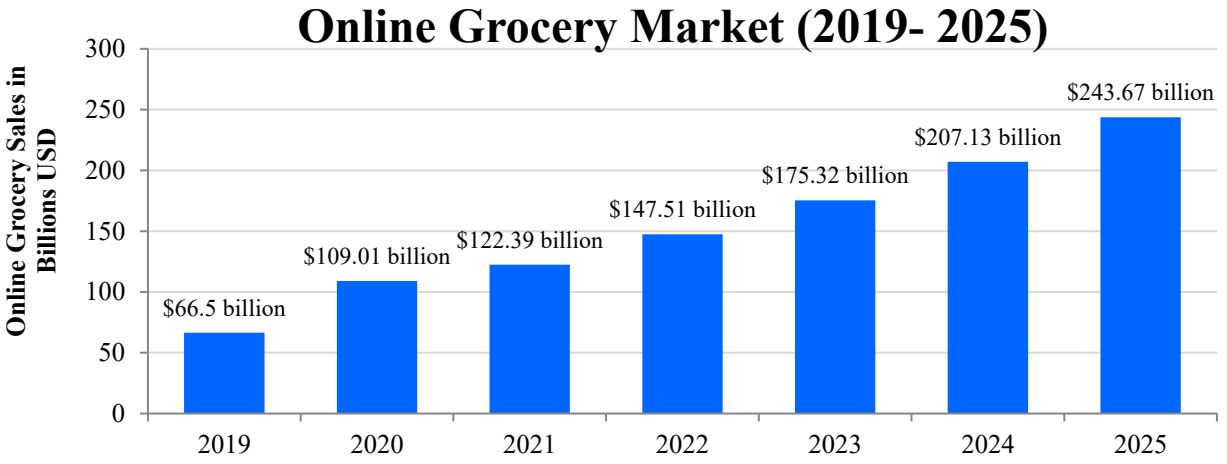


Figure 1: Online grocery market.

Secondly, the matching algorithm promotes the speed of processing the orders. When Instacart receives many orders at one store at the same time and deliveries near the exact location, especially in large cities, they group orders for simultaneous pickup on the shelf. When this happens, the matching algorithm comes into play, which balances the number of shoppers with customer demand. The more orders there are, the more options are offered; for example, if a shopper is not of age, they will not qualify for an order of alcoholic beverages. This not only improves efficiency but also increases the potential for error. It brings more benefits when more order comes in one specific area, and this algorithm gives more options and makes better decisions. Therefore, when new information comes, Instacart will rerun the matching algorithm every few minutes.

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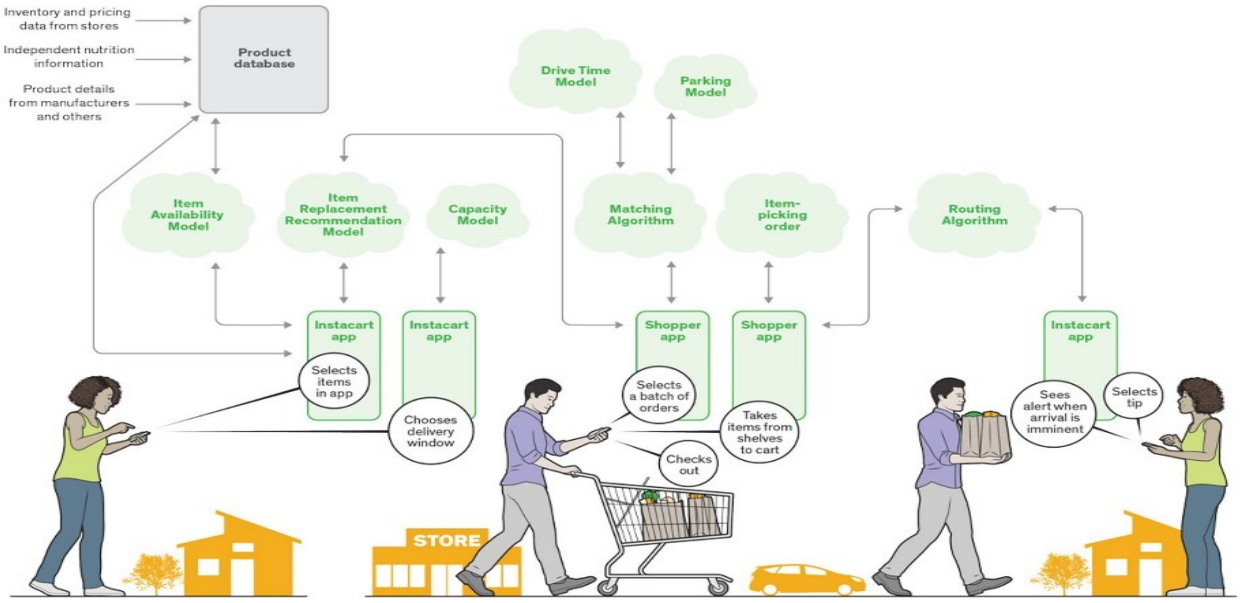


Figure 2: Intelligence algorithm of Instacart.

Thirdly, the routing algorithm is also important. Once the shopper is ready for delivery, this plays a crucial role in the optimal route from the store to the first destination and to the second and third destinations if one is to complete three different destinations. To finish the orders on time, the routing algorithm uses a real-time route to help shoppers hand in the commodities to the customers. The figure shows the estimated time for the shoppers to deliver the commodities plan and ensure the customer can get them on time.

The figure shows how the intelligence algorithm works when customer order merchandises, then the shoppers and shoppers pick all the things in the specified warehouse. After shopping, the routing algorithms help the shopper arrive at the customer as soon as possible, achieving on-time delivery.

4. Weakness and how to Improve

First, the dependency on the cooperators, some products out of stock will become a significant problem for Instacart. They dependent their retailers so much that they cannot control the stock and the quality of the commodities, which will affect the customer's experiences when they ask to change something similar due to the low inventory.

In addition, Instacart's sustainability will be challenged by the post-pandemic era. This company has proliferated because they have caught the chance of covid-19. When the epidemic recovers, people will be free to go out and shop, which means less reliance on delivery as a service, so there could be many layoffs of company employees.

As a result, Instacart needs to find ways to grow sustainably. They should get more relationships with other retailers like pharmaceuticals, pet products, and sporting goods. Otherwise, international expansion also is a good choice for Instacart to grow since they only operate in the United States and Canada. They still have opportunities to expand to other countries.

5. Conclusion

The epidemic not only brought a significant impact on online shopping but also boosted the growth of many companies, Instacart, has grown through its strengths, starting with its partnership with big supermarkets, expanding its range of business, and its intelligent algorithms. However, Instacart also needs to find ways to expand its scale to other countries and grow sustainably.

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The Effect of Experienced Regret Based on Gender Differences in Auction

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Abstract: This study aims to show how experienced regret influences the decisions made by bidders of different genders in an auction. - In this paper, the data is collected through a real-time recorded tv show about English auctions. In previous studies, female participants tend to be more risk-sensitive and rational than male bidders. Based on this trend, we hypothesized that female bidders would make quick decisions compared to male bidders after the bidder experience regret.

Keywords: experienced regret, gender differences, auction, bidder behavior, decision making

1. Introduction

For a long time, it has been known and widely accepted that experiences of regret can affect how people behave in an auction. Under the influence of numerous aspects, including gender differences, beliefs, private signals, etc., the theoretical model has difficulty forecasting investors' decisions and opinions. This study aimed to examine how different genders' experiences with regret affected their financial and economic judgments. This essay also explores the idea of the winner and loser regret, which has been sensed, and how it could affect the auctioning outcomes with different genders.

2. Literature Review

There are various types of auctions. Examples include English auctions, Dutch auctions, first-sealed price auctions, and second-sealed price auctions. In addition to those different auction techniques, William Vickery investigated how the value of these auction products affected their usefulness in 1961 [1]. Specifically, based on how differently each bidder values the items up for auction, there are private value auctions and common value auctions. In the first scenario, bidders assess the value of auction goods using information they independently acquired [1]. In the latter, bidders adjust how they respond to other bidders' actions while weighing the worth of the items up for auction. Milgrom and Weber created an associated value model in 1982, adjusting an item's price based on the value of other bids [2]. In this specific model, it is assumed that each bidder receives a private signal, and the bidders' signals are related. One bidder has an assumption that other bidders also receive the same call if they notice a beneficial sign regarding an auction item. As a result, the signal variables for each bidder's value judgment function for the auction item are included.

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Furthermore, limitations imposed by several factors in the real world make things much more complicated than theoretical models. Due to its interactions with several elements, including the objective cognition and subjective emotions of auction participants, the theoretical model may not be as accurate in forecasting the consumer behavior of a bid. According to research, a wide range of factors influences buying behavior. Experienced regret is one of the critical determinants of the bidder's behavior. Meanwhile, Women and men will consider risk and evaluate an auction item from different perspectives due to these gender differences. [3]. Women are more sensitive to danger than males are, according to Powell et al. [3].

Auctioneers of different genders reflect gender differences in the factor of experienced regret. 'Regret is a painful cognitive and emotional state of feeling sorry for misfortunes, limitations, losses, transgressions, shortcomings, or mistakes [4], which would happen to many people. Yet when researchers focus on the auctioneer's perspective in the first sealed bid auction, the experienced regret would perform in various ways, such as a sudden decision alternation, the differences between the bidder's valuation and the bidder's bid value, etc. [5]. The analysis in this paper is way more efficient since Bell pointed out that 'the value difference between the assets received and the highest level of assets produced by other alternatives is the primary factor that affects the degree of regret' in 1982. [6]. Therefore, based on the first sealed bid auction, to ensure that the non-representative emotion of seller regret is a calculated factor, it concluded that whether the seller regrets it or not, the optimal bidding strategy of IPV bidders remains the same [7]. This study will target seller regret as a factor in the selection of the sellers' auction methods.

3. Prediction

3.1. Whether Gender Differences Still Exhibit Initial Patterns of Price Differences Based on Experienced Regret Factors

Hypothesis 1

Female sellers are more likely to regret a certain amount of difference in value and change their choices for the choices they make. The specific performance is those female sellers will change their options based on a smaller value difference ratio.

Hypothesis 2

Male sellers often keep their original selection if they can switch bidding methods. The details are reflected in the data aggregation, which shows that despite the existence of a certain degree of regret experience, that is, when the price difference reaches a particular value, they still offer the behavior of not changing the bidding method in the next auction.

3.2. Bidders of Different Genders will have Winner's Regret and Loser's Regret, Respectively

Hypothesis 3

Female bidders are more likely to experience winner regret since they tend to risk aversion, which means they would not quickly lose. Thus, in a First sealed bid auction, female bidders would make their decision more carefully after they knew others' bids; their decision may have a loser regret effect on the female bidder if they overbid. Contrary, male bidders are more likely to experience winner regret since they may show a tendency to bid.

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4. Research Setting/Data Collection

4.1. Experienced Regret

Data for this research project was gathered via a recorded television program that acted as an auction. Figure 1 depicts the auction procedure. Along with the inquiry price, the gender of the auctioneer, and the last trade choice, the auctioneer's offer will also record the first and second prices. A total of 156 valid data were obtained from 2012 to 2014, after which the data were organized and evaluated. There are approximately equal numbers of male and female auctioneers.

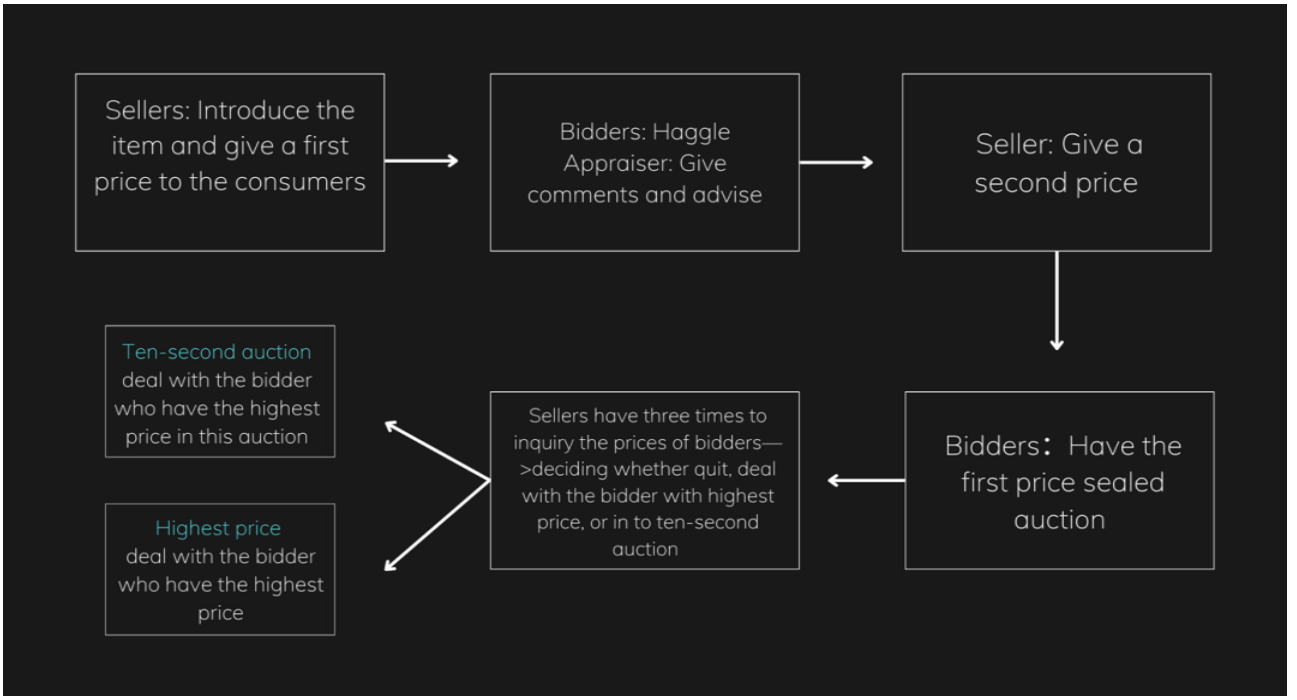


Figure 1: The General auction procedure.

It is feasible to track how gender could influence reactions in terms of felt regret by monitoring the price difference between each round of the final auction and their trade choice. Meanwhile, by observing the difference between the bidder's winning bid and the second-highest bid, the winner's regret's scale could also be known [8].

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4.2. Data Analysis

Gender	V	Bid value	Highest bid	2nd highest bid	Trade Option
F	300,000	400,000	400,000	315,000	1
F	1,500,000	2,200,002	2,200,002	1,972,000	1
F	100,000		0	180,000	0
F	80,000	90,000	90,000	70,000	1
F	120,000	140,000	140,000	130,000	1
F	100,000	120,000	120,000	100,000	1
F	1,800,000	1,610,000	1,500,000	1,200,000	1
F	30,000	80,000	80,000	60,000	1
F	120,000	180,000	180,000	160,000	1
F	50,000	100,001	100,001	880,00	1
F	300,000	455,555	455,555	400,000	1
F	80,000	88,000	88,000	30,000	1
F	300,000	320,000	320,000	288,888	1
F	500,000	990,000	990,000	916,666	1
F	120,000		60,000	58,000	0
F	150,000	190,000	190,000	150,000	1
F	900,000	280,000	280,000	250,000	1
F	600,000	500,000	500,000	250,000	1
F	150,000	260,000	260,000	150,000	1
F	8,600	38,800	38,800	25,000	1
F	250,000	498,000	498,000	210,000	1
F	220,000	220,000	220,000	160,000	1
F	300,000	420,000	420,000	250,000	1
F	130,000	150,000	150,000	100,000	1
F	1,200,000	220,000	220,000	1,800,000	1
F	1,000,000	1,200,000	1,200,000	900,000	1
M	100,000	10,000	10,000	91,500	1
M	1,500,000	2,156,000	2,156,000	1,800,000	1
M	11,999,999		0	999,000	0

Figure 1: Part of the raw statistics collected from 2012-2014.

4.3. Bidder Behavior in Different Genders

In the auction of the program, the bidder will check the top three bidding prices after confirming the bid amount. Then the auctioneer would learn the above information; the auctioneer can choose to opt-out, process the highest bid, or make a 10-second flash bid. According to Table 1, approximately 18.10% of male sellers and 7.69% of female auctioneers opted out in all observed cases. Female auctioneers are likelier to close rather than leave when sunk costs exist.

Table 1: Analyzation of auctioneer's behavior based on collected data.

Gender	Quit rate
Male	6÷78×100%=**7.69%**
Female	13÷72×100%=**18.10%**

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4.4. Gender Differences in Winner Regret

A utility model examines the relationship between gender differences and other anticipated winner regret and how they may affect consumer behaviors.

Table 2: Basic explanation of terms in the model.

Variable	Meaning	Definitions
Dependent variables	Bidder's utility	U_i
	F-Female	Gender
	M-Male	
Independent variables	Bidder's valuation	V (v_i)
	The final bid value of a single auction	Bid value (b_i = highest bid when trade option is 1)
	The highest bid value of a single auction that each bidder could observe	Highest bid
	The second highest bid value of a single auction that each bidder could observe	2nd highest bid (b^2)
	1-the auctioneer uses highest bid deal with the winner	Trade option
	0-the auctioneer chooses to cancel the auction	

Bidder's utility model(Filiz-Ozbay, Emel, and Erkut Y. Ozbay. [8]):
Bidder's utility = $\mathbf{U_i\,(v_i\,,\,b_i\,|\,b^2\,) = v_i - b_i - \int [\,a_0 + a_1(\,b_i - b^2\,)\,]\,dF(b^2)}$

Table 3: Utility value analysis in percentile perspective.

Gender	Percentile of who has a Positive utility	Percentile of who have a Negative utility
Female	15÷78×100% = 19,23%	63÷78×100% = 80,77%
Male	42÷72×100% = 58,33%	30÷72×100% = 44.44%

Women have the highest negative utility among all bidders regarding the final Utility percentage value, which supports prediction 2.

The reasons women are more likely to have negative utility were investigated in addition to the relationship between the final option and other factors. After listening to experts, 63 women in a sample of 189 gave a price far below their original valuation value and the second highest value. In comparison, 30 men offered roughly the same amount as the valuation value. As shown in Table 3, it is possible to deduce that since female sellers have a higher risk aversion for their items, they will be more careful, afraid, and seriously concerned when making decisions, culminating in female sellers bidding value being higher than their original valuation. As a result, there will be a winner's regret.

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5. General Discussion and Conclusion

Based on behavioral economics, this paper investigates the differences in auction behavior of auction participants of different genders and the degree of regret experienced during the auction process. In conclusion, gender differences influence bidders' purchase decisions and subsequent auction behavior. Gender differences in risk characteristics, sentiment, and price assessment have been observed among auction participants.

First, female auctioneers would typically withdraw from auctions because they are more cautious about their behavior. They may launch if the maximum price does not match the self-evaluation value. Second, men keep a relatively stable value evaluation and judgment on their auction items, or they continue to ensure the presentation of the final result despite being influenced by external comments and information.

On the other hand, female bidders experience more winner regret than male bids. A bidder will experience more guilt, decreasing the loser's utility. And when they make certain judgments, they do it with more excellent care, which leads to them paying higher rates and conducting quick evaluations to ensure the conclusion is delivered.

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Should Apple Raise Wages? What Happens if They Immediately Raise Wages per Worker by 15%?

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Abstract: This paper focuses on how increasing wages affects employees and companies. Primarily, it uses an efficiency wage model to confirm that increasing wages leads to increased employee productivity and reduced laziness, as well as increased firm productivity and attracting more highly skilled employees. The paper also examines what the benefits of a 15% increase in the minimum wage are to the firm. Increasing the minimum wage can reduce employee turnover as well as the firm's production costs.

Keywords: wage efficiency theory, increase wage, economic, impact on employee and the company

1. Introduction

The wages offered by a company have an impact on employee productivity, employee costs, and the number of employees seeking employment. By increasing wages, companies can reduce costs, increase employee productivity, and reduce company resignation rates. Research has shown that the top 500 technology companies in the world have increased employee happiness and benefit by increasing wages.

2. A Selective Literature Review

As one of the world's leading technology companies, Apple has been capturing the public's attention and it made headlines in 2022 when he announced that the hourly wage would be raised to $22, which is nearly three times of the minimum wage [1]. It is argued that Apple is right in choosing to pay its employees more because it can greatly increase the overall productivity level of the company [1].

The efficiency wage hypothesis explains the existence of wage premiums. In a fully competitive market, workers receive compensations equal to their opportunity costs. An efficiency wage refers to the above market-clearing level salary paid to an employee. The efficiency wage hypothesis proposes that the productivity of workers is positively correlated with their wages, thus, a higher wage effectively motivates workers to enhance performances, resulting in higher productivity levels of company.

The positive correlation between wages and productivity has been much discussed and analyzed. Shapiro and Stiglitz believe that workers' efforts are motivated by either external or internal oversight, and the latter reflects the perceived cost of a certain career, which includes a person's earnings relative to expected wages [2]. Psychologists think that effort is a response to an underlying motivation, which

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means motivation theory can be regarded as effort theory. Therefore, wages and effort should be seen as both endogenous and deterministic. Using data from 1970s New York, Goldsmith et al. have tested the efficiency wage hypothesis's basic principle that efforts depend on wage levels, and the results demonstrate that getting an efficiency pay does make a person put in more effort [3]. Their findings are also consistent with the stress-process theory, which states that unexpectedly high earnings reduce stress in life and increase self-efficacy, which in turn increases the amount of effort at work. Also, employees see higher wages as an acknowledgment of their competence, and work harder to repay the appreciation.

A higher minimum wage decreases the expected qulity of job applicants as it induces less motivated workers to apply for the job [4]. Therefore, a company can increase the salary of highly skilled employees to increase their motivation to work harder, which can lead to efficient production. It is also possible for the company to hire fewer employees, because the increased motivation of highly skilled employees can lead to higher productivity and workload.

The hypothesis also explains the existence of various other puzzling phenomena, such as involuntary unemployment. Carter finds an empirically verifiable way to model output growth, and the outcomes show that though high-wage policies reduce employment, but increase output [5]. Even when there is labor surplus, companies can be reluctant to cut wages since lower wages might actually reduce productivity and increase costs.

Companies always want to know whether their employees are making enough effort. Many direct pay-for-performance schemes are either expensive or impractical to operate, since it is difficult to observe the exact contributions of each individual worker; in such cases, it is profitable to raise each worker's wage above the market-clearing level. Workers makes conscious decisions to avoid or stay in work, and those who choose to shirk may face austerity or involuntary unemployment. The threat of losing a well-paid job if one is found to be lazy helps the employer to keep employees in line, as they are faced with higher opportunity costs for shirking. Efficiency pay allows companies to minimize the cost of monitoring. If every company raises wages to eliminate slacking, average wages will rise and employment will fall, resulting in unemployment in the new equilibrium. Since jobs are scarce, losing one's job may mean long-term unemployment. The dim prospect in turn serves as a disciplinary tool that motivates workers to do their best [2].

Cappelli and Chauvin have examined the implications of the efficiency wage model with factory-level data from the auto industry [6]. The results illustrate that as predicted by the efficiency wage model, wage premiums are associated with a higher level of discipline. Higher wages encourage employees not to shirk their responsibilities, and are associated with less avoidance behavior. In a labor market where it's difficult to find equally well-paid alternative jobs, avoidance behavior is costly, thus rarely occurs. Instead of enabling firms to select those who are less inclined to quit, wage premiums incentivize laborers to avoid being fired.

Chua et al. have modelled a company's ability to extract effort from workers with a variety of factors, which generate potentially testable predictions about wage differentials and the nature of unemployment [7]. In cases where monitoring is costly or difficult, the company should pay a higher salary to an employee. Having analyzed data from manufacturing industries in Singapore from 1978 to 2012, it is found that paying efficient wages can prevent workers from slacking off, and the regulatory strength is consistent with the efficiency wage hypothesis. Because of efficiency wages, companies are less dependent on oversight.

A business that pays efficient wages can attract more professional and qualified employees. An essential feature of a fully competitive labor market is that workers with equal levels of productivity receive equal compensations: wages depend only on the ability of the worker, not on the characteristics of the employer. However, some employers will offer a wage premium to attract more talented professionals [8]. Apple's high-tech workers are highly skilled, and expect to be paid a higher salary

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accordingly. A higher salary can attract more skilled workers, which boosts the productivity of the company. In the labor market model, the salary offered by a company affects the number of job seekers in that company. Assuming that a wage attracts enough job seekers to meet the company's demand for workers, the company can attract more capable workers by offering higher wages [9].

3. The Impact on the Company and its Employees after Raising the Salary of Employees

From the previous discussions it is clear that Apple should pay people more as it facilitates the company's growth. Now suppose they are to immediately increased every worker's salary by 15%, what will happen?

Because of recent moves by Google, Amazon, and Microsoft to increase employee wages to the point of retaining highly skilled employees and attracting talent, Apple has also begun to increase wages for corporate and retail employees [10]. The company should increase wages as reflected by some Amazon employees who had senior members of Amazon who believed that unless their wages were increased, they were not worth staying [11]. Amazon's unemployment rate increases to about 35% in 2021. Apple has increased its overall salary budget in order to support and retain the most fallen team members in the world. Apple also increased the starting salary for U.S. retail employees from $20 to $22 per hour. Apple's internal employees were thankful for this. In the wake of the flu pandemic and a tight labor market, Apple will not be able to compete with other tech giants if pay levels are disappointing. In 2022, with an increase in the turnover rate of highly skilled people, 20% of whom have shown the possibility of finding new jobs, Apple decided to raise the minimum wage by 45% [12]. Wage increases help attract more top talent and retain current employees. By increasing wages by 15%, Apple can keep more employees satisfied and reduce internal employee turnover when the labor market is unusually competitive.

4. Conclusion

The efficiency wage hypothesis explains why some companies may pay higher wages to their employees. The efficiency wage theory suggests that companies may find it profitable to pay workers above market levels because such a wage premium helps to encourage workers. Avoid lazy behavior, reduce the cost of the company and attract higher quality employees. Ketz et al. It argues that companies need to raise wages to motivate employees to do more so that they can reduce their own costs and increase their productivity. Because jobs are scarce, losing them can lead to long-term unemployment, so the price of escape is high. As a result, workers will work harder, reducing the company's monitoring costs and employee avoidance problems. It is clear from Chua et al.'s case that efficiency pay minimizes a company's monitoring costs, while employees face higher opportunity costs for shirking their responsibilities [7]. Compensation, as a disciplinary mechanism for employees, increases the likelihood that employees will keep their jobs and reduces the need for managers. Efficiency pay can also attract more employees, and a company that pays more efficiently can attract more professional and qualified employees. Amazon has attracted more highly skilled workers by raising wages. In the efficiency wage hypothesis, Goldsith et al. show that efficiency wages can increase a person's effort, and people who work harder earn more. Individuals who put more effort into their work are considered more productive. NLSY's data show that companies that pay efficiency wages can motivate employees to work harder.It is clear that Appke should pay its employees higher salaries and both employees and the company can well benefit from an 15% increase in the average salary level. This study can help the company to increase employee wages at a lower cost and thus increase productivity in the interest of the company.

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The Effect of COVID-19 on China's Real Estate Market via Different Angles

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Abstract: The trend of the real estate industry has become a hot topic of concern in contemporary society, and some studies have shown that after the epidemic, real estate has been conducted. The profitability of enterprises has declined significantly since there are many different opinions. This article aims to find the reasons from the three different perspectives of home buyers, housing enterprises, and governments based on the feature analysis method. The trend analysis method investigates the sales and pending sales of real estate products in the country. According to the analysis, real estate has indeed been on a downward spiral in recent years. The buyer does not have sufficient funds to buy a house. The cash flow of housing enterprises is also extremely tight, and in the year of the outbreak of the new crown epidemic, the volume of sales almost fell exponentially. Governments also need to continue to issue policies in a changing economic environment spectator control. In summary, China's real estate is still full of difficulties. These results shed light on guiding further exploration of real estate market.

Keywords: real estate businesses, local government, COVID-19, development trends, macro tuning

1. Introduction

In 2020, the COVID-19 swept through China's mainland, making the high-turnover housing enterprises worse. The prospect of the field became even bleaker. Many housing enterprises have begun to lay off employees and reduce wages, and the real estate industry has entered a downward period [1]. To be specific, the value of residential investment was 6,023.8 billion yuan in 2022, which has been sharply decreased to about 5.8% [2].

However, the real estate industry has been hit not just by COVID-19. As early as 2008, various housing enterprises have been walking on the road of high debt and high turnover. The model of relying on liabilities to auction land and build buildings and build buildings is inherently unsustainable because it is provided for urban land Give limited. The contradiction of real estate often leads to the bursting and looping of the asset bubble of debt default, where the economic cycle is the core contradiction of the instability of the financial market. In this period when deep reform is urgently needed, the new crown epidemic has broken out. It makes the funds in the hands of many people no longer abundant, and the real estate enterprises that are not full of cash flow are even worse. Therefore, the government aims to make the real estate industry sustainable and healthy. A series of policies

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have been introduced to help housing enterprises reduce debt. The "three red lines" are one of the influential policies. The introduction of this policy has tightened the financing channels and significantly reduced the scale of investment [3]. To explore the impact of real estate in the context of the epidemic due to the reactions of different groups, we will bring them to the masses of the people separately Fee-payers) [4], housing enterprises (producers) [5], government perspective [6] based on literature research methods and feature analysis methods. The analytical method is carried out in-depth and obtains the results of the objective study as much as possible. The rest part of the paper is organized as follows. The Sec. 2 will explain through income factor. The Sec. 3 will explain from market factor. The Sec. 4 will present the limitations and prospects while a brief summary will be given in Sec. 5.

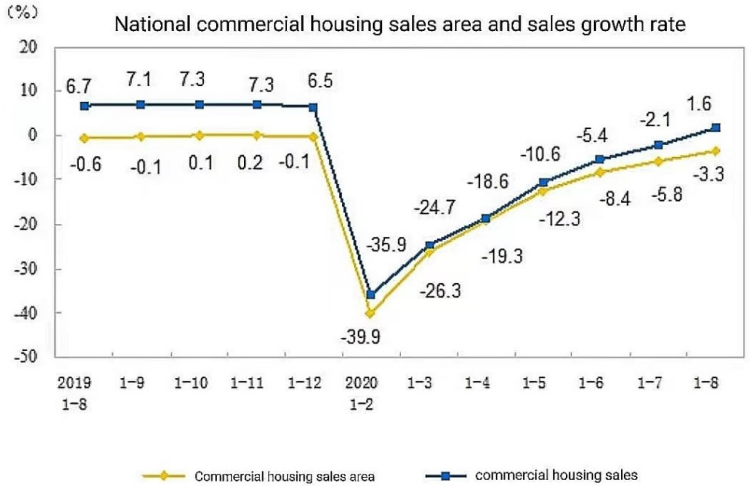


Figure 1: Real estate commercial housing sales and pending sales from January to August 2020.

2. Income Factor

Since 2019, the outbreak of the COVID-19, a major public health event, has had a great impact on China. During the epidemic, employees were unable to work in the company and had to work from home, resulting in a sharp drop in office efficiency. In addition, due to the outbreak of the epidemic, people have to isolate themselves at home, which greatly reduces the opportunity to go out and reduces the willingness and ability of residents to consume. Meanwhile, corporate sales fell, thus the profits fell. Especially in small and medium-sized enterprises, it is difficult to maintain the normal operation of the company. Therefore, in order to save the company's expenses, they had to choose to lay off staff. Layoffs have left a large portion of workers unemployed and their incomes reduced.

However, residents' income is a significant factor in the demand for real estate products. The sharp decline in income has led households who originally had the intention and behavior of buying a house to abandon or delay their home purchase plan, weakening the willingness to buy a house, reducing purchasing behavior, and consumers being more interested in real estate. According to the official data, the consumption level of residents is indeed affected by the reduction in income under the new crown epidemic. From the data in Figure 1, especially from December 2019 to February 2020, when the epidemic just broke out, the sales area of commercial housing and the sales of commercial housing dropped significantly.

3. Market Factor

Affected by the epidemic, not only the income of residents has been affected, but the supply of housing companies has also been affected. To be specific, real estate construction had to be postponed or

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suspended. It was difficult to quickly resume production under the subsequent improvement of the epidemic situation, resulting in some real estate opening times later than the original time. In addition, the epidemic has caused many enterprises to lack funds and reduce investment in real estate development. Seen from Figure 2, the national real estate development investment was 1,011.5 billion yuan from January to February, decreasing of 16.3% than former year. Situations similar to this have caused a supply gap in the real estate market, which has caused many inconveniences and brought trouble to real estate consumers, thereby affecting real estate consumption behavior.

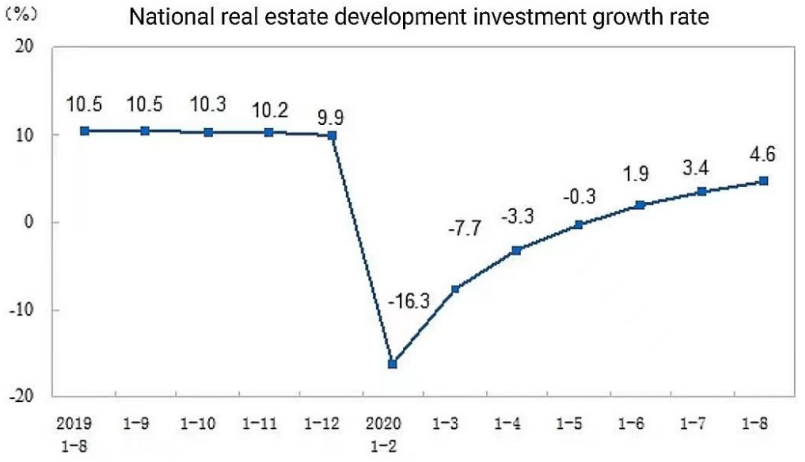


Figure 2: Real estate development investment completion from January to August 2022.

As an important uncertainty factor affecting the world, COVID-19 will undoubtedly have a certain impact on China's real estate industry. During the pandemic, the development of various industries is restricted and the income of most people is reduced, which leads to the demand for real estate will be delayed. From the perspective of real estate enterprises, relevant enterprises may modify the way of management or governance [7]. In the short term, the work stoppage "lockdown" and other factors may cause a certain impact on real estate enterprises [8].

During this period, the short-term operation of real estate enterprises was negatively affected, the transaction rate was reduced, and land transfer and enterprise resumption were limited. The related enterprise capital face is tight, small and medium-sized real estate enterprise debt repayment pressure increases [9]. The shutdown caused by the epidemic also involved the sales department of real estate enterprises, and offline sales activities were almost completely stopped. As a type of enterprise with high leverage and fast turnover, real estate enterprises undoubtedly bore huge pressure. Under these circumstances, many real estate enterprises will choose to lower the housing price and implement preferential policies to stimulate sales. Even if it will bring losses to the company, these losses will be short-term and limited. On the contrary, the rolling cash flow brought by such policies can bring greater profits to the next project [10].

In the short term, the land transaction volume will decrease, which will lead to a decrease in the quantity of real estate construction, which means that the newly started area, construction area, completed area, newly approved commercial housing and market area of real estate projects will decrease. However, in terms of medium and long-term impact, the recovery of real estate development depends on the recovery and development of the social economy. When the epidemic can be controlled, the state will encourage the resumption of production and work and provide support for real estate enterprises [11]. During the epidemic, many real estate enterprises are facing a crisis of survival. Mergers and acquisitions among real estate enterprises will be a very significant way of industry integration. When land resources are released, many real estate enterprises will carry out equity cooperation in various ways, and opportunities such as overall mergers and acquisitions will gradually emerge. The

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impact of the pandemic on the real estate market cannot be underestimated. A series of shutdowns caused by the epidemic have slowed down the development of the real estate industry, which has also affected the economic growth rate. However, this situation will not last for a long time. After the epidemic, the country and government will give support, and real estate enterprises will return to normal operation [12].

Local governments need real estate enterprises to purchase land to supplement finance, while local governments maintain the stability of the real estate market. Therefore, real estate enterprises can make profits in the stable real estate market to continue to operate. Thus, in the era of an epidemic, only when the real estate enterprises complete the land development process and complete the sales cycle, can the government ensure the normal operation of land finance in the future is sustainable [13]. Nevertheless, the current situation of the land auction market is not optimistic or even more severe than that in 2020. As shown in Table 1, from January to July of 2020, the area of land purchased nationwide dropped by 48.1% over the same period. It can be inferred that real estate enterprises can no longer carry out land development and provide land finance for the government. To this end, the government carried out macro-control and announced a series of measures, such as easing purchase and sales restrictions, increasing the proportion of provident fund withdrawals, and reducing payment and interest on housing loans.

Table 1: National real estate development and sales from January to July 2022.

Index	Absolute amount	Growth (%)
Investment in real estate development (100 million yuan)	79462	-6.4
Including: residence	60238	-5.8
Office building	3035	-10.3
Commercial business premises	6408	-10.2
Building construction area (10000 square meters)	859194	-3.7
Including: residence	607029	-3.8
Office building	33664	-3.3
Commercial business premises	77015	-9.0
Newly started building area (10000 square meters)	76067	-36.1
Including: residence	55919	-36.8
Office building	1904	-35.4
Commercial business premises	5202	-37.5
Completed building area (10000 square meters)	32028	-23.3
Including: residence	23279	-22.7
Office building	952	-32.6
Commercial business premises	2674	-30.2
Land purchase area (10000 square meters)	4546	-48.1
Land transaction price (100 million yuan)	2918	-43.0
Sales area of commercial housing (10000 square meters)	78178	-23.1
Including: residence	66087	-27.1
Office building	1838	9.7
Commercial business premises	4750	6.2
Sales of commercial housing (100 million yuan)	75763	-28.8
Including: residence	66328	-31.4
Office building	2480	3.1
Commercial business premises	4772	-2.0
Area of commercial housing for sale (10000 square meters)	54655	7.5

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Table 1: (continued).

Including: residence	26092	14.1
Office building	3905	5.1
Commercial business premises	12352	-3.5
Including: domestic loans	11030	-28.4
Utilize foreign capital	53	20.7
Self raised funds	31495	-11.4
Deposit and advance payment	28575	-37.1
Personal mortgage loan	14169	-25.2

To sum up, the government has three purposes for regulation. Primarily, it is suggested to stimulate real estate market consumption to help real estate enterprises recover funds and reduce inventory pressure to prevent systemic financial risks. High debt and high turnover drive the growth mode of the development of real estate enterprises. At present, the debt ratio of real estate enterprises is generally 60% to 70%. From the perspective of debt structure, the debt of real estate enterprises mainly includes interest-bearing debt, interest-bearing debt, and implicit debt, where interest-bearing debt has three pressures on real estate enterprises: the pressure to repay the capital, the pressure to pay interest, and the pressure to default at maturity. When the proportion of interest-bearing liabilities due within one year of a real estate enterprise is too high, such as more than 30%, its short-term debt pressure will be high, the loan will be pinched, and the high turnover will not be there, which is also the fundamental reason for the debt default of the real estate enterprise in 2021.

In addition, it is also proposed to send a signal to increase the confidence of real estate enterprises, encourage real estate enterprises to purchase land to save the depressed land auction market, and ensure local fiscal revenue. The finance of major cities in China is highly dependent on land finance. In 2021, there will be 13 prefecture-level cities in China with more than 100% land dependence. Once the land finance support to the local government is stopped, according to the current land finance scale, the gap must be borne by individuals or enterprises. If individuals cannot bear it, the gap must be borne by enterprises, which means that the current tax burden of enterprises will double, resulting in two serious consequences: a large number of enterprises will suffer from loss deflation due to a large increase in enterprise costs. In this case, one has to reduce the business scale and go bankrupt. 3

We will continue to use real estate as the driving force for economic development to ensure stable and good economic development and achieve the annual GDP growth plan. The annual GDP target growth rate in 2022 is 5.5%. According to Table 2, China's GDP growth rate in the first quarter of the first half year and the second quarter year on year is 4.8% and 0.4% respectively, which means that if the original target is achieved, the average growth rate in the second half year must be 8%.

Table 2: Year on year GDP growth rate.

Particular year	Q1	Q2	Q3	Q4
2017	7	7	6.9	6.8
2018	6.9	6.9	6.7	6.5
2019	6.3	6	5.9	5.8
2020	-6.9	3.1	4.8	6.4
2021	18.3	7.9	4.9	4
2022	4.8	0.4		

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4. Limitations & Prospects

Since the exploration in this paper is carried out from multiple perspectives, the depth of research is not enough, and the exploration of many problems is only on the surface. Second, because the experience is not enough, the analysis of a lot of data may not directly reflect reality, and the analysis of data may not be accurate. In the future, we will cut from more perspectives and expand the depth of research based on more relevant data and complex analyzing approaches, as well as refer to the research results of others to enrich the results.

5. Conclusion

In summary, this article examines the factors affecting the real estate industry from the perspective of the COVID-19. According to the analysis, the purchasing power of consumers has been seriously weakened. To be specific, more people have turned to conservative consumption and real estate investment, and the growth rate has once dropped to negative values. Starting from the housing enterprises themselves, low-selling sales make most of the housing enterprises with huge liabilities face cash flow problems However, the cash flow problem is also the most restrictive problem for the expansion of housing enterprises. The series of shutdowns caused by the epidemic have reduced the development speed of the real estate industry, which has also brought about an impact on the economic growth rate. On the one hand, it is necessary to continue to transfer real estate as a driving force for economic development, ensure stable and good economic development, and achieve the annual GDP growth plan. On the other hand, it is necessary to stimulate property market consumption in a timely manner, help housing enterprises raise funds and reduce treasury pressure, prevent systemic financial risks, and release signals to enhance the confidence of housing enterprises. On this basis, it can encourage housing enterprises to buy houses in the land, save the depressed land auction market, and ensure local wealth and political income. This article broadens the breadth of real estate research and analyzes the plight of China's real estate market from multiple perspectives. It is conducive to sorting out the impact of the connection between various groups under the epidemic on the real estate market. Nevertheless, the study is not in-depth enough, and the analysis of some of the issues is not specific enough, and we will continue to delve into the problem later while looking for more perspectives that can be inserted. Overall, these results offer a guideline for analysis the impacts of certain issues on real estate market.

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Comparative Analysis of Real Estate Financial Model: Evidence from Vanke and Evergrande

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Abstract: Contemporarily, the impact of the real estate industry on the overall economy is particularly prominent. However, the financing mode and financial structure of the real estate enterprises are still lack of summary and scientific analysis. Therefore, through the difference analysis of the financing mode and financial statement of Vanke and Evergrande, this study summarizes the financial mode that is more conducive to the booming of the real estate enterprises. In this paper, we collect the financial statement and enterprise investment data of Vanke and Evergrande, carry out difference analysis, visualization, and trend analysis on the data, as well as compare and explore the different financial models of them. Enterprises should pay attention to the proportion of long-term debt in total corporate debt to avoid causing excessive capital flow pressure. The management of enterprise leverage and risk assets is crucial to the long-term development. A healthy enterprise cannot develop without the correct use and scientific management of loans and risk assets. They should focus on the rationality of short-term loans, effectively mitigate the pressure of debt repayment. The real estate financial model proposed here is a summary from Vanke and Evergrande, which is not a universal financial model. These results shed light on guiding further exploration of the rational financial models in the real estate enterprises.

Keywords: Evergrande, Vanke, financing mode, real estate finance

1. Introduction

The real estate industry, as a pillar industry in China, plays a significant role in the development of the national economy, which was born in the market in the 1980s. The shortage of commercial housing supply that has been accumulated over several decades has led to the unprecedented prosperity of the real estate market, which has also cast a strong speculative color on this industry. With China's macro-control policies put from 1994 to 1997, all kinds of real estate development enterprises (e.g., Vanke Group and Evergrande Group) born in the unprecedented real estate bubble, were thoroughly baptized. Some enterprises were able to seek vitality from the market pressure brought by the vacancy of commercial housing making the industry become mature after learning from experience. In the 21st century, the real estate companies that only focus on the success of residential development have achieved considerable success through transforming them focus on the commercial real estate. Vanke

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and Evergrande Group, which were once the leaders of the real estate industry, have ended differently [1-4].

Nowadays, the performance of Vanke and Evergrande Group in the real estate market has been highly concerned and valued by the domestic and foreign industry becoming the center of many scholars' attention. Many research achievements have been made. Since the first half of 2021, the overwhelming news about Evergrande's bankruptcy has swept through. From the perspective of the financial statements, it seems that it is not owing to insolvency. The extreme lack of cash flow leads to this problem. Evergrande Group ranks at the bottom of the cash to debt ratio in various real estate enterprises. Systematic problems have always been one of the most important factors in Evergrande's long-term high debt ratio, which is easy to cause the depletion of liquidity and great economic trauma to the company [1]. Evergrande group is currently facing a dilemma which is the shortage of funds caused by a single financing means. It resulted in the inability to pay commercial bills when they are due, thus greatly increasing Evergrande's debt burden. On the contrary, through the analysis of Vanke Group's financial statements in the first quarter of 2020 and 2021, Vanke Group did not experience a decline in its performance. The profits, sales amount and revenue maintained a steady growth. Moreover, Vanke Group's net debt ratio of 15% and abundant cash flow have maintained a positive and high credit rating for ten consecutive years, making Vanke a model of stable operation of real estate enterprises. Besides, it has diversified financing channels, such as fast selling to recover funds from property buyers, bank loans, issuing convertible bonds, real estate trusts, stock issuance, and seeking cooperation. Maintaining a good relationship between banks and enterprises and actively expanding financing channels not only reduce enterprise risks, but also meet the needs of their own development [5-10].

Based on the background of the economic downturn and the real estate market becoming more and more sluggish, this article compares two typical real estate companies (Evergrande and Vanke group) with different development status in the real estate market by using data analysis, chart analysis, difference analysis and other methods. Looking forward to summarizing the financial model and financial structure that are constructive to real estate enterprises today from the difference between financing model, management structure and capital flow. This article is divided into three sections. First, this article analyzes the differences between the two companies. Then, it compares the average values of various indicators between the two companies and real estate industry after obtaining the differences between Evergrande and Vanke in financial models. In the last section, the article proposes the reference and improvement of the real estate enterprises in the process of the development process of these two enterprises.

2. Descriptions of Vanke and Evergrande

The development of a listed company is inseparable from the investment value of the stocks in the industry. The fluctuation of stock prices can not only reflect the company's economic position and operating status, but also future prospects and trends of the industry. Vanke shares were initially public offerings in Shenzhen Special Economic Zone Securities in December 1988, it was officially listed on the Shenzhen stock exchange in January 29, 1991. Besides, B shares were issued to foreign investors in April 1993 and listed on May 28 in the same year. In addition, raised as much as HK $451 million for the development of real estate. Vanke has blossomed and that has given it a certain elevated status. The share price soared more than 300 times, it cannot be divorced from the rapid development of the service industry in recent years and good business enterprise operation achievement [1].

Xu Jiayin absolutely controls China Evergrande, a Hong Kong-listed company through a BVI (British Virgin Islands) company, registered in the Cayman Islands, Since Evergrande Real Estate Group was listed in Hong Kong in 2009, operating income and share price sharply rise, also the

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earnings per share and net asset are multiplying which compared to previous year. It strongly confirms that economic situation and profitability of Evergrande group been developing steadily and keep reducing investment risk. However, the news of Evergrande officially defaulted caused widespread attention from domestic and abroad. By comparing the financial statements of Vanke in recent years, even though Evergrande's net assets and scale have always been superior to than Vanke, nevertheless, there is a data called shareholder's profit, it shows that Evergrande's shareholder profit attributable to listed companies is only half of Vanke. Therefore, it is kind of evidence that the investment value of Evergrande Group is far from the level of Vanke Group.

3. Analysis of Vanke and Evergrande's Financing Model

3.1. Vanke

There has always been an inseparable relationship between real estate and banks. The loans provided by banks to real estate enterprises, including long-term loans and short-term loans. Up to now, more than 80% of the financing funds of real estate enterprises have come from bank loans or other bank financial products, and Vanke Group is no exception. Vanke's balance sheet in 2021 shows that Vanke's short-term borrowings in 2021 will reach 14.41 billion yuan, accounting for 1.1% of the total current liabilities; Long term loans reached 154.3 billion yuan, accounting for 10.0% of total liabilities. As shown in Table.1, Vanke's short-term borrowings will be 25.11 billion yuan, accounting for 1.9% of the total current liabilities. Long term loans amounted to 132 billion yuan, accounting for 8.7% of total liabilities. However, these data are shown in Vanke's statements in 2019 as short-term loans of 15.37 billion yuan, accounting for 1.2% of the total current liabilities. Long term loans amounted to RMB 114.3 billion, accounting for 7.8% of total liabilities. In contrast, Vanke's short-term borrowing data for the five-year period, i.e., 2016, was 16.58 billion yuan, accounting for 2.9% of the total current liabilities. Long term loans amounted to 56.41 billion yuan, accounting for 8.4% of total liabilities.

Table 1: Loan financing data of Vanke and Evergrande.

	2019	2020	2021
Vanke short-term loan	153.7 B	251.1 B	144.1 B
Proportion in total current liabilities	1.2%	1.9%	1.1%
Evergrande short-term loan	3721.69 B	3354.77 B	2400.49 B
Proportion in total current liabilities	27.6%	22.3%	15.3%
Vanke long-term loan	1143 B	1320 B	1543 B
Proportion in total liabilities	7.8%	8.7%	10.0%
Evergrande long-term loan	4277.26 B	3810.55 B	3317.26 B
Proportion in total liabilities	23.1%	19.5%	16.8%

According to Table.1, in the four years from 2019 to 2022, the total amount of long-term loans made by Vanke Group through banks and the proportion of long-term loans in total liabilities are gradually increasing. In addition, the total amount of long-term loans is even more than 200% higher than five years ago. It indicates that Vanke Group needs to lock in the interest rate risk in the market by increasing long-term loans, to be able to benchmark risk in the market with fluctuating interest rates, but at the same time, it also makes Vanke Group's financial risk and capital pressure become greater, with potential risks. The cyclical nature of the real estate industry itself also determines that Vanke needs more long-term loans to match its production cycle. Second, Vanke's short-term borrowings have no obvious upward or downward trend compared with long-term borrowings. To be more precise, Vanke's short-term borrowings are volatile. In recent years, China's real estate market

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environment is not optimistic enough, and the volatility is large. Vanke Group's response to the volatility is to adjust and plan its short-term loans Thirdly, the continuous increase of Vanke's total amount of bank loans also reflects Vanke Group's continuous expansion of its development scale from 2019 to 2022, which also leads to the continuous expansion of Vanke's total amount of loans.

Equity financing is a kind of financing method that enterprises obtain external funds by transferring their ownership, which has a long-term characteristic. According to the financial statement data of Vanke Group represented in Table.1, the paid in capital of Vanke in 2019 was RMB 11.30 billion, while this figure in 2020 and 2021 was RMB 11.62 billion and RMB 11.63 billion respectively. Although the increase of Vanke's paid in capital is small, the proportion of paid in capital in owner's equity still shows a downward trend. It can be concluded that the amount of equity financing of Vanke is relatively stable, while the proportion of equity financing shows a downward trend because the total amount of owner's equity is rising while the paid in capital is not rising.

3.2. Evergrande

Evergrande Group is another real estate enterprise that relies heavily on bank loans for financing, even more than Vanke Group. According to the data of Evergrande Group's semi annual report in 2021, the short-term borrowings of Evergrande Group are RMB 240049 million, accounting for 15.3% of the total current liabilities. Long term loans amounted to 331.726 billion yuan, accounting for 16.8% of total liabilities. In 2020, Evergrande Group's short-term borrowings will be 335.477 billion yuan, accounting for 22.3% of the total current liabilities. Long term loans amounted to RMB 381.055 billion, accounting for 19.5% of total liabilities. In 2019, Evergrande Group's short-term borrowings were 372.169 billion yuan, accounting for 27.6% of the total current liabilities; Long term loans amounted to 427.726 billion yuan, accounting for 23.1% of total liabilities.

According to the results, the total amount of short-term loans and the proportion of short-term loans in total current liabilities of Evergrande Group have shown a downward trend, which means hat Evergrande Group has gradually realized the pressure and brought by high debts to Evergrande itself under the risk of debt crisis, and has begun to consciously reduce short-term bank loans, i.e., reduce risk exposure. Moreover, Evergrande Group's long-term loans, like short-term loans, also showed a downward trend in the total amount and the proportion of long-term loans in total liabilities. Although its long-term and short-term borrowings are relatively balanced, long-term borrowings still have the problems of high cost and low flexibility. Therefore, its moderate reduction of the total amount and proportion of long-term borrowings of enterprises is conducive to the sustainable development of enterprises. As a joint-stock enterprise, this will release its own capital pressure through equity financing by issuing shares every year. Its total equity in 2018-2020 will be maintained at about 350 billion yuan, while in 2021 it will rise to more than 400 billion yuan. Evergrande will expand the scale of equity financing to repay corporate loans, purchase land for land reserve.

4. Comparison Analysis

4.1. Net Profit & Cash Flow

According to the financial statement data of Vanke Group from 2019 to 2022 shown in Fig.1, Vanke's operating profit margin is 11.7% in June 2022, while 11.6% in 2021, and that in 2020 and 2019 is 19.1% and 20.8%, respectively. From the report data of Vanke, the main reasons for the decline of Vanke Group's operating profit margin include the decline of gross profit margin, the decrease of investment income and the provision for impairment caused by the market downturn, followed by the investment mistakes of Vanke Group. In contrast, Evergrande's financial report data shows that Evergrande's operating profit margin will be 8.7% in June 2021, while before that, Evergrande's operat-

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ing profit margin in 2018-2020 will be 27.19%, 15.09% and 13.30% respectively. In this case, Evergrande's operating profit margin has fallen very quickly, with the profit margin falling by more than 60% from 2018 to 2021. The reason for this sharp drop in operating profit margin is that Evergrande Group's main real estate development business suffered huge losses. However, under the condition that Evergrande's real estate development business was weak, Evergrande Group had to raise funds by selling its own assets, which led to a decline in profit margin.

According to the cash flow statement of Vanke from 2018 to 2021, the net cash flow from operating activities of Vanke is 33.62 billion, 45.69 billion, 53.19 billion and 4.11 billion respectively; Net cash flows from investment activities were -67.36 billion, -28.63 billion, 5.80 billion and -26.28 billion respectively; The net cash flows from financing activities were 44.8 billion, -33.34 billion, -32.5 billion and -23.1 billion, respectively. Compared with Vanke, its net cash flows from operating activities in 2018-2021 were 54.749 billion, -67.357 billion, 110063 billion and -14.831 billion, respectively. Net cash flows from investment activities were -60.363 billion, -55.308 billion, -24.128 billion and -19.618 billion, respectively. Net cash flows from financing activities were -17.651 billion, 143.163 billion, -76.885 billion and -37.446 billion respectively. By comparison, Vanke's liquidity is better than Evergrande Group after 2018. Secondly, Vanke's debt repayment pressure is more stable than Evergrande, so it is less likely to cause additional impact to the enterprise.

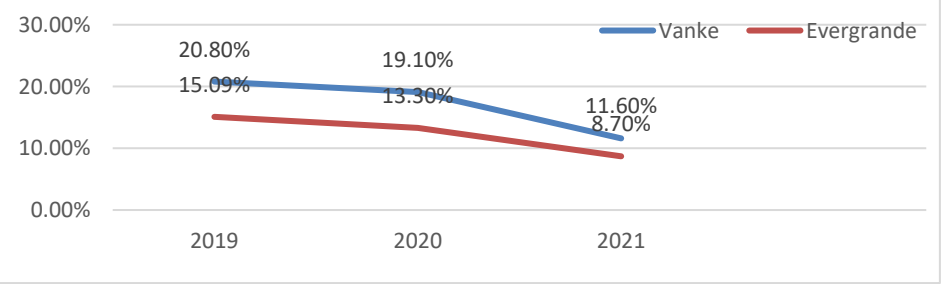


Figure 1: Line chart of operating profit margin of Vanke and Evergrande.

4.2. Asset Liability Ratio

The asset liability ratio is equal to the ratio of total liabilities to total assets. This indicator is an important indicator to evaluate the company's debt level. The asset liability ratio of Vanke Group in June 2022 is 79.16%, which is 0.73% lower than the asset liability ratio of 79.74% in 2021. The asset liability ratio of Vanke in 2020 is 81.28%, which is 3.65% lower than the asset liability ratio of 84.36% in 2019. This trend of declining asset liability ratio year by year is due to the decline of Vanke's net profit margin from 2019 to 2022, and the increase of operating cost is higher than the operating revenue, which led Vanke Group to reduce the pressure on capital flow by reducing the asset liability ratio, thus releasing the vitality of the enterprise. It can be seen from Evergrande's annual report that its asset liability ratio in June 2021 is 82.71%, down 2.43% compared with 84.77% in 2020. The asset liability ratio of Evergrande Group in 2019 is 83.75%, which is not much different from that in 2018 (83.58%). Therefore, compared with the declining asset liability ratio of Vanke Group, Evergrande's asset liability ratio has been maintained at a relatively high level, which indicates that the capital of Evergrande from external debt is too high, and the capital from owners is insufficient, which also leads to the high financial risk of Evergrande. Thus, the risk of enterprise capital chain rupture and bankruptcy reorganization is increased.

We conducted regression analysis on the asset-liability ratio of Evergrande and Vanke (Seen from Table. 2 and Table. 3). According to the results, under the condition of 95% confidence, the t-test statistic results show that the null hypothesis should not be rejected, so the asset-liability ratio of Evergrande and Vanke in the selected time interval has explanatory power.

DOI: 10.54254/2754-1169/17/20231111

Table 2: Regression analysis of Evergrande's asset liability ratio.

Metrics	Evergrande	Vanke
Multiple R	0.446939617	0.598059383
R Square	0.199755021	0.357675025
Adjusted R Square	-0.600489958	-0.284649949
Standard Error	2.744839964	1.644376606

Table 3: Loan financing data of Vanke and Evergrande.

	Coefficients	std	t Stat	P-value
Evergrande.				
Intercept	86.06	2.93	29.33	8.05E-06
X1	-0.31	0.37	-0.86	0.44
X2	0.51	2.53	0.20	0.85
X3	0.20	2.84	0.069	0.95
X4	-0.54	2.77	-0.19	0.86
Vanke				
Intercept	84.28	1.76	47.94	1.13E-06
X1	-0.22	0.22	-1.02	0.37
X2	-0.054	1.52	-0.036	0.97
X3	0.79	1.70	0.46	0.67
X4	1.13	1.66	0.68	0.53

4.3. Vertical Comparison Between the Overall Real Estate Industry

According to the research report on China's top 100 commercial real estate enterprises from 2018 to 2022, the average asset liability ratio of the top 100 commercial real estate representative enterprises in 2022 was 70.6%, and the solvency remained stable. From 2017 to 2022. As shown in the Table. 4, the asset liability ratio of the top 100 commercial real estate enterprises declined slightly which was in a reasonable range. In 2021, the average asset liability ratio of the top 100 commercial real estate representative enterprises was 70.6%, a small decrease of 0.7% compared with 2020. The reason is that the top 100 commercial real estate enterprises have expanded their asset scale through steady scale expansion and income growth from high-quality operations to achieve stable operation. At the same time, they have reduced their liabilities. According to the financial statements of Vanke Group from 2018 to 2021, the asset liability ratio showed a gradual downward trend, but it was always higher than the average value of the top 100 enterprises. As illustrated in the Fig. 2, the leverage of enterprises has been tightened and effective measures have been taken to reduce the asset liability ratio. Vanke Group has maintained growth through completion scale, significantly accelerated completion carry forward, insisted on prudent investment, and reduced the intensity of land acquisition to decline the asset liability ratio and make it close to the industry average. According to the financial statements of Evergrande Group from 2018 to 2021, the asset liability ratio increased to 84.77% from 2018 to 2020, and then decreased to 82.71%, while the effect is not obvious. Additionally, it is always higher than the average value of the top 100 enterprises. Evergrande Group not only misjudged the future situation of real estate in the main business of real estate and took the road of radical expansion, but also blindly diversified expansion. However, when Evergrande Group realized the problem, the huge scale of liabilities had hindered its liquidity, and it was difficult to quickly reduce the asset liability ratio to the industry average.

DOI: 10.54254/2754-1169/17/20231111

Table 4: Average asset liability ratio of Vanke, Evergrande and Top 100 enterprises from 2018 to 2021.

Year	2018	2019	2020	2021
Vanke Group	84.5856	84.359	81.2835	79.7398
Evergrande Group	83.58	83.75	84.77	82.71
Top 100 enterprises	72.2	71.6	71.3	70.6

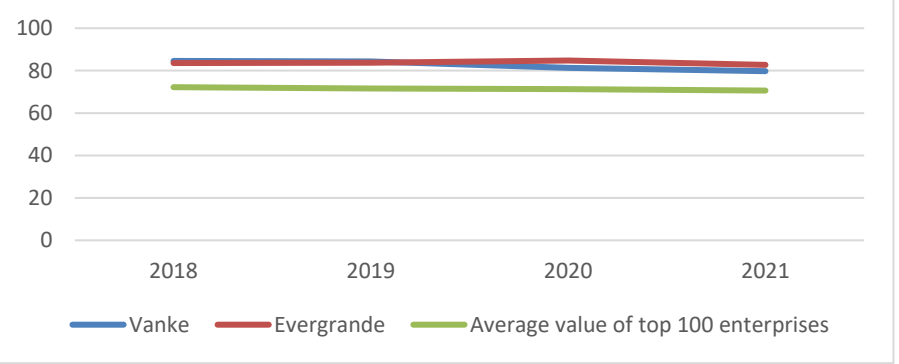


Figure 2: Line graph of the average asset liability ratio of Vanke, Evergrande and Top 100 enterprises from 2018 to 2021.

The cash flow ratio reflects the repayment ability of annual revenue cash to current liabilities. Cash flow ratio refers to the ratio of earnings before interest, income tax, depreciation and amortization (EBITDA) divided by the sum of interest or principal and interest. According to the research report on China's top 100 commercial real estate enterprises from 2018 to 2022, as listed in the Table. 5, the cash flow ratio of the top 100 commercial real estate enterprises in 2021 was 1.47%, up 0.04% from the previous year, basically stable. In order to achieve the dual goals of reducing debt and promoting development, the top 100 enterprises have achieved stable cash inflow through optimizing and strengthening operational real estate business enhancing short-term risk resistance. According to the financial statements of Vanke Group from 2018 to 2021, as shown in the Table.3, the cash flow ratio of Vanke Group increased steadily from 2018 to 2020, about 1 percentage point higher than the average of the top 100 enterprises. The cash flow ratio declined from 4.0% to 0.3% in 2021. In most cases, the cash flow ratio of Vanke Group was higher than the average value of the top 100 enterprises, which means that after the expansion to a certain extent, the cash flow of operating activities continued to rise. The large-scale financing development and large-scale leverage were not being carried out, which indicates that Vanke is beginning to enter a more benign and healthy development mode. According to the financial statements of Evergrande Group from 2018 to 2021, the cash flow ratio of Evergrande Group in 2018 was as low as - 15.3% indicating that the enterprise was in a period of seriously unhealthy capital flow. It rose rapidly to 34.5% and 39.2% in 2019 and 2020, but fell to - 3.0% in 2021. The reason for the negative cash flow ratio of the enterprise in 2018 is that Evergrande Group has a relatively weak income in other industries except the real estate industry, which leads to a large number of accounts receivable. According to the results, the cash inflow from business operations is relatively small. Year 2019 to 2020 was a period of rapid development for Evergrande. It fulfilled the huge demand for sales by rapidly increasing land reserves and construction projects. Therefore, the cash outflow climbed. By 2021, the reason for the negative cash flow ratio is that the enterprise had relatively high debt interest. In view of the incentives such as weak sales, the profit and cash inflow of the enterprise diminished.

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Table 5: Average cash flow ratio of Vanke, Evergrande and Top 100 enterprises from 2018 to 2021.

Year	2018	2019	2020	2021
Vanke Group	3.0	3.6	4.0	0.3
Evergrande Group	-15.3	34.5	39.2	-3.0
Top 100 enterprises	1.5	1.47	1.43	1.47

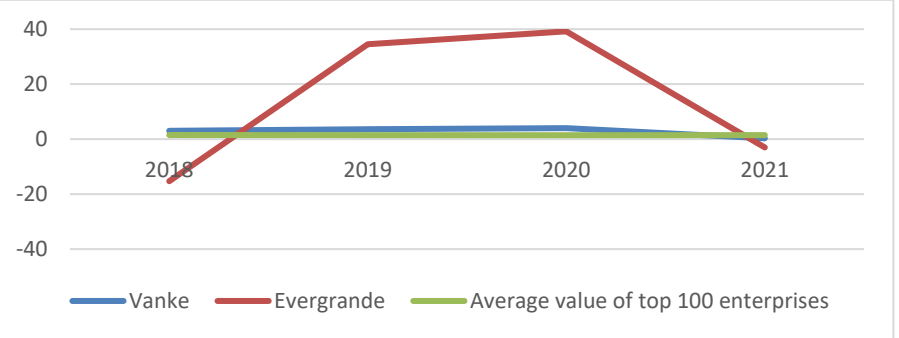


Figure 3: Line graph of the average cash flow ratio of Vanke, Evergrande and top 100 enterprises from 2018 to 2021.

5. Suggestions

Financing is always been on the indispensable conditions for real estate companies, the downturn in Evergrande can provide enlightenments function for others. Based on the analysis, the debt crisis of Evergrande Group is mainly reflected in the financing model and the pressure on payment collection has significantly increased. With the continuous suppression of the three red line policy, the financing models of real estate enterprises have shown deterioration and contraction [9]. The existing problems in the financing structure of Evergrande Real Estate Group are that the proportion of internal financing and long-term debt in equity financing is relatively low, the total amount of debt is huge, which makes extremely hard repayment pressure of the company. It should strike a balance between maintaining a relatively fast and stable development and making economic structural adjustment.

Thus, under these circumstances, it often requires long-term stable funds, otherwise, it might fall into a long-term economic crisis [10]. According to Management information and financial analysis, the company's leverage ratio is as high as 469 times, and its debt ratio reached 82.7%. Therefore, it aims to optimized the capital structure in order to face with unreasonable status of Evergrande Group's financing model and structure. By controlling the risk of cash flow, enterprises can change the financing model from the previous risk financing to a stable structure, which not only completely liberates the liquidity risk of funds, also largely enhance enterprise management capacity. Besides, due to the small proportion of long-term loans of it, the number of long-term loans can be appropriately increased. It effectively eases the pressure of debt repayment to achieve the goal of reducing the debt ratio.

Moreover, Enterprise risks can be reduced by establishing an effective risk early warning mechanism. A professional data analysis team can be deployed to calculate risk-related data such as debt ratio, profit, etc. implement risk early warning data sorting and calculation to weight the corresponding data. After the corresponding indicators are obtained, relevant risk management shall be carried out. Lastly, it also discusses a financing approach of multi-channel, multi-factor investment includes real estate trust. Furthermore, signing up to the TV show is one of channel to gain public recognition, and raise funds. The increase in financing channels will make the company's reserves relatively abundant. By comparing the differences between the two real estate companies, there are some shortages

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and defects in the existing financing model and structure of Evergrande. It mainly aiming at controlling cash flow and reducing debt ratio which effectively optimized and put forward a new financing strategy and plan, not only revitalize cash flow, but also make certain Reduce enterprise risks. Thus, the business prospects of enterprises can be qualitatively improved. The improvement of the financing model has significantly strengthened the function and operation effect of the corporate governance structure, also potentially affected the investors' intervention in the enterprise. Stable business pattern can bring higher profit. Enterprise risk managers are able to complete preparation in the risk warning mechanism and cash flow management.

6. Limitations & Prospects

This article utilizes many theoretical and quantitative tolls in researching the topics, each analysis will involve a large proportion such as net profit cash flow, asset ratio through the financial statement of the two companies. It is determined that the development and operating conditions of the two companies in recent years, which is able to propose some conclusions from the case. However, this method is useful but it has its limitation from the perspective of the number of samples and the types of data, only part of data in financial report were listed. Therefore, adding more real estate companies and various analysis method like what-if analysis under the condition that this indicator reaches the highest level. Hence, it makes observation in changes of business and financial circumstances of the enterprise which manly used for predicting enterprise potential. Moreover, trend analysis method should be added as well, it is able to collect the information from multiple periods and plotting it on a horizontal line to find actionable patterns. The real estate industry is probably to face larger consolidation soon. It may require to sale continued assets as a mean of financing and improving balance sheets. Right sequence and speed are key to success in the period of economy transition.

7. Conclusion

In summary, we analyze the specific financing models and various data in the financial statements in the past three years of the two real estate companies, while comparing industry average asset-liability ratio. In addition, it indicated that there are still a lot of improvement in the development process of Vanke and Evergrande, summarizes a set of financial models and financial structures that are more conducive to sustainable development of enterprises, mainly including optimizing capital structure, controlling cash flow risks. and diversified financing methods. Overall, these results offer a guideline for the new financing strategy and plan in the real estate companies in the future.

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The Impact of COVID-19 Pandemic on Singapore's Resilience in Real Estate Market

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Abstract: Contemporarily, most of the research into COVID-19-induced mania in the real estate markets leaves public housing in the cold. Singapore with its robust public housing system provides the world with a perspective on another merit of such a system, particularly when a country takes on exact challenges. Deployed the method of qualitative analysis, this paper extracts data to dissect Singapore's real estate market consisting of public housing, private housing, and commercial properties. We analyze common causes behind increased home prices in Singapore (e.g., a new stamp duty regime and the pandemic-induced financial relief measures) and conclude that the whole of the housing in Singapore will be resilient based on reverting supply and its fundamentals. Besides, the disparate systems in public housing and private housing have created space to shield their residents against shocks. Although it is hardly stopped to channel demand from private housing to public housing, private housing can cushion blows for the public. Additionally, by analyzing pieces of news and financial figures, the paper verifies the saying that "this is a world that is ever-changing." Even if the brick-and-mortar barely falters, the purpose of doing business is vicissitude. Therefore, the paper expects a transformation in commercial real estate in Singapore.

Keywords: Singapore, COVID-19, real estate, public housing, private housing

1. Introduction

As the unprecedented pandemic has been raging in the world since the outset of 2020, it was apparent that many industries and sectors would inevitably take a beating as people are confined to their homes to live, play, and work [1]. The real estate sector in Singapore is no exception [2]. According to The World Bank, the COVID-19 turmoil has kicked off a global recession in more than a century [3]. On the other hand, the sector of real estate has always been playing an overarching role in an economy. In general, housing is the largest portion of households' wealth, the mortgage loan is a major component of banks' loan books, and the construction sector is a material contributor to economic growth. A stable real estate sector is a pillar of macroeconomic and financial stability. To salvage its economy damaged by the coronavirus, central banks in many countries have rolled out ease monetary policies over the past two and a half years, inadvertently increasing housing prices and rents in major cities worldwide such as London and New York [4]. However, none of them has established a regime that

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combined robust public housing and rigorous private housing systems similar to Singapore. In the meantime, capital in bulk and companies are flocking to the city-state against a backdrop of US-Sino tensions and the burgeoning South-eastern Asian economy [5]. Therefore, it is worth exploring whether Singapore's real estate, especially residential housing, would lose its resilience in the face of the disruption of the pandemic and rounds of capital injected with its stage-managed housing systems.

In real estate financing, Eugenio analyzes a dynamic correlation between the prosperity of credit and housing prices [6]. The rise of housing prices usually goes along with the dual credit boom of households and enterprises, but most of such a boom will eventually lead to an economic recession. Then, Deng found that real estate risk is negatively related to long-term investment, equity financing, and debt financing of enterprises, so he concluded that the greater the risk is, the less the external finance is [7]. Besides, in the face of the plight of the market environment, Manu tended to innovate real estate financing methods. Mortgage financing and trust fund financing (REITs) can overcome the five main factors restricting financing to some extent: law, macroeconomic environment, collateral barriers, insufficient risk assessment mechanism, and the lack of active financing channels [8]. Last, the research by Zhang and Liu suggests that Singapore's real estate sector caught by the COVID-19-induced imbalance between demand and supply prioritize its financing problem because it is a capital-intensive sector for a long cycle, a slow capital withdrawal, and a large number of quotas in investment [9, 10].

To catch a glimpse of how an epitome-like public housing system shields people from the global pandemic and to have a clue of future investment in Singapore's real estate market, this paper will concentrate on public housing, private housing, and commercial real estate, respectively. Meanwhile, to examine the market in perspective, the paper will be deployed the method of qualitative analysis, present data, go through them, and try predicting whether Singapore would ride out the situation at hand. The rest part of the paper is organized as follows. The following Section 2 will concentrate on public housing; Section 3 will be concerning private housing; Section 4 will focus on commercial real estate; Section 5 is the conclusion to the paper.

2. Public Housing

Dwellings in Singapore are categorized into two kinds, i.e., public housing and private housing. The former is home to around 80% Singaporeans, the ratio one of the highest in the world, and subsidized and regulated by the Housing and Development Boards (HDB). The HDB flats have constituted a monumental piece of Singaporean history, long being a poster child in public housing for countries and regions worldwide.

Only Singaporean citizens are eligible to apply for a brand-new HDB flat with a 99-year ownership lease. A new HDB flat is also known as Build-to-Order (BTO) flat. After a five-year minimum occupation period, the lease of a BTO flat can be transferred to other Singaporeans in the resale HDB market. In the wake of the Government’s measures in 2013, including a decrease in HDB flat loans, the resale market had been subdued since 2013 until the eve of the COVID-19 pandemic. In the third quarter of 2021, the resale HDB prices edged past those in 2013 [11]. As illustrated in Fig. 1, the resale HDB market has had a winning streak during the coronavirus pandemic, and there was a staggering rebound at the height of the plague [12]. Fig. 2 registers that the pandemic has given rise to extra transactions in the resale market.

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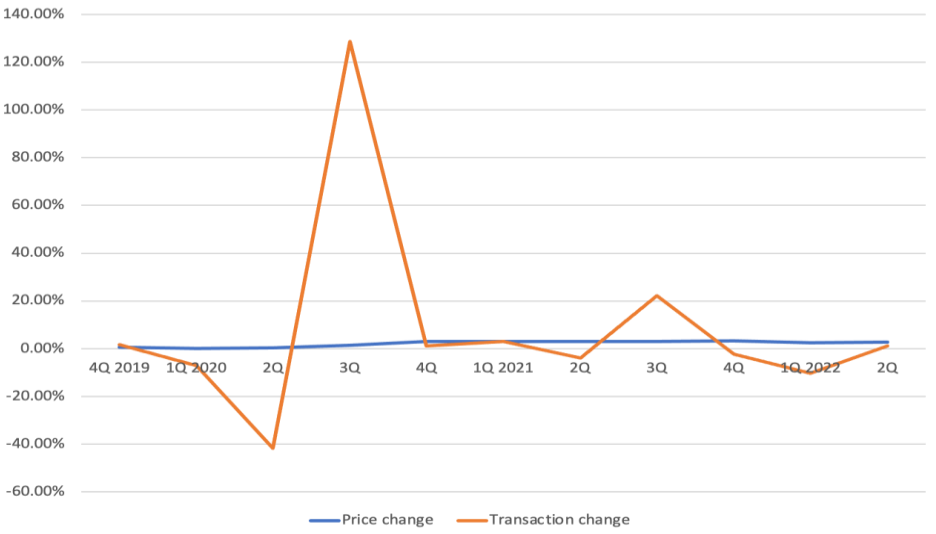


Figure 1: Price changes and transaction changes in resale HDB market from fourth quarter of 2019 to second quarter of 2022 [12].

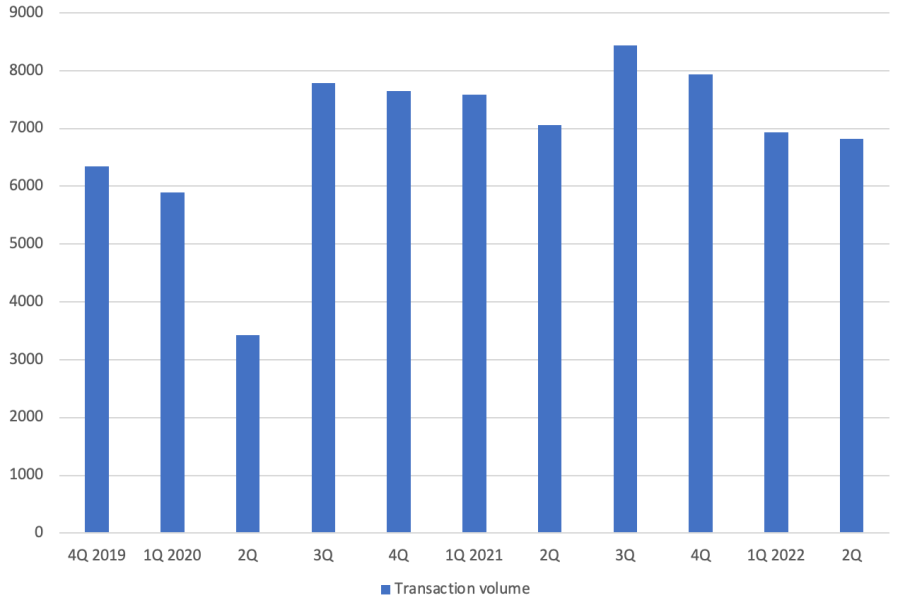


Figure 2: Transaction volumes in resale HDB market from fourth quarter of 2019 to second quarter of 2022 [12].

As seen from Table 1, resale HDB prices increased further in 2021 as the pandemic made inroads in the city-state. In November 2021, there was a record breaker that a whopping twenty-nine HDB flats fetched over S$1 million. Normally, a BTO flat application could be up to 4.5 years. The pandemic adds to this problem with construction project delays. Channel NewsAsia (CNA), the Singaporean state-run news outlet, reported that all completed BTO projects were delayed from six to ten months, citing border restrictions and a global supply chain crisis [13].

DOI: 10.54254/2754-1169/17/20231113

Table 1: Annual price change and transaction in resale HDB market from 2019 to 2021 [12].

Resale HDB market	2019	2020	2021
Price change	0.1%	5%	12.7%
Transaction	6,339 (2.7%)	24,748 (4.4%)	31,017 (25.3%)

In addition, demographic changes that occurred during the pandemic contributed to the yawning gap in BTO flats between demand and supply, as displayed in Fig. 3. CNA in 2021 saw a sharp rise in the number of marriages and divorces on the back of COVID-19-related restrictions lifted [14]. Meanwhile, multigeneration living in a flat is not uncommon in Singapore, whereas the work-from-home arrangement and infection risk exposed to the elderly at home are other reasons why people crave a more spacious and well-ventilated flat. Multiple rounds of financial relief from the Government shielded against recession for people in Singapore. Therefore, many Singaporean citizens and permanent residents streamed to the resale market, pushing prices of HDB flat to a new high.

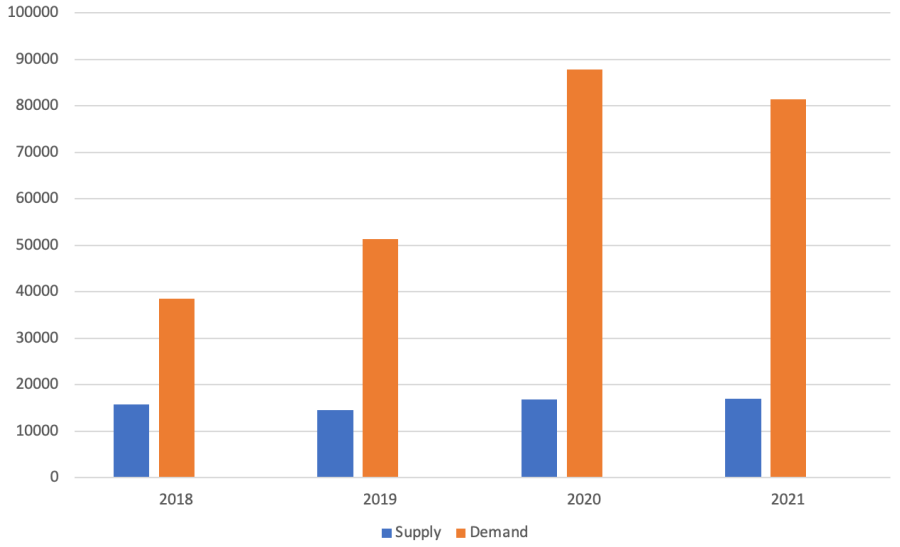


Figure 3: BTO flat supply and demand from 2018 to 2021 [15].

In 2019, the Government of Singapore rolled out a procedure-fewer housing grant, the Enhanced CPF Housing Grant (EHG), that increases income ceilings and maximum grant amount, and so forth [16]. For example, a household's income ceiling of HDB flat was up from SG$12,000 per month to SG$14,000 per month. The new grant makes HDB flats more affordable but intensifies the competition in buying an HDB flat. The annual rise of 5% in 2020 is the steepest one since 2012, with the eight-year high transaction volume. In the following year, the momentum was even more relentless, drawing down Government's intervention that introduced property cooling measures in December. The cooling measures increase the Additional Buyer's Stamp Duty (ABSD), elaborated in Table 2, and tighten the Total Debt Serving Ratio (TDSR). Under the new TDSR framework, buyers can get a maximum loan equivalent to 55% of their monthly income, down from 60%, for their first dwelling. In this case, the cooling measures channel demand for a condo to an HDB flat.

DOI: 10.54254/2754-1169/17/20231113

Table 2: Additional buyer's stamp duty [17].

Type of buyer		Previous rate	New rate since 16 Dec, 2021
Singapore citizen	First property	0%	0% (no change)
	Second property	12%	17%
	Third property	15%	25%
Permanent resident	First property	5%	5% (no change)
	Second property	15%	25%
	Third property	15%	30%
Foreigner	Any property	20%	30%
Entity	Any property	25%	35%

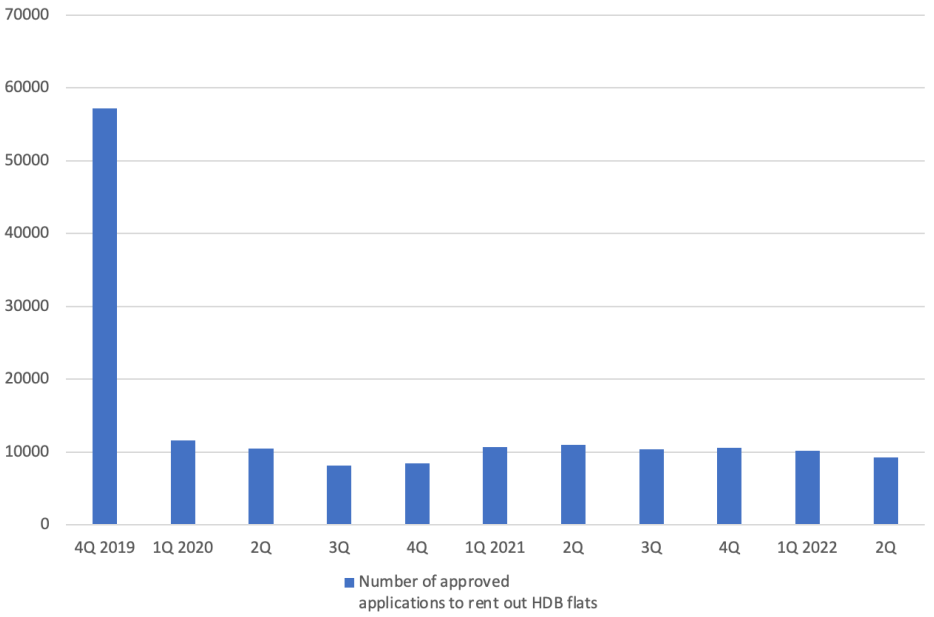


Figure 4: Number of approved application to rent out HDB flats from fourth quarter of 2019 to second quarter of 2022 [18].

On the rental market, as presented in Fig. 4, a dramatically decreased approved number of applications to rent out HDB flats since the start of the pandemic plunged rental HDB flats into a shortage. Hence, some tenants switch to purchasing an HDB flat in perspective.

In short, a backward supply, demographic changes, a new remote work lifestyle, the latest housing grant, and increased rents are among those ingredients for the out-of-the-ordinary public housing market amidst the pandemic. The subsequent property cooling measures even added fuel to it.

3. Private Housing

Meanwhile, Singapore's private residential real estate defied the pandemic-induced recession. Private housing accounts for around 20% of residential real estate on the island but makes it one of the most expensive housing markets in the world. Singapore's private residential real estate consists of non-landed condos and landed houses. As presented in Fig. 5, the prices of private housing have been on a rising streak during the COVID-19 plight. Such a trend is similar to that in the HDB flats, both of which recovered from a massive drop in the first two quarters of 2020. As outlined in Table 3, the

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private housing leveled off in 2020. The public and private housing markets began presenting similar trends in 2021.

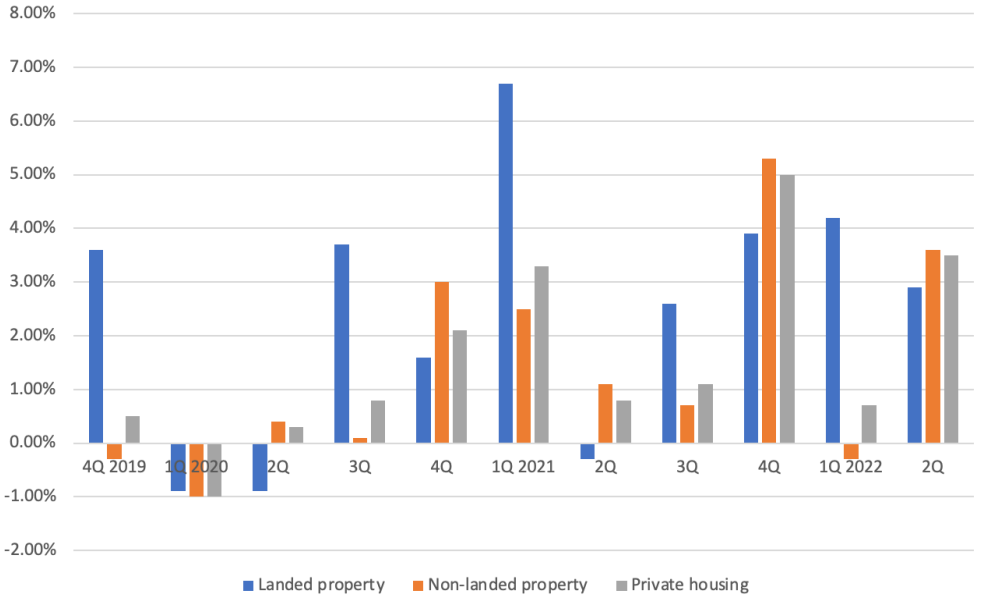


Figure 5: Price changes in private residential real estate from fourth quarter of 2019 to second quarter of 2022 [19].

Table 3: Annual price changes in private residential real estate from 2019 to 2021 [20].

Price	2019	2020	2021
Landed property	5.7%	1.2%	13.3%
Non-landed property	1.9%	2.5%	9.8%
Private housing	2.7%	2.2%	10.6%

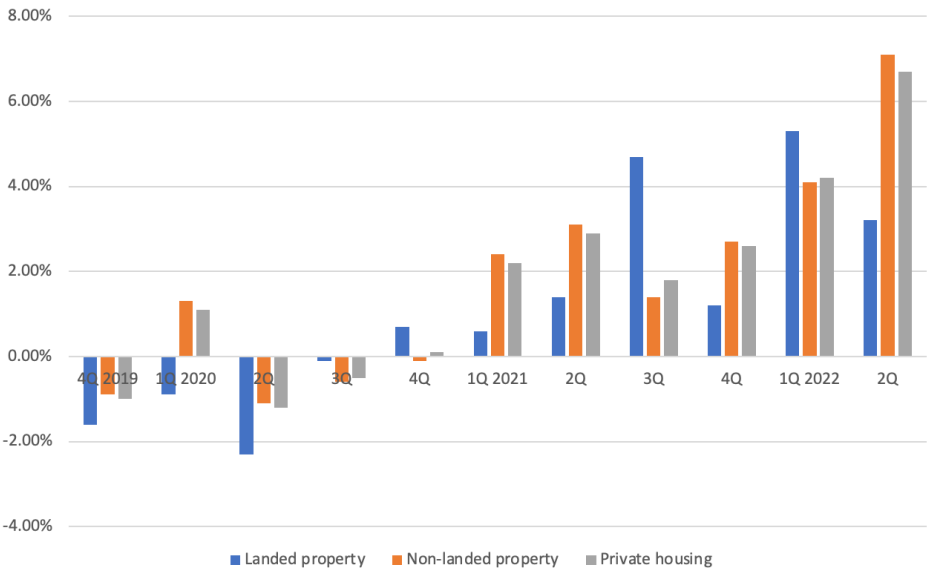


Figure 6: Rents changes in private residential real estate from fourth quarter of 2019 to second quarter of 2022 [19].

DOI: 10.54254/2754-1169/17/20231113

As shown in Fig. 6 and Table 4, trends of rents and prices were palpably positively correlated. In 2020, rents in private housing dramatically decreased as expatriates fled Singapore. Coupled with the inference in Section 2, rent and price interact as a real estate market is a highly dynamic market where the one-way effect is practically non-existent.

Table 4: Annual rent changes in private residential real estate from 2019 to 2021 [20].

Rental	2019	2020	2021
Landed property	-3.4%	-2.7%	8.2%
Non-landed property	1.9%	-0.5%	9.9%
Private housing	1.4%	-0.6%	9.9%

During the COVID-19 pandemic, foreign buyers have usually hogged headlines for their splurges in luxury dwellings. According to Savills, a global real estate serving firm, the Asian ultra-wealthy are keener on real estate investment than their American and European counterparts are. Besides, Singapore is long well-known as a haven asset for global investors. Therefore, the hikes in home prices brought by the pandemic beg the question: are foreign buyers finger-pointing when Singapore has won brownie points in pulling off the pandemic and added appeals to international investors amid uncertainty?

Table 5: Breakdown of private residential real estate bought by singaporeans and foreigners from 2019 to first half of 2022 [21].

	Singapore citizens	Permanent residents	Non-residents	Companies	Total
2019	15,495 (79.7%)	2,852 (14.7%)	1,017 (5.2%)	78 (0.4%)	19,442
2020	18,520 (82.2%)	3,133 (13.9%)	756 (3.4%)	134 (0.6%)	22,543
2021	30,958 (82.7%)	5,147 (13.7%)	1,135 (3%)	193 (0.5%)	37,433
H1 2022	10,681 (80.2%)	2,134 (16%)	444 (3.3%)	52 (0.4%)	13,311

According to Table 5, the transactions of foreign buyers have not resurged even after the height of the pandemic in 2020. Furthermore, the impact of cooling measures on foreign buyers seemed to be minuscule. In regional alternatives, Australia's stamp duty for foreigners is 8%, and Hong Kong's is 15%. Amid the slew of news regarding foreign buyers, it was easy to spot that most deals were from luxury or prime regional real estate. In other words, mass-market condos remain untouched, so local homebuyers will not be priced out by overseas bidders. Private residential real estate prices would not see a wild ride should these foreign buyers withdraw from Singapore. When the theory that foreign buyers drive up housing prices cannot hold water, the supply will be the next to examine.

As demonstrated in Table 6, what is clear is that the dwindled supply of private residential real estate is one of the factors that elevate the prices. The cause of this problem is the same as that of the short supply in BTO flats – construction project disruptions. In addition, exceedingly low mortgage rates throughout the pandemic also contributed to the red-hot market. Central banks in many countries and regions introduced an easy monetary policy to undergird their economies because of the pandemic, so median mortgage rates across Singaporean banks were 1% from 2020 to October 2021. A

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housing loan rate below 2% is normally considered super cheap. The core inflation rate index in Figure 8 is a glimpse of low interest rates during the COVID-19 turbulence.

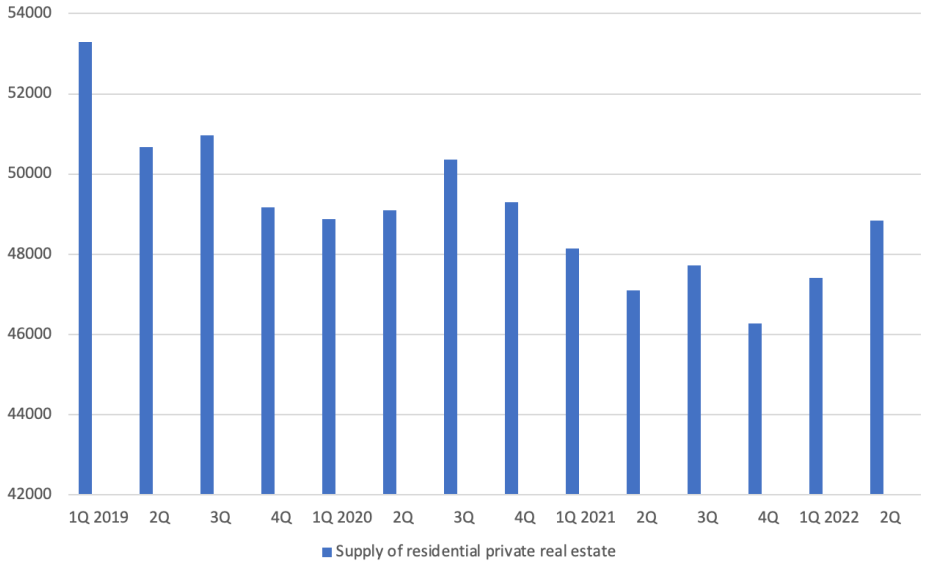


Figure 7. Supply of whole of private residential real estate from first quarter of 2019 to second quarter of 2022 [22].

Table 6: Annual supplies and their changes in private residential real estate from 2019 to first half of 2022 [23].

	2019	2020	2021	1H 2022
Supply of private housing	204,095	197,634 (-3.2%)	189,227 (-4.3%)	96,251 (1.1%)

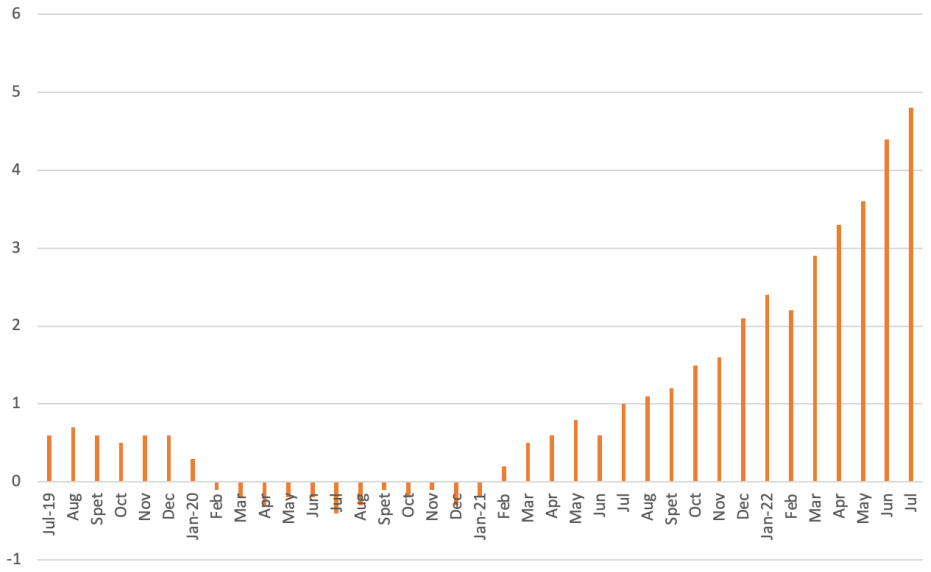


Figure 8: Singapore core inflation rate from July 2019 to July 2022 [24].

DOI: 10.54254/2754-1169/17/20231113

In addition, the external environment plays a part in the private housing market, possibly lead up to long-term changes. In the past decade, the world has witnessed China as an Asian economic powerhouse driven by its full-fledged technology giants. After a company siphons off tremendous market shares at home, it will look overseas. To Chinese companies, Southeast Asia is a springboard considering distance, untapped markets, similar cultures, China's influence in this region, and so forth. ASEAN has been the largest trading partner of China. Singapore, meanwhile, has been using its financial clout to position itself at the heart of Southeast Asia's technology sector. Therefore, Alibaba in May 2020 set up a headquarters for its overseas subsidiary before Bytedance, the owner of the video-sharing app TikTok, announced its global headquarters in Singapore in September. Tencent also clambered onto the bandwagon and unveiled a Singapore plan for its regional hub in the same year. Barring from Chinese technology companies, players in other sectors in China set foot in Singapore. Wuxi Biologics' research-and-development center and manufacturing capabilities will settle in the island nation. The booming of start-ups in Southeast Asia has drawn down a record amount of venture funding, followed by China's top-tier venture capital firms opening their offices in the Southeast Asian financial hub.

As Singapore's rival in many fields, Hong Kong has been undergoing a brain drain and foreign worker exodus out of social unrest and draconian anti-COVID-19 measures. Consequently, Singapore becomes the alternative to Hong Kong's foreign firms, which still want to have business with China but distance themselves from the country. For example, hedge fund Bridgewater founder Ray Dalio opened a family office in Singapore during the pandemic for his business in China.

At the outset of the pandemic, rents in the private housing dramatically decreased as expatriates fled the nation. As Singapore gradually lifted relevant measures and kept the pandemic at bay, it draws not only those expatriates back but the expatriates from other regions such as Hong Kong. The Financial Times reported that the demand for a place in Singapore's international schools has bumped up in 2021 and 2022. Moreover, rent surges in the privare housing in the first and second quarters of 2022 suggest that the property cooling measures held back people from purchasing housing and left them to rent condos. Consequently, a shortage of supply and low interest rates are a drive in the private housing mania.

4. Commercial Real Estate

Commercial properties are sliced into office space, retail shops, and industrial real estate. According to the Financial Times, Singapore office rents have returned to the pre-pandemic level in 2022[25]. Nevertheless, downward pressure is still heaping on retail shops as the COVID-19 pandemic bites.

Fig. 8 and Table. 7 demonstrates disparate trends between office rental and retail rentals during the pandemic. In 2021, the division even more stuck out as demand for offices began increasing, while the retail shops have been bearing the most brunts among Singaporean real estate over the past two and a half years. The pandemic has changed the norm of the physical workplace, with employers citing saving rental costs, decreased commuting time, boosts to productivity. The fresh round of Chinese companies that put up their stronghold in Singapore has filled the void left by these employers, while the pandemic-induced closures of bookshops, restaurants, and others have been common to name a few. Mapletree Commercial Trust's REIT, one of the best-performing Singaporean REITs and investing in two major shopping malls in the city-state, has decreased by around 17% [26], with Frasers Centrepoint Trust, an investor for Singaporean community malls, has seen a drop by 5% in the meantime [27]. On the one hand, the return of international tourists will salvage those major shopping malls. On the other hand, the pandemic expedites the advent of the digital economy, so retail shops will play less of a part in essential lives. Therefore, landlords of brick-and-mortar retail locations have to rethink the use and design of shops and take pains to transform them into mixed-use, experience-focused, etc.

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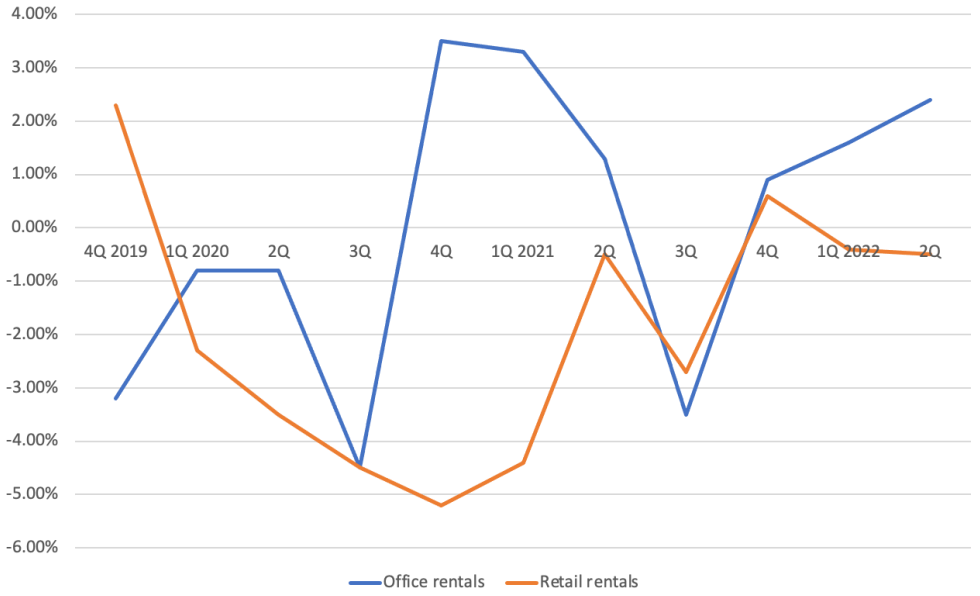


Figure 8: Rent changes in commercial real estate from fourth quarter of 2019 to second quarter of 2022 [22].

Table 7: Annual Rent Changes from 2019 to 2021 [22].

	2019	2020	2021
Office rental	-0.6%	-10.7%	1.9%
Retail rental	2.9%	-14.7%	-6.8%

Table 8: Household Balance Sheets from 2015 to 2021 [28].

Year	Household assets	Household liabilities	Household net worth
2015	1,837.2	318.4	1,518.7
2016	1,947.2	325.9	1,621.3
2017	2,075.2	341.8	1,733.3
2018	2,170.5	346.0	1,824.5
2019	2,334.4	341.1	1,993.2
2020	2,499.5	335.3	2,164.2
2021	2,745.5	359.5	2386.0

During the COVID-19 outbreak, firms around the world have increasingly harnessed cloud technologies to store information, run software, and base entire systems, for business continuity and minimalization of disruption. In the context of the digital economy, the data center could be a new growth locomotive for Singapore's commercial real estate. For instance, Keppel Date Centre REIT, the only data center REIT listed on the Singapore Exchange, has had an above-the-average-market performance during the pandemic [29].

Furthermore, in the elaboration of Table 8, Singaporean residents have seen increased household net worth in 2020 and 2021, primarily benefiting from multiple rounds of financial reliefs and increased housing value. Coupled with strict regulations, a monthly housing loan for a Singaporean family cannot exceed 60% and the bulk of liabilities for most Singaporeans is housing loans, so household liabilities in Singapore are in control.

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To sum up, Singapore's commercial real estate is transforming, and foreign investment will see the commercial real estate through when the pandemic blows over.

5. Conclusion

In summary, even if the current upward in Singapore's residential markets seems inexorable, it is lowly likely to raise bubbles in the real estate markets. On the one hand, more influx than outflux in population and capital, scarce lands, commendable infrastructures, and stable environment beef up the fundamental of Singapore's real estate. On the other hand, Singaporeans can be shielded against the headwind with their public housing, which is essentially the wellspring of the resilience of the entire residential markets, but pre-emptive measures for spillover effects from ultra-luxe residential properties are necessary. Therefore, from the long-term perspective, it is inferred that a further increased supply of BTO flats and condos will be on the way. From the short-term point of view, as the market expects a much higher interest rate to tame inflation on track and a looming increased tax aimed at making up fiscal revenues that have decreased during the pandemic, high prices will be brought down. Among retail shops, the survivors are those who observe the changes after the pandemic and try to fit them. A retail shop will probably not stick to selling merchandise but build some sites for user experience.

Compared with the post-global financial crisis booming property market in Singapore, the pandemic-induced prosperity, for now, has not reached yet in terms of prices. However, the entire market underwent a decade-long decline. According to the analysis, the authorities will deploy more dynamic data to control supply in residential properties. On this basis, the dynamic of research data should be improved because it is an interlaced situation in which every factor is in flux.

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The Impact of Population and Fertility Policy of China on the Real Estate Market

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Abstract: The population structure and development model of China have undergone significant changes, i.e., the new population is decreasing and the aging population is increasing. Meanwhile, population policies and supporting measures have also changed. The implementation of the three-child policy has also triggered discussions in the industry and the academic community has also carried out in-depth research on the relationship between the real estate market based on demographic changes. This paper will compare the results of the implementation of the two-child policy and the three-child policy. To be specific, this study will explore the impact of the population birth policy on the urban real estate market through urban classification, as well as the demographic dividend brought by the birth policy and changes in the structural demand for real estate. According to the analysis, real estate companies in the implementation of the two-child policy have faced new challenges and new opportunities. In the future, the birth policy will affect the family structure. This will further influence the development direction and project development of the real estate market.

Keywords: real estate, fertility rate, population structure, fertility policy

1. Introduction

In the past two years, there has been a clear deviation between the birth population and housing prices in China, and the population fertility policy has changed twice in just seven years. In 1978, the central government proposed that a couple have one child, with a maximum of two children, and local governments have already started implementing family planning policies. In 1982, in order to control population growth by 2000, family planning became one of the obligations of citizens. In 2014, China relaxed its population policy and implemented a two-child birth policy. In 2021, China will once again relax the population fertility policy, and implement three-child and supporting measures. In other words, the government will help reduce the burden of parenting and provide financial support [1].

China's family planning policy has lasted for 40 years, but two consecutive birth plans has been implemented for 7 years. Contemporary social phenomena (e.g., the rising number of people and the sharp rise in the elderly dependency ratio) have led to the birth rate of 7.52% in 2021 as shown in Fig. 1, the lowest since 1949, and the national marriage registration rate in 2021 will be the lowest since 1986 [2].

The decline in the number of births means that the growth rate of the total population will decline. Besides, it also means that the incremental space for real estate will gradually decrease, but this does

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not mean that housing prices have peaked. The demand is more prominent in first- and second-tier cities with higher housing prices and raising costs [3]. However, the willingness of society to respond to population policies has gradually weakened, so only opening the fertility policy has little effect on boosting the fertility rate [4]. Besides, due to the high cost of survival and marriage and childbirth, the fertility rate of first- and second-tier cities is lower, and population growth has become an intractable problem. These social challenges can only be confronted by continuous regulation and control of population and fertility supporting policies. Meanwhile, they must be adapted to local real estate policies. The results of this study will have a huge impact on China's marriage and childbearing rate in the future, which will also have a boosting effect on the real estate market.

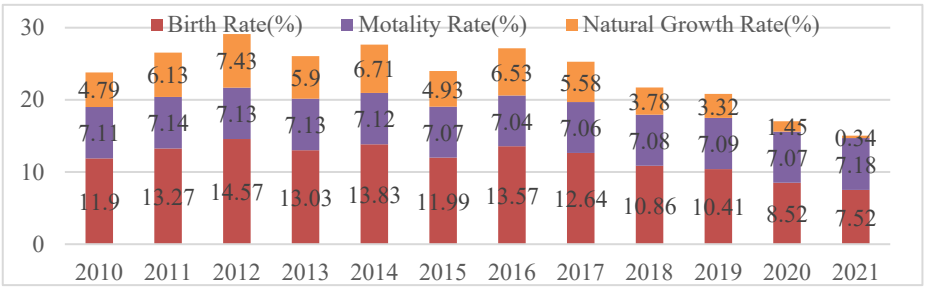


Figure 1: The birth rate, death rate & natural growth rate in China 2010-2021.

2. Theorem & Literature Review

Forty years since the reform and opening, the birth control policy, as the basic national policy of China's population and fertility, has had a profound impact on China's economic development. In the early stage of policy implementation, family planning promoted economic development to a certain extent. On the one hand, many laborers poured into the market, especially the female labor force was liberated from the family to social production, which increased the supply of labor resources and reduced the labor cost of enterprises. The cost of capital has dropped, the national economic development has grown, and the disposable income of residents has also risen.

However, the family planning policy has had some adverse effects on China's population structure. Firstly, family planning has distorted the intergenerational structure of the population. The problem of "getting old before getting rich" is prominent, and China is rapidly entering an aging society [5]. At the national level, the aging of the population has brought about a shortage of labor and a huge pressure on social security. At the family level, the distorted intergenerational structure makes "4-2-1" (4 elders, 2 parents, 1 child) main family structure [6], and the soaring population dependency ratio means that young people have to bear extremely heavy burdens. Secondly, family planning has led to distortions in the intra-generational structure, and the sex ratio of men and women in China is seriously unbalanced (seen from Fig. 2).

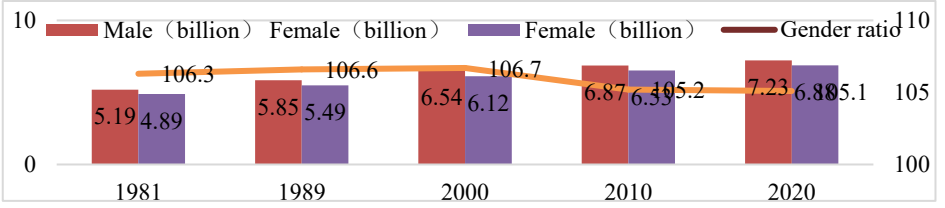


Figure 2: Gender ratio.

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3. The Impact of the Second-Child Policy

Following the "single two-child" policy proposed at the Third Plenary Session of the 18th Central Committee in 2013, the demographic dividend has gradually emerged [7]. By 2015, the policy effect had diminished, the birth rate began to decline, and the growth rate of the total population slowed down. In particular, the proportion of the labor force is gradually declining, which has a huge impact on the growth rate of social and economic development. In the meantime, the old-age dependency ratio also reached a high level of 13.7% [8]. Against the background of accelerating aging and weakening demographic dividends, the fertility policy has been adjusted again.

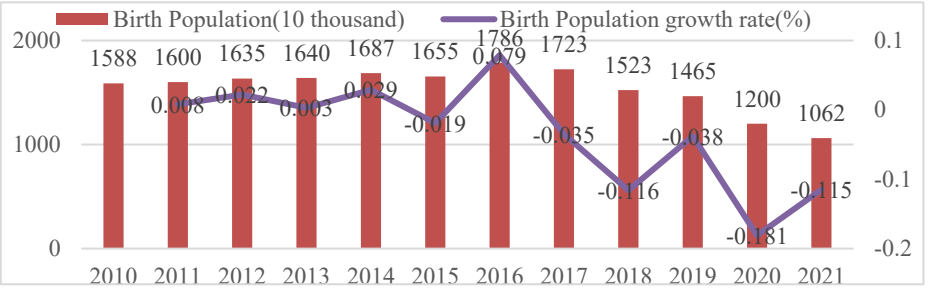


Figure 3: China's birth population and growth rate from 2010 to 2021.

In the end of 2016, in the five years since the two-child policy evolved from the dual-one-two-child policy to the comprehensive two-child policy, China has achieved the goal of expanding its population size and increasing its natural population growth rate. In 2016, China's birth population reached its peak in nearly a decade (2010-2021), as depicted in Fig. 3. At this time, the demographic dividend has reached a high level. he increase in the total social population and the increase in the per-household population has spawned new housing needs, i.e., high ancillary facilities requirements and new family room designs. At the same time, this also drives the cyclical changes in the real estate market. Real estate enterprises usher in new challenges and new opportunities.

3.1. New Challenge

In the short term, due to the comprehensive liberalization of the two-child policy, the number of newborns has increased, and the child dependency ratio has also increased. Besides, the cost of parenting has increased, and the pressure of life has increased. Overspending will not be considered by many families. In the long run, owing to the diminished fertility accumulation effect of the two-child policy, the fertility rate has slowed down, and the old-age dependency ratio is also rising every year. Seen from Fig. 4, the growth rate of the old-age dependency ratio is faster than that of the child dependency ratio. In the future, more old-age support burdens will be added at the same time. If the rate of deepening aging and the rate of declining fertility cannot be effectively alleviated, the scale of labor supply will decrease in the future. The elderly has no rigid demand for real estate, and the age of loan buyers is generally no more than 65 years old [9]. In addition, ascribed to the low proportion of elderly buyers without loans, the deepening of aging will affect the vitality of the real estate market.

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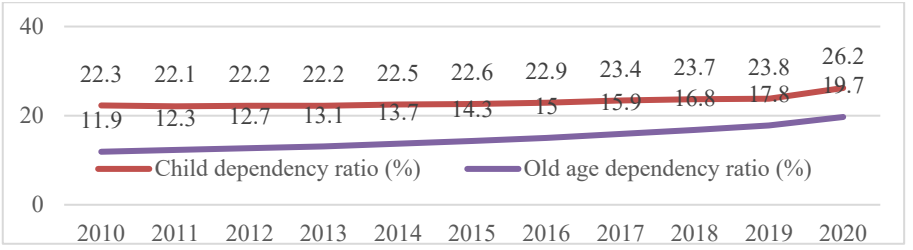


Figure 4: Child dependency & old age dependency ratio in the year of 2010-2020.

The 2018 survey on reproductive willingness of women of childbearing age shows that women of childbearing age plan to have an average of 1.76 children [10]. From a geographical point of view, on account of the high cost and high pressure of childbirth and maintenance costs, the willingness of women to have children in first- and second-tier cities is relatively lower than the others. From the perspective of urban and rural areas, urban women's willingness to regenerate is also relatively lower than that of rural women. Although the urbanization process is developing rapidly, rural women are more willing to give birth than urban women. Nevertheless, since the disposable income is lower than that of the urban population, the willingness to buy a home is not very strong.

3.2. New Opportunities

The increase in the number of newborns increases the rigid demand for house purchases. In order to meet the space for raising a second child in the future, the demand for early purchases or replacements has increased. In addition, most cities have opened preferential purchase conditions such as purchase restrictions, and there will be demand for replacement or large-sized houses in the short term. As illustrated in the Fig. 5, China's residential sales area in 2013 and 2016 showed a clear growth trend.

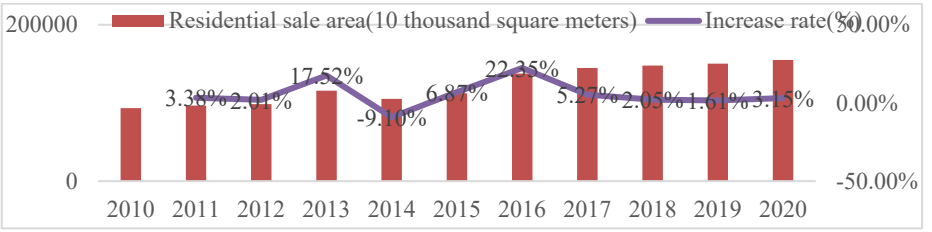


Figure 5: China residential sale area from 2010-2020.

In the long run, the second child born under the two-child policy will become a marriageable population in 20 to 25 years. Even if there are no children yet, the demand for early home purchase still exists and increases. Although the population per household decreased, it did not affect the increase in the total number of households. Therefore, small units will be chosen by couples or families preparing for marriage to buy homes in advance. As depicted in Fig. 6, with the deepening of the degree of aging, it is common for families with two children to have the elderly living together. This will drive demand for four or even five rooms. This type of family structure will increase the requirements of home buyers for house design. Some elderly people who have accumulated wealth in the early stage have higher configuration requirements for housing, including surrounding environment, property services, comfort, convenience. Older-friendly communities with simple units and well-equipped facilities will be popular.

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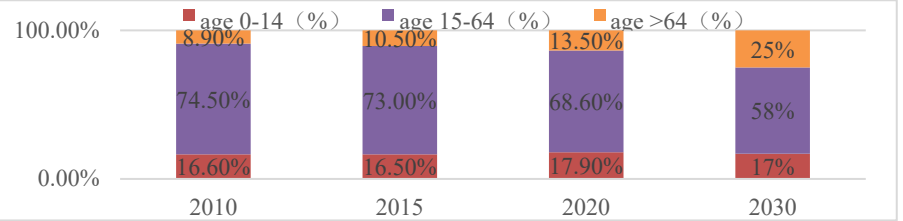


Figure 6: Population age structure.

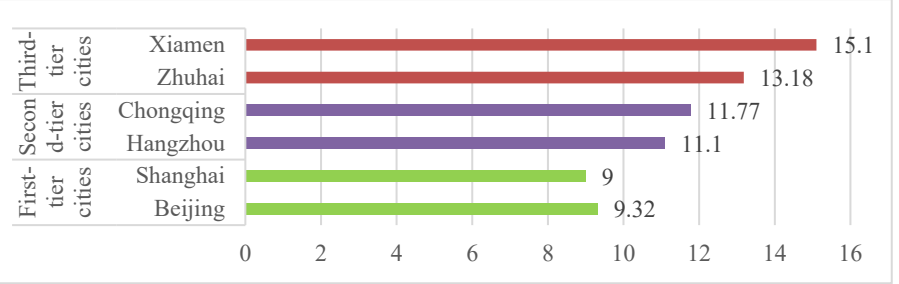


Figure 7: Birth rate.

The development potential of the third- and fourth-tier small and medium-sized cities are higher than the first- and second-tier key cities. As exhibited in the Fig. 7, the fertility rate of first- and second-tier cities in 2016 was lower than that of third-tier cities. In the same region and under the same conditions, the less working hours and the pressure on economic life, the higher the willingness to have children, and the stronger the demand for replacement or repurchase. Business, housekeeping, medical care, education and other supporting resources have increasingly become one of the key concerns of family home buyers. Families with multiple children have higher and higher requirements for children's education and supporting services. Hence, the housing prices in the school district are "rising all boats" in the pursuit. The small peak of childbearing brought about by the opening of the two-child policy has led to an increase in school-age children, and high-quality educational resources are very popular. Therefore, first-hand and second-hand school district houses around high-quality kindergartens, primary and secondary schools are sought after.

4. The Impact of the Three-Child Policy

In 2019, China's total fertility rate was less than 1.5, while the world's average fertility rate was 2.4 [11], which is enough to show that the fertility rate has fallen below the warning line. Due to the gradual weakening of the fertility stacking effect and the continued decline in the number of women of reproductive age. Seen from the Fig. 1, the number of births may continue to shrink in the future according to this trend.

Judging from the results of a recent survey of more than 10,000 questionnaires collected by the China Index Academy across the country, 58% of married families have a single child, and 30% of families with two children. Nearly 55% of families with two children are willing to have three children. In Gansu and Guangxi Province, the willingness to have three children is relatively strong, and the proportion of the willingness to have children exceeds 50%. The willingness to have children in Hebei, Fujian and other provinces is also above 40% [12]. In the first-tier key cities with high living costs and high fertility pressure, the problem of "inability to reproduce" occurs.

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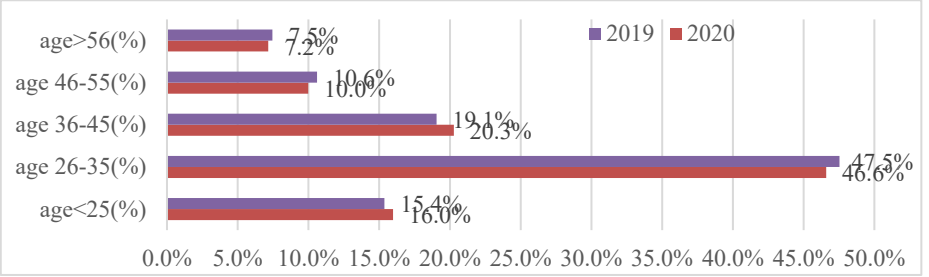


Figure 8: Age comparison of home buyers in 2020 and 2019.

From the perspective of real estate, the most profitable cities for the three-child policy are second-tier cities. First-tier cities have high parenting costs and low willingness to give birth, but second-tier cities have infrastructure, living conditions and cultural environment comparable to first-tier cities. The three-child policy has brought an increase in family members, and the demand for house replacement will increase and bring some incremental house replacement customers, which also indirectly brings about an increase in the demand for house purchases.

Second, as shown in the Fig. 8, the growth rate of per capita living area in rural areas is higher than that in urban areas. For rural families with multiple children, the cost of replacement or repurchase is lower. Because the willingness to have children is much higher than in cities, the future demand will also further increase. According to the results, future home buyers are still people in the marriageable and childbearing age group of 25-36 years old.

5. Suggestions & Prospects

The single boom phase in China began with the 1950 Marriage Law, which denied the feudal marriage system. Later in the 1970s, when the educated youth returned to the city, a cultural generation gap began to appear in the society, and the cultural quality of the family was uneven. In 1990, the Marriage Law was amended, and the law recognized freedom of marriage [13]. Nowadays, economic living standards and education levels are constantly improving, and people's views on marriage and fertility are gradually changing. First, with the decline in the birth rate and the deepening of the aging population in recent years, the number of people who are eligible for marriage and children is also declining. Meanwhile, the persistent problem of the imbalance between males and females has not been effectively addressed. It prolongs the mate selection time. The probability of male and female pairing is relatively reduced. In addition, population mobility leads to the flow of talent to big cities.

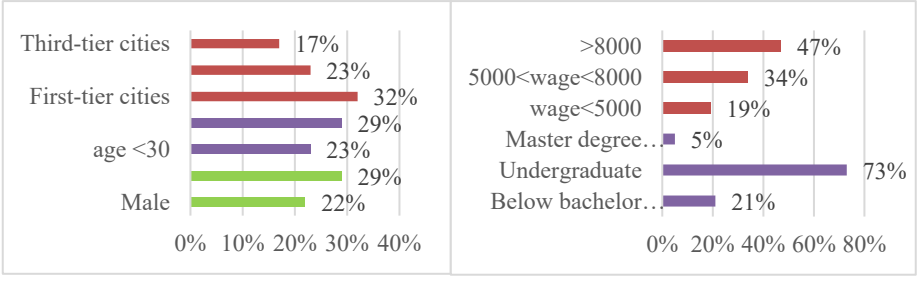


Figure 9: Percentage of unmarried people as functions of different social demographics.

While the cost of living and home ownership in key first-tier cities is high, but there are many opportunities for personal development, young people prefer to enjoy free time and money after struggle. As presented in the Fig. 9, Kochi female unmarried people in first-tier cities are typical. Moreover, the continuous improvement of education level has allowed more young people to have more ways to realize their self-worth, not just marriage and childbirth. Besides, the non-marriage rate of high-

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income and highly educated groups is relatively high. The time of higher education delays the time of marriage registration.

Since the willingness, concept and pursuit of those who take the initiative to not marry conflict with marriage and childbearing. Thus, the two-child and three-child policy does not have the effect of promoting marriage for such people. The single apartment, small-sized properties in first- and second-tier cities and the rental market of serviced apartments will generate more demand. Passive non-marriage is often unable to pay for the cost of marriage and childbirth due to economic conditions, but because of traditional ideas, marriage has become a rigid need. The two- and three-child policies plus supporting measures are more effective for such groups. Especially for people who migrate from rural areas to cities, housing subsidies and other factors can further stimulate the needs of such people to settle down in third- and fourth-tier cities.

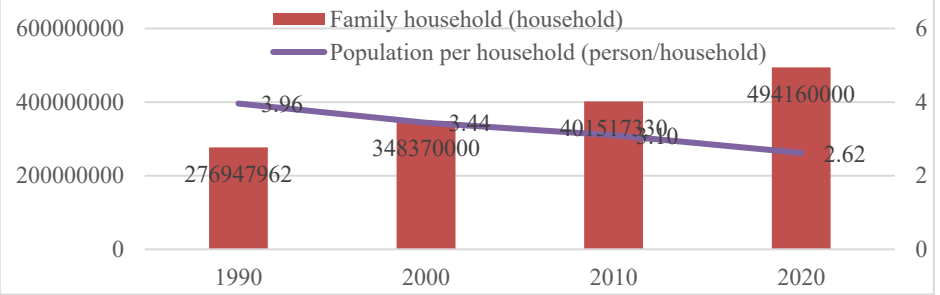


Figure 10: China's population per household from 1990-2020.

As illustrated in the Fig. 10, owing to the declining effect of the universal two-child policy, the per-household population has also continued to drop to 2.62 in 2020 in recent years. The seventh census data shows that there are 494 million households in China. The average household population of 2.62 in 2020 is 0.48 less than the 3.10 in the sixth national census in 2010. The trend of family miniaturization is accelerating. Since the number of pregnant women is also shrinking, the fertility rate may continue to decline. Unmarried and late childbearing have become social trends. Thus, some family types (e.g., DINK or young couples) will choose to live in high-end small apartments. The fission of the family (from parents + children to children or lovers) will generate new demand for housing. Moreover, the increasingly small family will increase the market attention of small units. In first- and second-tier cities with high housing prices, small units will be more popular among young people.

Life in key first- and second-tier cities is still pursued and longed for. The first- and second-tier cities have better commercial, medical, service, education and other resources. After graduating from colleges and universities, young people choose to struggle and develop in the city, and the demand for rental of small-sized real estate and serviced apartments in the central area will only increase. The third- and fourth-tier livable cities will have huge development potential. Owing to the high pressure and high cost of living in key first- and second-tier cities, most people choose to retreat to other cities to enjoy living conditions and resources similar to the original cities at a lower cost. In third- and fourth-tier cities, medium-to-large units will become the mainstream, and the main target buyers are families with multiple children.

6. Conclusion

In summary, this article examines the impact of the past two-child policy and today's three-child policy on real estate. China has been enjoying the demographic dividend during the implementation of the two-child policy. Since 2016, the effects of the demographic dividend and the fertility policy

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have weakened accordingly. It is a huge challenge for real estate due to declining fertility rates and a deepening aging population. Nowadays, the changes in the concept of marriage and childbirth and the progress of social and cultural thinking have led to changes in the family structure, i.e., the per capita population is getting smaller and smaller. This will bring new opportunities for real estate. Third- and fourth-tier cities are more affected by birth policies and are more suitable for the development of multi-child family housing. The first- and second-tier cities are more suitable for the development of single-unit apartments and small family units. This paper synthesizes China's past birth policies and summarizes China's population structure in the past two decades, thereby analyzing the impact on the real estate market and proposing real estate development directions based on relevant data. This paper also overturns the development concept of "bring new baby to save the market" in the field of real estate research in the past. Overall, these results offer a guideline for policy implementation regarding to population policy for real estate market.

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Trust Products: An Option to Protect the Basic Needs of People with Disabilities

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Abstract: The survey shows that people with disabilities in today's society are still vulnerable groups in society, and some families with a certain economic foundation are unable to manage the property left by their parents due to their children's disabilities, resulting in the inability to guarantee their basic life. Based on mobile phone data and literature summary, this paper analyzes the difficulties encountered by the disabled, and combined with current policies and domestic and foreign solutions to this problem, comes up with a solution in line with China's domestic conditions. The main objective of this paper is to find reliable products or models that guarantee the living needs of people with disabilities, and the main method of qualitative research is used. This study mainly concludes that the problems faced by people with disabilities include insufficient institutional supply, lack of dedicated custodial supervisors, and insufficient protection of other safeguards. This paper puts forward the idea of investing the amount people use to buy trust products and forming a variety of different investment methods, which are mainly composed of stable investment and risk investment, in order to fully guarantee the safety of investment and the rate of return of enterprises, and ensure the normal life needs and rehabilitation expectations of the disabled.

Keywords: provide for the aged, trust products, dedicated custodial supervisors

1. Introduction

According to the second National Sample Survey on Disabled Persons, there are 82.93 million disabled persons in China. Among all disabled people in China, there are 5.54 million with intellectual disabilities, 4.14 million with mental disabilities, and 13.52 million with multiple disabilities. These disabled persons accounted for 6.68 percent, 7.40 percent, and 16.30 percent of the disabled persons in China, respectively. At the same time, severe and very severe intellectual disabilities accounted for 25.34 percent of the total population with intellectual disabilities.

At the same time, when observing the standardized marital status data of the disabled, it is not difficult to find that the marital status of the intellectually disabled is: 45.35% of them are unmarried, and 41.98% of them have a spouse in their first marriage. Meanwhile, 34.17% of the mentally disabled are unmarried, and 49.71% have a spouse in their first marriage. At the same time, we also found that in order to guarantee the basic life of the mentally disabled, their family members bear more than

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80% of the expenses, and the proportion of family support for the mentally disabled is also more than 70%.

From the above data, it can be seen that people with disabilities, that is, people with mental or physical disabilities, are a large number of special difficulties that are difficult to survive and develop in society as a whole. They depend heavily on their immediate family members, especially their parents, and family is the fundamental basis of their social life.

The subjects of this study were middle-aged and elderly people over 65 years of age with a disability certificate, who had intellectual and mental disabilities (some of them were multiple disorders with intellectual or mental disabilities), and their families.

In modern society, people with mental disabilities are protected mainly through medical treatment and policy. Most medical treatments are based on extensive research conducted on patient samples. These methods can be applied to education in order to compensate for the defects of the handicapped or improve their intelligence. The policy approach is mainly to update and improve the social welfare system (similar to seeking help from social welfare organizations), but few cases or cases are starting with patients or relatives of patients. This paper aims to resolve the difficulties faced by patients and their relatives while ensuring the maximum self-interest of the patients [1].

Research shows that at present, society has high requirements for trust products and services, and these products are mainly selected by individuals or families with large amounts of disposable money, so it is difficult to attract people from middle-class families to join or purchase them. However, the introduction of trust products aimed at helping and protecting people with mental disabilities or the target population of this paper is relatively rare in China, and there is also a lack of practical investigation data and perfect solutions.

The main method of this research is qualitative research. The research form is mainly to enhance the understanding of the nature of the problem through cooperation with professional teachers, interviews, lectures, and other ways [2]. At the same time, the paper also uses various data published by the country and domestic and overseas literature to conduct analysis and research and tries to find out the difficulties and needs of families of adults with mental disabilities, so as to ensure the demands of people at all levels of society. This paper aims to build on the existing concept of a new trust product, develop more services to meet the urgent needs of people with mental disabilities and their families, and drive economic recovery.

2. Literature Review

2.1. Research on the Current Situation of Domestic Care Services

Since the concept of care service was formally proposed in 2007, domestic scholars have carried out more and more research on care services for the disabled, but the term has not been widely used in academic research. For example, there were only 81 articles on “care services for the elderly (adult) mentally disabled” in CNKI, and the correlation was mostly low. A direct search of "mentally disabled" yielded only 131 results. It can be seen that there are still few studies on trust services for people with mental disabilities and their families. Most of the research on this aspect is not well-targeted, and most of the research continues to be carried out in the category of disabled people. At present, social research has been carried out in two directions: the level of care institutions and the level of families of people with mental disabilities.

2.1.1. Care Institution Level

The number and quality of care facilities cannot meet the special needs of people with mental disabilities. This paper investigates the current situation of the disabled in Changsha by means of a questionnaire survey and finds that the lack of service standards, lack of funds, lack of professional level

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of service personnel, and lack of professional and perfect related supporting facilities are the common problems faced by the care institutions in Changsha.

2.1.2. The Family Level of People with Mental Disorders

In order to have a deeper understanding of the problem, this paper investigates the needs of 71 autistic families and concludes that families with better economic conditions expect to have professional and reliable trust institutions to manage their assets, so as to ensure the life and care needs of their children.

2.2. Research on the Current Situation of Foreign Care Services

Although the relevant research on the care of the disabled in developed countries started earlier, its focus is generally on health care, and the attention to the care and needs of the disabled is also low. Although foreign countries have long paid attention to the care services for the disabled, the lack of service demand and low service quality are still urgent problems and the focus of attention.

In Western countries, treatment and help for people with disabilities started earlier. Since the 1960s, Britain has been committed to providing help to people with intellectual and mental disorders, so that they can receive convenient services at home or in the community. The Japanese guardianship insurance system provides life care services for the disabled, the elderly with poor self-care ability, and people suffering from specific diseases. Japan has established a relatively perfect service system combining family guardianship and social training. The structural construction of “Beech Town” in Japan is a typical successful representative of the conservation institution for adults with disabilities. It is mainly divided into three parts: vocational skill training institute, welfare factory, and family residence for disabled people. There are currently 64 such institutions.

Overseas care services for people with mental disabilities focus on a large amount of financial assistance from the government. At the same time, the huge subsidies for people with mental disabilities have also greatly reduced the economic burden on their families. In terms of employment and work, the government paid attention to the living needs of people with disabilities earlier and provided special employment opportunities. For example, Japan combines the employment of people with disabilities with targeted training and treatment in institutional Settings and provides sustainable care services for people with disabilities as much as possible. All these cases provide certain experiences with reference meaning or value for the development of the care service in our country. Trust products should gain knowledge from them and create good trust products suitable for China's national conditions.

3. Implementation Strategy of Care Services

3.1. To Improve the Relationship Between Power and Responsibility

To improve the power and responsibility relationship between the entrusted enterprise and the principal, it is necessary not only to stipulate the amount to be paid every month to guarantee the basic life of the principal and his family members but also to stipulate the proportion of the amount that can be used for other venture investments under the condition of surplus. This is not only to ensure the minimum living standard of the disabled and their families but also to give the trust company profit space, so as to achieve the purpose of improving the social security system for the disabled and driving the economy through the coordination of various subsidy policies.

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3.2. To Establish a Market

Trust products help qualified parents to increase and maintain the value of their assets through the operation of professionals and solve their worries. In terms of concrete operation, we should not only continuously explore the form and route of establishing trust products under the business model, so that the products can fully conform to China's national conditions, but also gain social credibility by building a communication platform with the disabled groups and their families to achieve the effect of fair and open money flow and treatment. At the same time, we can also set up special pilot products in big cities to attract qualified families to take out trust funds. Together with the relevant product departments, they manage and control the trust funds and part of the proceeds for the expenses of the disabled in the care institutions. Other additional income is owned by the company as additional earnings income.

3.3. To Improve Regulatory Policies for the Pension Trust Business

Trust companies should deeply participate in the development of the market, actively develop trust products specifically aimed at ensuring the production and life of people with disabilities, arrange investors' access standards and quantities in a differentiated manner, and give a clear introduction and positioning to ensure that people with disabilities in need can subscribe for the most suitable products. They also need to follow the latest national research, comply with regulatory policies, and standardize business development.

4. Application and Model Innovation of Trust Products in the Pension Market

4.1. The Application Mode of the Pension Trust

Because trust products are a special system of property transfer and property management, with the development of the capitalist market economy, the combination of property transfer function and property management function of trust products has become more and more closely. The trustee has also changed from the original passive role to the actual manager of the property that can enjoy the actual management right. At the same time, its property management function also began to become increasingly prominent. From these aspects, a variety of financial services are derived, such as the use of national debt and other stable income products for income. At the same time, it has become an important part of the financial industry of various countries in today's society. Not only that, in the field of social welfare taking care of the disabled, trust products have also opened up a broad and unique application space with their unique advantages of reliability and professionalism.

4.1.1. Financial Trust Business for the Development of the Pension Industry

Real estate and institutions aimed at ensuring the normal life of the disabled are expected to become a breakthrough in the institutional industry due to their association with various enterprises and their driving force to the families and groups of the disabled. Trust products can be designed flexibly according to the situation of the trustor, the development of his family property, and the mode of capital operation. By initiating and establishing a special trust social welfare industry fund for the disabled, it focuses on providing equity, creditor's rights, or portfolio integration to service agencies and government agencies or suppliers in the market field of the social disabled, so as to achieve the purpose of clear rights and responsibilities of joint management. This also allows consumers to feel the reliability of the product. In terms of funding sources, we can adopt structured arrangements and carry out population stratification.

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4.1.2. Securitization Trust Business of Specific Pension Assets

In the social service market for the disabled, companies can also add some provisions on regular fees for the operation of elderly care services, so as to form specific property or property rights with predictable and stable cash flow. For example, the occupancy fee or deposit paid when carrying out rehabilitation projects, and the pension service fee, room fee, and catering fee are paid regularly by children or their families. This has also given rise to many kinds of trust products. For example:

1. Life cycle financial pension trust. Studies have shown that the allocation proportion and risk exposure of risky assets in its portfolio automatically decrease with the approach of the retirement maturity date of target customers, which greatly meets the needs of these individual investors.

2. Trust products of "housing for retirement". The elderly can take their houses as trust property or provide a mortgage to the trust institution, and the trust institution not only takes care of and invests their property, but also provides funds for the disabled and their families as a source of funds and life security to help their normal life and rehabilitation treatment.

3. Property protection pension trust products. By setting up special trust products, people with disabilities and their families can safely deliver their funds, movable and real estate to the trustee, who will contact a professional fund handling or investment team to take professional care of the funds according to the instructions of the principal. For example, to manage funds by leasing, selling, or keeping them, and to use the trust proceeds for specified purposes. Or use a part (about 70% of the assets) to invest in products with stable returns, and use about 20% of the assets to invest in venture capital. This is mainly to protect the stability of the property of the disabled, and it is also a necessary option to protect their normal life.

4. Using securitization technology, we can design a closely connected and extensive service chain for people with disabilities and their families to achieve the purpose of fund recovery for elderly care services. For example, we can refer to the pension industry in the United States and improve the professional division of labor system of real estate developers, real estate and investment trusts (REITs), and residential operators.

The property management needs of the elderly have certain particularities. They do not take the rate of return on investment as the main goal but pay more attention to the security of property management or whether it can ensure its subsequent normal life. At the same time, they are very interested in estate planning and long-term management of the remaining life stage. They are less sensitive to management fees than trust in wealth management institutions. At present, there is a great lack of financial products suitable for elderly people to invest in the market.

The pension planning period is often as long as decades, including the matching of pension assets and the pension cycle. We need to take a global view from a cross-cycle perspective. According to the characteristics and needs of the elderly, trust institutions can design special pension financial trust products by giving full play to the advantages of diversified trust property and flexible operation.

4.2. Difficulties and Suggestions of Current Pension Trust Business Innovation

Although trust products have a broad space for operation in the pension market, the trust practice in the domestic pension field is still relatively slow. The advantages of trust functions have not been effectively brought into play. This is mainly reflected in the following aspects: first, trust products are still mainly projected investment and financing businesses, and the accumulated customer base is mainly fixed income preference. The standard and quantity threshold of our existing qualified investors are relatively high, so the market recognition and development space of trust financial products are limited; Second, trust products are mainly medium and short-term, and investors have high requirements for cash income return in the current period. The lack of a circulation mechanism for trust products makes it difficult to solve the contradiction between short-term trust funds and the long-term

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pension industry. Third, the trust property is dominated by funds, which is subject to the lack of trust property registration and tax system. It is difficult for enterprises to accept the entrusted management of movable property, real property, and other property rights, and the tax cost is too high. Fourth, trust companies lack professional operation and management experience and talent accumulation in the field of rehabilitation and life of the disabled. It is difficult for them to provide high-quality professional elderly care services for the disabled; Fifth, the charitable trust business in China has just started, and the supporting tax policies are not yet in place. We also lack the necessary experience in participating in the social welfare services of the project and play a very limited role.

In the process of deepening aging in China, we not only need to continue to consolidate the operation of the enterprise-led system of basic security for the disabled but also need to give full play to market forces. We should attach great importance to the unique role of the trust mechanism in solving the problems of normal life and the rehabilitation of the disabled in our country. We should take trust companies and trust products as the link, actively build and improve the innovative system and pay attention to the policy environment that is conducive to trust in solving this social problem and ensuring the safety and reliability of trust products.

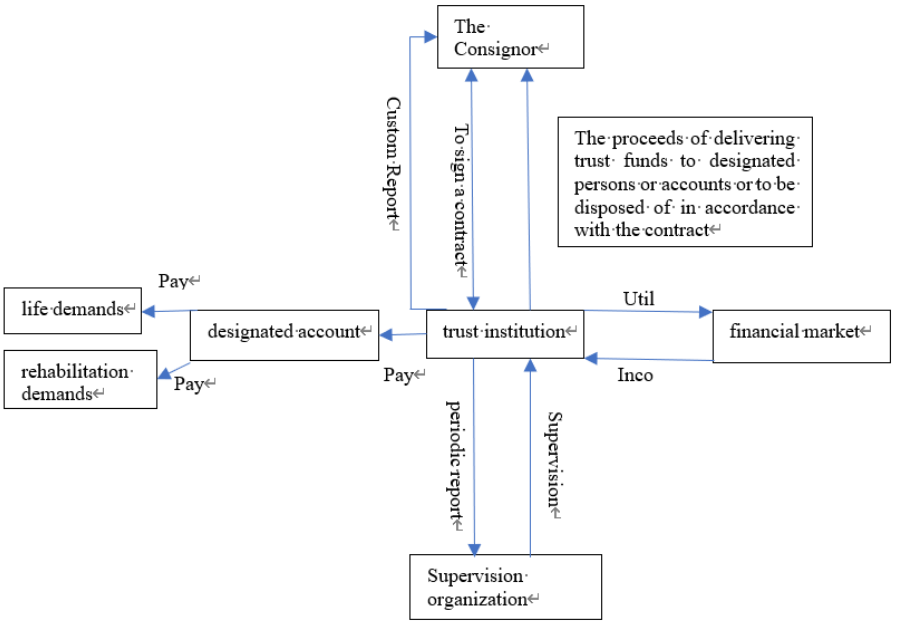


Figure 1: A pension trust product design.

5. Conclusion

Although trust products have a long-term impact and benefits in the market of how to protect the basic needs of the disabled, it can be seen from the current situation that the trust practice in relevant fields in China is still relatively slow, and even the lack of relevant research reports, that the advantages of trust function have not been effectively brought into play. The practice of our country has the following problems: 1. Trust is protective and can make up for the shortage of kinship guardianship; 2. Lack of specialized guardianship supervisors; 3. The protection of other safeguards is insufficient. To solve these problems, this paper suggests that we can improve the relationship between power and responsibility, open the market, and improve the supervision policy of pension trust businesses. In the process of deepening and promoting this project, trust products not only need to continue to consolidate the social welfare system provided by the government but also need to give full play to market forces. We should attach great importance to the unique role of the trust mechanism

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in solving the living problems of the disabled and their families in our country. We should take trust companies and trust products as the link to actively build and improve the special means and matters needing attention that are conducive to the application of trust in this special market.

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Impact of COVID-19 on the Supply Chain of Small and Medium Enterprises: Case Studies on Food, Manufacturing and Hospitality Industries

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Abstract: The constant flux in the supply chain has intruded on the demand and supply equilibrium throughout the globe. Firms that elongated the operation period have to pursue changes in suppliers to respond to the tumultuous trading environment due to the COVID-19 pandemic. This paper aims to develop a framework for supply chain disruption for different small and medium enterprises (SMEs) in the Food, Manufacturing, and Hospitality industries. SMEs are susceptible to fluctuant economic change since the change puts an enormous threat to the sustainability of SMEs. Therefore, strategic foresight is crucial for SMEs to be competitive in the market. In this paper, rationalization and digital transformation are chosen as potential measures to conquer the unsettled economic environment. Reformation and innovation in SMEs could provide opportunities to maintain the firm's long-term healthy operation. This study can help SMEs comprehend the importance of modern strategies and survive during the outbreak of COVID-19.

Keywords: COVID-19, digital transformation, rationalization, small and medium enterprises, SMEs, food industry, manufacturing industry, hospitality industry

1. Introduction

The business environment has changed since the novel coronavirus swept the globe in 2020. This has caused a great impact on the global economy, especially on the survival of small and medium enterprises (SMEs). The situation faced by SMEs has become more and more severe. COVID-19 has not only made the supply chain disintegrate but also made the distribution of commodities troublesome [1]. World Trade Organization has shown that SMEs are essential for economies since they account for 60% of employment from 95% of companies worldwide [2]. They play an important role in maintaining the health of the economy. As Singh and Kumar stated in their research, SMEs in different industries should evolve a long-term strategic scheme for being flexible during a doubtful business environment [3].

In this paper, the impacts and consequences of supply chain disruption in SMEs are illustrated. Case studies on the food, manufacturing, and hospitality industries are conducted. Additionally, potential solutions to minimize the risk of supply chain disruption in SMEs are demonstrated. The paper is useful for SMEs to find a better way to meet their needs in an uncertain economic environment.

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2. Impact of COVID-19 on Small and Medium Enterprises

The COVID-19 pandemic has had an overwhelming effect on the economy as well as the logistics industry. A delay in raw material transportation is likely to affect the production cycle of finished products, thereby affecting consumers' purchase of products and the survival of companies. The situation is exacerbated for SMEs as firms may not have enough retained earnings or other limited resources to overcome the short-term cash flow problem [4]. Moreover, the disruption in supply chains caused by the pandemic has not only affected the demand-supply equilibrium but also caused a comprehensive and negative effect on a company's prestige [5], which could influence the future transaction of a start-up company.

2.1. The Food Industry

Firms that compete in different sectors may face internal and external risks based on diverse industry structures. The rising population in the world has increased the burden on the food industry to provide enough food on time. During the lockdown period, scarcity of food appeared in some regions as all types of food supply chains have been seriously influenced by the pandemic, for example, the supply chain of fresh vegetables, fruits, baked foods, perishable goods, and grains [6]. It is also noticeable that considering the threat of being infected, people have been prevented from ordering food from online platforms, which creates a challenge for a company to distribute food [7]. Moreover, it is inevitable for food supply chain employees to work outside, which increases the chances of viral transmission in the supply chain [8]. As a consequence, food production faces a huge productivity decline compared with the productivity before the pandemic. This leads to less supply to the final customers and, therefore, a reduced sales turnover.

As for SMEs, the problem is likely to be magnified as big and multinational firms appear to be better at adjusting and adopting changes. This leads to a loss of employees in SMEs and worsens food security. Resilience and sustainability in the long term are also negatively impacted. In response to disruptions, the literature suggests that the food supply network is supposed to be capable of withstanding, adapting, and recovering from COVID-19 by adjusting operations and adapting environments to meet the consumer's needs [9].

2.2. The Manufacturing Industry

In the manufacturing industry, risks include supply chain disruption due to the halt of production for raw materials and spare parts, various hindrances in logistics, and the obscure timeline for restoration [1]. For instance, due to the strict epidemic prevention and control measures in China, Shanghai faced a great restriction on the export of spare parts during the lockdown. Therefore, the supply chain was hugely affected globally. In addition, the poor performance of logistics may bring other difficulties to enterprises, particularly SMEs. The raw materials that have not been sent out due to the shipping issue will remain in the warehouse as inventories. When orders are unsuccessfully processed, the renting burden of SMEs can be increased.

What is more, the internal environment in the warehouse will also greatly impact the quality of the spare parts. For example, if the warehouse is built in a rainy region, there is a high probability of metal parts becoming rusted, thus affecting the next transaction. The cost of drying the warehouse will amplify the burden on SMEs. Furthermore, some of these SMEs may be pushed to seek new suppliers and buyers in a local region within the province to eliminate the risk of inventories, but establishing these new trade relationships would not be easy, especially during the pandemic [10].

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2.3. The Hospitality Industry

The hospitality industry in this study includes accommodation and catering. The homestay market becomes extraordinarily popular in recent years. Plenty of homestays, from high-end to economical, have been constructed near tourist attractions to attract customers. However, the COVID-19 pandemic brought pressure on cash flow supervision. Most enterprises in the hospitality industry are investment and labor-intensive and are under significant financial pressure to cover their rents, fixed costs, and employee salaries [10]. It is common for them to take a bank loan to cover the initial investment and pay it back with a long-term sales turnover. Nerveless, with the burden of covering fixed costs and a decrease in the sales turnover under the COVID-19 pandemic, enterprises in the hospitality industry may find it struggling to maintain sustainability and the risk of them going into bankruptcy is exceptionally high.

Moreover, the COVID-19 pandemic has changed tourists' behavior. For example, people fear going out and eating outside. This leads to the breakdown of the tourism market. The supply chain of the hospitality industry has been influenced as the geographical advantage stops making them competitive.

SMEs are susceptible to crisis because of a lack of preparation, limited cash flows, and the inability to allocate resources strategically [11]. SMEs might greatly depend on the supply chain to gain customers. This makes enterprises in the coordination-intensive industry get exposed to more risks. Shocks from one firm quickly spread to others, producing profound cascading effects on the tourism supply chains [12]. Consequently, SMEs are likely to be the final victims in this supply chain to suffer diminishing revenue.

3. Potential Solutions to Minimize Risks

After experiencing the early epidemic impact, many companies have taken countermeasures to hedge major risks that could be encountered in the future. For SMEs, an effort could be made to support the resilience and sustainability of the firm. Even if the future epidemic trend is not fully revealed yet, it is advantageous to take some precautions before the possible latent outbreak. Figure 1 demonstrates the benefits of adopting potential solutions in SMEs to reinforce sustainability.

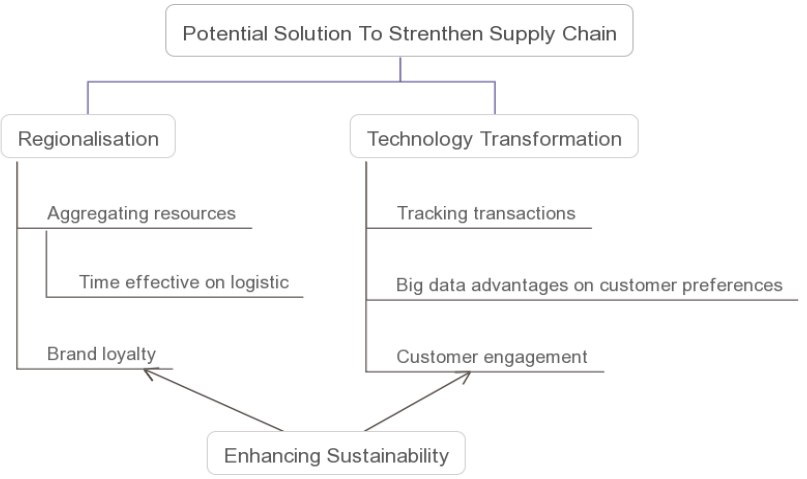


Figure 1: Potential solution to strengthen the supply chain.

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3.1. Globalization to Regionalization

Before the outbreak of the COVID-19 pandemic, managers have been prompted to compete in offshore manufacturing, cut overheads through worldwide economies of scale, systematize products internationally, and finance national market-share battles through international cash flows or other support activities [13]. This is a great challenge for SMEs, but once it functions prosperous internationally, it will win huge profits for the company. Notwithstanding, latent risks have been revealed with the emergence of COVID-19. The company that emulates in the global marketplace might confront delivery delays caused by dependency on remote cheap sources and the convoluted logistics network structure which will impair SME's liquidation and long-term revenue. As a consequence, managers are highly recommended to rationalize the company. SMEs can obtain resources from nearby in a short time avoiding the risk of delayed expected production period and could dispense the final product at the right time. Moreover, local SMEs that regard local customers and communities as target audiences rather than putting foreign customers as a priority are more likely to gain brand loyalty and win the trust of their customers.

3.2. Technology Transformation

Technology transformation or digital transformation aims to utilize technology to enhance a firm's overall performance. For instance, SMEs can exert digital design on the business model, thus using information technology to help understand and evaluate the digital value network design and feedback from customers [14]. Digital Transformation could yield superiority to SMEs for firms to be more competitive. For example, without a comprehensive digital control structure, the possibility of fraud is tremendously high as the supervision system is comparatively flimsy. However, with the presence of a thorough digital design, the likeliness of fraud might be reduced as any abnormal transactions are alarmed. Besides, the robustness of the supply chain could be strengthened. For instance, Walmart has recently used big data and digital transformation in the supply chain to give customers the expected arrival time of their orders. The mechanical tracking scheme not only enables a supplier to have a more inclusive understanding of the dealing process but also acquires a better insight into customer needs within a specified area.

4. Conclusion

This paper studies SMEs in three industries under a volatile business environment. The three industries are the food industry, the manufacturing industry, and the hospitality industry, respectively. The instability of the supply market has witnessed the bankruptcy of SMEs that failed to look out for changes in this dynamic condition. Hence, the survival of an enterprise is guaranteed by the ability of an organization to have the foresight to oversee the tendency of the future. This paper posits that the regionalization and transformation of technology would assist SMEs to intensify their ability to meet the ever-changing surrounding. Measures introduced in this paper could fabricate competitive advantages, which in turn, leads to a lower probability of being submerged in the trade competition.

However, the disadvantages of technology transformation and rationalization have not been introduced in this paper. The implementation of the settlement in SMEs needs further studies to elaborate. Besides, data collection through questionnaires or surveys could be utilized to manifest the usefulness of the measures. Moreover, additional policies could be spotted in future studies, such as the government policy on the use of big data and customer tracking system.

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An analysis of Tsingshan Holding Group Co's Big Short Position on Nickel Futures

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Abstract: This paper analyzes the case study of the world's largest nickel producer: Tsingshan Holding Group's $8 Billion trading loss. We examine Tsingshan's trading position before and after the surge in nickel prices to better understand the rationale behind their decision to short 200,000 tons of nickel futures mostly on the London Metal Exchange. Moreover, this paper outlines the impact of Tsingshan's trading loss on their various stakeholders. For instance, the rise of almost 250% in nickel futures resulted in the LME suspending all nickel trading on March 8th 2022 meanwhile creating a large liquidity crisis for the LME. On the other hand, Tsingshan's broker China Construction Bank Corp and their largest counterparty JP Morgan Chase provided large sums of loan packages so that Tsingshan could avoid defaulting on meeting their margin calls. We concluded that the case study revealed various underlying issues. One was the failure of LME's ability to regulate OTC trading, and the second was Tsingshan's poor liquidity management which put them in a vulnerable position.

Keywords: Tsingshan Holding Group, margin call, nickel futures, LME, CCB, JP Morgan

1. Introduction

The global futures market thrives nowadays, but not without risks. The recent event of the China-based Tsingshan Holding Group explicitly reveals such risks.

Founded in 1988, Tsingshan Holding Group is a private enterprise specializing in mining and smelting nickel and producing stainless steel. Nickel is a globally important and strategic metal, especially given that it is the primary raw material to produce lithium-ion batteries for electric vehicles. Consequently, Tsingshan needs to have access to a reliable resource of nickel. To secure nickel supply, Tsingshan invested and opened a nickel mining business in Indonesia in 2009, and 2013. The Morowali Industrial Park, a joint-venture establishment between Tsingshan and its Indonesian partner, was established and became a local hub of nickel processing and stainless-steel production. This movement helped Tsingshan build a complete supply chain in terms of both upstream nickel mining

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and downstream nickel-based products. As of 2020, Tsingshan already had an 18% global nickel market share.

As the company grew larger, Tsingshan wished to gain more control in the nickel market. However, its Indonesian nickel mining did not earn Tsingshan pricing power over nickel. This was because the nickel produced there does not meet the trading criteria of LME. Tsingshan had nickel only in terms of nickel-iron alloys (10% nickel), high nickel matte (70% nickel) and other intermediate products while LME merely accepts electrolytic nickel (with a nickel content of no less than 99.8%). Despite this, Tsingshan, as the world's biggest nickel producer and accounting for about one-fifth of the global nickel marke and believed they have bargaining power over nickel, which emboldened it to short nickel [1]. More specifically, Tsingshan made a forecast for 2022 based on its annual nickel output of 600,000 tons in 2021, and it was expected that the output will increase by 40%, with a total of 850,000 tons [2]. In addition, its Indonesian nickel mines produced nickel with costs lower than $10,000 per ton, and reports had it that Tsingshan's leader would consider shorting nickel whenever prices went over $20,000 per ton [3].

In mid-February, most likely before the Ukrainian War, the benchmark nickel price for LME was at around $23,000 per ton, which stimulated Tsingshan to short 200,000 tons of nickel futures (the exact number was not officially released by Tsingshan, thus we are assuming that the amount shorted is 200,000 tons which were gathered from various reports.) [3]. Because Tsingshan knew that its own nickel does not meet the delivery criteria of LME, they did not intend to make delivery at all and was confident that it could swap nickel from Russia at a lower price for delivery to minimize the loss once the price dropped. Thus, such a price hedge was conducted for the purpose of Tsingshan's own profitability through the manipulation of 'volatile' nickel prices. However, Tsingshan underestimated the situation between Russia and Ukraine. The war caused Europe, The United States as well as other countries to impose sanctions on Russia, limiting the trading of nickel, which caused a sharp drop in the supply of nickel in the market. This cut off the channel for Tsingshan to acquire nickel that meet the delivery criteria and led to the serial rise of nickel prices that broke historical records, putting the nickel giant into a dilemma.

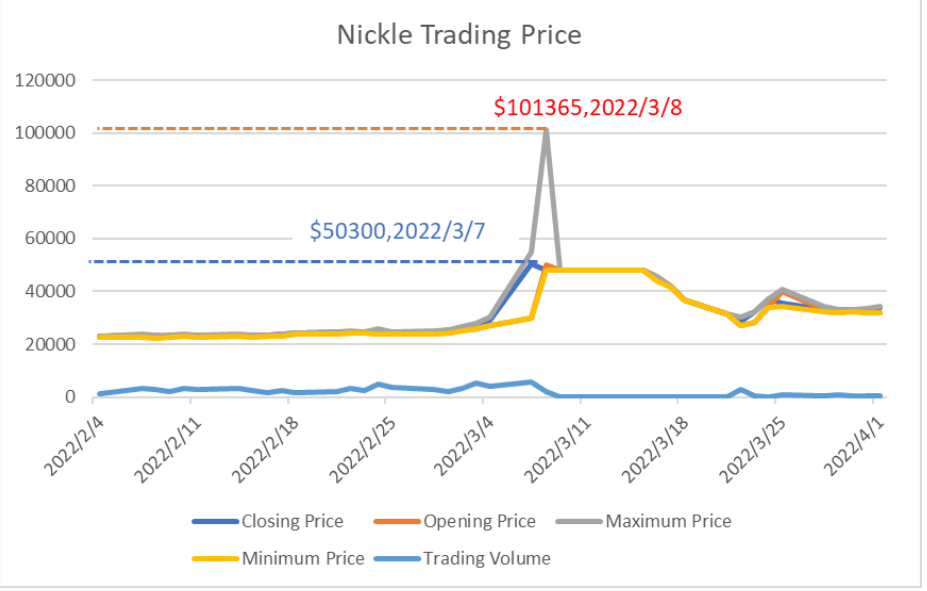


Figure1: Nickel trading price from 4th of February 2022 to 1st of April 2022 represented by Nickel's closing price, opening price, maximum price, minimum price and trading volume [4].

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On March 7, the closing price reached $50,300 per ton, which is represented by the dark blue line in Figure 1. On March 8, the LME nickel futures March contract soared greatly, rising to a record high of $101,365/ton [3]. Merely within two days, the price had witnessed the largest increase of nearly 250%. As a result, the Tsingshan futures account shrunk to -$12 billion, and if Tsingshan failed to cover margin call, they would be forced to close their position. Tsingshan had to either purchase nickel in the market at an unprecedentedly high price to make delivery or to pay liquidated damages-both directions would result in huge losses for Tsingshan.

As it turned out, Tsingshan managed to go through this crisis mainly with the aid of the Chinese government, but this very event was valuable in producing important lessons. Tsingshan's own shorting decision was doubtlessly the main reason that contributed to the crisis. However, the involvement of the Chinese government, LME, and third-party financial organization such as CCB and JPMorgan in this crisis are crucial, which will be future explored in this paper.

2. LME's Involvement

2.1. LME's Involvement

The London Metal Exchange (LME), one of the world's largest metal futures exchanges, suspended nickel trading at noon on March 8, 2022, rolling back prices to the March 7 closing price and cancelling all nickel trading on March 8. In addition, the LME will allow for a delayed delivery period for nickel and said it is working on a mechanism to voluntarily reduce short positions in the market through a "netting out" of large numbers of long and short positions before the reopening. It is also actively planning to reopen the nickel market and will announce this mechanism to the market as soon as possible. There is much speculation as to the reason for the LME's suspension. Some speculate that it may be the reason for China's involvement in the decision of the LME, which was wholly acquired by the Hong Kong Stock Exchange in 2012. This explanation is unconvincing; although the LME was wholly acquired by HKEX, it is still an international exchange in the UK and is still regulated by the FSA in the UK. There is a plausible explanation that the LME decided to save itself.

2.2. The Reason of LME's Involvement

The LME is an exchange and essentially a company. It needs to make a profit and carries the risk of insolvency. The nickel incident exposed the inadequacy of curtain management and risk prevention in the LME market, which did not foresee the volatility in the market following its refusal to accept delivery of the Russian metal. In addition, the LME allows over-the-counter (OTC) trading under its trading rules. OTC transactions are not recorded; thus, it is difficult for the LME to regulate all futures transactions. This makes it difficult for the LME to regulate all transactions. With market changes such as the Russian-Ukrainian war, a short squeeze will be triggered after one side bets heavily on nickel prices. If the LME could have foreseen the situation, stopped nickel trading in advance, and increased traders' margins, this event might not have evolved so severely. A significant rise in the price of nickel futures would result in the long side closing out their nickel futures positions, converting paper gains into cash gains. In contrast, a rise of almost 250% in nickel futures would result in all nickel shorts triggering the margin mechanism and forcing their positions to close. However, such a significant increase makes it difficult to close out positions, and even if all positions on the short side are closed out, the margin cannot be made up. As a result, the LME, as an exchange of both the long side and the short side, faces a huge liquidity crisis. Figure 2 shows the role of the LME, nickel futures buyers and sellers, and the flow of funds when the price of nickel rises.

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Figure 2: Trading process.

When the price of nickel futures rises, on the one hand, the short side struggles to cover its margin, and then the LME cannot get equity. On the other hand, the long side sells its futures. Equity decreases on the LME's account. Thus, the LME is only out on the account and loses liquidity. When a sharp increase in the price of nickel futures, the LME is likely to become insolvent and put itself in a default situation, leading to bankruptcy. The nature of the LME's cancellation of the nickel trade was therefore to avoid an exchange default. In short, as there is no way for the exchange to achieve a forced close-out, the exchange needs to cover the profits of the long positions with other funds. On 8 March, the LME lose liquidity on its books, and its account will not be able to support a large cash payment to the long side, leading to a collapse of the LME. As a result, during the March 8 session, the LME called an emergency halt to nickel futures trading.

2.3. The Impact of LME's Involvement on Tsingshan Holding Group

The LME made a nickel suspension decision in the face of surging nickel futures prices, giving the Tsingshan Holding Group, which was facing devastating losses, a respite. On 7 March, Nickel futures on the LME opened from US$29,770 and surged to an all-time high of US$55,000 during the session, up 88.81% from the previous day's close. On 8 March, Nickel futures on the LME continued to surge overnight trading, breaking through US$100,000 from the US$50,000 barrier, peaking at US$101,365, up by up to 101.52% [3]. The delivery date for Tsingshan Holding Group is on 9 March. If the LME does not make a decision, Tsingshan Holding Group is faced with two options. One is to deliver on 9 March. This option is almost impossible with the LME not accepting Russian nickel. The second is to cover the margin. But facing a loss of over 10 billion, the Tsingshan Holding Group cannot afford it. Instead, the LME announced the suspension of nickel futures trading and the cancellation of all trading on 8 March local time. All trades on the 8th of March were nullified, on the day trading resumed, the rate of increase or decrease was based on the closing price on 7 March. In addition, the LME allows for late delivery of nickel. The former cancelled a $4 billion deal for Castle Hill Group. At the same time, the latter also allows Tsingshan Holding Group to be ready for delivery.

2.4. The Impact of LME's Involvement on Other Groups

The LME's decision to suspend trading has also had an impact on multiple sides of the trading floor. The short side, represented by the Tsingshan Holding Group, was unable to close after the initial margin was lost as prices soared, leaving them in a position where they were at the mercy of many sides. This would result in a large number of brokers with clients holding nickel futures suffering a huge blow or bankruptcy. Suspensions allow the short side to avoid bankruptcy due to forced liquidation of positions due to strong price movements. Additionally, if the price of nickel is allowed to rise, it can lead to a chain of problems in subsequent trades, reducing the expectation of market stability. If the trader is also a producer, as in the case of the Tsingshan Holding Group, it would, in turn, be detrimental to stabilising the nickel price, which could lead to systemic risk. As the world's largest non-ferrous metals exchange, LME's mental future prices and mental stocks significantly impact global production and sales of non-ferrous metals. The result of non-intervention in nickel futures could be the collapse of the entire world metal chain. The LME's suspension, therefore, not only

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preserves the short side, represented by Tsingshan Holding Group, the brokers and itself but also protects the health of the nickel and non-ferrous metals markets.

On the contrary, the suspension of the LME's trading has to some extent harmed the long side of nickel futures, for which the LME has also been sued. US hedge fund Elliott Management sued the London Metal Exchange for over $456 million [5]. In addition, Jane Street, a US trading company, has also filed a lawsuit against the LME, Jane Street said, “Exchanges function to create an orderly market and a level playing field for investors. The LME’s arbitrary decision to cancel nickel trades during a period of heightened volatility severely undermines the integrity of the markets and sets a dangerous precedent that calls future contracts into question” [6].

3. Tsingshan’s Survival

3.1. Margin Call

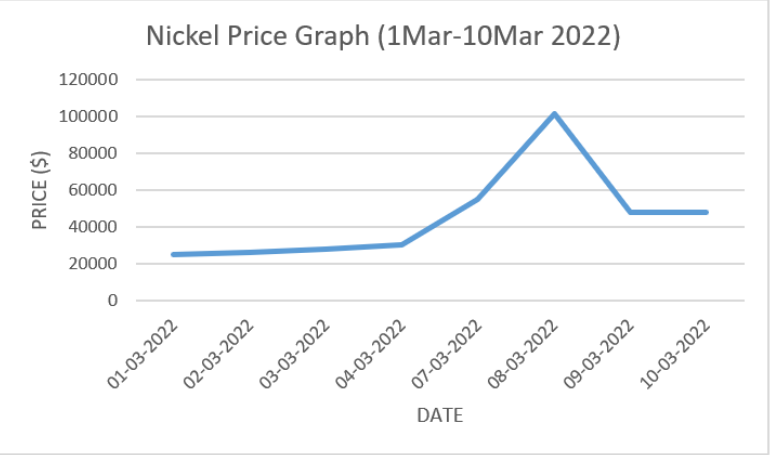


Figure 3: Nickel price graph from 1st March 2022 to 10th March 2022 [4].

The graph could be organized using a table represented below (bid price):

Table.1: Nickel price graph in Figure 3 translated.

Date	1-Mar	2-Mar	3-Mar	4-Mar	7-Mar	8-Mar	9-Mar	10-Mar
Price	25,400	26,505	27,970	30,295	55,000	101,365	48,063	48,048

Since we are assuming that the total amount of nickel shorted is 200,000 at roughly $20,000 per ton, we can use the above data to calculate margin calls.

$$March\ 1 = (25.4 - 20) \times 200{,}000{,}000 = \$1.08\ \text{billion}$$

$$March\ 2 = (26.505 - 20) \times 200{,}000{,}000 = \$1.301\ \text{billion}$$

$$March\ 3 = (27.970 - 20) \times 200{,}000{,}000 = \$1.594\ \text{billion}$$

$$March\ 4 = (30.295 - 20) \times\ 200{,}000{,}000 = \$2.059\ \text{billion}$$

$$March\ 7 = (55 - 20) \times 200{,}000{,}000 = \$7\ \text{billion}$$

$$March\ 8 = (101.365 - 20) \times 200{,}000{,}000 = \$16.273\ \text{billion}$$

DOI: 10.54254/2754-1169/17/20231120

$$March\ 9 = (48.063 - 20) \times 200{,}000{,}000 = \$5.6126\ \text{billion}$$

$$March\ 10 = (48.048 - 20)200{,}000{,}000 = \$5.6096\ \text{billion}$$

As shown in figure 3 and the translated data in table 1, we can notice that on March 8th, nickel prices peaked at 101,365 dollars per ton which left Tsingshan with a margin call of 16.273 billion dollars to pay. We can sum up the total number of margin calls from March 1st 2022 to March 10th 2022 to around 40.5292 billion dollars. The tremendous amount of margin calls leaves Tsingshan in a difficult state, as they cannot pay their margin call which will inevitably lead to bankruptcy. However, they were saved by their vital stakeholders- China Construction Bank Corp, JP Morgan Chase & Co and most important the Chinese government.

3.2. Tsingshan's Stakeholders

China Construction Bank Corp (CCB) - Tsingshan's broker played a vital role in the company, where their short positions on the LME along with a sudden spike in nickel prices had left Tsingshan with hundreds of millions of dollars in margin calls which they had failed to pay. As a result, they had put CCB 'in a bind', where the bank had to make hefty margin calls on their own to cover the short position on the LME the following morning. As, if Tsingshan had decided to 'walk away from its commitments' CCB could lose billions of dollars [7]. The LME had also helped Tsingshan by providing additional time for a unit of China Construction Bank Corp- CCBI Global Markets so that they could pay the large sum of margin calls.

JPMorgan Chase & Co is the largest counterparty of the Tsingshan's nickel 'big short', and had been caught in an "unprecedented short squeeze, putting the bank at the centre of one of the most dramatic moments in metals market history." [8]. Quoting unnamed sources from a report by Bloomberg, 50,000 tonnes of Tsingshan's total nickel short position of more than 150,000 tonnes is held through an over-the-counter position with JPMorgan. It is important to note that the over-the-counter position with JP Morgan meant that nickel trading did not occur on the LME but via the broker-dealer network. This meant that the LME had limited knowledge of Tsingshan's nickel trading with JP Morgan, as some of Tsingshan's nickel contracts were not directly on the LME [9]. According to LME, they expected their members such as JPMorgan to disclose details on OTC positions notwithstanding contractual confidentiality clauses, but that in countries where by law they were prevented from revealing identifying information about their clients, they could report client positions in anonymized form [9].

"Based on Tsingshan's OTC position with JP Morgan, the tycoon's company would have owed JPMorgan about 1 billion USD in margin on Monday. The nickel producer has been struggling to pay margin calls to its banks and brokers." [10]. Because of this, JPMorgan has provided Tsingshan with credit promises so that they could avoid defaulting on its margin calls [10].

3.3. Beijing's Role

Beijing is exploring a plan to rescue one of the world's top nickel producers-Tsingshan Holding Group from billions of dollars of potential losses. Due to their inability to meet margin calls, one option under consideration is for Tsingshan to swap some of the lower-grade nickel pig iron (NPI) it produces which does not meet the LME's quality standards for refined metal held in China's State Reserves Bureau. According to two analysts, China is estimated to hold around 100,000 tonnes of nickel in state stocks [11]. Tsingshan could then deliver the high-grade metal against its contract on the LME, pay off its brokers and close its lossmaking position [10].

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A large reason behind why Beijing needs Tsingshan to 'stay alive', is their role as a 'poster child' in Southeast Asia for China's Belt and Road Initiative, President Xi Jinping's vast infrastructure programme [11]. According to Tsingshan Holding group, they recognize that they have actively implemented "the Belt and Road Initiative," by "accelerating the development of international strategy, building large industrial parks in Indonesia, India, Zimbabwe and other countries, and deploying in the field of green new energy, thus marching into the ternary materials, power batteries and other relevant industries." [12].

4. Evaluation

4.1. Tsingshan's Risks

Prior to the increase in nickel prices, Tsingshan Holdings Group had already made a short sale in the LME and had also committed to purchasing 200,000 tons of spot nickel, along with holding OTC positions with JPMorgan. Because Tsingshan did not intend to make delivery at all and were confident that it could swap nickel from Russia at a lower price, they were unable to deliver the nickel on schedule. As a result, the main trading risks that Tsingshan faced were: first, his inability to pay attention to the unique circumstances surrounding the Russian-Ukrainian war and the possibility that it might suddenly disrupt the market's total supply. Second, is the danger of rivalry from other businesses. Third, is the potential for late delivery as a result of international disputes.

Looking back on this incident, there were undoubtedly explanations for why the LME did not update the exchange rules promptly in response to changes in economic development and shorting by foreign capital using the exchange rules. Despite this, the Tsingshan Holdings Group's weaknesses in areas such as hedging risk control, trading strategy, liquidity management, and market acuity were all large enough risks which led to their eventual downfall.

4.2. Tsingshan's Future

The losses from the aforementioned events may have harmed Tsingshan Holdings Group's possible investment in the nickel battery sector in the future, which could have the following negative effects. First, because the company is an industry leader or benchmark, its capital chain is impacted, which could lead to new competition and changes in the sector. Second, the production costs of upstream and downstream industries will be impacted by nickel raw materials as important raw materials for lithium batteries and nickel batteries. Price increases will cause the production costs of the key demand side to increase, which will result in price increases for many industries' key raw materials. Short-term price hikes may also result in phenomena like a shortage of raw materials, which could have an impact on how efficiently some businesses, like new energy cars, produce their products. Third, Tsingshan Holdings Group, one of China's major foreign metal trading corporations, might harm the reputation of other Chinese businesses, which would also affect the credibility of the company.

In the future for Tsingshan Holdings Group, the strategies that can be adopted are as follows: First, rationalize trading strategies to manage risk. Second, manage liquidity well to prevent delivery risk and ensure liquidity. For small varieties of commodities, ensure that there are sufficient spot sources for delivery and prevent the delivery risk under the short-selling scenario. Third, conduct adequate research on counterparties, and comprehensively collect and grasp information on all aspects of politics, economy, market inventory, and counterparties related to derivatives trading globally. Study in depth the rules of relevant derivatives exchanges, pay attention to rule changes, have a full understanding of possible loopholes in the rules that may be exploited, and make contingency plans for emergencies.

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5. Conclusion

The essay is aimed to point out Tsingshan's main risks by analyzing the whole case thoroughly. Meanwhile, the paper is devoted to providing practical advice on developing new strategies to avoid similar losses for both Tsingshan and other speculators in the market. To make it logical, the nickel incident was recalled from the perspective of three main subjects: Tsingshan Holding, LME and parties who came to Tsingshan's rescue (JP Morgan, China Construction Bank Corp and China government), and the corresponding countermeasures and the underlying interest relationship has been discussed. LME suspended nickel trading to save itself. China Construction Bank Corp, Tsingshan's broker, had to deal with huge margin calls on their own to cover the short position. JP Morgan provided Tsingshan with credit promises because of its unwillingness to see Tsingshan default on its margin calls. Beijing's salvage of Tsingshan largely depended on its important role in China's Belt and Road Initiative.

The crisis reveals underlying risks in both the regulation of LME and the management of large international companies like Tsingshan group. LME possesses enough tools to acquire information regarding over-the-counter trading related to nickel, but it did not exert such tools, which allowed nickel OTC trading to be kept invisible and nickel prices to keep climbing up to an irrational extent. In this sense, this crisis exposes LME's insufficient regulation of OTC metal trading. LME needs to both more effectively exert tools rendered under the current rulebook and to come up with new measures to increase transparency in each aspect of metal trading. This should be prioritized in its future work to better fulfil its role in maintaining the market order. In the meanwhile, Tsingshan's poor management of liquidity risks is another major issue that is exposed by the crisis. Given that physical resources are limited, there is always a possibility that prices will be distorted because of excessive capital chasing. This means that by controlling the flow of physical resources one could manipulate futures prices, which is indeed what is happening in the crisis. In its bold shorting decision, Tsingshan makes itself vulnerable to such manipulation and puts itself at risk. In the future, Tsingshan must learn from this crisis and pay more attention to managing liquidity. Lastly, bold speculative action as that of Tsingshan in this crisis is an existing issue that lies the seed of crisis in the futures market. Hedging is frequently used as a strategy to maintain the value of products. While rational hedging is encouraged, excessive hedging is speculation and brings risks. Noting that Tsingshan's productive capacity of nickel that meets the trading criteria of LME is limited, Tsingshan may engage in speculation. The futures market still needs more regulations that prevent speculation and reduce risks generated by speculation.

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The Effect of Basic Education, Health, and Racial Factors on the Spatial Distribution of Poverty Rate in Los Angeles County

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Abstract: This work focuses on the spatial distribution of poverty rates in Los Angeles County and the impact of multiple socioeconomic factors on poverty rates and distribution. The scale of the study is based on census tract to ensure the fineness of the study. The three socioeconomic factors are basic education, health, and race. The primary research method was to perform regression analyses on socioeconomic factors and poverty rates. Initially, a conventional Ordinary Least Square regression analysis was conducted, and it was found that this model did not explain the distribution of poverty rates by region in Los Angeles County well. Therefore, a geographically weighted regression model was applied to explain the relationship between different socioeconomic factors and poverty rates. It was found that basic education has the effect of reducing local poverty in relatively poor areas; while for wealthier areas, merely receiving basic education is insufficient, which leads to higher poverty rates. Health insurance is more of a burden for relatively poor areas, thus worsening poverty, while for relatively affluent areas, health insurance can help alleviate local poverty by avoiding high medical bills. In areas where one ethnic group is concentrated, an increase in the proportion of one ethnic group has a positive effect on reducing the local poverty rate, but in areas where other ethnic groups are concentrated, it has a negative effect on reducing the local poverty rate.

Keywords: geographically weighted regression, poverty rate, Los Angeles County

1. Introduction

According to the U.S. Census Bureau's income and poverty report [1], the official poverty rate in 2020 was 11.4 percent, up 1.0 percentage point from 10.5 percent in 2019. This is the first increase in poverty after five consecutive annual declines. In 2020, there were 37.2 million people in poverty, approximately 3.3 million more than in 2019. Between 2019 and 2020, the poverty rate increased for non-Hispanic Whites and Hispanics. Among non-Hispanic Whites, 8.2 percent were in poverty in 2020, while Hispanics had a poverty rate of 17.0 percent. Among the major racial groups examined in this report, Blacks had the highest poverty rate (19.5 percent) but did not experience a significant change from 2019. The poverty rate for Asians (8.1 percent) in 2020 was not statistically different from 2019. From the above data, we can know poverty has been a complex social problem in the US, meanwhile, the appearance of poverty typically results from multiple factors, such as education, race,

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health, food poverty, etc. Poverty has a significant impact on the children and teenagers, it usually results in juveniles dropping out of high school and are likely to have employment problems. Although only 1 percent of children who are never poor end up being poor as young adults, 32 percent of poor children become poor as young adults [2]. Their lack of education and other public resources in turn restricts them and their children to poverty, once again helping to ensure a vicious cycle of continuing poverty across generations. Also, low-income families tend to have low intakes of fruit and vegetables and high intakes of junk food. They also tend to suffer more health problems from cancer, diabetes, obesity, and heart disease, which result in higher mortality rates, higher prevalence of acute or chronic diseases, and more emotional and behavioral issues [3]. So, it is hard for people who are already restricted in poverty to get out of it. According to the report, Social Security kept 26.5 million people out of poverty in 2020, and economic impact or stimulus payments kept 11.7 million people out of poverty. Unemployment insurance payments and refundable tax credits kept 5.5 million and 5.3 million out of poverty, respectively [4]. We can see the government has a leading role in improving poverty. Therefore, the government and other poverty departments should actively respond to the poverty situation and make new policies and programs to reduce poverty growth. My research purpose is to help the government to have a thorough understanding of the urban poverty issue in LA so that they can respond to urban poverty issues accordingly, and help more people get out of poverty and get a better life in the future. My major study question is how the spatial distribution of the poverty rate is affected by basic education, health, and racial factors. More specifically, how do the number of secondary schools, education attainment, health insurance coverage, and percentage of specific ethnic groups influence the local poverty rate?

2. Data

To analyze and interpret the research questions, I obtained data from the US Census Bureau on poverty rates as well as basic education, health, and race. I attempted to regress them to find the relationship between the distribution of poverty rates and these factors. Since the study area is limited to Los Angeles County, I needed to keep the scale of the data as small as possible to provide a more refined analysis. The smallest administrative unit of the US Census Bureau data is the census tract, so all my data are obtained at the census tract scale. Also, all data were collected in 2019 and all have 2341 rows, corresponding to 2341 census tracts in Los Angeles County. Table 1 is a detailed list of the data.

Table 1: Data.

Dimension	Variables	Details
Poverty (Dependent Variable)	Poverty Rate	The percentage of the population below the poverty line among the total population.
Basic Education	Middle School Count	The number of middle schools within a 3km range of the census tract.
	High School Count	The number of high schools within a 3km range of the census tract.

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Table 1: (continued).

	Middle School Enrollment	The percentage of the population who have enrolled in schools among those aged 10-14.
	High School Enrollment	The percentage of the population who have enrolled in schools among those aged 15-17.
	Middle School Degree 18-24	The percentage of the population who have less than a high school degree among those aged 18-24.
	High School Degree 18-24	The percentage of the population who only have a high school degree among those aged 18-24.
	Middle School Degree 25+	The percentage of the population who have less than a high school degree among those aged 25 or older.
	High School Degree 25+	The percentage of the population who only have a high school degree among those aged 25 or older.
Health	Uninsured Rate	The percentage of the population who do not have health insurance among the total population.
Race	White Ratio	The percentage of the population who are white among the total population.

DOI: 10.54254/2754-1169/17/20231121

Table 1: (continued).

African American Ratio	The percentage of the population who are African Americans among the total population.
Native American Ratio	The percentage of the population who are native Americans among the total population.
Asian Ratio	The percentage of the population who are Asian among the total population.
Pacific Islander Ratio	The percentage of the population who are Pacific Islanders among the total population.
Other Ratio	The percentage of the population who are of other races among the total population.

In addition, the number of high schools and the number of middle schools are the only ones not obtained from the US Census Bureau. I use the 2019 California school shapefile obtained from the California Geoportal and perform a spatial join to obtain the number of middle and high schools in the three kilometers around each census tract. Although other data have been considered in other similar studies, I will focus on these variables and examine their relationship with the distribution of poverty rates in Los Angeles County.

3. Method

3.1. Ordinary Least Square

Since the dependent variable of poverty rate is a percentage form of data, and the regression analysis model commonly used for percentages as the dependent variable is usually General Linear Regression, but according to the "Spatial Regression Analysis of Poverty in R" [5], their dependent variable is also the poverty rate and they use the standard regression model, which is the Ordinary Least Square model. Therefore, I will first use the OLS model to explore the relationship between the explanatory variables and the poverty rate. First, I selected all the explanatory variables and analyzed them using the OLS model in ArcGIS Pro, but not all the explanatory variables were significant. In this case, Middle School Degree 18-24, High School Degree 18-24, and Pacific Islander Ratio had p-values of 0.24, 0.99, and 0.94. This means that these three explanatory variables did not have a significant effect on the change in the poverty rate. I excluded these explanatory variables from the OLS analysis, and the obtained results are shown in Table 2.

DOI: 10.54254/2754-1169/17/20231121

Table 2: OLS coefficient.

Variable	Coefficient	Standard Error	t_Stat	P-value	Adjusted R-square	AICc
Middle School Count	-0.17807	0.075879	-2.34672	0.019007		
High School Count	0.249246	0.044683	5.578139	8.94E-08		
Middle School Enrollment	-0.02811	0.013874	-2.0258	0.042889		
High School Enrollment	-0.05159	0.01241	-4.15754	3.9E-05		
Middle School Degree 25+	0.531888	0.041685	12.75983	0		
High School Degree 25+	-0.15161	0.025918	-5.84982	2.7E-08	0.4582947	16307.5847
Uninsured Rate	0.462382	0.037355	12.3782	0		
White Ratio	0.159708	0.024243	6.587893	1.06E-09		
African American Ratio	0.258257	0.027841	9.275991	1.9E-14		
Native American Ratio	0.551268	0.056586	9.742173	3E-15		
Asian Ratio	0.182184	0.025852	7.047149	1.46E-10		
Other Ratio	0.15738	0.028437	5.53431	1.08E-07		

From the table we can see the p-value of all the explanatory variables is less than 0.05, which means that all these variables can explain the changes in the poverty rate. For example, Middle School Degree 25+ has a coefficient of 0.531888, a standard error of 0.041685, a t-test statistic of 12.75983, and a p-value of 0. This means that when all other explanatory variables are held constant, a 1% increase in the percentage of people with a middle school education among those aged 25 and older is associated with a 0.5312% increase in the poverty rate. Also, the p-value is very small; this then proves that the regression coefficient for the percentage of people with a middle school education among those aged 25 and older is not zero. In addition, the results include an adjusted R-squared of 0.4582947 for this model, indicating that about 45.8% of the change in the poverty rate can be explained by the relationship with the explanatory variables considered in this study.

DOI: 10.54254/2754-1169/17/20231121

3.2. Geographically Weighted Regression

In the previous section, I used an OLS regression model to analyze the relationship between poverty rates and explanatory variables. However, we did not consider the effect of spatial information on the relationship between these explanatory variables and poverty rates. To investigate whether the relationship between these explanatory variables and poverty rates varies with space, I used the Spatial Autocorrelation tool in ArcGIS Pro to analyze the residuals obtained from the OLS regression model. The results show that the residuals from the OLS analysis have a z-score of 27.626255, and there is a less than 1% likelihood that this clustered pattern has a spatial autocorrelation with each other, which would suggest that OLS is not the best model to study the relationship between poverty rates and explanatory variables. Thus, we need to consider spatial regression models for further analysis of the variables.

Before performing the spatial regression analysis, I need to perform exploratory regression analysis on the explanatory variables to select the desired explanatory variables again. As in "Spatial Regression Analysis of Poverty in R" [5], I took a similar approach. The explanatory variables used in the previous section were analyzed. The results showed that high school enrollment, the ratio of native Americans, and middle school enrollment had significant percentages of 8.76%, 1.64&, and 0.07%, indicating that these three explanatory variables did not have a significant effect on the change in the poverty rate, so I removed these three variables to obtain a more concise and efficient model. As mentioned by Kamenetsky [5] I need to perform model selection to find more parsimonious models that may have fewer explanatory variables. Also, I need to avoid multicollinearity between explanatory variables and thus reduce the redundancy of the data. In figure 2, it is shown that there is multicollinearity between ratio white and ratio other, so I eliminate ratio other for the following spatial regression analysis.

Summary of Variable Significance

Variable	% Significant	% Negative	% Positive
HIGH_COUNT	100.00	0.00	100.00
NOHIGH_25	100.00	0.00	100.00
UNINSURED	100.00	0.00	100.00
RATIO_AFRI	91.54	3.63	96.37
RATIO_OTHE	64.45	21.14	78.86
HIGH_25	56.66	67.31	32.69
MID_COUNT	55.56	32.61	67.39
RATIO_WHIT	49.19	67.29	32.71
RATIO_ASIA	41.87	53.27	46.73
HIGH_ENROL	8.76	98.73	1.27
RATIO_NATI	1.64	0.00	100.00
MID_ENROLL	0.07	57.43	42.57

Summary of Multicollinearity

Variable	VIF	Violations	Covariates
MID_COUNT	2.89	0	--------
HIGH_COUNT	2.75	0	--------
MID_ENROLL	1.73	0	--------
HIGH_ENROL	1.60	0	--------
NOHIGH_25	2.63	0	--------
HIGH_25	1.78	0	--------
UNINSURED	2.17	0	--------
RATIO_WHIT	9.34	276	RATIO_OTHE (1.16)
RATIO_AFRI	4.31	0	--------
RATIO_NATI	1.19	0	--------
RATIO_ASIA	6.32	0	--------
RATIO_OTHE	8.10	23	RATIO_WHIT (1.16)

Figure 1. & Figure 2.

Finally, I perform geographic weight regression analysis using the remaining explanatory variables with poverty rates to explore whether and how the relationship between explanatory variables and poverty rates changes with spatial relationships. In contrast to the spatial autoregressive regression used by Kamenetsky [5] and Liu [6] in their articles, I choose to use the geographically weighted regression tool in ArcGIS Pro to analyze the poverty rate with the explanatory variables and generate a series of visualizations to help better interpret results. Finally, the residuals generated by the GWR analysis were analyzed by spatial autocorrelation to explore whether their distribution was random and to see if GWR could better explain the relationship between the variables and the variation in poverty rates. The results show that the GWR-resulting residuals have a z-score of 0.263197, which means that they are randomly distributed and do not show significant patterns.

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4. Results

4.1. Model Comparison

In the previous section I analyzed two regression models for the explanatory variables and poverty rates, an OLS regression model that does not consider the spatial component and a GWR model that considers the variation in the spatial component. To measure the performance of the two models, I have selected four important indicators to compare them. Moreover, the GWR model performs the best when there are 123 neighbors. These are adjusted R-square, AIC, MAE, RMSE, and p-value of the global Moran's I. The specific results obtained are in Table 3 below.

Table 3: Model comparison.

Model	AIC	Adjusted R-square	Moran's I
Ordinary Least Square	16307.3783048	0.458295	0
Geographically Weighted Regression	15495.5112	0.7480	0.792399

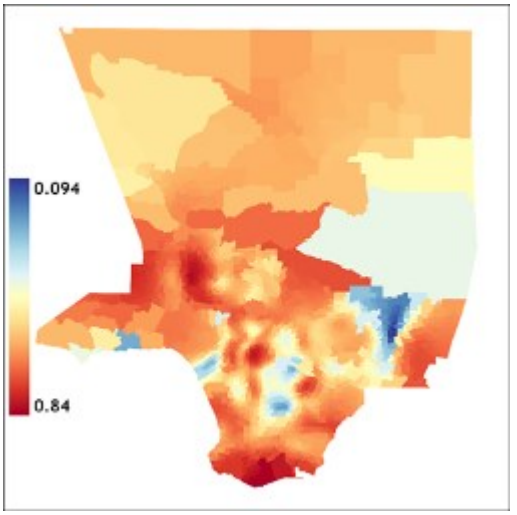


Figure 1: GWR local R^2 map.

From the table we can see that GWR outperforms OLS in any respect, where the AIC of the GWR model is much smaller compared to OLS, and the adjusted R-square and p-value of the global Moran's I of GWR have a significant improvement over OLS. From the local R-square map produced by GWR analysis, it shows high R-square values in most regions in Los Angeles County. These indicate that the data can better fit the GWR model rather than the OLS model, so I will next interpret the results obtained from the GWR model.

4.2. GWR Results

By analyzing the poverty rate with each explanatory variable, we ended up with eight coefficient maps that represent the impact of the variation of each explanatory variable poverty rate in different regions. The nine maps in the following sections include the coefficient maps of the eight explanatory variables with the poverty rate and the visualization maps of the distribution of the poverty rate in Los Angeles County.

DOI: 10.54254/2754-1169/17/20231121

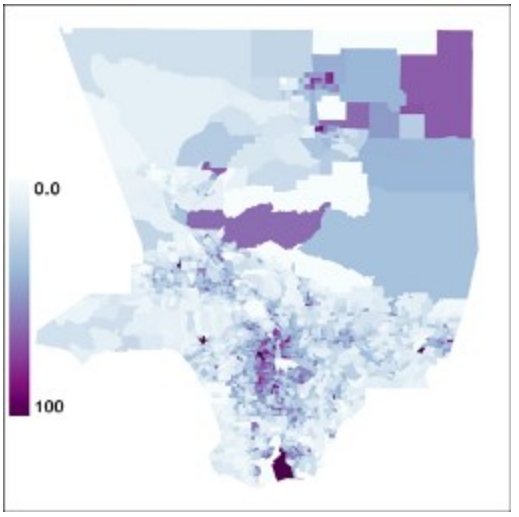


Figure 2: Poverty distribution map of Los Angeles County.

In the GWR coefficient maps, the redder parts indicate that an increase in this explanatory variable tends to have a decrease in the local poverty rate, and conversely the bluer areas indicate that an increase in this explanatory variable tends to have an increase in the local poverty rate. At the same time, the lighter the color means that the explanatory variable has a smaller effect on the poverty rate in this region. The results are then interpreted in terms of basic education, health, and race.

4.3. Basic Education

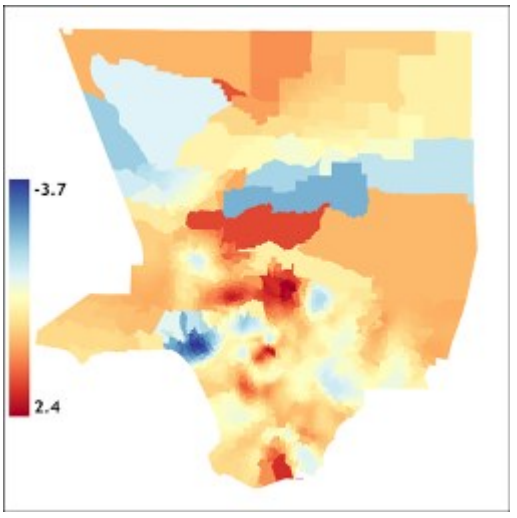


Figure 3: Coefficient map of middle school count.

DOI: 10.54254/2754-1169/17/20231121

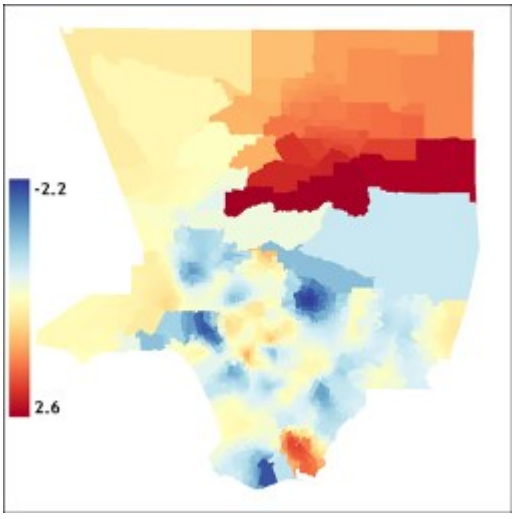


Figure 4: Coefficient map of high school count.

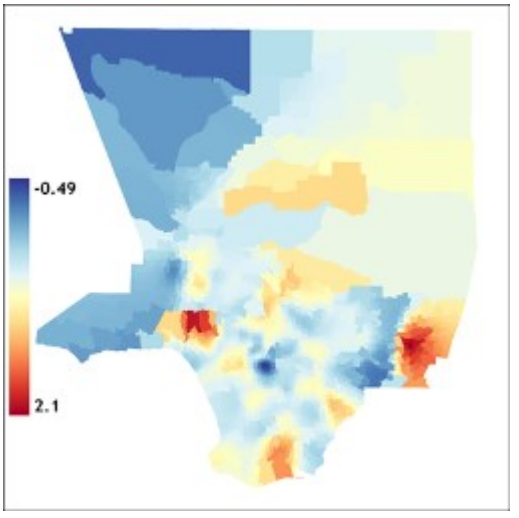


Figure 5: Coefficient map of middle school degree 25+.

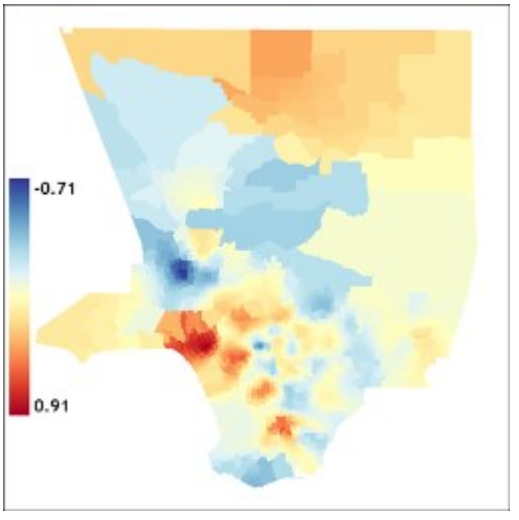


Figure 6: Coefficient map of high school degree 25+.

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Looking at the level of education, we have four explanatory variables: the number of middle and high schools, and the percentage of people aged 25 and older who have middle and high school degrees. The number of middle schools shows a small effect on the poverty rate on most scales, but there are still some regions that show a large effect. In the Santa Monica and Hollywood areas, an increase in the number of middle schools tends to have a lower local poverty rate, while in Long Beach, Downtown, and areas north of Downtown, an increase in the number of middle schools tends to have a higher local poverty rate. Contrary to the number of middle schools, the increase in the number of high schools tends to have a lower local poverty rate in most areas. Comparing the map of poverty distribution, we can see that the increases in the number of middle schools correspond to the increases in the poverty rate in areas with high poverty rates, while in areas with low poverty rates, the increases in the number of middle schools correspond to the decreases in the local poverty rate. As for the number of high schools, an increase in the number of high schools tends to have a lower local poverty rate in both high and low poverty areas. This is more in line with our general perception of the improvement of poverty rates through basic education. This is because, in wealthier regions, people do not usually end up with lower secondary education, while in poorer regions, a certain percentage of the population stops studying after lower secondary education. Such differences create differences in the educational attainment of the population, which leads to differences in poverty rates. In contrast, high school education equips people to survive in society, so the number of high school schools has a positive effect on improving poverty in both poor and affluent regions.

In terms of educational attainment for those aged 25 and older, the higher percentage of people with a middle school education corresponds to a lower poverty rate in most regions and corresponds to the higher poverty rate only in the Beverly Hills region and in a few regions in the East. The effect of the percentage of people with a high school education on the poverty rate varies more spatially, as the higher percentage of people with high school education in areas with higher poverty rates corresponds to a lower local poverty rate, while the opposite is true in areas with lower poverty rates. In general, the proportion of people with a basic level of education can help improve poverty rates, but in a small number of wealthier regions, simply having a relatively low level of education can increase local poverty rates. This is consistent with our understanding that basic education does have a positive effect on poverty but having only a basic level of education in wealthier regions makes it difficult to find suitable jobs.

4.4. Health

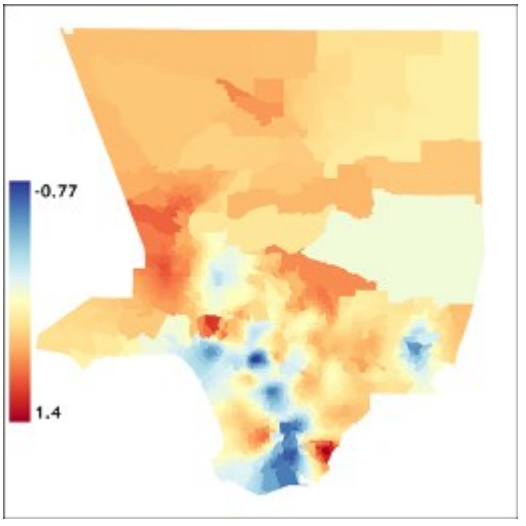


Figure 7: Coefficient map of uninsured population.

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In terms of health, the increase in the percentage of people who do not have health insurance corresponds to lower local poverty rates in regions with high poverty rates; while in most other regions, the increase in the percentage of people who do not have health insurance tends to have higher local poverty rates. This may be because, in regions with high poverty rates, people cannot afford health insurance, or an additional expense would exacerbate their poverty. In other regions with lower poverty rates, having health insurance does not put much of a burden on people's lives, and even avoids high medical expenses at some levels. Without health insurance, these people may not be able to afford the high cost of health care and thus become poor.

4.5. Race

For the results on race, I combined the poverty rate with the percentage of each ethnicity in the population to interpret the results. The following six figures show the coefficient maps and the distribution maps of whites, African Americans, and Asians in Los Angeles County.

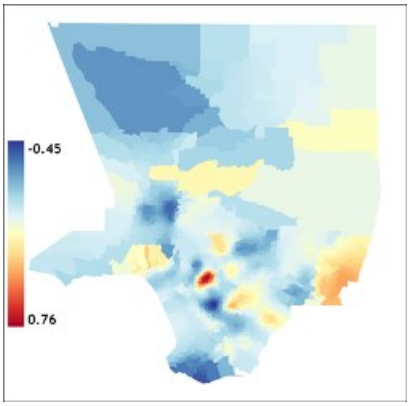


Figure 8: Coefficient of white ratio.

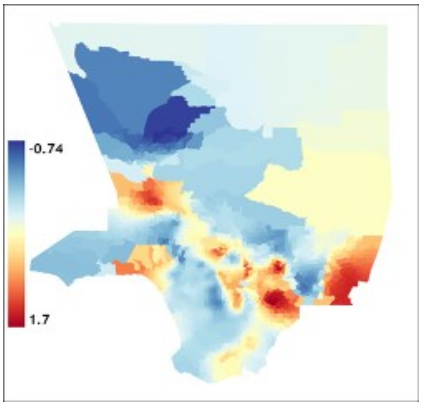


Figure 9: Coefficient of black ratio.

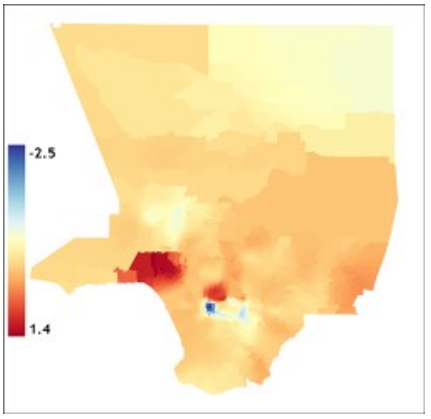


Figure 10: Coefficient of Asian ratio.

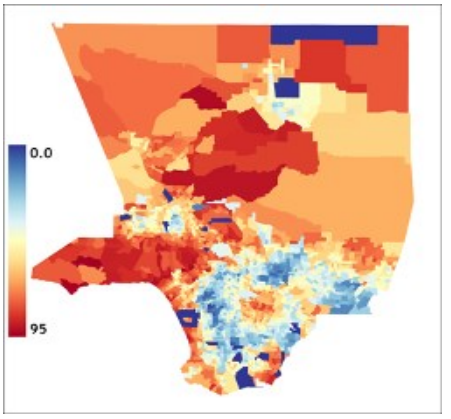


Figure 11: Distribution of whites.

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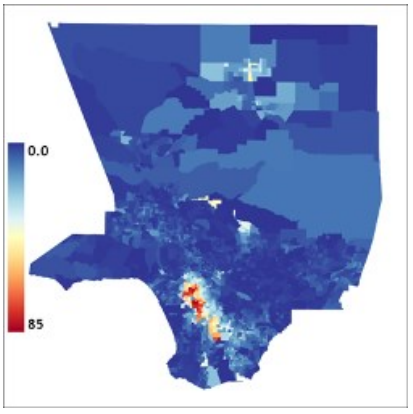


Figure 12: Distribution of black.

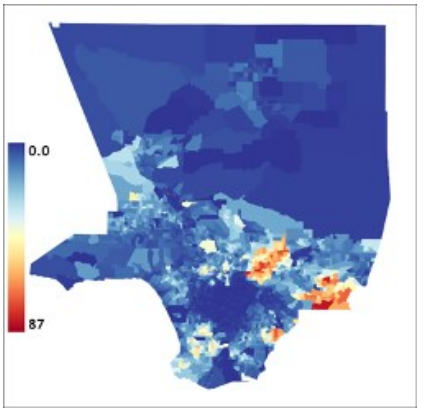


Figure 13: Distribution of Asians.

In terms of race, the increase in the proportion of Whites in the population tends to have a reduction in the local poverty rate in most regions; however, in the Downtown area of Los Angeles, the increase in the proportion of Whites in the population corresponds to a higher local poverty rate. This may be because people in Downtown, an area with high poverty rates, are also among the relatively poorer segment of the white population, and therefore do not have a positive effect on reducing poverty rates.

The effect of the African American proportion of the population on the poverty rate varies more significantly spatially. Combining the poverty rate with the distribution of African Americans, we can find that in areas with a high percentage of African Americans, an increase in the percentage of African Americans in the population tends to have a lower local poverty rate; while in areas with a high percentage of other minority populations, an increase in the percentage of African Americans in the population corresponds to a higher local poverty rate. This may be due to the inability of African Americans to adapt well to specific minority cultures in these regions, making it relatively difficult to find suitable jobs.

Finally, the percentage of Asians has a relatively small effect on changes in poverty rates in most regions and a positive or negative effect on improving poverty rates in only a few regions. In areas with a high white population, an increase in the Asian population corresponds to higher poverty rates, while in a small number of areas with a high African American population, an increase in the Asian population tends to have a lower poverty rate. This may be since Asians have lower income levels relative to whites, which does not help improve poverty rates locally, while for African Americans, Asians have relatively higher incomes, which have a relatively positive impact on improving poverty rates locally.

4.6. Conclusion

In general, basic education has the effect of reducing local poverty in relatively poor areas; while for wealthier areas, merely receiving basic education is insufficient, which leads to a higher poverty rate. For instance, the increases in the number of middle schools correspond to the increases in the poverty rate in areas with high poverty rates, while in areas with low poverty rates, the increases in the number of middle schools correspond to the decreases in the local poverty rate. Health insurance is more of a burden for relatively poor areas and thus worsens poverty, while for relatively affluent areas, health insurance can help alleviate local poverty more by avoiding high medical costs. The race is more complex, with the percentage of whites and African Americans having a significant impact on changes in poverty rates, but the percentage of Asians having a relatively small impact. In general, however, an increase in the percentage of a particular ethnic group has a positive effect on reducing

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local poverty rates in areas where that ethnic group is concentrated, but in areas where other ethnic groups are concentrated, it has a negative effect on reducing local poverty rates.

5. Challenges/Gaps and Future Direction

In this analysis, I only considered the effects of basic education, health, and ethnicity on the change in poverty rate at the data level. However, more factors may have an impact on the change in poverty; therefore, in future studies, I may consider adding other factors in other dimensions to study the factors that have an impact on the poverty rate more comprehensively. Meanwhile, among the three dimensions, only considering the effect of basic education on the poverty rate may not be sufficient, and higher education and pre-school education can be added in the future. At the same time, only one factor was selected for the health dimension, which does not reflect the comprehensive effect of health factors on the poverty rate. At the methodological level, I used only two regression models, OLS and GWR, but it is possible that there are better models than these to analyze the effect of explanatory variables on the poverty rate. Therefore, in future studies, other spatial regression models, such as spatial lag regression models, could be considered. Overall, this study explains the effects of basic education, health, and ethnicity on the spatial distribution of poverty rates to some extent, but there are still many shortcomings that could be improved to provide a more thorough analysis of the factors that influence the spatial distribution of poverty rates.

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The Governance Model Investigation of Urban Village's Commercialization Based on Cultural Insight

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Abstract: With the development of the city, urban villages, though an important part of the cities now, seem to be unable to avoid the fate of disappearing. Urban villages developed in China as a result of some original villages being surrounded by contemporary tall buildings. This paper reviewed the history and the development of urban villages, compared slum management in other countries to the management of urban villages in China, and takes Nantou Gucheng, an urban village in Shenzhen, as an example to explore the balance between economic development and preservation of cultural heritage. The paper shows that the urban village provided stalls for the brands like a commercial center, which was meaningless. The government should dig deep into the history of the urban villages. Besides, the government makes it possible to provide improved support to ensure old shops run by the original residents of urban villages for more than 10 years can continue to operate.

Keywords: land economy, urban village, government

1. Introduction

In the process of industrialization and urbanization, due to the special land policy in China, some original villages were surrounded by modern high buildings, and urban villages were formed [1].

Firstly, there is the origin of Urban villages. As the paper mentioned, in China there is a special land policy that urban land is owned by the government, while rural land is owned by rural collectives. With the vigorous development of cities, the urban area is constantly expanding, and the government needed to purchase rural land from rural collectives to satisfy such needs [2-3]. Thus, more and more buildings were built above the cultivated land and developed from rural areas to the urban center. However, at the same time, local farmers kept their original residences and housing. Therefore, due to unclear property rights, inadequate land management, and other factors, those areas with farmers' houses lag behind the development of surrounding cities and eventually become urban villages.

The problems inside Urban villages are as follows. The inefficiency of land use and management lag problems make the improvement of urban villages so urgent. For one thing, the efficiency of land use in urban villages is low, especially in the central part of the city. Because most of the buildings inside urban villages have been built for several years, some of them are only three to five stories high. The first floor is usually small shops, and the second floor is owned by the shop owners. In this case, tenants can only rent the few rooms left. In order to meet the housing demand of a

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large floating population, buildings inside urban villages usually have dense distribution. Those illegally dense buildings not only cause poor lighting inside the house but also greatly wastes the space for multistorey buildings. If there is construction going on upstairs, it will be a danger for people who are passing through the corridors between those dense buildings. For another, village management lags behind, which leads to inadequate infrastructure constructed inside urban villages. To be more specific, there are many illegal structures inside urban villages, such as telephone poles; there is a lot of old infrastructure waiting to be renovated, including sewage treatment lines and rubbish bins that pile up all year around. The lack of infrastructure easily gives rise to safety and sanitation problems. Therefore, even though, with the help of the government, the environment is improving, the going on change is not fast enough.

It is necessary for cultural preservation in the urban village to be achieved. As an essential part of the city, urban villages are full of specially mixed memories. On one hand, the village nourishes new community attachments among migrant worker tenants. There are usually small shops along the main street of every urban village, and the traditional handicraftsmen make various snacks and barbecues [4-5]. In the evening, after the sky gets dark, urban villages are particularly lively and the streets are brightly lit. Because of strict limitations on vendors in the city, outside urban villages, it is hard to see any vendors. Unlikely urban villages, cities with high-rise blocks seem "lonely". Hence, after work, young people prefer to congregate in urban villages where they can easily get a sense of belonging. On the other hand, the aboriginal residents' cultural heritage, such as ancestral shrines, is still reposed in this land. The parallel cultures all bear strong senses of belonging, bonding the people and the whole city together.

Similar to the urban village in China, the slum is also a highly populated urban residential area consisting of densely packed housing units. However, unlike urban villages, which usually provide housing for migrant worker tenants, slums are usually sanctuaries for drug traffickers, prostitutes, and the poor. In addition, the formation of urban villages is caused by the special land policy in China instead of population aggregation. Besides, the conditions in slums are worse than conditions in urban villages. Although there are many differences between urban villages and slums, the government's management of the problems of dense buildings inside cities is still worthy of reference. The paper shows the urban village development in the United States, Brazil, and

Around 1840, rapid urbanization began in the United States. As a large number of people flooded into cities, problems such as housing shortage, unemployment, and poverty appeared in cities, and slums formed. According to Lunlin Shao, Tianhao Zhai, and Xi Luo, the reconstruction of American slums can divide into mainly three stages: the first stage is the community improvement movement, which is that the middle class in the community promoted the reconstruction of slums through social influence; the second stage was the urban renewal movement, in which the government enacted laws on demolition and reconstruction of slums, resulting in the demolition of the slums and the relocation of indigenous people; the third stage is a neighborhood renewal program with the goal of community development [6-7]. Collaborating with the community development fund, private companies led the renovation to achieve community self-governance. In conclusion, the economy is the fundamental mean in the governance of American slums, which focuses on market development, employment rate, and cultural and environmental reengineering.

For Brazil, the authors concluded that the Brazilian government's policy of slum management has gradually developed from being passive and ignoring into a humane one. Specifically, from the Brazilian government's tough governance to public access to democratic rights and deep participation in urban renewal, the overall governance has been developed in a more humane way. Some people pointed out that the Brazilian government learned the negative consequence of hardline governance of slums, gradually strengthened the "soft development", and formed a help program oriented by improving education, music, and sports for residents inside the slums. Since 1990, from

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Rio de Janeiro to Belo Horizonte city, the Brazilian government mainly adopted the method of rationalization of slum management by trying to integrate slums into cities and retain local characteristics. Finally, this strategy achieved certain results.

In Mexico, according to Wang, the local government played a significant role in slum management in Mexico. He found that starting in the 1970s, the Mexico government introduced legislation to intervene in the expansion of slum areas in cities. The government legalized illegal land used for constructing slums and helped build some basic infrastructures such as sewer lines in slums. In the 1980s, the government issued a series of follow-up measures to improve the infrastructures and living environment inside slums including improving street lighting, paving sidewalks, and building schools. In the 21st century, the Mexican government committed to poverty alleviation, focusing on the poor living in slums. The government implemented new social security, credit, and health program. A report pointed out that the growth rate of Mexico's slums is controlled at a floating rate of 0.5%, which can prove that the Mexican government has achieved positive results in slum management [8].

This paper investigates urban village's commercialization based on cultural insight in a Chinese city named Shenzhen. Firstly, the work summarized the current situation of urban villages in Shenzhen. In Section 3, the work utilized the case of Nantou Gucheng to present the reconstruction plan of the local government. In Section 4, the paper makes discussion the failure of the government in 2017 by exploring the reasons for the failure and government actions after the failure and making some commercial suggestions about the renovation of urban villages. Finally, Section 5 summarized the conclusion of the article.

2. Current Situation of Urban Villages in Shenzhen

Shenzhen is one of the most prosperous cities in China, and urban villages are an indispensable part of Shenzhen. Thus, I will introduce the basic information of urban villages in Shenzhen in terms of land scales, construction scales, the situation of residents, and the local government's plans.

2.1. Land Scales

In Shenzhen, the land scales of urban villages account for more than one-third of the land scales of the whole city. To be more specific, there are 336 administrative villages and 1044 natural villages. People naturally get together from the villages called natural villages, and several natural villages are grouped together into a big administrative area called administrative villages. These villages occupy nearly 321 square km of land, and among them, the villages inside the city, or urban villages, cover 93.46 square km of the land.

According to Figure 1 below, Baoan district has the largest number of administrative villages, which is almost twice as many as in another district. However, Longgang contains the largest number of natural villages, and villages---Baoan, Longhua, Pingsha, Dapeng---have a relative number of natural villages

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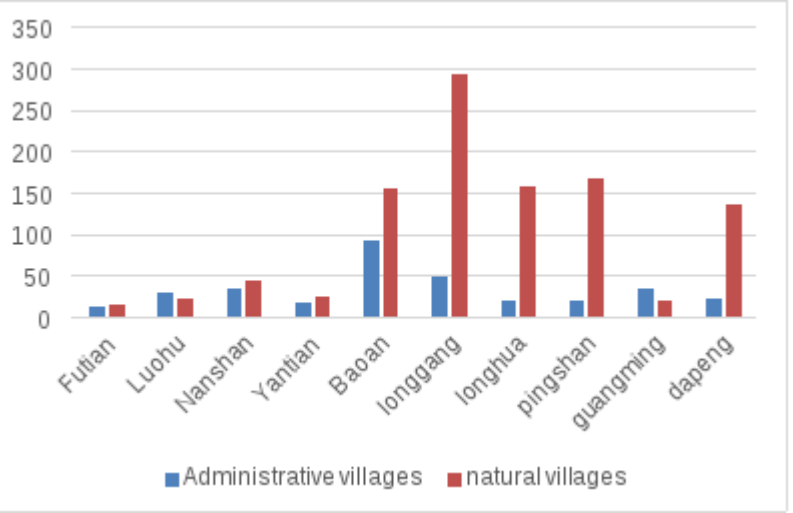


Figure 1: The specific distribution of villages among the administrative region in Shenzhen.
Source: Shenzhen planning and land development research center (the data was processed)

2.2. Construction Scales

Construction areas of Urban villages in Shenzhen now are nearly 450 million square meters which account for two-fifths of the total construction area of the whole city. These construction areas include 29 million for residential architecture and 14 million for industrial architecture [9-10].

Figure 2 has a clear demonstration: in Shenzhen, 62 percent of the land is used for residential construction, 31 percent of the land is used for industrial construction, and 5 percent of the land is used for an office building.

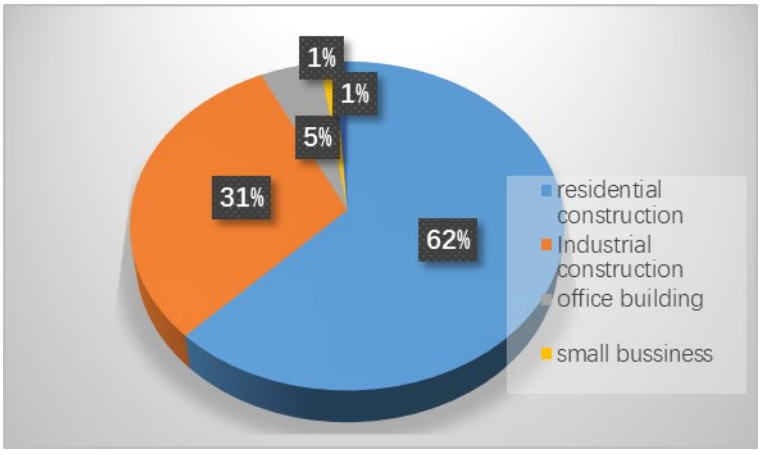


Figure 2: The areas of various types of construction in urban villages in Shenzhen.
Source: Shenzhen planning and land development research center (the data was processed)

In fact, urban villages provide an industrial place for 70 percent of middle and small-sized enterprises in Shenzhen, because the rent there is really cheap. In Urban villages, two-thirds of factory rent in urban villages are only 10-20 yuan per meter per month, which is quite lower than state-owned industrial parks in the same district.

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2.3. The Situation of the Residents in Urban Villages

The whole of Shenzhen city has 21,650,000 people, and 12,630,000, nearly half of the total population, live in urban villages. People with a college degree and above make up 36.3% of the total.

Table 1: Per capita area statistics for urban villages of each distinct in Shenzhen.

Administrative area	Futian	Luohu	Nanshan	Yantian	Bao an	Longgang	Longhua	Pingshan	Guangming	Dapeng
Per capita Area (km^2)	18	22	28	24	37	40	33	57	43	79
	Mean: 38.1									

Source: Shenzhen planning and land development research center (the data was processed)

As Table 1 shown, urban villages in the Dapeng district have the largest per capita area, and urban villages in Futian have the least per capita area. The mean per capita area in urban villages in Shenzhen is 38.1.

2.4. Local Government Reconstruction Plan of Urban Villages

Shenzhen government used three types of strategies to govern urban villages, including demolition and rebuilding, comprehensive treatment, and functional changes. At first, demolition and rebuilding are the main methods used by the local government. The government wanted to change the original layout and functional structures of urban villages thoroughly so that the urban villages enabled to be considered in city planning. However, since the unique policy of ownership of land in China, farmers own rural lands and government owns urban land, many local residents who owned the land of urban villages gained millions of dollars for removal. Besides, some of the reconstruction projects produced the problems like overdevelopment and poor quality of reconstruction, which caused people's dissatisfaction. Things began to change after the plan get into the second phrase---comprehensive treatment.

In 2016, the government revised the treatment scheme which now emphasized comprehensive treatment. Not only did the government optimize the hardware equipment, such as water pipes and trash cans, but the government also increased the public space in urban villages. They were only partially demolished to improve the living conditions in urban villages.

In the third part of the governance of urban villages, the government clearly delineated functions within urban villages. For example, the government laid out a commercial street in the Futian village of Shenzhen, and other parts for residence. Then, they would encourage some small and medium-sized enterprises to enter the street by enacting some welfare policies. In other words, they clarify the functions of urban villages in the city to better integrate urban planning.

3. Case Analysis of Nantou Gucheng

3.1. General Situation of Nantou Gucheng

Nantou Gucheng is an urban village located on Nanshan distinct in Shenzhen. It covers an area of about 3,850,000 square meters, and it has a history of more than 1700 years. As the epitome of Shenzhen's history, Nantou Gucheng still maintains the old street pattern, which contains six horizontal and one vertical main street. There are 1000 architectures, 10 protected buildings, and 34 historical buildings in Nantou Gucheng, so it is one of the focuses of the Shenzhen Cultural Protection Bureau.

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With the increase of urbanization, Nantou Gucheng gradually becomes an urban village with old factories and illegal self-built buildings. 82.4 percent of the buildings in Nantou Gucheng are private buildings without proper legal procedures. For the government, this unclear property right makes it difficult to renew Nantou Gucheng. In addition, now 30,000 people live in Nantou Gucheng, but natives have moved out of there. At present, mainly migrant workers, who tend to find low-rent housing, live there.

3.2. Reconstruction Plan of Local Government in Nantou Gucheng

Due to the significance of Nantou Gucheng's historical meaning, the biggest challenge of its renewal of it is that at the same time as urban renewal, historical protection needs to be considered. There are three main stages of updating Nantou Gucheng: in situ conservation, integral moving, and integration of business & culture. Firstly, in 2003 the local government proposed to conversate Nantou Gucheng in situ without destroying the distribution of buildings inside. For instance, the government hired a group of experts in architecture to restore and renovate the South Gate of Nantou Gucheng. Even though this stage lasted 8 years, from 2003 to 2011, and those experts have already discussed a plan, the effectiveness of renovation work was not high due to the limitation of funds and policies related to cultural protection.

Secondly, in 2013 the government passed the bill of the land planning department to demolish a small part of buildings in Nantou Gucheng and keep the rest of the buildings, but due to dissenting views from other departments, the plan was not implemented in the end. Those critics, such as the tourist administration, argued that there were many illegal constructions inside Nantou Gucheng, which hugely impact the historical features of Nantou Gucheng. Therefore, without integral moving those illegal constructions, it is hard to thoroughly solve the problems as urban villages or even to protect the historical meaning. These critics suggested that the government should fund to help the residents move, and then organize companies to remove the illegal constructions and maintain historical sites. They also state that by analyzing the case of the integral moving of urban villages in Shanxi, the government may need to spend 100 million yuan. Nonetheless, although the government may need to spend a lot at first, after transformation, the revenue of Nantou Gucheng enables to reach 10 million per year, and considering the historical significance, those spending is worthy of it.

Thirdly, in 2016 the district government asserts that the integration of creative and cultural design can further improve the economy and promote culture to achieve cultural innovation. In this case, at Hong Kong Shenzhen biennale in 2017, the government announced to introduction some high-end brands into Nantou Gucheng. However, the renovation did not achieve the goal. In fact, the designers transformed the houses based on the need of residents, while the government expected to make the inner space of Nantou Gucheng into a commercial street, which is far away from the aspiration of the residents. As a result, even though the government and the residents reached an agreement, minimizing the removal places and compensating for partial demolishment, this transformation broke the original economy form inside the village and failed to effectively introduce middle and high-end brand enterprises into the village as the expectation of the government. In short, this transformation failed.

The last transformation of Nantou Gucheng was in 2019. The distinct government launched a new plan of reconstruction led by the private company Vanke. Drawing on the experience of the last reconstruction, the local government collected residents' opinions at first and then combined their wishes to form the plan. The reconstruction this time emphasized respect of history, and the designers researched the architectural styles in Nantou Gucheng again to make sure that the reconstruction could retain the historical buildings and cultural memories as much as possible. Specifically, architects combined the old and the new materials, and by controlling the proportion of the new

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materials, they successfully create an overall historical atmosphere in Nantou Gucheng. After reconstruction, all the patterns of streets from the Ming Dynasty were mainly retained, including North Fang, South Gate, and so on. In addition, designers separated Nantou Gucheng into four major functions---industry, culture, commerce, and residence. Therefore, reconstruction this time received a good response.

4. Discussion

This part mainly focuses on the failure of the government in 2017 by exploring the reasons for the failure and government actions after the failure and making some commercial suggestions for the renovation of urban villages. According to the case of Nantou Gucheng, in order to meet the survival needs of local residents, before implementing the reconstruction plan, the government should investigate the situation of original industries thoroughly and inquire about the willingness of the locals. After that, the government could adjust the industrial construction inside the urban villages to improve economy efficiency. In fact, in the case of Nantou Gucheng, after the renovation in 2017 failed, the government immediately began a new investigation, which separated the population into three categories---residents, tourists, and workers. The investigation showed people's needs mainly into three aspects, residence, business, culture, and recreation, which were considered by the government and included in the reconstruction in 2019. Nevertheless, although Nantou Gucheng has undergone renovation, there were only one main street and two auxiliary streets that successfully achieved commercial transformation. The remaining parts still maintain the normal living form of the urban village： the distance between buildings is too close; illegal buildings can be seen everywhere, and other common problems of urban villages still exist. In this case, the government should consider a wider range of reconstruction to make urban village be more likely incorporated into the city.

In addition, it is beyond doubt that introducing brands into Nantou Gucheng is a good strategy, but the brand type and background significance do not form a special link with the urban villages. The urban village, Nantou Gucheng, only provided stalls for the brands like a commercial center, which was meaningless. Under this circumstance, the government should dig deep into the history of the urban villages and find some special relationships between the culture and commercialization of those urban villages, before finally forming a unique commercialization direction of renewal. Therefore, the government enables to provide better help for the old shops run by the original residents for more than ten years inside urban villages to continually operate.

5. Conclusion

In conclusion, the reconstruction of urban villages in China can be separated into three stages: in the first stage, the planning, construction, and management of urban villages were extremely chaotic. In the second stage, the construction of urban villages was mainly aimed at mediating the interest of the government, village collective, and estate agents. In addition, the planners not only paid attention to the reconstruction of the physical environment but also the construction and functional remodeling of public space. In the third stage, the transformation target of urban villages changed to adjust the interest of four groups, including migrant worker tenants. Furthermore, we can draw a conclusion from the example of Nantou Gucheng that when the city grows and develop, the city government should not culturally ignore such “urban village memories.” They deserve to be preserved and organically developed as unique characteristics of the city to allow for a sustainable symbiosis of the culture and the social economy.

There are still some deficiencies in this article. The article has not collected enough quantitative data to measure the economic development of the reconstruction of urban villages. In addition, the

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impact analysis of the reconstruction of urban villages in the city has not been analyzed by a mathematical model. In the future, this work would conduct the regression model to investigate the impact of the reconstruction of urban villages on local economic development.

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Research on Algorithmic Trading and Its Role in Pricing Efficiency in Chinese Stock Market

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Abstract: This paper uses the A-share stock data in 2021 as a sample to study the impact of algorithmic trading activities on pricing efficiency through empirical analysis. Combining with the current market transaction structure and institutional characteristics in China, this study uses the proportion of small transaction volume STR as a proxy variable to measure the intensity of algorithmic trading activities in China. Empirical results show that algorithmic trading can effectively improve the pricing efficiency of Chinese stock market. In addition, an important way for algorithmic trading to improve pricing efficiency is to reduce stock market volatility and reduce investor heterogeneity. Through extended analysis, the findings demonstrate that algorithmic trading has a differential impact on the pricing efficiency of different stocks, with the highest degree of improvement in pricing efficiency for stocks with high market prices; at the same time, algorithmic trading can play a better role under the condition of sufficient market liquidity.

Keywords: algorithmic trading, pricing efficiency, securities market

1. Introduction

The rudimentary theory concerning algorithmic trading can be traced back to America in the early 1980s. The technological changes and destabilized stock market caused by large orders encouraged the application of algorithmic trading in the capital market in 2000. It uses pre-programmed instructions to model and generate the best configurations of orders given different variables. The system aims at reducing risk, enhancing dealing speed and satisfying the demand of investors. It was relatively late for algorithmic trading to be introduced to China markets. Compared with 75% of the US market based on algorithms, China has only about 20% of the total trading volume. The increasing explorations towards algorithms triggered the question whether its engagement is beneficial to the capital allocation efficiency. To further improve the trading system, our study focused on the adjusting speed of prices based on market variation and how well the share prices reflect available information. In this paper, a regression model was built to investigate the relationship between stock pricing efficiency and algorithm trading system.

Algorithmic trading is a new type of trading. As Chen pointed out, previous literature has not conducted systematic research on the impact of algorithmic trading on the overall quality or efficiency

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of capital markets [1]. In China, algorithmic trading is still immature and there is a large gap compared to mature markets, but in developed capital countries such as the EU and the US, it has become a major trading instrument. So, this is an important topic that is worthen studying in the future. Niu asserted that algorithmic trading has obvious advantages in reducing market impact of trading, improving trading efficiency and reducing human interference [2]. In terms of reducing the market impact of trading, Zhou argued that algorithmic trading can help investors reduce market shocks. Chen and Zhou were also elaborated AT can improve trading efficiency and reduce human interference. In the paper of Zhou that algorithmic trading can help fund managers effectively reduce tracking error and transaction costs [3]. Chen believed that the impact of algorithmic trading on the capital market is mainly reflected in the fact that algorithmic trading reduces the impact on the market through large order splitting, thus reducing transaction costs [1]. In addition, trade execution path can be obtained by hiding the trade intention, etc. Niu also pointed out that algorithmic trading can facilitate price discovery. Traders can develop algorithmic trading strategies based on massive amounts of historical and real-time data to correct price deviations that occur in the market [2]. Hendershott's research also showed that algorithmic trading can provide continuous liquidity in times of severe market volatility, increasing market price elasticity and effectively curbing price volatility [4].

Fama presented the theory of market efficiency, also known as the efficient market hypothesis (EMH), defining market efficiency achieved when the stock prices can fully reflect the information available [5]. The practical measurement is focused on the speed of stock price change and the market performance according to the updated information. In the model designed by Fama, the abnormal rate of return which is used as a measure of security performance should equal zero. This assumption, of course, is very limited in reality. Thus, Grossman and Stiglitz revised this idea to allow for slight and inconsistent profits as a result of information imperfection [6]. The premise for both researchers is that individuals interpret information only from security prices regardless of their preferences or education level.

With the foundation of theories and models built, Busse and Green examined the time needed in minutes for price to respond to positive and negative news reports in real time and supported statements above empirically [7]. Additionally, they discovered a similar trend measured in minutes between abnormal return performance and price response. However, the price reaction is found less significant in the Morning period. This can be influenced by individual preferences and decisions. Is the machine going to show the same pattern? Viljoen, Westerholm and Zheng studied SPI 200 futures and found the upheaval of trading and average trade size happens in the morning opening [8]. It shows a pattern surprisingly inversely related to the AT activities. The decisions made by AT traders are usually driven by low transaction costs and low level of information symmetry. These AT traders are defined as informed individuals in Grossman and Stiglitz 's model. They are described as the main contributors promoting market liquidity. AT improves the efficiency of traders and thus contributes to market liquidity [9].

Previous literature has shown that algorithmic trading can have a huge impact on securities markets. Aggarwal addressed the problem of endogeneity bias by using the introduction of co-location, an exogenous event after which algorithmic trading is known to increase. Matching procedures are used to identify a matched set of firms and set of dates that are used in a difference-in-difference regression to estimate causal impact. The results reflected that securities with higher algorithmic trading have lower liquidity costs, order imbalance, and order volatility. Weller measured information price efficiency from a dynamic perspective [10], using price information content as an evaluation factor, using quarterly panel market data of the US stock market to study and found that although algorithmic trading is very important for converting information into prices, it may also hinder information. Capture and reduce the price efficiency of available information [11]. When Boehmer explored the impact of algorithmic trading on market quality from the perspective of the global stock

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market, they took liquidity and volatility into the perspective of measurement, combined with information efficiency to comprehensively judge the impact on the entire market, and found that algorithmic trading will produce a narrower impact. The effective spread improves market liquidity; at the same time, the absolute value of the autocorrelation of intraday returns is relatively small, which improves the information [12]. Wang took the A-share market data from 2016 to 2021 as a sample and found that algorithmic trading has significantly improved the pricing efficiency of my country's stock market. It is also concluded through the mediation effect analysis that algorithmic trading mainly improves the stock market pricing efficiency by slowing down market volatility and investor belief heterogeneity. In addition, the positive impact of algorithmic trading in improving pricing efficiency is more pronounced for high-priced stocks, when market liquidity is plentiful, and when market sentiment is high [13].

In order to have a broader view of AT appliances and performance in the financial market, fifteen quantitative funds with best performance since its inception were selected. The chosen funds according to their different investing strategies have been divided into three groups which are active quantitative fund, enhanced index fund (EIF) and quantitative hedge fund. According to data analyzed by CMFDB, active quantitative funds and EIF accounted for 50% and 44% respectively of total market share. In terms of capital scope, active quantitative funds and EIFs are relatively larger than quantitative hedge funds. Consequently, this analysis will focus on active quantitative funds and EIFs specifically.

2. Method

2.1. Sample and Data

The data in this paper are obtained from the RESSET database of daily and time-of-day stock data for the A-share market for 2021. In addition to deleting missing values of indicators, samples from the financial industry and listed companies that were ST, *ST or PT at the end of the year were also excluded.

Table 1: Descriptive statistics of 52 A-share stocks.

	Minimum	Maximum	Mean	S. D.
Trading Price (¥)	1.130	83.200	12.584	14.017
Trading Deals	1.000	2,760	7.317	27.137
Absolute effective bid-offer spread (¥)	0.000	0.370	0.012	0.011
Relative effective bid-offer spread (¥)	0.000	0.009	0.002	0.001
Amplitude (%)	0.253	19.261	2.861	2.028
Until Now Yield (%)	-9.987	10.022	0.011	0.022

Table 1 shows that the data used in this empirical study has a total of 52 A-share stocks on the Shanghai Stock Exchange, with 18,821 daily trading samples. Summarize the maximum, average and deviation values of trading price, volume, amplitude, etc. The mean of daily until-now-yield is 0.011%, with a minimum of -9.987% and a maximum of 10.022%.

Subsequently, Shanghai composite index was used as a reference standard. The data are obtained from the daily data of Shanghai Stock Exchange A-share market from 2017-2022. The daily opening price, closing price, volume and fall and rise of nearly 50 companies over five years were collected. Removing the samples where the in-sample variables did, a total of 365,000 daily observations of sample data for 50 stocks were obtained. The line graphs were then synthesized with the values of these four variables.

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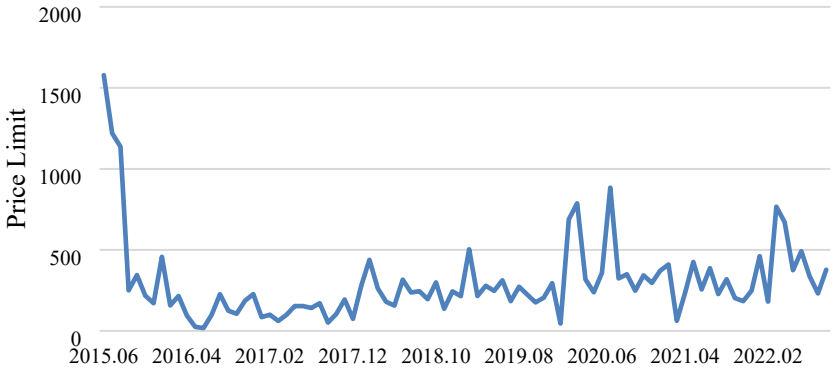


Figure 1: The trend of monthly price limit of Shanghai Composite Index from 2015 to 2022.

The price limit of Shanghai composite return was calculated from 2015 June to 2022 September. Since the price limit is positively correlated to the rate of return, price volatility can be used as a prediction of the rate of return. Compared with the quantitative funds above, the tendency of Shanghai composite index monthly price limit in Figure reports basically equal status with some big fluctuations but canceled out later in these seven years since the dramatic index drop happened in 2015.

2.2. Variable Definitions

Core Explanatory Variable: Algorithmic Trading. Separate identification of orders generated by algorithmic trading has not yet been implemented in Chinese exchanges. Thus, it is not possible to directly observe whether a particular order is generated by a computer algorithm. Measuring the activity of algorithmic trading needs to rely on relevant proxy variables. Given that high-frequency conditions are not yet available for algorithmic trading in China, the frequency of trading and the degree of trade automation are still somewhat different from those in mature securities markets. Therefore, in terms of variable selection, it is not feasible to refer to some foreign literature on algorithmic trading due to the lack of data sources.

Based on the institutional framework and investor level restrictions, most of the current algorithmic trading in China are basic algorithmic trading types, such as Stop Loss Orders, Call Orders, Strike Orders, Volume Weighted Average Price (VWAP), Time Weighted Average Price (TWAP), etc. The main characteristics of such standardized algorithmic orders are: splitting of larger parent orders and trading sub orders according to different benchmark price strategies on a time and volume basis. The existing literature suggests that a higher ratio of small orders traded indicates more algorithmic trading and that the proportion of small orders traded is proportional to the intensity of algorithmic trading. Therefore, the small order volume ratio STR is used as a proxy variable for algorithmic trading. The small order volume ratio STR, which characterizes the proportion of small order volume to total volume, is calculated as:

$$STR_{i,t,1} = \frac{Vol\_B_{i,t,0} + Vol\_S_{i,t,0}}{\sum_{m=0}^{1}(Vol\_B_{i,t,m} + Vol\_S_{i,t,m})} \quad (1)$$

$Vol\_B_{i,t,m}$ and $Vol\_S_{i,t,m}$ are the main buy volume (shares) and main sell volume (shares) of stock i in the m th tranche of the sell order on trading day t, respectively, with $m = 0$ for a single transaction amount less than ￥50,000 and $m = 1$ for a single transaction amount greater than or equal to ￥50,000; $STR_{i,t,0}$ denotes the proportion of the volume of stocks with a single transaction amount less than ￥50,000 of stock i in trading day t to the total volume of that day. The larger the value, the

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higher the proportion of small orders in the day's volume of the stock and the stronger the algorithmic trading activity.

Table 2 shows the results of STR calculation for 52 stocks. By finding the buying and trading volume of these 52 stocks and determining whether their single transaction amount is greater than or equal to ￥5,000, or less than ￥5,000. Later, the above data were calculated. From the chart, it is obvious that some stocks have smaller STR, such as code 600010. Indicating their weaker algorithmic trading activity. Some stocks have larger STR, such as code 600007. Indicating stronger algorithmic trading activity.

Table 2: Descriptive Statistics of 52 A-share stocks.

Code	STR	Code	STR	Code	STR	Code	STR
600000	0.080	600033	0.041	600019	0.098	600056	0.295
600004	0.362	600035	0.063	600020	0.048	600057	0.249
600006	0.152	600036	0.404	600021	0.241	600058	0.470
600007	0.498	600037	0.319	600022	0.009	600059	0.383
600008	0.031	600038	0.715	600023	0.036	600060	0.402
600009	0.577	600039	0.212	600025	0.157	600061	0.186
600010	0.003	600048	0.225	600026	0.117	600062	0.318
600011	0.152	600050	0.015	600027	0.073	600063	0.132
600012	0.407	600051	0.404	600028	0.017	600064	0.202
600015	0.040	600052	0.320	600029	0.109	600066	0.329
600016	0.003	600053	0.766	600030	0.199	600067	0.185
600017	0.016	600054	0.586	600031	0.172	600068	0.047
600018	0.074	600055	0.576	600032	0.408	600070	0.423

Core Explained Variable: Pricing efficiency. Hou et al. (2005) proposed to use the delay of stock price to information to describe the severity of the friction affecting the stock market. This method has been adopted by many scholars [14]. If the market cannot reflect the information into the stock price in a timely and sufficient manner, then the information will be absorbed in the subsequent time, resulting in a lag in the price response. The lag of this price response can be obtained by a regression model with lagged market returns. The stronger the explanatory power of the lagged variable, the longer the price response time to information. Referring to the above research, this paper uses the degree of explanation of lagging market returns on individual stocks as a proxy variable for pricing efficiency, and constructs $D1$ and $D2$ indicators. The specific calculation method is as follows:

$$r_{i,t} = \alpha_i + \beta_i \times r_{m,t} + \sum_{n=1}^{4} \delta_{i,n} \times r_{m,t-n} + \varepsilon_{i,t} \quad (2)$$

Among them, $r_{i,t}$ represents the rate of return of stock i at time t; $r_{m,t}$ represents the market rate of return at time t; $r_{m,t-n}$ represents the market rate of return with a lag n period; $\varepsilon_{i,t}$ is the random error term.

First, estimate the model (2) to obtain the regression coefficient of determination R^2 of the original model; then, set the coefficient of the lagging market return to zero, estimate the regression equation, and obtain the regression coefficient of determination R'^2 of the restricted model. Based on the above calculations, the first price lag reaction indicator can be obtained:

DOI: 10.54254/2754-1169/17/20231123

$$D1_i = 1 - \frac{R'^2}{R^2} \tag{3}$$

Similar to the F-test, this measure captures the proportion of individual asset returns explained by lagged market returns. The smaller the value of $D1$, the lower the dependence of the asset return on past market information, the shorter the time required for assets to absorb market information, and the higher the pricing efficiency.

In addition to the coefficient of determination of the regression equation, we can also use the parameter size of the explanatory variables in the regression equation to measure the dependence of the return of a single asset on the lagged market return, and obtain the second lagged response indicator:

$$D2_i = \frac{\sum_{n=1}^{4} |\delta_{i,n}|}{|\beta_i| + \sum_{n=1}^{4} |\delta_{i,n}|} \tag{4}$$

$D2$ captures the proportion of the regression coefficient of lagged market returns in all regression coefficients in Equation (2). The smaller the value, the higher the pricing efficiency.

In order to keep the above construction method consistent with the positiveness of pricing efficiency, this paper revises the above indicators, and defines the first pricing efficiency indicator of individual stock i as:

$$E1_i = ln\left(\frac{1}{D1_i}\right) = ln\,(R^2 - R'^2) \tag{5}$$

$$E2_I = \frac{1}{D2_i} = \frac{|\beta_i| + \sum_{n=1}^{4} |\delta_{i,n}|}{\sum_{n=1}^{4} |\delta_{i,n}|} \tag{6}$$

It can be seen from equations (5) and (6) that the main difference between the pricing efficiency indicators $E1$ and $E2$ and the information response lag indicators $D1$ and $D2$ is that the former is the reciprocal of the latter, which ensures that the economic significance between the two remains consistent. The larger the index $E1$, the higher the pricing efficiency of the stock; the larger the index $E2$, the higher the pricing efficiency of the stock.

Table 3: Variable definitions.

Types	variable name	specific calculation method
Explained variables	E1	Explanation degree of spot price as a percentage of lag period
	E2	The ratio of the spot price regression coefficient to the lag period
Explanatory variables	STR	Small order volume/total volume

The definitions of all variables in this paper are shown in Table 1. The core explanatory variables are STR and the explained variables are E1 and E2. E1 is an explanation degree of spot price as a percentage of lag period and E2 is the ratio of the spot price regression coefficient to the lag period.

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3. Results and Discussion

3.1. Results

The results in Table 1 show that the regression coefficients of the algorithmic trading strength STR on the two efficiency indicators E1 and E2 are 2.19 and 2.772, respectively, and the coefficients of and are significant at the 5% confidence level. That is to say, there is a positive correlation between algorithmic trading intensity and pricing efficiency. The higher the intensity of algorithmic trading in trading, the higher the pricing efficiency.

Table 4: STR and efficiency regression results.

Var		Coeffi-cient	Std.err.	t	P>|t|	[95%conf.	interval]
E1	STR	2.190	0.213	9.90	0.000	1.680	2.536
	cons	11.441	0.694	19.64	0.000	9.834	13.952
E2	STR	0.772	0.031	12.03	0.000	0.709	0.935
	cons	0.605	1.251	0.41	0.686	-1.813	3.203

3.2. Discussion

According to the result, algorithmic trading has improved the efficiency of stock market pricing. However, in order to evaluate the long-term benefits of greater intensity of algorithmic trading, we also observe and discuss how the returns of five active quantitative funds have fared in the investment market in recent years in response to the growth of AT, based on the long-term volatility of trading markets.

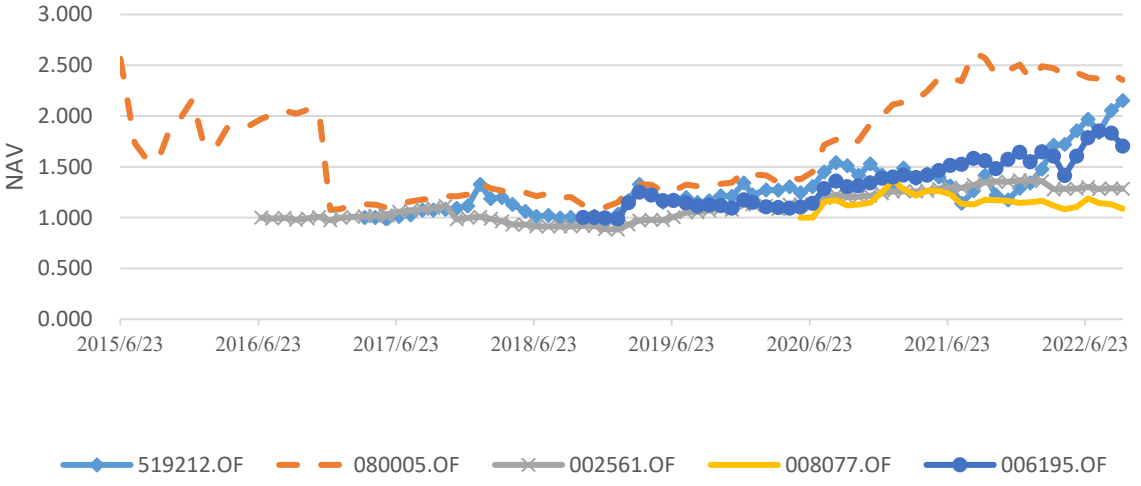


Figure 2: The trend of net value of active quantitative funds from 2015 to 2022.

With different dates of establishments, Figure 2 illustrates all five active quantitative funds have shown a stable increasing trend on yield rate. The earliest one was built in 2015 June. Non-significant increment in terms of long run but positive rate of return was maintained. The performance of EIFs demonstrates a larger fluctuation and bigger overall rise reported in Figure 3. This results in relatively higher risk since the yield rate had frequently reached negative in the process of holding. This EIFs

DOI: 10.54254/2754-1169/17/20231123

established in recent years also reflects better performance in investment market with the evolution of AT.

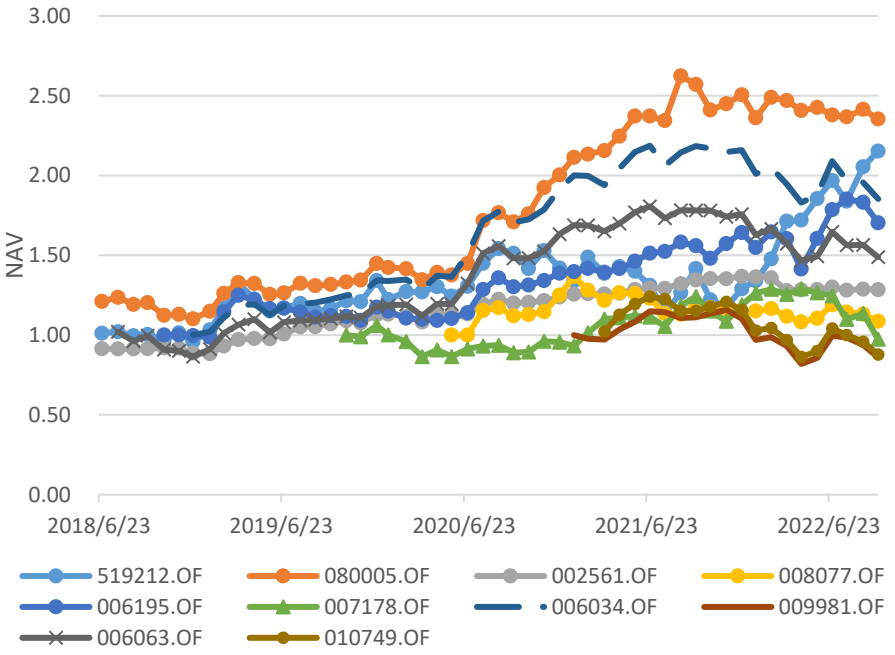


Figure 3: The trend of net value of EIFs from 2018 to 2022.

The development of algorithmic trading along with generated quantitative funds is overwhelming in the last ten years. Increasing number of market entities especially private funds enhanced the concentration of financial market. With the graduating perfection on the algorithm, more types of products are adopted in China stock market. However, the preference of third-party agencies is still focus on the market neutral strategies, also known as Alpha strategies. Concerning the high uncertainty of China market, the current algorithm progress is not enough to support popularization among A-share market. This requires computer to capture the change of market information immediately and adjust correspondingly. These adjustments are dependent on the stored factors analyzed previously. Large-scale quantitative solutions need generous history data and powerful algorithm. It is mentioned at the beginning of the paper that China is a late adopter of algorithmic trading and lacks referable examples. According to our results, algorithm indeed improves the efficiency of stock price-setting, in a broader way saying, market efficiency. This is not omitting the risks and bad consequences brought by inducing algorithm. Moreover, more fails reflect the inefficiencies of quantitative strategies instead of stock markets. For example, the black swan event of Alpha hedge fund happened in 2014 lessoned analysts to rethink the combination of alpha strategy on how to adapt China stock market. Most of the risks are ignored by agencies on the way pursuing revenues. The regulations regarding opaqueness funds especially hedge funds on employing algorithm requires further strengthening.

The A-share market has a large number of individual investors, a growing team of analysts, constantly regulated information disclosure, and complete online data. These are opportunities for quantitative and algorithmic trading due to the availability of relatively independent and timely data compared with traditional volume and price and financial data. The research and use of alternative data such as sentiment metrics, business flow metrics, reporting metrics, and sensor metrics was spawned. As an investment application, domestic alternative data started later, and it is far from mature overseas market applications. At present, domestic alternative data is still in its infancy, and the market has not yet formed a unified understanding.

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4. Conclusion

This paper takes the data of some A-share stocks in 2021 as a sample, combines the current market transaction structure and institutional characteristics in China, uses the proportion of small order trading volume as a proxy variable to measure the strength of algorithmic trading in my country, and empirically analyzes the impact of algorithmic trading activities on pricing efficiency. The empirical results show that algorithmic trading can effectively improve the pricing efficiency of my country's stock market.

Regarding the future development trend of quantitative investment in China, the "China Private Equity Investment Fund Industry Development Report 2021" summarizes six aspects: Firstly, the industry has huge space and will maintain stable or fast development in the future. The second is that the position of private equity funds in the large capital management industry is expected to increase. Third, foreign capital will remain stable development, and it is difficult to pose a challenge to people in the short term. Fourth, the investor structure is expected to be optimized. Fifth, the proportion of equity and quantitative strategy products is expected to continue to rise. Sixth, the industry concentration is expected to further increase. This research report also investigates the general trend of the industry. Market institutions believe that quantification will develop in the direction of standardization, mainstreaming, platform, internationalization, intelligence, and strategizing. Among them, the strongest perception is for standardization. The challenges can be understood brought by foreign investment and artificial intelligence are more controversial directions for each market body. The controversy of artificial intelligence is reflected in the fact that all quantitative practitioners are actively learning artificial intelligence on a large scale, but do not feel strongly about its trend. This may be due to the fact that in the specific use, on the one hand, institutions are in the pioneering period for new algorithms, and on the other hand, there are doubts about its interpretability, so the use is more cautious. Data show that the application of artificial intelligence, fundamental quantification, high-frequency data, and high-frequency factor are the three most concerned about the direction of the market. After research and comparison, the report found that AI strategies outperformed other hedge fund strategies in the long term, with the highest annualized rate and Sharpe ratio.

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A Comparative Policy Analysis for Cross-border M&A between China and Africa that Advances China's Leading Position in Mining

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Abstract: China is still looking for resources and has recently engaged in aggressive cross-border M&A in the mining industry. Per China's 14th Five-Year Plan, the resource plan builds the foundation of China's rapid industrial development and growing economy. In recent years, it has been observed that acquisitions are focusing more on emerging markets' resources, such as Africa. Despite the negative effect of the pandemic, which cooled down cross-border mergers and acquisitions (CBMAs) in the mining industry, mining M&A's strategic importance to global industrial development makes it a major area of study. This phenomenon of mining M&A becoming China's story is closely related to economic policies and regulations in China and Africa. Hence, this article develops a comparative analysis of the different procedures in China and critical geographies in Africa that affects China's unceasingly expanding mining industry through acquisitions in Africa. Through comparative research analysis, we find that China's One Belt One Road Initiative (BRI) promotes CBMAs and investments in Africa and reduces operational barriers in policies and technology. The CBMAs' success relies on a thorough understanding of local rules, major players, and legal policies in both nations. African countries have worked to improve their mining codes and raised their devotion to ESG to attract foreign investments. The inference is that Africa still possesses a great untapped potential for Chinese investors in the mining sector who understands the local market realities and can alleviate risks.

Keywords: comparative policy, cross-border M&A, mining, China, Africa

1. Introduction

China has said to strengthen its strategic resource exploration in 2021-2025, including natural gas, copper, chrome, and rare earth, among others [1]. The resource grab is vital for allowing China to manage emergencies in times of political disputes and secure resource supplies. Africa is imperative in the Chinese economy that demands key minerals at this time. China's mining investment has dramatically expanded, especially in Sub-Saharan Africa. This region is rich in cobalt, chrome, and manganese found in South Africa, Ghana, and Sudan. China has also expressed an increasing interest in the mining belt of central southern Africa, which includes Tanzania, Zambia, and Mozambique, and is rich in copper, gold, iron, and manganese [2].

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Investment in Africa as part of China's global development strategy results from a decision process that requires balancing socio-political, economic, and geological conditions affected by policies and regulations [3]. Proper decision evaluation plays a determining role in the success of complementary development. In this optic, the paper takes a comparative literature research approach to analyze choices and policies that affect China-Africa CBMAs' decisions on reasons for their failures or success.

The paper is discussed three-fold. First, it investigates the effects of the global pandemic on Africa's mining M&A activity. Then it aims to explore the choice of Africa as China's primary source of natural resources as a strategic partner in its economic and industrial development. Moreover, CBMA policies in China and some critical geographies in Africa's mining sector are investigated to observe its impact when making investment decisions, along with its opportunities and obstacles. Lastly, the study will shed light on potential challenges Chinese investors may face when engaging in CBMA. The study aims to provide useful recommendations and insights for Chinese companies looking to improve their overseas mining M&A performance in Africa.

2. Global Mining M&A in Africa with a Backdrop of COVID-19

Although critical minerals are vital resources under any global condition, the COVID-19 pandemic's impact did have a hard blow on the mining investment environment of major resource countries. These countries are turbulent in the face of problems intensified by the pandemic, such as the failure of political governance, financial overspending, and rising unemployment. As a result, the global mining M&A market in 2020 has significantly cooled. According to Globaldata's Q1 2022 report, the global metals and mining industry's M&A deals amounted to $7.8B. This figure depicted a notable fall of 78.7% over the prior quarter and a 47.4% drop compared to the last four-quarter average of $14.73B [4].

In response to the impact of the pandemic, countries with significant resources have taken measures to strengthen their control of resources and intensified government intervention in the mining industry. Hence, studying government regulations and policies that vary across geographical regions is crucial when making CBMA decisions in the mining industry. Dangers and opportunities coexist, and the global mining supply chain and industrial developments are being restructured at an accelerated pace during the pandemic. More mining investments are flowing to developing countries such as Africa, which are enacting new mining policies to attract foreign investment and M&As during the pandemic to reap greater financial benefits. More to ensure the supply of critical minerals and support global industrial supply chains.

Africa, rich in natural resources, is a strategic location for China's investment. China and Africa's developments are complementary since the two nations are in different stages of industrialization. Africa is at an early industrial stage and demands technology and financial support for its modern advancements. While China has moved ahead in recent decades to the late stages of modernization and possesses cutting-edge technology, that now demands critical minerals to sustain its fast industrial developments. Hence, the industrial growth and mineral reserve motivated China's investment and CBMAs in Africa's mineral resources, which could result in mutual benefits for the two nations.

The rapid development of the Chinese economy demands prime resources to fuel its economic activities. China's 14th Five-Year Plan emphasized the high quality and innovation of modern developments, which will continue to seek investments in African mining industries through cross-border M&As. Before investments, evaluating regulations and risks is a crucial step in making responsible decisions. Therefore, this paper aims to recognize the essential factors that affect China's CBMA decisions concerning Africa's mining corporations.

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3. Choice of Africa

3.1. High-grade Natural Resources

Unsurprisingly, international investors, specifically China, would target resource-rich Africa in this era of constant technological advancement. Technological innovations in electric vehicles and rechargeable batteries have created a high demand for metals, such as cobalt and copper, found in many African mines. As the world's factory, China generates massive demand for minerals to secure private raw material supplies and fuel exports. Africa sits upon trillions of dollars worth of extractable resources, which are essential for Chinese manufacturing. According to the United Nations Environment Programme, Africa holds about 30 percent of the earth's total mineral reserves, 40 percent of the world's gold, and almost 90 percent of chromium and platinum. It is also home to the world's most significant cobalt, diamonds, platinum, and uranium reserves [5]. These abundant mineral resources spread across vast geographic areas are critical, particularly for emerging economies like China, in ensuring a supply of raw materials for economic growth.

3.2. Intergovernmental Collaborations between China and Africa (Belt and Road Initiative)

Chinese President Xi Jinping introduced the One Belt, One Road Initiative (BRI) in 2013 during his visit to Central and Southeast Asia. It had a wide impact on trade and investment in Africa. With a population exceeding 1.4 billion, China requires raw materials and is hungry for energy, thus making Africa an attractive investment destination.

The BRI aims to connect countries in Asia, Europe, and Africa along two routes: the land-based Silk Road Economic Belt and the ocean-going Maritime Silk Road. The Maritime Silk Road includes many African countries, such as South Africa in the far south, Egypt and Algeria in North Africa, and inland places such as Zimbabwe and the Democratic Republic of Congo [6]. Hence, BRI provided a framework for China's growing stakes in Africa; as said in the 2017 McKinsey & Company report, China's foreign direct investment in Africa has grown with an annual growth rate of 40 percent over the past decade [7].

Benefitting cross-border M&As and investment in Africa is BRI's call for greater policy cooperation, including financial integration, establishing free-trade areas, and improving new technology collaborations [6]. It reduces transaction costs while removing technical and implementation barriers to international trade issues [8]. Thus, China's BRI initiative promotes Chinese outbound investment along the BRI route.

China also works closely with African governments to create special economic zones, called Overseas Cooperation Zones (OCZs), to neutralize the Regulatory framework that does not entirely motivate foreign direct investment, such as cross-border M&As [9]. The development of OCZs is a way for Chinese firms to minimize the risk of exposure to foreign markets and follow the state laws and regulations in those markets [10].

Due to trade and investment promotion, Chinese CBMAs increased significantly in BRI areas. China's Ministry of Commerce reported a $200 million investment in BRI countries, contributing to 7.1% of China's total foreign direct investment. While in 2017, Chinese firms' direct investment in these BRI countries reached $14.36 billion, about 12% of the total investment [9].

Consequently, BRI is committed to intergovernmental cooperation and exchange that promotes investment, such as CBMAs in the African region. It provides financial and policy support for Chinese firms engaging in CBMAs in countries along the BRI route. But successful CBMA along BRI routes also has its risks and challenges. It is critical to conduct proper due diligence. Deal success often depends on finding the right partners and support networks that understand local regulations, market players, and legal policies in China and Africa [6].

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4. CBMA Policies in China and Key Geographies in Africa's Mining Sector

The success of mergers and acquisitions across national borders is heavily influenced by legislation regulating the mining investment and M&A environment. Hence, this section will explore the regulatory conditions in China and several African countries, namely the Democratic Republic of Congo (DRC), South Africa, and Mozambique.

4.1. China

Some new regulatory trends in China have had a notable impact on the country's M&A market. Recent antitrust, national security reviews, and data security compliance regulations have created a stricter foreign trade environment. As the buy-side of the CBMAs in Africa, China may result in financial and strategic losses if it fails to conduct proper data compliance due diligence; based on such information, China may decide to adjust the deal price or terminate the deal to avoid potential significant risks [11].

China's rising infrastructure and energy investments in various developing countries, such as Africa, have led to the demand for guidance on greening the Belt and Road Initiative (BRI) released by China's National Development Reform Commission [12]. Incorporating ESG (environmental, social, and governance) into M&A's decision to create a greener economy results in major consideration in the due diligence process leading up to the M&A transaction [11]. ESG increases sustainability and helps Chinese businesses improve their brand image and meet customers' sustainable preferences.

Thus, China's outbound M&A investment in Africa will focus on conducting proper due diligence on data compliance and evaluating associated risks in the mining and energy sector. It will also pivot on the African firms' ESG commitment to meet their conservation and sustainability goals.

4.2. The Democratic Republic of Congo (DRC)

The DRC is famous for its high-risk, high-return mining opportunities. It has much-untapped gold, cobalt, which accounts for nearly half of the world's reserve for this metal, and high-grade copper. However, the country also possesses some political and security risks due to widespread corruption and inadequate underlying structures [13].

The 2002 Mining code regulates the mining sector in the country. The Mining Code covers regulations relating to the acquisition, and termination of mining rights, environmental protection, cultural heritage, and tax and customs incentives [13]. Laws allow for expropriation with fair compensation for public interest reasons, including public works requirements, community heritage, and the presence of precious minerals. Foreign investors may own unrestricted mining rights under the condition that they elect domicile with a mining and quarrying agent to act on their behalf.

Unfortunately, obstacles faced by foreign companies are often not regulations but are related to corruption. Government officials favor certain foreign investors for historical and political reasons, and they then receive benefits and superior terms when conducting business in the DRC. Furthermore, during the civil war from 1994 to 2002, foreign investment was discouraged, including cross-border M&A activity. But the development of the Mining Code in 2002 helped to reinstate the inflow of investment in the mining sector. The country's economic position also necessitates foreign funding to exploit its mineral resources. Recently, China has become one of the major investors in the DRC mines, owning approximately 80% of the mineral-processing plants in Katanga and up to 90% of these extracted minerals exported to China [13]. Risks exist, but the plentiful resources that can contribute to China's industrial development determined that the DRC remains a strong target of Chinese firms' CBMAs in Africa's mining sector.

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4.3. South Africa

South Africa is rich in cobalt, chrome, and manganese. Its vital legislation is the Companies Act 71 of 2008 and the Companies Regulations, 2011, which contain Takeover Regulations regulating public and private M&A activities [14]. Regulated companies under the Companies Act include public companies, state-owned companies, and private companies if 10% of their shares have been transferred within two years immediately preceding a proposed M&A transaction. For South Africa, no special laws are designated for overseas buyers or investors. The Protection of Investment Act, 22 of 2015, states that "foreign investors and their investment must not be treated less favorably than South Africa investors in like circumstances."

The Broad-Based Black Economic Empowerment Act, 53 of 2003, is legislation aimed at addressing racial inequalities during apartheid and encouraging the participation of historically disadvantaged persons (HDPs) in the economy. A score on a company's contribution to Broad-Based Black Economic Empowerment (B-BBEE) is measured considering its management control, skills development, and socioeconomic development, with Level 1 being the highest through to Level 8. Although companies are not obligated to obtain a particular rating, a good rating can help a foreign firm to compete for public and private mining opportunities [14].

Obstacles may be observed in regulatory approvals in cross-border M&A transactions. Intermediate and larger mergers may be subject to pre-implementation approval under competition/antitrust rules in the Competition Act, 89 of 1998, to prevent adverse economic effects within South Africa. The approval process involves assessing whether the merger will avoid competition in the specified markets and if it conflicts with public interests such as employment, participation of HDPs, and the ability of national mining companies to compete in the global market [14]. Such a competitive approval process can be incredibly challenging if it opposes public interest or if third-party stakeholders intervene [14]. Due to mining being a strategic sector for most African countries, obtaining sector-specific approvals may be complex and uncertain. South Africa's ministerial consent is often required to implement mining transactions, which can take three to twelve months (or even longer) to receive this consent [15].

South Africa still possesses great prospects for foreign investors who understand the regional market realities and can mitigate risk. New laws such as the Competition Amendment Act 2018 elevated the importance of public interest review, which means reviewers may grant an anti-competitive merger if it addresses considerable public interest or results in technological efficiency that will offset the negative impact on market competition [14]. The embracement of ESG will also drive and affect how M&A activities are implemented.

4.4. Mozambique

With its large coal reserves and great potential for additional mineral deposits, Mozambique is uniquely positioned in China's foreign mining investment strategy. Apart from the vast coal resources, recent investments have focused on heavy mineral sands useful for various industrial purposes.

Mozambique had many reforms to the legal systems and raised its environmental protection policies. The country's cross-border trade and investment improved over recent years by refining its business environment. New reforms introduced by the government include stricter anti-corruption measures, tax and customs incentives, compulsory independent audits, and export licenses, which work to build investor confidence and encourage investors to view Mozambique as a desirable investment destination [16]. Tax and custom incentives under the Tax Incentives Code include deductions and exemptions from Value Added Tax for imports of specified equipment, deferred tax payment, and accelerated depreciation of new or reinstated buildings and equipment; all aimed to encourage and benefit foreign investors in Mozambique [16]. The Ministry for Land and Environment

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is responsible for regulating the environment. Small-scale mines will only be subject to Basic Rules on Environmental Management for Mining Activity to mitigate environmental damage and protect human health. Larger mines involved in the extraction of minerals for construction and exploration will be required to submit an environmental management (EM) plan, including a monitoring and rehabilitation program and an emergency and risk situation control program [17]. The government also passed green policies to work towards reducing greenhouse gasses.

Most foreign investments have the same rights and obligations as local investors [16]. However, distinctions in Mozambique mining laws exist between rights obtained by Mozambican nationals and those that foreign investors can get. Mining passes, marketing licenses and certificates may only be granted to Mozambican citizens or companies fully owned by Mozambican individuals. Furthermore, companies can only acquire mining concessions under Mozambican laws; foreign investors can hold companies under the condition that the company includes Mozambican nationals [17].

5. Challenges Facing Chinese Investors in Africa

5.1. Political Risks

Political risks are quite prominent problems that exist in many African countries. Civil conflict and fragmentation within the African countries' ruling parties often cause major failures in state-owned enterprises and deplete investor confidence. It may result in business losses due to a country's political decisions and actions. One example is Eskom in South Africa, whose poor policy implementation has caused unreliable energy supply and major economic losses. In August 2022, South Africans experienced Stage 6 load shedding, which means areas take shifts and undergo six hours per day without electricity. This power outage resulted in an economic loss of over ZAR 4B (USD 241M) daily. Mineral sales were reduced by 14.4% in 2022 [18].

The Russia-Ukraine war also interrupted mineral sales with high fuel prices, food insecurity, and inflation in many African countries. In response to global inflation, workers in the mining sector strike for salary increases to compensate for the rising cost of living. These strikes further plummeted mineral production. There is an urgent need for African countries to take action in their internal governmental management to change the political climate for foreign investment in Africa.

5.2. Social and Economic Instabilities

The pervasiveness of corruption also has severe economic implications on African countries and negative perceptions by Chinese investors. Governmental officials can keep valuable resources to benefit themselves or use their status to carry out activities after receiving bribes. This inefficient use of politicians' power creates severe issues for the African government's credibility and goes against the welfare of their citizens, further contributing to economic instabilities in those countries.

The high unemployment rate, wealth and social inequalities, and restricted and unequal access to public services cause civil unrest and dissatisfaction among workers in the mining sector, decreasing efficiency and productivity.

6. Conclusion

China’s expanding industrial development has led to a rising interest in mining CBMAs, particularly in Sub-Saharan Africa, due to its high demand for essential resources. Hence, the M&A and foreign investment policies of the involved parties should be evaluated to raise the success rate of such transactions. Many of these African countries are along the BRI route, which aids CBMAs in Africa through greater intergovernmental collaborations with China in policies and creating special economic zones like OCZs. China’s outbound M&As will remain focused on African companies’

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data compliance while keeping in mind their environmental goals to go green. Obstacles and risks persist due to corruption and government fragmentation, and the rising concerns of unemployment and great income inequalities also lead to unrest that discourages foreign investors. However, African countries are really working to improve their political climate by introducing new reforms, including anti-corruption, tax cuts, and independent audits aimed at reducing transaction costs and political risks. There is also great importance in considering public interests and technological contributions that are unique to developing countries like Africa, which may be used to Chinese investors' advantage to gain favorable terms when working with governmental authorities. The study has potential limitations where legal policies are not discussed in relation to active cases that can demonstrate their effectiveness due to limited data published on CBMA deals. Further studies may inspect various case studies of mining CBMAs between China and Africa under their legal and political climates. Studies may also look deeper into the related risks of mining CBMAs in Africa and ways of addressing such issues to create a better trade environment for the parties involved. A bright future awaits Chinese mining CBMAs in Africa if there is full comprehension of local policies and preferences, and can transform risks into opportunities.

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The Role of In-House Procurement According to Finnish Municipalities' Purchase Invoice Data

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Abstract: Public sector is a large consumer for ICT systems and services development used for various public services. Tendering for such systems is governed by laws aimed at eliminating unfair advantages and offering all possible parties equal opportunities to participate in the tendering process. In this article, we study in-house procurement, where the acquiring organization is an owner of the subcontractor that delivers the system. Municipalities' purchase invoice data is used to determine how greatly municipalities in Finland depend on in-house procurement. In conclusion, the understanding if included municipalities have ICT service and development units within the organizations needs closer examination, as in-house companies may offer municipalities with limited resources divided costs in the public procurement process.

Keywords: in-house companies, purchase invoice data analysis, public ICT procurement, public procurement act, municipalities

1. Introduction

Public procurement of Information and Communication Technology (ICT) systems and services is large, and international companies and governments at national, regional, state and city levels are major buyers of ICT goods and services [1]. As an example, the state of Finland alone made procurement worth overEUR 1000 million [2] on ICT during the year 2020.The public procurement process is mandated by the EU and national procurement legislation within the EU [3]. Public ICT system development projects are often triggered by EU or national legislation, which sets a time frame for the development, which must be followed under the threat of sanctions [4]. The preparation of the tender is a heavy and complex process that requires resources and the necessary expertise at the very beginning of procurement planning stage [4]. Furthermore, strict parameters set by laws and directives hinder the effectiveness of the procurement [5]. According to the Finnish Procurement Act [6], the procurement can be taken to the Market Court for resolution, which typicallydelays the procurement process by up to a year.

An assumption is, that in many cases, the lack of resources needed for the tendering process can be solved with in-house procurement. In-house companies are owned and controlled by the state,

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municipality or a group of municipalities, from which procurement can be carried out without tendering in accordance with the Procurement Act [7]. With this setup, the public administration can avoid lengthy and uncertain procurement processes, to stay within the deadlines set by the legislation. Insufficient procurement resources may also affect the desire to take advantage of the opportunity to use in-house companies to procure ICT goods or services. In this article, we examine in-house purchase data to determine how greatly municipalities in Finland depend on in-house procurement. Furthermore, we examine what could be the adequate ways to explore the reasons, why municipalities use or do not use in-house procurement.

2. Background and Motivation

Finland is a Nordic EU member state with 5,5 million citizens. Hartung and Kuźma [8] depict that Procurement Directive within European Union gives opportunities for the member states to determine how to implement in-house procurement into the legislation. At least Finland and Poland have in-house procurement included in procurement legislation, whereas some other member states have not it in their legislation [8]. Public agencies have an option to buy in-house, which is not in the circle ofthe Public Procurement Act [6]. In-house procurement is an interesting way tobuy ICT goods and services because the owner of the in-house company does notneed to follow procurement procedures in acquisition, which is a significant andallowed derogation to the Public Procurement Act [6]. An in-house companymust be owned by different procurement units, and it can only have limitedbusiness with parties other than the owners from outside sources [6]. At present, an in-house unit may have a five percent or a maximum of EUR 500 000 businessoutside the procurement units [6]. However, the limit for outside business is tenpercent, and the EUR 500 000 restriction evaporates if the market cannot providethe needed service [6]. Furthermore, the in-house position also requires that theowner agency has a deputy in the in-house company to ensure the decision-making authority [6].

The phenomenon is interesting in Finland where the number of municipalities is as high as 309, and public sector owns over 2000 in-house companiesand Finnish Competition and Consumer Authority (FCCA) estimates that theoverall turnover in Finnish in-house companies in all sectors is yearly over EUR40 billion [9]. The public discussion in Finland has focused on changing theProcurement Act to even more allowing direction in in-house procurement byraising the limits to sell goods and services outside the in-house [9]. This hasinflicted a counter reaction in the regular market. Currently, five percent limit tosell outside the in-house means, that for example from EUR 15 million turnoverin-house company can make sales worth EUR 750 000 outside the stakeholders. If the limit was to be raised in 20%, which has been suggested in Finland, the sales outside the in-house company's stakeholders would raise substantially. The current threshold for EUR 500 000 is suggested to be removed. With these estimates, the sales outside all the in-house companies in Finland may grow up to eight billion euros. This is problem-some because the municipalities and other stakeholders can purchase goods and services from the in-house company without following Public Procurement Act.

The Procurement Act only applies to procurement that exceeds EU thresholds and national thresholds [6]. The Procurement Act does not apply to so-called small procurement that fall below the threshold values. In Finland, thenational threshold value is EUR 60 000 for estimated costs over four years [6]. Typically, even medium-sized ICT system procurement exceeds the national orEU threshold value, in which case tendering has to be done. One key form of operation of in-house companies is organizing public tenders, where they tender ICT products and services from commercial vendors. Sincethe in-house companies have a large owner base, it is possible to get favorable offers based on the tender volume. The public administration can acquire thepurchased ICT systems and services without tendering by using its ownershipin the in-house company. The aim is to determine the scale for the in-housepurchases, which can be evaluated through public agency

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purchase invoices. As an example, the Figure 1 presents the geographical coverage for one in-house, Kuntien Tiera, in Finland. In addition, Table 1 presents some key data regarding the studied in-house organizations.

Table 1: All the studied organizations are characterized in the table below (T/O refers to annual turnover in million euros).

In-house	T/O	Empl.	Owners
Sarastia	15,4	914	284
Istekki	15,3	833	63
2M IT	11,8	515	47
Monetra	77,6	1173	>42
Kuntien Tiera	47,2	274	403

3. Research Approach

In this research, we examine in-house purchase invoice data to determine how greatly municipalities in Finland depend on in-house procurement. Furthermore, we examine what could be the adequate ways to explore the causes, why municipalities use or do not use in-house procurement. The focus groups are the largest municipalities and largest ICT in-house companies in Finland. Opening the purchase invoice data is voluntary. Eleven largest municipalities in Finland have opened the purchase invoice data, hence, these receive closer examination.

Municipalities' purchase invoice data is available Avoindata.fi [11] and at the municipalities' websites. In addition, invoice purchase data inquiries were made directly to the municipalities when the information was ambiguous or noncomplete. Shareholder information was searched on the websites of in-house companies and inquired by e-mail, and in some cases additionally by the phone. Public documents such as shareholder agreements were used to determine whether the in-house position existed.

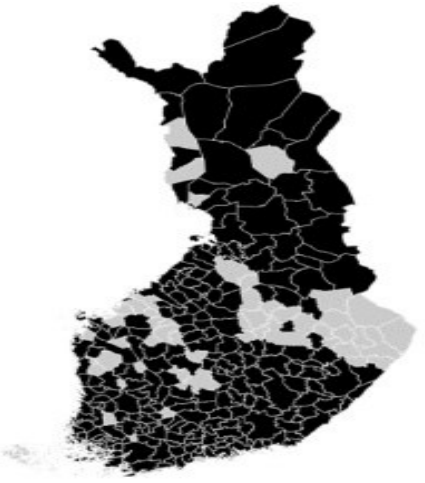


Figure 1: Kuntien Tiera, depicted geographically with black color, has 403 owners including municipalities, joint authorities and other in-house companies [10].

Another limitation involves the purchase invoice accounts. AURA is an official handbook maintained by Ministry of Finance that gives guidelines for mandatory economic reporting of municipalities and joint municipal authorities [12]. It contains a mandatory level of chart of accounts, and it was used to ensure comparabilitybetween the accounts of different municipalities. All the ICT

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related purchases were chosen to be inspected. The full calendar year 2021 is chosen to be the reference year for all municipalities.

4. Results

A summary of 11 largest municipalities in Finland is presented in Table 2, together with five largest in-house companies and their monetary value per municipality included. Based on the findings, municipalities have varying ways to acquire ICT solutions. Whether the larger municipalities rely more on traditional ICT procurement from the market, whereas the smaller cities use eagerly in-house procurement, remains unresolved and demands more research. Overall, limited resources altogether might lead towards in-house procurement. The more precise analysis of the data is presented through Primary Empirical Conclusions (PECs), based on purchase invoice data and other necessary documents. The PECs are listed in the following:

Table 2: Purchases from chosen in-house companies by 11 biggest municipalities in Finland, based on open purchase invoice data year 2021. *VAT included; **Not owner.

Municipality	Istekki	Monetra	Kuntien Tiera	Sarastia	2M-IT	Total 1000 €
Helsinki	-	1	2	240	-	243
Espoo	-	-	1 321	1 282	144	2 747
Tampere	-	-	-	-	-	-
Vantaa	-	<1	798	104	-	902
Oulu	197	5 471	195	-	-	5 862
Turku	-	1	11 901	5 695	4 935	22 532
Jyväskylä	-	6 414	549	-	-	6 963
Kuopio*	21 820	4 950	-	-	-	26 770
Lahti	3**	1	216	<1**	-	219
Pori	-	1	417	3 174	5 993	9 584
Kouvola	-	-	67	2 414	-	2 481
Total €	22 019	16 837	15 465	12 909	11 072	78 303

PEC1: Municipal autonomy. Municipalities in Finland have autonomy to acquire independently solutions from the in-house companies or from the free market which is visible in the results. Table 1 presents the differences in relying on in-house procurement. Municipal autonomy results in non-standardized ICT purchasing practices, and as imaginable, the variety in solutions is high, which may lead to challenges in building effective and inter-operable systems. Moreover, based on the results, it seems like some municipalities have direct access to the best products in the market, whereas some others need to adopt what suits the best for the group of stakeholders that own the in-house company. Understanding if included municipalities have ICT service and development units within the organizations needs closer examination, as in-house companies may offer municipalities with limited resources divided costs in the public procurement process.

PEC2: Selection of the supplier. The chosen accounts reveal that each municipality purchases accounting services in centralized manner from one of their own in-house companies. The result is sensible. Repetitive task such as accounting services are more manageable if one company provides them.

PEC3: In-house position through ownership and decision-making power. In-house companies own shares of other in-house companies. The explanation lies in the shareholder agreement. For example, Monetra's shareholder agreement reveals that the in-house position is ensured to some

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extend through cross-ownership between the in-house companies. However, the cross-ownership might not be enough to ensure in-house position, and the decision-making power is necessary at least as a legislative demand [10].

PEC4: Un-used ownership. Some owners have no purchases from their in-house companies. For example, Tampere holds in-house position and decision-making power in Monetra, but has no related purchases. The ownership may have originated from previous contracts, acquisitions and mergers.

PEC5: Difficulties in gathering the data. Half of the in-house companies provide complete shareholder information. Generally, the in-house companies responded to the inquiries with interest, and provided the names of the owners. Sarastia, Istekki and Meita provided full shareholder information including the names and division of the shares. In these cases, the relationships between the municipalities and in-house companies are rather easy to determine.

5. Conclusions

Examining the relationship between Finnish municipalities and in-house companies reveals several future research areas. In-house procurement is more common for smaller municipalities. It seems that many municipalities buy shares from the in-house companies to prepare themselves for the future needs resource-wise. Moreover, larger municipalities may have wider ICT services and development units within the organization.

In this article, the in-house position was sometimes demanding to determine. It seems that determining the in-house position is demanding for the municipalities as well. Finnish Competition and Consumer Authority (FCCA) has made a decision on inadequate interpretation on in-house position [13]. Municipality or its stakeholders need to participate in strategic decision-making in the in-house company. If decision-making power is not adequate in the in-house company, the legal ramifications may follow. The criteria how municipalities and in-house companies interpret the in-house position contradicts to some extend with the FCCA interpretation. Interpretations on in-house position need more research. Finally, difficulties in gathering the data and receiving information from in-house companies contradicts with the openness and equality principles. For almost half of the cases, information on shareholders in in-house companies was not available.

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Event Study: The Effect of the Passing Away of Queen Elizabeth II on the UK Stock Market

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Abstract: This study assesses the heterogeneous impact of the death of Queen Elizabeth II on industry leaders in the United Kingdom. It reveals the firm-specific characteristics that lead to this heterogeneity. This study applies an event study methodology to a sample of 20 leading UK companies across a 250-day estimation window and a 40-day event window. According to the event study, the death of Queen Elizabeth II has had a differential impact on most UK companies for different industries. In contrast, companies in the Biotech, Oil & Gas, Mining, and Tobacco industries were less affected. However, companies in the Retail, Telecommunications, Banks, and Defense Contractors sectors show significant negative CARs. This article has implications for investors in identifying company sector-specific characteristics that drive premium returns and guiding diversification by improving the sectoral diversity of portfolios. However, the study is limited by a relatively small sample size. There is a gap in earlier research on the related change of kingship and stock market performance, and this study makes two contributions to the literature. The authors first analyze the impact of the death of Queen Elizabeth II on British firms. Secondly, the study also provides guidance on how investors can diversify across different sectors in the UK to reduce risk.

Keywords: Queen Elizabeth II, UK stock market, risk

1. Introduction

On September 8, 2022, Queen Elizabeth II, who reigned over the United Kingdom and other Commonwealth realms, passed away. According to a YouGov survey, nearly three-quarters (76%) of Britons are upset by the Queen's death [1]. There's a general agreement that social events can influence stock market performance. The relationship between politics and economics has also been hotly debated. Whether it's the previous trade war between the US and China or the recent war between Russia and Ukraine. These political events profoundly affect the economic performance of the countries in the event. The purpose of this article is to examine what impact the death of Queen Elizabeth II, who reigned for 70 years, will have on the stock market in the United Kingdom when the time comes on September 8, 2022.

It is essential to explore the impact of the Queen's death on the UK stock market for at least two reasons. First, it is the first change of power for the British monarch in 70 years since 1952. Since World War II, political and economic developments have taken on different forms and potential in different countries, so we can learn about today's British society by understanding the connection between the monarchy's change and the UK's economic performance. Second, as a constitutional

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monarchy, we can also understand the current influence of the British monarch on the British economy through this research.

A large and growing of literature has investigated the effect that an event could have on the British stock market. Hudson and Urquhart, in their research, found some evidence for the "negativity effect," but little evidence for large correlations between war events and market returns [2]. For Brexit, Shahzad et al.'s research indicated that the market first reacted negatively to Brexit, but as the UK's future economic relations with the EU began to take shape, the market started to perceive the benefits of Brexit [3]. According to the findings from Breinlich et al., the first stock price movements were influenced by concerns about a cyclical slump and the depreciation of the pound after the referendum [4]. The event research approach was utilized by Ramiah et al., and the findings indicate that Brexit negatively impacted the banking, travel, and leisure sectors, and Brexit has a mixed impact on ARs, with evident sector-by-sector variances [5]. In particular, significant changes in the network topologies are seen in the insurance, consumer goods, consumer services, mining, and technology sectors, whereas the oil and gas and healthcare sectors have not been impacted by Brexit stress [6]. Chortareas, G. et al. found that the Bank of England Monetary Policy Committee's (MPC) asset purchase announcements from 2009 to 2017 had a significant impact on domestic equities returns and volatility, and the extent of this impact was dependent on the Bank's information dissemination through inflation reports and the publishing of the MPC's voting records [7].

Since the passing away of Queen Elizabeth II happened just two months ago, the impact of the Queen's passing away and the change of monarchy it represents on the UK's stock market has not yet been discussed. Therefore, in this paper, the author will research and discuss the reaction of the UK stock market to the demise of Queen Elizabeth II and see if it had a positive or negative effect on the UK's stock market and if there is any difference across different industries.

Table 1: Sample list & benchmark.

Serial Number	Company Name	Stock Exchanging Market	Benchmark Index
1	Shell Plc	LSE	FTSE100
2	BP Plc	LSE	FTSE100
3	Tesco Plc	LSE	FTSE100
4	Rio Tinto Group	LSE	FTSE100
5	Legal & General Group Plc	LSE	FTSE100
6	Unilever Plc	LSE	FTSE100
7	Vodafone Group Plc	LSE	FTSE100
8	HSBC Holdings Plc	LSE	FTSE100
9	Lloyds Banking Group Plc	LSE	FTSE100
10	GSK Plc	LSE	FTSE100
11	Anglo-American Plc	LSE	FTSE100
12	Aviva Plc	LSE	FTSE100
13	Imperial Brands Plc	LSE	FTSE100
14	AstraZeneca	LSE	FTSE100
15	Sainsbury's Plc	LSE	FTSE100
16	British American Tobacco Plc	LSE	FTSE100
17	Barclarys Plc	LSE	FTSE100
18	Prudential Plc	LSE	FTSE100

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Table 1: (continued).

19	BT Group Plc	LSE	FTSE100
20	BAE Systems Plc	LSE	FTSE100

2. Data and Methodology

To perform the event-study analysis, the author initially defined the event window and estimation window. The day Queen Elizabeth II passed away is deemed the event day and ordered on 8 September 2022. The event study approach makes the assumption that the market was aware of the information on the event day. The event window is 40 days from t+20 to t+20, while the estimation window is 250 days from t-271 to t-21, guaranteeing the correctness of the market model. Only trading days are taken into consideration for the research.

The author sorted the companies in the United Kingdom (UK) by their revenue in 2022 [8]. Table 1 lists my sample's top 20 high-revenue firms in 2022. Table 2 illustrates that 20 firms cover a range of 11 industries. Specifically, the samples are relatively distributed in each industry equally. The market model assumes a linear relationship between the stock return i and the market portfolio returns [9]. For our analysis, we collected the daily closing price for the leading index of the UK. Then with a 250-day estimation window, we use the market model to obtain the intercept and slope coefficients of the OLS regression model. With a 40- day event window, the abnormal return is calculated as follows:

$$AR_{it} = R_{it} - \left(\hat{\alpha} + \hat{\beta} * R_{mt}\right) \tag{1}$$

where, AR_{it} is the abnormal return for index i on day t; R_{it} is the return for the index i on day t; R_{mt} is the rate of return on the leading index m on day t; $\hat{\alpha}$ and $\hat{\beta}$ are intercept and slope coefficients obtained from market model respectively.

Cumulative abnormal returns are computed:

$$CAR_{i,p-q} = \sum_{t=p}^{q} AR_{it} \tag{2}$$

Here, $CAR_{i,p-q}$ is the cumulative abnormal return for each index i for the event window (p–q).

Table 2: Number of observations by industries.

Industries	Number of firms in the sample
Oil & Gas	2
Retail	2
Mining	2
Asset Management	1
Consumer Goods	1
Telecommunication	2
Banks	3
Biotech, Pharmaceuticals	2
Insurance	2
Tobacco	2

DOI: 10.54254/2754-1169/17/20231127

Table 2: (continued).

Defense Contractors	1

3. Result Analysis

The event study results in Table 3 illustrate the heterogeneous effects across 20 top-revenue companies in the UK. Regarding the result of the abnormal return, only two companies did not exhibit any significant result during the event window: BT Group and BAE Systems. Prior to the day of the Queen's passing away, limited numbers of firms indicated a significant positive or negative AR except at t-11, when AR is significantly positive for the firms in the Oil & Gas industry, which are Shell and BP. On the event day, Vodafone Group and two companies in the Retail sector (Tesco and Sainsbury's) perform negative AR. At t+1 and t+2, two firms, including Barclays and Prudential, experienced significantly negative AR, while Tesco and Sainsbury's experienced significantly positive AR at t+2. From t+8, the number of companies with significant negative AR increases and peaks at three on t+13 and t+14, which includes companies that do not show significant negative results in CAR. Additionally, at t+5, t+7, t+9, t+12, t+14, t+16, t+19, and t+20, one company showed a significant positive abnormal return each day, while the company that showed significant positive AR on t+19 and t+20 is the same, which is Imperial Brands. It is worth noting that companies including Pesco, GSK, and AstraZeneca did not show any significant abnormal return after the event day. The result from GSK and AstraZeneca indicates that the Queen's passing away does not have a lasting effect on the Biotech and Pharmaceuticals market.

Based on the result of CAR (Table 4), companies that show a positive significant cumulative abnormal return after the event include Shell, BP, Rio Tinto Group, Unilever, Lloyds Banking Group, Anglo-American, Aviva, Imperial Brands, and British American Tobacco, while the rest of the 20 sample companies showed a significantly negative CAR after the event. Specifically, Shell, BP, Aviva, Imperial Brands, and British American Tobacco began to show a discontinuous positive significant CAR before the event, and the significant positive impact of Shell, BP, Aviva, and Imperial Brands continues to t+20. Rio Tinto Group and Anglo American from the Mining industry experienced significantly positive CAR starting from t+14. Unilever and Lloyds Banking Group show a significant positive cumulative impact from t+11 to t+14 and from t+5 to t+10, respectively.

The company from the Biotech and Pharmaceutical industry, GSK, showed significant negative cumulative abnormal returns during the whole event window. Vodafone Group, Barclays, Prudential, BT Group, and BAE Systems all show consistently significant negative CARs on or after the day of the event, with Vodafone Group showing a significant negative CAR starting at t-0 and no significant CARs on days t+9 and t+10. BT Group experiences a persistent significantly negative CAR from t+8; Barclays, Prudential, and BAE Systems start a significant negative CAR earlier from t+1. Tesco and Sainsbury's, from the Retail market, and HSBC Holdings experienced significantly negative CAR starting from t+12, t+14, and t+13, respectively, with Sainsbury's not showing a significant CAR at t+17. Legal & General Group and AstraZeneca exhibited significantly negative CAR from t+13 to t+15 and t+17 to t+19, respectively, with AstraZeneca also showing a significant negative CAR on t+9.

Table 3: 20 Companies' abnormal return and T-statistics of AR.

Days	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
t-20	-0.01	-0.01	0.01	0.00	0.04*	-0.01	-0.01	-0.02	0.01	-0.06*
	(-0.78)	(-0.53)	(0.57)	(0.10)	(2.15)	(-1.28)	(-0.89)	(-1.60)	(0.47)	(-2.71)

DOI: 10.54254/2754-1169/17/20231127

Table 3: (continued).

t-19	0.03	0.02	-0.01	-0.03*	0.01	0.00	0.00	0.01	0.01	-0.10*
	(1.73)	(1.53)	(-0.27)	(-1.99)	(0.42)	(-0.46)	(0.29)	(1.06)	(0.76)	(-4.63)
t-18	-0.01	0.00	-0.01	0.00	0.00	-0.01	0.00	0.00	-0.01	0.03
	(-0.45)	(-0.05)	(-0.46)	(0.09)	(-0.02)	(-0.62)	(0.00)	(-0.34)	(-0.37)	(1.53)
t-17	-0.02	-0.01	0.01	-0.02	0.00	0.01	0.00	-0.01	0.00	-0.03
	(-1.20)	(-0.98)	(0.51)	(-1.48)	(0.25)	(0.68)	(-0.38)	(-0.72)	(0.22)	(-1.50)
t-16	-0.01	0.00	0.00	0.04*	-0.01	0.00	0.01	0.00	-0.01	0.01
	(-0.82)	(-0.26)	(0.22)	(2.30)	(-0.35)	(-0.45)	(1.28)	(-0.05)	(-0.53)	(0.51)
t-15	0.01	0.01	0.00	0.00	0.00	0.01	-0.01	-0.01	0.01	-0.01
	(0.54)	(0.92)	(0.25)	(-0.15)	(-0.09)	(0.64)	(-0.87)	(-0.50)	(0.37)	(-0.25)
t-14	0.01	0.02	0.00	0.01	-0.05*	0.00	0.00	-0.01	-0.01	-0.01
	(0.70)	(1.36)	(0.24)	(0.57)	(-2.60)	(-0.21)	(-0.35)	(-1.11)	(-0.43)	(-0.58)
t-13	0.01	0.01	0.00	-0.01	0.00	0.02	0.00	-0.01	-0.02	0.02
	(0.74)	(0.73)	(-0.01)	(-0.49)	(-0.20)	(1.71)	(0.06)	(-0.79)	(-1.40)	(0.73)
t-12	0.00	0.01	0.00	0.01	-0.02	0.00	-0.01	0.00	0.00	0.00
	(-0.05)	(0.35)	(-0.06)	(0.59)	(-1.11)	(0.16)	(-1.21)	(0.35)	(-0.22)	(0.14)
t-11	0.04*	0.03*	-0.01	0.03	0.01	-0.01	-0.02	-0.01	0.01	-0.01
	(2.61)	(2.15)	(-0.73)	(1.87)	(0.42)	(-1.39)	(-1.48)	(-0.50)	(0.40)	(-0.66)
t-10	-0.01	-0.01	-0.02	-0.02	-0.01	0.01	-0.01	-0.02	0.00	0.00
	(-0.64)	(-0.80)	(-1.25)	(-1.25)	(-0.66)	(1.43)	(-0.69)	(-1.40)	(-0.14)	(-0.07)
t-9	0.01	0.01	-0.01	0.00	-0.01	-0.01	0.00	0.00	0.00	-0.01
	(0.63)	(0.82)	(-0.64)	(0.23)	(-0.29)	(-0.67)	(0.14)	(0.00)	(0.21)	(-0.35)
t-8	0.01	0.01	-0.01	0.01	0.00	0.00	-0.01	0.01	0.00	0.01
	(0.88)	(0.40)	(-0.61)	(0.93)	(-0.06)	(-0.51)	(-0.72)	(0.72)	(-0.27)	(0.36)
t-7	0.01	-0.01	0.00	-0.02	0.01	0.01	0.01	0.02	0.02	0.01
	(0.80)	(-0.45)	(-0.14)	(-1.47)	(0.55)	(0.64)	(0.95)	(1.84)	(1.02)	(0.48)
t-6	-0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.02	-0.01
	(-0.64)	(-0.18)	(-0.22)	(0.21)	(0.37)	(0.02)	(0.53)	(0.90)	(1.26)	(-0.40)
t-5	0.01	0.03	-0.01	-0.01	0.00	0.00	-0.02	0.01	0.00	0.00
	(0.97)	(1.78)	(-0.47)	(-0.84)	(-0.08)	(-0.37)	(-1.61)	(0.62)	(0.07)	(-0.17)
t-4	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	-0.02
	(-0.16)	(0.01)	(0.24)	(0.03)	(0.66)	(-0.12)	(0.27)	(0.17)	(-0.23)	(-0.81)
t-3	0.01	0.02	0.01	0.01	-0.01	-0.01	-0.01	0.00	-0.01	0.00
	(0.52)	(1.32)	(0.36)	(0.43)	(-0.32)	(-0.72)	(-1.19)	(0.11)	(-0.47)	(0.16)
t-2	-0.02	-0.03	0.02	0.00	0.02	0.01	0.01	-0.01	0.04*	-0.01
	(-1.38)	(-1.82)	(1.26)	(-0.06)	(0.87)	(0.93)	(0.54)	(-0.74)	(2.58)	(-0.44)

DOI: 10.54254/2754-1169/17/20231127

Table 3: (continued).

t-1	-0.01	-0.01	-0.02	-0.01	0.00	0.01	-0.02	-0.01	0.00	0.00
	(-0.70)	(-0.93)	(-1.15)	(-0.73)	(0.05)	(0.63)	(-1.83)	(-0.82)	(0.05)	(0.16)
t	0.00	0.00	-0.05*	0.02	0.00	0.00	-0.02*	0.00	0.01	0.00
	(-0.18)	(-0.12)	(-2.62)	(1.12)	(0.10)	(-0.51)	(-1.97)	(-0.05)	(0.52)	(-0.14)
t+1	0.00	0.00	0.00	0.02	0.01	0.01	0.00	-0.02	0.00	-0.01
	(-0.25)	(-0.10)	(0.21)	(1.02)	(0.28)	(0.56)	(-0.20)	(-1.44)	(-0.09)	(-0.27)
t+2	-0.01	-0.01	0.05*	0.00	-0.01	0.01	0.01	0.00	0.00	0.01
	(-0.87)	(-0.67)	(2.43)	(-0.01)	(-0.57)	(1.03)	(0.76)	(-0.12)	(-0.20)	(0.46)
t+3	0.02	0.02	-0.03	0.01	0.00	0.00	-0.01	0.00	0.01	-0.01
	(1.06)	(1.68)	(-1.33)	(0.42)	(0.21)	(0.47)	(-0.52)	(0.16)	(0.47)	(-0.26)
t+4	0.02	0.02	-0.03	-0.01	0.01	-0.01	-0.01	0.00	0.02	-0.01
	(1.53)	(1.54)	(-1.34)	(-0.36)	(0.66)	(-0.66)	(-0.78)	(-0.20)	(1.11)	(-0.49)
t+5	-0.01	-0.01	-0.02	-0.01	0.01	0.00	0.02	0.02	0.03*	0.00
	(-0.92)	(-0.98)	(-1.21)	(-0.38)	(0.64)	(0.09)	(1.67)	(1.53)	(1.99)	(0.15)
t+6	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.01	-0.01
	(-0.10)	(-0.11)	(0.03)	(0.71)	(0.32)	(-0.37)	(-0.37)	(0.55)	(0.90)	(-0.39)
t+7	0.01	0.01	-0.03	0.00	0.00	0.01	-0.01	0.02	0.03*	0.00
	(0.59)	(0.63)	(-1.54)	(-0.08)	(-0.08)	(1.18)	(-1.25)	(1.23)	(2.29)	(-0.13)
t+8	0.00	0.00	0.00	-0.01	0.00	0.02	0.02	-0.03*	-0.01	-0.01
	(0.32)	(-0.23)	(0.21)	(-0.73)	(0.10)	(1.69)	(1.60)	(-2.14)	(-0.45)	(-0.51)
t+9	0.01	0.02	0.01	0.04*	-0.01	0.01	0.01	-0.01	-0.03*	0.00
	(0.91)	(1.44)	(0.55)	(2.31)	(-0.65)	(0.56)	(0.64)	(-0.49)	(-2.22)	(0.02)
t+10	-0.03*	-0.03	-0.02	-0.01	-0.01	0.00	0.01	0.01	-0.02	0.03
	(-2.01)	(-1.84)	(-1.07)	(-0.56)	(-0.33)	(0.20)	(0.47)	(1.17)	(-1.57)	(1.26)
t+11	0.00	-0.01	-0.01	-0.01	-0.02	0.01	-0.01	-0.02	-0.04*	0.01
	(-0.22)	(-0.57)	(-0.65)	(-0.42)	(-0.96)	(1.27)	(-1.19)	(-1.78)	(-2.49)	(0.40)
t+12	0.02	0.01	0.00	0.04*	-0.03	0.00	-0.01	0.00	0.00	0.00
	(1.31)	(0.63)	(-0.24)	(2.33)	(-1.59)	(0.32)	(-0.62)	(-0.18)	(-0.05)	(-0.15)
t+13	0.00	0.01	-0.02	0.01	-0.06*	0.00	-0.01	-0.03*	0.01	0.02
	(0.17)	(0.41)	(-1.22)	(0.82)	(-3.39)	(-0.47)	(-0.53)	(-2.40)	(0.95)	(0.79)
t+14	0.01	0.02	-0.04*	0.03	-0.01	0.01	-0.02	-0.01	0.01	-0.01
	(0.81)	(1.13)	(-2.33)	(1.85)	(-0.56)	(1.22)	(-1.75)	(-1.01)	(0.43)	(-0.35)
t+15	0.00	0.00	0.03	0.00	0.02	-0.03*	-0.01	0.00	-0.01	-0.01

DOI: 10.54254/2754-1169/17/20231127

Table 3: (continued).

	(-0.10)	(-0.07)	(1.64)	(-0.05)	(0.93)	(-2.92)	(-0.71)	(-0.22)	(-0.39)	(-0.44)
t+16	0.02	0.02	0.01	0.01	0.02	-0.02*	0.02*	-0.02	0.00	0.01
	(1.30)	(1.25)	(0.46)	(0.48)	(1.25)	(-2.52)	(2.10)	(-1.34)	(0.08)	(0.41)
t+17	-0.02	-0.01	-0.01	0.00	0.02	0.01	0.00	0.01	0.00	-0.01
	(-1.15)	(-0.83)	(-0.43)	(0.17)	(1.28)	(1.16)	(-0.34)	(0.84)	(0.29)	(-0.55)
t+18	0.02	0.02	-0.04*	0.01	-0.03	0.00	-0.02	-0.01	0.01	0.00
	(1.47)	(1.29)	(-2.07)	(0.33)	(-1.84)	(-0.18)	(-1.72)	(-1.20)	(0.34)	(0.16)
t+19	-0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
	(-1.32)	(0.76)	(-0.25)	(0.31)	(0.27)	(-0.04)	(-0.41)	(0.54)	(-0.30)	(0.01)
t+20	0.01	0.02	0.01	0.00	-0.01	0.00	-0.01	-0.01	0.00	0.02
	(0.95)	(1.34)	(0.29)	(0.19)	(-0.52)	(-0.07)	(-0.87)	(-0.74)	(-0.03)	(0.73)

Note(s): This table presents the results of the event study analysis for the top 20 companies. * indicates the value is significant at 5% level. The value listed in the bracket represents the t-statistics. The number in the first row corresponds to the serial number of each company，which is shown in Table 1.

Table 3: 20 Companies' abnormal return and T-statistics of AR (continued).

Days	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
t-20	0.01	0.12*	0.00	-0.01	0.02	-0.01	-0.50	-0.51	-0.02	-0.50
	(0.34)	(5.03)	(-0.13)	(-0.41)	(1.00)	(-1.15)	(-1.09)	(-1.17)	(-1.15)	(-1.22)
t-19	0.03	0.00	0.01	-0.03	0.00	0.01	-0.13	-0.13	0.00	-0.13
	(1.33)	(0.16)	(1.04)	(-1.95)	(-0.05)	(1.47)	(-0.28)	(-0.31)	(0.02)	(-0.33)
t-18	-0.02	0.01	0.00	0.01	0.00	0.00	-0.61	-0.61	0.00	-0.60
	(-1.10)	(0.23)	(-0.42)	(1.13)	(-0.07)	(-0.24)	(-1.35)	(-1.40)	(-0.32)	(-1.46)
t-17	-0.02	0.00	0.00	0.02	0.01	0.01	-0.45	-0.45	0.00	-0.42
	(-1.15)	(-0.03)	(0.11)	(1.63)	(0.31)	(0.94)	(-0.99)	(-1.04)	(-0.19)	(-1.02)
t-16	0.03	-0.02	0.01	0.00	0.01	0.01	-0.58	-0.56	0.02	-0.52
	(1.58)	(-0.81)	(0.57)	(-0.26)	(0.53)	(1.01)	(-1.27)	(-1.30)	(1.28)	(-1.25)
t-15	-0.01	0.00	0.01	0.00	-0.01	0.01	-0.27	-0.30	-0.02	-0.26
	(-0.39)	(0.05)	(0.71)	(0.32)	(-0.44)	(1.09)	(-0.60)	(-0.70)	(-1.49)	(-0.63)
t-14	-0.02	-0.05	-0.01	0.00	0.00	0.00	-0.57	-0.53	0.00	-0.53
	(-1.29)	(-1.90)	(-0.50)	(-0.21)	(0.00)	(-0.41)	(-1.25)	(-1.23)	(-0.13)	(-1.30)
t-13	-0.02	-0.01	0.00	0.02	-0.01	0.01	-0.47	-0.46	0.00	-0.42
	(-1.22)	(-0.24)	(-0.17)	(1.48)	(-0.37)	(0.65)	(-1.04)	(-1.06)	(-0.05)	(-1.03)
t-12	0.01	-0.01	0.01	0.02	0.00	0.01	-0.30	-0.30	0.00	-0.27
	(0.41)	(-0.41)	(0.72)	(1.34)	(-0.07)	(1.31)	(-0.66)	(-0.70)	(-0.29)	(-0.67)
t-11	0.04*	0.00	-0.01	-0.02	-0.01	-0.02*	-0.09	-0.09	0.01	-0.12

DOI: 10.54254/2754-1169/17/20231127

Table 3: (continued).

	(2.13)	(0.10)	(-1.27)	(-1.33)	(-0.62)	(-2.06)	(-0.20)	(-0.20)	(0.79)	(-0.30)
t-10	-0.02	0.00	0.00	0.01	-0.02	0.01	-0.29	-0.31	-0.02	-0.27
	(-0.95)	(-0.20)	(-0.23)	(1.08)	(-1.13)	(0.90)	(-0.64)	(-0.72)	(-1.44)	(-0.65)
t-9	0.01	0.00	0.00	0.00	-0.01	0.00	-0.44	-0.46	-0.01	-0.42
	(0.68)	(-0.03)	(-0.24)	(0.33)	(-0.28)	(-0.33)	(-0.97)	(-1.06)	(-0.53)	(-1.03)
t-8	0.01	0.00	0.00	0.00	-0.02	0.01	-0.06	-0.06	0.00	-0.06
	(0.62)	(-0.06)	(0.43)	(-0.05)	(-1.17)	(0.88)	(-0.13)	(-0.13)	(-0.14)	(-0.15)
t-7	-0.03	0.00	0.01	-0.03*	0.02	0.00	0.06	0.03	0.01	-0.01
	(-1.73)	(0.14)	(0.70)	(-2.19)	(1.03)	(0.36)	(0.13)	(0.06)	(0.78)	(-0.03)
t-6	0.01	0.02	0.02	-0.02	0.00	0.01	0.13	0.10	0.00	0.07
	(0.77)	(0.70)	(1.72)	(-1.71)	(-0.25)	(0.51)	(0.28)	(0.24)	(0.13)	(0.17)
t-5	-0.01	0.00	0.01	0.01	-0.01	0.01	0.51	0.47	-0.01	0.43
	(-0.52)	(0.20)	(1.35)	(0.56)	(-0.33)	(1.04)	(1.12)	(1.09)	(-1.09)	(1.04)
t-4	0.00	0.02	-0.01	-0.01	0.01	-0.01	-1.27*	-1.21*	-0.01	-1.20*
	(0.04)	(0.70)	(-1.27)	(-0.91)	(0.42)	(-0.94)	(-2.80)	(-2.80)	(-0.95)	(-2.91)
t-3	0.01	0.00	0.01	0.00	0.01	0.00	-0.45	-0.45	-0.01	-0.39
	(0.30)	(-0.13)	(1.08)	(0.08)	(0.49)	(0.17)	(-0.99)	(-1.04)	(-0.94)	(-0.94)
t-2	0.01	0.02	0.00	-0.02	0.02	0.00	-0.48	-0.46	-0.02	-0.46
	(0.60)	(1.01)	(-0.02)	(-1.15)	(1.23)	(0.02)	(-1.05)	(-1.06)	(-1.37)	(-1.12)
t-1	-0.01	0.00	0.01	-0.01	-0.01	0.00	0.01	0.00	0.01	0.00
	(-0.48)	(0.11)	(0.60)	(-0.39)	(-0.43)	(0.13)	(0.02)	(0.00)	(0.46)	(-0.01)
t	0.01	0.01	0.00	0.01	-0.05*	0.00	-0.55	-0.53	-0.02	-0.52
	(0.73)	(0.32)	(0.17)	(0.53)	(-2.31)	(-0.03)	(-1.21)	(-1.22)	(-1.60)	(-1.25)
t+1	0.03	0.00	0.00	-0.01	0.02	-0.01	-0.99*	-0.95*	0.00	-0.93*
	(1.56)	(0.03)	(-0.27)	(-0.91)	(1.05)	(-0.56)	(-2.17)	(-2.19)	(-0.30)	(-2.25)
t+2	0.00	-0.01	-0.01	0.00	0.05*	-0.01	-1.19*	-1.16*	0.02	-1.11*
	(-0.10)	(-0.61)	(-1.39)	(-0.21)	(2.36)	(-0.67)	(-2.61)	(-2.69)	(1.30)	(-2.68)
t+3	-0.01	0.01	0.01	-0.02	-0.01	0.00	0.17	0.15	0.00	0.14
	(-0.30)	(0.37)	(0.63)	(-1.49)	(-0.46)	(0.34)	(0.38)	(0.34)	(-0.14)	(0.35)
t+4	0.00	0.01	-0.01	-0.01	-0.03	-0.02	0.32	0.29	0.00	0.25
	(-0.08)	(0.28)	(-1.08)	(-0.49)	(-1.29)	(-1.59)	(0.71)	(0.66)	(-0.24)	(0.59)
t+5	-0.01	0.01	0.00	0.00	0.00	0.01	-0.41	-0.41	0.00	-0.40
	(-0.68)	(0.51)	(0.42)	(-0.29)	(-0.25)	(0.73)	(-0.91)	(-0.94)	(0.33)	(-0.98)
t+6	0.01	0.00	0.00	0.00	0.01	0.01	-0.09	-0.09	-0.01	-0.11
	(0.56)	(0.12)	(0.34)	(0.23)	(0.49)	(0.80)	(-0.20)	(-0.20)	(-0.66)	(-0.28)
t+7	0.00	0.00	0.01	0.00	-0.04	0.01	-0.10	-0.10	-0.01	-0.10
	(-0.26)	(-0.01)	(0.60)	(-0.06)	(-1.93)	(1.23)	(-0.21)	(-0.24)	(-0.71)	(-0.24)

DOI: 10.54254/2754-1169/17/20231127

Table 3: (continued).

t+8	0.00	0.00	-0.01	0.00	0.00	-0.01	-0.72	-0.68	-0.02	-0.61
	(0.24)	(-0.17)	(-1.24)	(-0.36)	(0.07)	(-1.26)	(-1.59)	(-1.58)	(-1.40)	(-1.49)
t+9	0.02	0.00	0.01	-0.01	0.01	0.01	0.13	0.10	0.01	0.11
	(1.30)	(0.15)	(1.28)	(-0.61)	(0.56)	(0.91)	(0.29)	(0.23)	(0.41)	(0.26)
t+10	-0.03	0.00	-0.01	0.02	0.00	-0.01	0.55	0.54	-0.02	0.48
	(-1.57)	(0.00)	(-0.60)	(1.74)	(-0.17)	(-0.91)	(1.22)	(1.25)	(-1.30)	(1.16)
t+11	-0.02	-0.02	0.01	0.01	-0.01	0.00	-0.44	-0.40	-0.01	-0.37
	(-1.09)	(-0.77)	(1.32)	(0.88)	(-0.27)	(0.29)	(-0.96)	(-0.92)	(-0.77)	(-0.90)
t+12	0.02	-0.01	0.01	-0.02	-0.01	0.00	-0.15	-0.17	-0.02	-0.16
	(1.00)	(-0.31)	(0.48)	(-1.45)	(-0.50)	(-0.46)	(-0.33)	(-0.39)	(-1.35)	(-0.40)
t+13	0.03	-0.05*	-0.01	0.01	-0.04	0.00	-0.57	-0.56	0.01	-0.50
	(1.50)	(-2.14)	(-0.84)	(0.91)	(-1.81)	(0.23)	(-1.26)	(-1.29)	(0.96)	(-1.22)
t+14	0.04*	-0.01	0.01	0.00	-0.05*	-0.02*	0.44	0.42	-0.03*	0.43
	(1.99)	(-0.28)	(0.90)	(-0.09)	(-2.29)	(-2.42)	(0.96)	(0.97)	(-2.32)	(1.03)
t+15	-0.01	0.03	-0.01	0.00	0.01	-0.02	-0.49	-0.44	0.00	-0.50
	(-0.57)	(1.08)	(-1.30)	(-0.11)	(0.61)	(-1.50)	(-1.07)	(-1.01)	(-0.18)	(-1.21)
t+16	0.02	0.02	0.00	-0.02	0.01	0.00	-0.50	-0.51	0.04*	-0.46
	(1.00)	(0.93)	(0.11)	(-1.27)	(0.66)	(0.31)	(-1.10)	(-1.17)	(3.16)	(-1.12)
t+17	0.01	0.00	-0.01	-0.01	0.01	-0.01	-1.63*	-1.54*	0.00	-1.50*
	(0.34)	(-0.02)	(-1.02)	(-0.46)	(0.60)	(-1.42)	(-3.59)	(-3.57)	(-0.03)	(-3.64)
t+18	-0.01	0.00	0.01	0.00	-0.04*	0.01	-0.18	-0.18	-0.02	-0.16
	(-0.45)	(-0.06)	(1.06)	(0.10)	(-2.17)	(0.95)	(-0.39)	(-0.42)	(-1.42)	(-0.38)
t+19	-0.02	0.00	0.03*	-0.01	-0.01	0.00	-0.03	0.00	-0.01	-0.03
	(-1.00)	(0.03)	(2.92)	(-0.42)	(-0.41)	(0.00)	(-0.06)	(-0.01)	(-0.48)	(-0.08)
t+20	0.00	0.00	0.02*	0.02	0.00	0.01	-0.36	-0.36	0.00	-0.31
	(-0.03)	(-0.02)	(2.31)	(1.46)	(0.14)	(1.42)	(-0.79)	(-0.84)	(-0.31)	(-0.74)

Note(s): This table presents the results of the event study analysis for the top 20 companies. * indicates the value is significant at 5% level. The value listed in the bracket represents the t-statistics. The number in the first row corresponds to the serial number of each company，which is shown in Table 1.

Table 4: 20 Companies' cumulative abnormal return and T-statistics of CAR.

Days	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
t-20	-0.01	-0.01	0.01	0.00	0.04	-0.01	-0.01	-0.02	0.01	-0.06*
	(-0.35)	(-0.18)	(0.13)	(0.03)	(0.93)	(-0.54)	(-0.23)	(-0.59)	(0.16)	(-2.18)
t-19	0.01	0.01	0.01	-0.03	0.05	-0.02	-0.01	-0.01	0.02	-0.15*
	(0.42)	(0.33)	(0.07)	(-0.60)	(1.11)	(-0.74)	(-0.15)	(-0.20)	(0.41)	(-5.89)
t-18	0.01	0.01	0.00	-0.03	0.05	-0.02	-0.01	-0.01	0.01	-0.12*
	(0.22)	(0.32)	(-0.03)	(-0.57)	(1.10)	(-1.00)	(-0.16)	(-0.33)	(0.29)	(-4.67)

DOI: 10.54254/2754-1169/17/20231127

Table 4: (continued).

t-17	-0.01	0.00	0.01	-0.05	0.05	-0.02	-0.01	-0.02	0.02	-0.15*
	(-0.31)	(-0.01)	(0.08)	(-1.04)	(1.20)	(-0.71)	(-0.25)	(-0.59)	(0.36)	(-5.87)
t-16	-0.02	0.00	0.01	-0.01	0.04	-0.02	0.00	-0.02	0.01	-0.14*
	(-0.68)	(-0.10)	(0.13)	(-0.31)	(1.05)	(-0.90)	(0.08)	(-0.61)	(0.18)	(-5.46)
t-15	-0.01	0.01	0.02	-0.02	0.04	-0.01	-0.01	-0.03	0.01	-0.15*
	(-0.44)	(0.21)	(0.18)	(-0.36)	(1.01)	(-0.62)	(-0.15)	(-0.80)	(0.30)	(-5.66)
t-14	0.00	0.03	0.02	-0.01	0.00	-0.02	-0.01	-0.04	0.01	-0.16*
	(-0.12)	(0.67)	(0.23)	(-0.17)	(-0.11)	(-0.72)	(-0.24)	(-1.21)	(0.16)	(-6.13)
t-13	0.01	0.04	0.02	-0.02	-0.01	0.00	-0.01	-0.05	-0.01	-0.14*
	(0.21)	(0.91)	(0.23)	(-0.33)	(-0.20)	(0.01)	(-0.22)	(-1.50)	(-0.31)	(-5.54)
t-12	0.01	0.04	0.02	-0.01	-0.03	0.00	-0.02	-0.05	-0.02	-0.14*
	(0.19)	(1.03)	(0.22)	(-0.14)	(-0.67)	(0.08)	(-0.53)	(-1.37)	(-0.38)	(-5.43)
t-11	0.05	0.08	0.00	0.02	-0.02	-0.01	-0.04	-0.05	-0.01	-0.16*
	(1.36)	(1.75)	(0.06)	(0.45)	(-0.49)	(-0.51)	(-0.91)	(-1.55)	(-0.25)	(-5.96)
t-10	0.04	0.06	-0.02	0.00	-0.03	0.00	-0.05	-0.07*	-0.01	-0.16*
	(1.07)	(1.48)	(-0.22)	(0.05)	(-0.78)	(0.09)	(-1.09)	(-2.07)	(-0.29)	(-6.01)
t-9	0.04	0.08	-0.03	0.01	-0.04	0.00	-0.05	-0.07*	-0.01	-0.16*
	(1.35)	(1.76)	(-0.36)	(0.12)	(-0.91)	(-0.19)	(-1.05)	(-2.08)	(-0.22)	(-6.29)
t-8	0.06	0.08	-0.04	0.02	-0.04	-0.01	-0.06	-0.06	-0.01	-0.16*
	(1.74)	(1.89)	(-0.49)	(0.42)	(-0.93)	(-0.41)	(-1.24)	(-1.81)	(-0.31)	(-6.00)
t-7	0.07*	0.08	-0.05	0.00	-0.03	0.00	-0.04	-0.04	0.00	-0.15*
	(2.10)	(1.74)	(-0.52)	(-0.04)	(-0.69)	(-0.13)	(-1.00)	(-1.12)	(0.03)	(-5.61)
t-6	0.06	0.07	-0.05	0.00	-0.02	0.00	-0.04	-0.03	0.02	-0.16*
	(1.82)	(1.68)	(-0.57)	(0.02)	(-0.53)	(-0.13)	(-0.86)	(-0.79)	(0.45)	(-5.93)
t-5	0.07*	0.10*	-0.06	-0.01	-0.02	-0.01	-0.06	-0.02	0.02	-0.16*
	(2.25)	(2.28)	(-0.67)	(-0.25)	(-0.57)	(-0.28)	(-1.28)	(-0.56)	(0.47)	(-6.07)
t-4	0.07*	0.10*	-0.05	-0.01	-0.01	-0.01	-0.05	-0.02	0.02	-0.18*
	(2.18)	(2.28)	(-0.62)	(-0.23)	(-0.28)	(-0.33)	(-1.20)	(-0.49)	(0.40)	(-6.72)
t-3	0.08*	0.12*	-0.05	0.00	-0.02	-0.01	-0.07	-0.02	0.01	-0.17*
	(2.41)	(2.72)	(-0.54)	(-0.10)	(-0.42)	(-0.63)	(-1.51)	(-0.45)	(0.24)	(-6.60)
t-2	0.06	0.09*	-0.02	-0.01	0.00	-0.01	-0.06	-0.02	0.05	-0.18*
	(1.80)	(2.11)	(-0.26)	(-0.12)	(-0.04)	(-0.24)	(-1.37)	(-0.73)	(1.10)	(-6.95)
t-1	0.05	0.08	-0.04	-0.02	0.00	0.00	-0.08	-0.03	0.05	-0.18*
	(1.48)	(1.80)	(-0.52)	(-0.35)	(-0.02)	(0.02)	(-1.84)	(-1.03)	(1.12)	(-6.82)
t	0.05	0.08	-0.09	0.00	0.00	0.00	-0.11*	-0.03	0.06	-0.18*
	(1.40)	(1.76)	(-1.09)	(0.01)	(0.02)	(-0.19)	(-2.35)	(-1.05)	(1.29)	(-6.93)
t+1	0.04	0.07	-0.09	0.02	0.01	0.00	-0.11*	-0.05	0.06	-0.19*

DOI: 10.54254/2754-1169/17/20231127

Table 4: (continued).

	(1.29)	(1.73)	(-1.05)	(0.33)	(0.14)	(0.04)	(-2.40)	(-1.59)	(1.26)	(-7.15)
t+2	0.03	0.07	-0.04	0.02	0.00	0.01	-0.10*	-0.05	0.05	-0.18*
	(0.90)	(1.50)	(-0.51)	(0.33)	(-0.10)	(0.48)	(-2.21)	(-1.63)	(1.19)	(-6.78)
t+3	0.05	0.09*	-0.07	0.02	0.00	0.02	-0.11*	-0.05	0.06	-0.18*
	(1.38)	(2.07)	(-0.80)	(0.46)	(-0.01)	(0.67)	(-2.34)	(-1.57)	(1.35)	(-6.99)
t+4	0.07*	0.11*	-0.10	0.02	0.01	0.01	-0.11*	-0.05	0.08	-0.19*
	(2.06)	(2.58)	(-1.10)	(0.35)	(0.27)	(0.39)	(-2.54)	(-1.65)	(1.72)	(-7.38)
t+5	0.05	0.10*	-0.12	0.01	0.02	0.01	-0.09*	-0.04	0.11*	-0.19*
	(1.65)	(2.25)	(-1.37)	(0.23)	(0.55)	(0.43)	(-2.11)	(-1.08)	(2.39)	(-7.26)
t+6	0.05	0.10*	-0.12	0.02	0.03	0.01	-0.10*	-0.03	0.12*	-0.20*
	(1.60)	(2.22)	(-1.36)	(0.45)	(0.69)	(0.27)	(-2.21)	(-0.87)	(2.69)	(-7.57)
t+7	0.06	0.11*	-0.15	0.02	0.03	0.02	-0.11*	-0.01	0.15*	-0.20*
	(1.87)	(2.43)	(-1.70)	(0.43)	(0.65)	(0.77)	(-2.53)	(-0.42)	(3.46)	(-7.68)
t+8	0.07*	0.10*	-0.14	0.01	0.03	0.03	-0.10*	-0.04	0.15*	-0.21*
	(2.01)	(2.35)	(-1.65)	(0.20)	(0.70)	(1.48)	(-2.12)	(-1.21)	(3.31)	(-8.09)
t+9	0.08*	0.12*	-0.13	0.05	0.02	0.04	-0.09	-0.05	0.11*	-0.21*
	(2.42)	(2.83)	(-1.53)	(0.93)	(0.42)	(1.72)	(-1.95)	(-1.39)	(2.56)	(-8.07)
t+10	0.05	0.10*	-0.15	0.04	0.01	0.04	-0.08	-0.03	0.09*	-0.18*
	(1.52)	(2.22)	(-1.76)	(0.75)	(0.27)	(1.80)	(-1.83)	(-0.96)	(2.04)	(-7.06)
t+11	0.05	0.09*	-0.16	0.03	-0.01	0.05*	-0.10*	-0.05	0.05	-0.18*
	(1.42)	(2.03)	(-1.91)	(0.62)	(-0.14)	(2.34)	(-2.14)	(-1.62)	(1.20)	(-6.74)
t+12	0.07*	0.10*	-0.17	0.07	-0.03	0.06*	-0.10*	-0.06	0.05	-0.18*
	(2.01)	(2.24)	(-1.96)	(1.36)	(-0.83)	(2.47)	(-2.30)	(-1.69)	(1.19)	(-6.86)
t+13	0.07*	0.10*	-0.19*	0.08	-0.09*	0.05*	-0.11*	-0.09*	0.07	-0.16*
	(2.08)	(2.37)	(-2.23)	(1.62)	(-2.29)	(2.28)	(-2.43)	(-2.58)	(1.50)	(-6.22)
t+14	0.08*	0.12*	-0.24*	0.11*	-0.10*	0.06*	-0.13*	-0.10*	0.07	-0.17*
	(2.44)	(2.75)	(-2.74)	(2.21)	(-2.53)	(2.79)	(-2.88)	(-2.95)	(1.65)	(-6.50)
t+15	0.08*	0.12*	-0.21*	0.11*	-0.09*	0.04	-0.14*	-0.10*	0.07	-0.18*
	(2.40)	(2.72)	(-2.38)	(2.20)	(-2.13)	(1.56)	(-3.07)	(-3.04)	(1.52)	(-6.86)
t+16	0.10*	0.14*	-0.20*	0.11*	-0.07	0.01	-0.11*	-0.12*	0.07	-0.17*
	(2.98)	(3.14)	(-2.28)	(2.35)	(-1.59)	(0.50)	(-2.53)	(-3.53)	(1.55)	(-6.52)
t+17	0.08*	0.12*	-0.21*	0.12*	-0.04	0.02	-0.12*	-0.11*	0.07	-0.18*
	(2.47)	(2.86)	(-2.37)	(2.40)	(-1.04)	(0.98)	(-2.61)	(-3.22)	(1.64)	(-6.96)
t+18	0.10*	0.14*	-0.24*	0.12*	-0.08	0.02	-0.14*	-0.12*	0.08	-0.18*
	(3.13)	(3.29)	(-2.83)	(2.51)	(-1.83)	(0.91)	(-3.06)	(-3.66)	(1.76)	(-6.83)
t+19	0.08*	0.15*	-0.25*	0.13*	-0.07	0.02	-0.14*	-0.11*	0.07	-0.18*
	(2.54)	(3.55)	(-2.89)	(2.60)	(-1.72)	(0.89)	(-3.16)	(-3.46)	(1.66)	(-6.83)

DOI: 10.54254/2754-1169/17/20231127

Table 4: (continued).

t+20	0.10*	0.17*	-0.24*	0.13*	-0.08	0.02	-0.15*	-0.12*	0.07	-0.16*
	(2.96)	(4.00)	(-2.82)	(2.66)	(-1.94)	(0.87)	(-3.39)	(-3.74)	(1.65)	(-6.24)

Note(s): This table presents the results of the event study analysis for the top 20 companies. * indicates the value is significant at 5% level. The value listed in the bracket represents the t-statistics. The number in the first row corresponds to the serial number of each company，which is shown in Table 1.

Table 4: 20 Companies' cumulative abnormal return and T-statistics of CAR (continued).

Days	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
t-20	0.01	0.12*	0.00	-0.01	0.02	-0.01	-0.50	-0.51	-0.02	-0.50
	(0.18)	(3.95)	(-0.06)	(-0.14)	(0.38)	(-0.59)	(-0.14)	(-0.14)	(-0.26)	(-0.15)
t-19	0.03	0.12*	0.01	-0.03	0.02	0.00	-0.63	-0.64	-0.02	-0.64
	(0.89)	(4.08)	(0.45)	(-0.79)	(0.35)	(0.17)	(-0.18)	(-0.18)	(-0.25)	(-0.19)
t-18	0.01	0.13*	0.01	-0.02	0.02	0.00	-1.24	-1.24	-0.02	-1.24
	(0.31)	(4.25)	(0.24)	(-0.41)	(0.33)	(0.04)	(-0.35)	(-0.35)	(-0.33)	(-0.36)
t-17	-0.01	0.13*	0.01	0.01	0.02	0.01	-1.69	-1.69	-0.02	-1.66
	(-0.30)	(4.23)	(0.29)	(0.13)	(0.44)	(0.53)	(-0.47)	(-0.48)	(-0.37)	(-0.48)
t-16	0.02	0.11*	0.01	0.00	0.03	0.02	-2.27	-2.25	0.00	-2.18
	(0.54)	(3.59)	(0.57)	(0.05)	(0.64)	(1.05)	(-0.64)	(-0.64)	(-0.08)	(-0.63)
t-15	0.01	0.11*	0.02	0.01	0.03	0.03	-2.54	-2.56	-0.02	-2.44
	(0.33)	(3.63)	(0.92)	(0.15)	(0.48)	(1.61)	(-0.71)	(-0.73)	(-0.42)	(-0.71)
t-14	-0.01	0.07*	0.01	0.00	0.03	0.03	-3.11	-3.09	-0.03	-2.97
	(-0.36)	(2.14)	(0.67)	(0.08)	(0.48)	(1.40)	(-0.87)	(-0.88)	(-0.45)	(-0.86)
t-13	-0.04	0.06	0.01	0.02	0.02	0.03	-3.58	-3.54	-0.03	-3.39
	(-1.01)	(1.95)	(0.59)	(0.58)	(0.34)	(1.73)	(-1.01)	(-1.01)	(-0.46)	(-0.99)
t-12	-0.03	0.05	0.02	0.04	0.02	0.05*	-3.88	-3.85	-0.03	-3.67
	(-0.79)	(1.63)	(0.94)	(1.02)	(0.31)	(2.41)	(-1.09)	(-1.09)	(-0.52)	(-1.07)
t-11	0.01	0.05	0.01	0.02	0.00	0.03	-3.98	-3.94	-0.02	-3.79
	(0.35)	(1.71)	(0.32)	(0.58)	(0.08)	(1.35)	(-1.12)	(-1.12)	(-0.34)	(-1.10)
t-10	-0.01	0.05	0.00	0.04	-0.02	0.04	-4.27	-4.25	-0.04	-4.06
	(-0.15)	(1.55)	(0.21)	(0.94)	(-0.34)	(1.81)	(-1.20)	(-1.21)	(-0.67)	(-1.18)
t-9	0.01	0.05	0.00	0.04	-0.02	0.03	-4.71	-4.70	-0.05	-4.49
	(0.21)	(1.52)	(0.09)	(1.05)	(-0.44)	(1.64)	(-1.32)	(-1.34)	(-0.79)	(-1.31)
t-8	0.02	0.04	0.01	0.04	-0.05	0.04*	-4.77	-4.76	-0.05	-4.55
	(0.54)	(1.47)	(0.30)	(1.04)	(-0.88)	(2.09)	(-1.34)	(-1.35)	(-0.82)	(-1.32)
t-7	-0.01	0.05	0.01	0.01	-0.03	0.04*	-4.71	-4.74	-0.04	-4.56
	(-0.38)	(1.58)	(0.64)	(0.30)	(-0.50)	(2.28)	(-1.32)	(-1.35)	(-0.64)	(-1.33)
t-6	0.00	0.06*	0.03	-0.01	-0.03	0.05*	-4.58	-4.63	-0.04	-4.49
	(0.03)	(2.13)	(1.48)	(-0.27)	(-0.59)	(2.54)	(-1.29)	(-1.32)	(-0.61)	(-1.31)

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Table 4: (continued).

t-5	-0.01	0.07*	0.05*	0.00	-0.04	0.06*	-4.07	-4.16	-0.05	-4.06
	(-0.25)	(2.29)	(2.14)	(-0.08)	(-0.71)	(3.07)	(-1.14)	(-1.18)	(-0.86)	(-1.18)
t-4	-0.01	0.09*	0.03	-0.02	-0.03	0.05*	-5.35	-5.37	-0.06	-5.26
	(-0.23)	(2.84)	(1.52)	(-0.39)	(-0.55)	(2.59)	(-1.50)	(-1.53)	(-1.07)	(-1.53)
t-3	0.00	0.08*	0.04*	-0.01	-0.02	0.05*	-5.80	-5.82	-0.08	-5.65
	(-0.07)	(2.74)	(2.04)	(-0.36)	(-0.37)	(2.68)	(-1.63)	(-1.66)	(-1.28)	(-1.64)
t-2	0.01	0.11*	0.04*	-0.03	0.00	0.05*	-6.28	-6.28	-0.10	-6.11
	(0.25)	(3.53)	(2.03)	(-0.74)	(0.09)	(2.69)	(-1.76)	(-1.79)	(-1.59)	(-1.78)
t-1	0.00	0.11*	0.05*	-0.03	0.00	0.05*	-6.27	-6.28	-0.09	-6.12
	(0.00)	(3.62)	(2.33)	(-0.87)	(-0.07)	(2.76)	(-1.76)	(-1.79)	(-1.49)	(-1.78)
t	0.01	0.12*	0.05*	-0.03	-0.05	0.05*	-6.82	-6.81	-0.11	-6.63
	(0.39)	(3.87)	(2.41)	(-0.70)	(-0.93)	(2.75)	(-1.91)	(-1.94)	(-1.85)	(-1.93)
t+1	0.04	0.12*	0.05*	-0.04	-0.03	0.05*	-7.81*	-7.75*	-0.11	-7.56*
	(1.22)	(3.89)	(2.28)	(-1.00)	(-0.54)	(2.46)	(-2.19)	(-2.21)	(-1.92)	(-2.20)
t+2	0.04	0.10*	0.03	-0.04	0.02	0.04*	-9.00*	-8.92*	-0.10	-8.67*
	(1.17)	(3.41)	(1.60)	(-1.07)	(0.34)	(2.12)	(-2.53)	(-2.54)	(-1.62)	(-2.52)
t+3	0.04	0.11*	0.04	-0.06	0.01	0.05*	-8.82*	-8.77*	-0.10	-8.52*
	(1.01)	(3.71)	(1.91)	(-1.57)	(0.17)	(2.29)	(-2.48)	(-2.49)	(-1.66)	(-2.48)
t+4	0.03	0.12*	0.03	-0.07	-0.02	0.03	-8.5*	-8.48*	-0.10	-8.28*
	(0.96)	(3.93)	(1.38)	(-1.73)	(-0.32)	(1.47)	(-2.39)	(-2.41)	(-1.71)	(-2.41)
t+5	0.02	0.13*	0.03	-0.07	-0.02	0.04	-8.92*	-8.89*	-0.10	-8.68*
	(0.60)	(4.32)	(1.58)	(-1.83)	(-0.41)	(1.85)	(-2.50)	(-2.53)	(-1.64)	(-2.53)
t+6	0.03	0.13*	0.04	-0.07	-0.01	0.04*	-9.01*	-8.98*	-0.11	-8.80*
	(0.90)	(4.41)	(1.75)	(-1.75)	(-0.23)	(2.26)	(-2.53)	(-2.55)	(-1.78)	(-2.56)
t+7	0.03	0.13*	0.04*	-0.07	-0.05	0.06*	-9.10*	-9.08*	-0.12	-8.90*
	(0.76)	(4.41)	(2.05)	(-1.77)	(-0.95)	(2.89)	(-2.56)	(-2.58)	(-1.94)	(-2.59)
t+8	0.03	0.13*	0.03	-0.07	-0.05	0.04*	-9.83*	-9.76*	-0.14*	-9.51*
	(0.89)	(4.28)	(1.44)	(-1.89)	(-0.92)	(2.24)	(-2.76)	(-2.78)	(-2.26)	(-2.77)
t+9	0.06	0.13*	0.04*	-0.08*	-0.04	0.05*	-9.70*	-9.66*	-0.13*	-9.40*
	(1.58)	(4.40)	(2.06)	(-2.09)	(-0.71)	(2.71)	(-2.72)	(-2.75)	(-2.17)	(-2.74)
t+10	0.03	0.13*	0.04	-0.06	-0.04	0.04*	-9.14*	-9.13*	-0.15*	-8.93*
	(0.75)	(4.40)	(1.77)	(-1.51)	(-0.78)	(2.25)	(-2.57)	(-2.60)	(-2.46)	(-2.60)
t+11	0.01	0.12*	0.05*	-0.05	-0.05	0.05*	-9.58*	-9.52*	-0.16*	-9.30*
	(0.17)	(3.80)	(2.41)	(-1.22)	(-0.88)	(2.40)	(-2.69)	(-2.71)	(-2.63)	(-2.71)
t+12	0.02	0.11*	0.06*	-0.07	-0.06	0.04*	-9.73*	-9.69*	-0.18*	-9.46*
	(0.70)	(3.55)	(2.65)	(-1.70)	(-1.06)	(2.16)	(-2.73)	(-2.76)	(-2.94)	(-2.75)

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Table 4: (continued).

t+13	0.05	0.06	0.05*	-0.05	-0.09	0.04*	-10.31*	-10.25*	-0.16*	-9.96*
	(1.50)	(1.87)	(2.24)	(-1.40)	(-1.74)	(2.27)	(-2.89)	(-2.91)	(-2.72)	(-2.90)
t+14	0.09*	0.05	0.06*	-0.06	-0.14*	0.02	-9.87*	-9.83*	-0.19*	-9.54*
	(2.56)	(1.65)	(2.68)	(-1.43)	(-2.60)	(1.03)	(-2.77)	(-2.80)	(-3.25)	(-2.78)
t+15	0.08*	0.08*	0.04*	-0.06	-0.13*	0.01	-10.35*	-10.27*	-0.20*	-10.04*
	(2.25)	(2.50)	(2.04)	(-1.46)	(-2.37)	(0.26)	(-2.91)	(-2.92)	(-3.29)	(-2.92)
t+16	0.10*	0.10*	0.05*	-0.07	-0.11*	0.01	-10.85*	-10.77*	-0.15*	-10.50*
	(2.79)	(3.22)	(2.09)	(-1.89)	(-2.12)	(0.42)	(-3.05)	(-3.06)	(-2.58)	(-3.06)
t+17	0.11*	0.10*	0.03	-0.08*	-0.10	-0.01	-12.49*	-12.31*	-0.15*	-12.00*
	(2.97)	(3.20)	(1.59)	(-2.04)	(-1.90)	(-0.32)	(-3.51)	(-3.50)	(-2.58)	(-3.49)
t+18	0.10*	0.10*	0.05*	-0.08*	-0.14*	0.00	-12.67*	-12.50*	-0.17*	-12.16*
	(2.73)	(3.16)	(2.11)	(-2.01)	(-2.71)	(0.17)	(-3.56)	(-3.55)	(-2.90)	(-3.54)
t+19	0.08*	0.10*	0.08*	-0.08*	-0.15*	0.00	-12.69*	-12.50*	-0.18*	-12.20*
	(2.19)	(3.18)	(3.53)	(-2.15)	(-2.86)	(0.17)	(-3.56)	(-3.56)	(-3.01)	(-3.55)
t+20	0.08*	0.10*	0.10*	-0.07	-0.15*	0.02	-13.05*	-12.86*	-0.18*	-12.50*
	(2.18)	(3.17)	(4.66)	(-1.67)	(-2.81)	(0.90)	(-3.67)	(-3.66)	(-3.08)	(-3.64)

Note(s): This table presents the results of the event study analysis for the top 20 companies. * indicates the value is significant at 5% level. The value listed in the bracket represents the t-statistics. The number in the first row corresponds to the serial number of each company, which is shown in Table 1.

4. Conclusion

This paper examined the impact of the passing away of Queen Elizabeth II on the UK markets by using a sample of 20 top-revenued companies in 2022 from 11 different categories and found that this event generated heterogeneous effects among different firms. This research has identified that the departure of Queen Elizabeth II had a small impact on the UK companies in the Biotech, Oil & Gas, Mining, and Tobacco industries, which had few or no significant abnormal returns in the days following the event. In terms of cumulative impact, companies in the Retail, Telecommunications, Banks, and Defense Contractors sectors show significant negative CARs for at least eight days after the event. However, companies in the Oil & Gas, Mining, and Consumer Goods industries show significant positive CARs after the event. This study can provide insight to investors. For example, this study reveals the heterogeneous stock performance of companies in different categories in the UK in response to the passing away of Queen Elizabeth II. Therefore, this study provides investors with guidance on where to diversify their capital in the UK to mitigate investment risk when there is a change of the crown or the death of a beloved celebrity. In addition, this study has some limitations. First, the sample for this study is limited to the top 20 UK listed companies by revenue in 2022, and only 11 of these industries are covered. It would be a fruitful area for further work focusing on improving the sample size and the imbalance in the sample distribution across industries, especially those with only one company in this study. A further study, with a larger sample size, could also classify British companies by market capitalization, providing investors with insights into portfolio diversification based on size anomalies.

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Analysis on the Profit Recovery of China's Budget Airlines after the Epidemic

-- A Case Study of Spring Airlines

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Abstract: The purpose of this paper is to explore the changes in profitability of Spring Airlines, the representative low-cost airline in China, after the epidemic and to explore the reasons behind the changes in profitability. I compared three years of operating income, operating profit and operating cash flow, plotted the time series of passenger number changes for 31 months starting from December 2019, collected from government websites and summarized the national relief policies for the airline industry after the outbreak. I find that both operating income and operating cash flow rise above pre-epidemic levels in 2021, mainly due to the recovery and rise in passenger numbers driven by the improvement in the epidemic and the strong growth forces inherent in the low-cost airline market; however, profits show the opposite trend, mainly because aviation fuel prices bottom out and then rise in 2020, driving up the company's operating costs and compressing its profits; I also explore the impact of policies and find that multi-faceted, aggressive policies do largely reduce the pressure on the company to survive during the epidemic.

Keywords: Spring Airlines, budget airlines, epidemic

1. Introduction

At present, low-cost airlines have a broad market prospect in China. According to the Asia Pacific Aviation Center, over the ten-year period from 2011 to 2020, global low-cost airlines will increase their market share from 27.5% to 35.1% for intra-regional routes and 16.6% for international routes, while Asia Pacific's market share for domestic routes will climb from 20.5% to 31.5% and international routes from 4.6% to 13.3%. The market share of domestic routes in Asia Pacific climbs from 20.5% to 31.5% and international routes from 4.6% to 13.3%. With a market share of 11.1% of domestic routes in 2020, China's low-cost airlines have ample room for future growth and huge growth potential compared to other countries and regions. But the sudden outbreak has added a great deal of uncertainty to the industry's growth. Will low-cost airlines be devastated by the epidemic? Will budget airlines be able to develop further in the midst of the epidemic? Addressing these questions will allow the majority of investors to maintain confidence in the industry's growth at this particular stage.

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Currently, research on the post-epidemic Chinese aviation market is generally focused on the macro level. For example, at the very beginning of the outbreak, some scholars have calculated that on February 13, 2020, at the trough of the epidemic, there were only 3,931 civil aircraft movements, which was about 23% of the pre-epidemic level. But one segment of China's airline industry, the low-cost airline market, is not well studied. A big reason for this is that only one of China's low-cost airlines, Spring Airlines, has gone public, and operating data on other companies is hard to find. Although there is previous literature examining the operations and performance of Spring Airlines [1-3]. However, the epidemic had a great impact on the market of low-cost airlines and changed the previous performance level of Spring Airlines, and research papers on the performance of Spring Airlines after the epidemic are still in a gap. Therefore, studying Spring Airlines' business performance after the epidemic is important to understand the business logic of low-cost airlines through difficult times and to discover the industry highlights and shortcomings highlighted in the epidemic.

This paper examines Spring Airlines' operating conditions in the two years since the outbreak in terms of revenue, operating costs, and cash flow from operating activities, and explains the reasons for the changes in Spring Airlines' operating conditions from three perspectives: changes in passenger numbers, fluctuations in the company's operating costs, and policy support. I identified a mismatch between operating profit and the recovery rate of operating revenue, and thus found that fluctuations in aviation fuel had a significant impact on Spring Airlines' profit; I tracked the change in passenger numbers for 31 months out of Spring Airlines, further confirming the trend that the Chinese low-cost airline market is still expanding; the epidemic was also a rare opportunity to observe the impact of policies on low-cost airlines, and I found that the government's comprehensive and strong policies did help Spring Airlines survive the winter of the epidemic.

2. Literature Review

2.1 China's Airline Industry Performance since the Outbreak

It has been found that wars and pandemics in history had contribute to the vulnerability of the global aviation [4]. In fact, Covid-19 had made a massive knock-on effect on global business and travel and tourism, therefore, pro-longed travel restrictions caused significant financial losses for the airlines all of the world. Right before the Covid-19 breakout in Wuhan, during the Chinese Spring Festival travel season the daily flight number was about 17,000 country wide, about 2 million passengers were ferried daily. However, the number of flight kept decreasing after the Wuhan lock down on January 23rd, reaching the lowest point of 3,931 flights on February 13th, about 23% of the pre-pandemic level. During the pandemic, The State Council of China introduced policies and supporting schemes to help aviation sector reduce their costs. The number of passengers appears a significant recovery during 2020, at February 13th, passenger volume was 0.13 million or 7.5% of the pre-pandemic level, then average daily passenger volume increased to 0.46 million in March, 0.52 million in April, and 0.79 million in May, finally, On June 5th, daily passenger volume reached 1.04 million, about 61.5% of the level in 2019. Average load factor also increased to 70% [5]. Compared to most other countries, the aviation sector in China’s domestic services recovered much faster.

2.2 Current Status of Chinese Low-Cost Airlines

There are two fundamental strategies, the first is the differentiation strategy, which means offering a service at a high quality; the second option is cost leadership, which is based on strict cost savings over the whole of the value chain to offer customers a service at an economic price [6]. The LCCs mainly focus on the last strategy, they prefer create profits by saving input Since the operating costs of an aircraft are quite high [7], but the incremental costs of an additional passenger are very low, one

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of the main objectives of airlines is to achieve a high degree of capacity utilization [8]. uggage or meals and beverages during the flight separately, which can make customers choose and combine the ones corresponding to their personal preferences, which is a typical saving strategy [9,10]. For some low-cost airlines, the seperation mentioned above has already contributed more than one-quarter of total revenue and is steadily increasing [11]. low-cost airlines also do not offer any kind of loyalty program to save costs [12]. But the purpose of other airlines' operation of flyer programs is to retain passengers by offering the possibility to collect miles, which can be used to buy flights or profit from other benefits such as travel class upgrades or VIP lounge access [13]. People also consider that LCCs are doing well at controlling operation costs through using single model fleet and operating short-haul flights. During the initial developing period, LCCs always operate new routes to avoid the competition with FSAs or charter airlines.

Recently, LCCs changed its strategies in many aspects. An opinion polls show that the extremely high baggage fees resulted in high dissatisfaction of clients. So, significant change in pricing of low-cost airlines is the reduction of the immense charges for additional passengers, in order to decrease frustration among customers.

Low cost carriers (LCCs) remains underdeveloped in China, partly because various legacy regulation, especially those related to route entry into congested hub airports and the lack of competition in the input market [14]. Up to now there is only one LCC has gone public in China, which is Spring airlines, and existing researches about China's LCC mainly focus on Spring Airlines. Many researchers has assessed the performance of the Spring Airlines [1-3]. China has developed a mature high-speed rail (HSR)system, and thus the airlines in China face a frequent and fierce competition [15]

2.3 China's Low-Cost Airlines Recover after the Outbreak

Spring Airlines is the first low cost carriers (LCCs) of China, which established in Shanghai City in 2005. At the beginning of operation, Spring Airlines actively launched air routes between tourist cities with non-class I airports, and its network has been transformed from a star structure which concentrated in sector of Shanghai into a complex one with China wide multi-hubs. Before the Covid-19 breakout, Spring Airlines tends to enter larger airports and the time slot control airport, because the passenger of these airport are generally higher and Spring Airlines can benefit from low fares to get more passengers. Spring Airlines also prefer to enter the tourist city, which also indicate that the target passengers of Spring Airlines are mainly price-sensitive passengers. On the route, Spring Airlines expands the route based on the existing service airport in order to utilize the existing resources of the service airport, thereby reducing operating costs and improving economies of scale.

3. Methodology

This paper is a case study of the Spring Airline's business condition The date used in this paper are obtained from the Annual Report of Spring Airlines from 2015 to 2021.I collected the data from the items of The Statement of profit or loss and The statement of cash flows to analyse the change of critical financial indicators in time series in order to summary and predict the tendency of profit changes.

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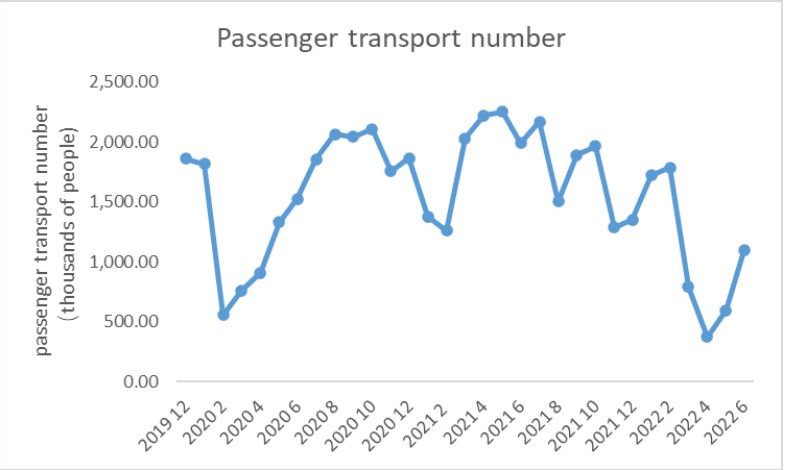


Figure 1: Change chart of spring airlines passenger transport numbers from December 2019 to June 2022.

I plotted the time series of changes in passenger numbers of Spring Airlines before and after the pandemic. As can be seen from the figure, since the outbreak of the Wuhan epidemic in February 2020, the number of Spring Airlines passengers has fluctuated very sharply with a very fast frequency. Since the bottom fell out in February, the tone of passenger numbers throughout the year has been one of recovery, and in August, the number of passengers reached 1,858.03 thousand, higher than the level before the epidemic, and for the next three consecutive months, the number of passengers continued to exceed the 2,000 thousand mark.

And the change in passenger numbers for the whole year 2021 seems unstable and elusive.

Then, the number of passengers of Spring Airlines in the first half of 2022 shows a typical "U" shape change.

Table 1: Key accounting data reflecting operating conditions and profitability.

	2019	2020	compared to 2019	2021	compared to 2019	compared to 2020
sales revenue	14,702,890,815	9,267,097,101	-36.97%	10,777,379,081	-26.70%	16.30%
operating profit	1,575,885,470	-726,766,827	-146.12%	-733,075,041	-146.52%	-0.87%
operating cash flow	1,934,032,259	323,445,688	-83.28%	2,175,614,946	12.49%	572.64%

I have summarized and compared key operating data for three years. In terms of revenues since the outbreak, although operating revenues have rebounded significantly in 2021, the magnitude is not at all sufficient to return to pre-epidemic levels. Profits were even less promising, with the 2021 figures not only not rebounding but also showing a very small decline; however, the company's operating cash flow situation was a surprise to the outside world, with cash flow in 2021 not only increasing nearly five-fold compared to 2020, but also showing a significant increase of more than ten percent over the pre-epidemic figures.

From the government website, I summarized the various policy incentives the government has adopted for the civil aviation industry since the outbreak of the pandemic in 2020 and I find that the range of bail-outs can be summed up in three broad categories. First, the full exemption of airlines

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should pay civil aviation development fund in 2020. Second, the implementation of airport, air traffic control, jet fuel pricing preferential policies. The third is to coordinate the Ministry of Finance to temporarily suspend the pre-payment of value-added tax by branches of aviation enterprises. From the perspective of results, I expressed the reasons for unit cost reduction in the annual report of Spring Airlines, and found that the government's rescue policy did greatly help budget airlines like Spring Airlines to reduce the operating pressure brought by the epidemic.

4. Result

The purpose of this paper is to examine the impact of the epidemic on the business, profitability and strategic choices of low-cost airlines, using Spring Airlines as a microcosm of low-cost airlines. I analyze and interpret Spring Airlines' business situation through three main modules. The first module is a study of passenger numbers, because passenger numbers are the fundamental source of all strategy, revenue, profit and cash for a low-cost airline like Spring Airlines, whose main business is passenger rather than cargo transportation. In the second part I delve into Spring Airlines' financial results. I compare the three main operating indicators and find a mismatch between the changes in operating revenue, operating profit and operating cash flow, especially the extremely pleasing growth in cash flow. Delving into the reasons for this, I can see how Spring Airlines' management has led the airline to break through the difficult circumstances and continue to grow in a bad environment. In the third part, I analyze the policy benefits for the airline industry. A series of strong policies can protect airlines through difficult times in terms of financing, cost savings, and deregulation, etc. The policy has undoubtedly played a big role in Spring Airlines' survival and development.

4.1 A Study of Passenger Numbers

Four consecutive months of higher than pre-epidemic passenger numbers starting in July 2020 reflect the tremendous growth power of China's low-cost airline market. According to the Asia Pacific Aviation Center, China's low-cost airlines will account for 11.1% of the domestic airline market share in 2020, up 1 percentage point from 2019. The number of low-cost airlines is still relatively small in terms of both number and market share, however, the increase in market share during the epidemic shows a rigid trend of structural and differentiated market demand. However, the increase in market share during the epidemic shows the rigid trend of market structure and differentiated demand. And another record ridership in April and May 2021 reaffirms this trend.

However, the recurrence of the outbreak in China has significantly affected the potential upward trend of passengers, as shown by the fact that in the summer of 2021, which is also the traditional peak season of the airline industry, the number of passengers reached a new high in July, but in August the recovery of passengers was hampered by the recurrence of the outbreak in the country due to the emergence of the Delta and Omicron mutant strains.

However, the recurrence of the outbreak in China has significantly affected the potential upward trend of passengers, as shown by the fact that in the summer of 2021, which is also the traditional peak season of the airline industry, the number of passengers reached a new high in July, but in August the recovery of passengers was hampered by the recurrence of the outbreak in the country due to the emergence of the Delta and Omicron mutant strains. The logic behind the "U" shaped trend in passenger numbers in 2022 is also very simple. The sharp decline in passenger numbers is due to the forced closure of Shanghai, Spring Airlines' main operating city, due to the epidemic, and the rise in passenger numbers is also due to the relaxed control of the epidemic, which has led to a significant rise in passenger numbers in the short term. In conclusion, in the long run, China's low-cost airlines can enjoy passenger dividends for a certain period of time due to the development of the market, so the revenue and profit of low-cost airlines still have a lot of upside in the future, but in the short term,

DOI: 10.54254/2754-1169/17/20231128

the recurring epidemic threatens the survival and safety of these companies, and the future of low-cost airlines will be very bright as long as they survive the current business crisis.

Although I start with the expansion of the low-cost airline market and find that expansion exists and predicts that it will continue in the future, this conclusion still has the limitation that I currently only have data for two and a half years after the epidemic, a short time span, and I do not know the exact extent of the impact of the epidemic on market expansion. I still need to monitor ridership in the future before I can model post-epidemic market growth.

4.2 Spring Airlines' Financial Results

The decline in Spring Airlines' main business revenue in 2020 was mainly due to the significant decrease in passenger numbers caused by the epidemic. Although Spring Airlines, like many airline companies, converted some of its passenger aircraft to freighters during the epidemic and did see an increase in revenue from cargo, due to the excessive share of the passenger segment in the total operating income and the freight business accounting for only 1.61% of the total business, the passenger business decreased by 37.19%,or ¥5,340,254,419.10, compared to 2019, while the freight business rose by 19.89%, or ¥24,545,573.28, with the former rising by 218 times the amount of the latter's decline. Such a decline for low-cost airlines is inescapable, because the operating model of such companies is to focus on passenger transport, the expansion of other business lines to a certain level for such companies is contrary to their cost-saving corporate strategy. The logic behind Spring Airlines' revenue growth in 2021 is equally simple: the recovery of passengers driven by the improvement of the epidemic will lead to a rise in revenue

I can split the change in profit into the change in revenue and the change in cost, and since revenue has been analyzed in the previous paragraph, I will focus on the analysis of cost. The reduction in the company's operating costs in 2020 can be interpreted in three ways. The first is the decline in the number of flights leading to a series of variable costs; the second is the significant reduction in costs due to the plunge in international oil prices; and the third is the government's exemption from the Civil Aviation Development Fund payable by airlines. The fluctuation of international oil prices is the main reason for the change in costs in the two years of the epidemic, where in 2020, the costs reduced by the decrease in oil prices account for 59.75 of the total cost savings; while in 2021, the impact of oil prices is more pronounced, with the increase in costs due to the increase in oil prices accounting for 70.54% of the total increase. From this I can see that the revenue level in 2021 is higher than in 2019, but the profit is an opposite result, the key reason is that the higher oil price pushes up the cost and thus reduces the profit. In addition, policy support does provide a great deal of support for airlines to reduce costs and stabilize profits. In 2020, the reduction in costs due to the exemption of airlines from the Civil Aviation Development Fund (CADF) payable by airlines accounted for 17.76% of the total cost savings; while the removal of the exemption in 2021 also contributed 8.60% of the cost increase, which not only further illustrates the mismatch between profit and turnover growth in 2021, but also confirms that the policy is very strong. The logic of cash flow recovery is also simple, that is, the recovery of the pandemic drives the improvement of liquidity position.

The data I obtain in this section comes from Spring Airlines' financial statements, but the financial statements naturally have unrefined parts, such as our inability to break out what the company's revenue from each business is from operating income, and changes in the company's pricing strategy, all of which prevent us from conducting a more in-depth study of operating results.

DOI: 10.54254/2754-1169/17/20231128

4.3 Policy Analysis

The Chinese government has also played a big role in supporting the airline industry through difficult times. The achievements of the policy are as follows: 1. In 2020, the civil aviation development fund payable by exempted airlines exceeded 5 billion yuan. 2. The preferential price policy of airport, air traffic control and jet fuel has reduced the operating cost of the airline by 3.6 billion yuan within two years. 3. The Ministry of Finance extended the exemption policy of aviation equipment and expanded the exemption. The Chinese government's assistance to the aviation industry is comprehensive. On the operational side, such as reducing aviation fuel fees; on the financing side, eligible airlines are encouraged to issue corporate credit-type bonds; and in the face of the cash flow problems commonly faced by airlines due to the epidemic, airlines are allowed to apply for subsidies from local governments for epidemic prevention and control expenses. These policies are so strong and refined, and combined with the key role of the policies in reducing costs and stabilizing profits for Spring Airlines, as I discussed in the previous paragraph, I can see that the policies are indeed the key reason why China did not see a massive wave of airline industry closures after the epidemic. There is a certain inherent flaw in this part of the study that the relevant statistical departments only publish some of the actual effects of the policies, and I are unable to interpret the full range of the implementation efforts and effects of the policies.

5. Conclusions

The purpose of this study is to investigate the change in operating revenue of Spring Airlines, a representative low-cost airline in China, after the outbreak and the reasons for the change. I explore the changes in Spring Airlines' operations after the outbreak based on quantitative research, mainly a comparative analysis of three-year data; I apply a combination of quantitative and qualitative analysis to analyze the reasons behind the changes in operations, I plot a time series of changes in passenger numbers, and I summarize the government's relief policies for the airline industry by category from government websites. This study finds that after the epidemic, comparing the data in 2020 with 2021, operating income and operating cash flow both rebounded significantly, especially the latter even exceeded the pre-epidemic level, the main reason for the rise of these two figures is the rise in passenger numbers, and such a rise comes not only from the weakening of closure control measures, but also from the strong growth potential of the low-cost airline market; however, operating profit is not However, operating profit was not as satisfactory, mainly due to the rebound in aviation fuel prices in 2021 after bottoming out in 2020, which led to cost expansion and profit compression; policies also played an important role in helping airlines to tide over the difficult times, and this role was mainly reflected in the significant reduction of airline costs.

However, this study also has limitations. Due to the limited access to financial information and the fact that the study covers only two years of the impact of the epidemic, which is relatively short for a study, I were unable to distill the long-term trend in passenger growth after the epidemic and I were unable to explain the reasons for such a large difference in the multiples of cash flow and profit growth. I recommend that subsequent studies continue to track changes in passenger numbers and look more closely at the operations of low-cost airlines such as Spring Airlines from a cash flow perspective.

This study inherits the pre-epidemic scholars' research on the performance of the low-cost airline industry and Spring Airlines, and fills the gap in the post-epidemic research on the development status of the low-cost airline industry and Spring Airlines' collection of the epidemic impact. In addition, due to the all-round strength of the bailout policy at this particular node of the epidemic, it is now more appropriate than ever to study the role of the policy on the development of the industry.

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Therefore, studying the policy and the effect of the policy in these two years can show how big the actual impact of the policy on the enterprises and the industry is.

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Analysis and Suggestions on "Crude Oil Treasure" Event

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Abstract: Since the global COVID-19 has broken out, the international crude oil market has been turbulent and crude oil prices have hit new lows. In April 2020, the Bank of China (BOC) "Crude Oil Treasure" May 2020 contract product caused 9 billion losses. The paper discusses the case of BOC 's "Crude Oil Treasure" and it is divided into the following three parts. First, we sort out the background and process of the BOC 's "Crude Oil Treasure" and expound the operation principles of the product. Furthermore, we analyze in detail the reasons why the failure occurred. At first, we summarize the external factors under the background of the COVID-19. Then, we discuss the internal reasons for the occurrence of cross-position events. From two perspectives of product design and risk control, we try to analyze the inadequacies of Bank of China in this case. Finally, we combine the above-mentioned reason analysis and give suggestions on how to prevent such incidents from happening again from both the perspectives of both banks and investors.

Keywords: reasons of product formation, problems in product design, suggestions for the bank

1. Introduction

1.1. Overview of the "Crude Oil Treasure"

In January 2018, the Bank of China (BOC) launched the "Crude Oil Treasure" product for individual domestic customers. This product is based on the crude oil futures price in the international market, where the customers may buy the crude oil, with the price being based on the WTI crude oil futures contract and Brent crude oil futures contract.

According to the product introduction published on the official website of the BOC, although the quotation of "Crude Oil Treasure" is linked to the price of WTI crude oil futures, it is quite different from the international WTI crude oil futures trading mechanism.

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First, the minimum transaction quantity of "Crude Oil Treasure" is only 1 barrel, (versus WTI futures 1,000 barrels), meaning that investors of BOC 's "Crude Oil Treasure" could start investing the product with 500 yuan.

Second, BOC 's "Crude Oil Treasure" requires a 100% margin, while WTI crude futures contract requires a 10% initial margin and does not require full capital deposits to hold the contract. The former has no leverage, while the latter has leverage. Leverage refers to the use of debt or borrowed funds to amplify returns from an investment or project [1]. For instance, without leverage, you can buy $100 of goods with $100 of capital. Suppose there is 20 times leverage, which means that your $100 capital can leverage $2,000 in goods. In essence, the unleveraged transaction of "Crude Oil Treasure" should be of the nature of wealth management, not futures, and there should not be a phenomenon that requires customers to repay money [2].

Third, most investors in China are speculators, without ability to hold physical commodities. On the one hand, "Crude Oil Treasure" is very attractive to investors due to its low threshold for trading. Thus, "Crude Oil Treasure" is also known as paper crude oil business. On the other, the product is also very attractive to BOC, because it can use the margin spread as interest free deposit and increase its lending business.

Investors of "Crude Oil Treasure" do not directly participate in the trading of crude oil futures in the international market; their product is linked to the international crude oil futures price. To buy the product, customers log in the system of Bank of China, open a personal "Crude Oil Treasure" account, deposit a sufficient margin to realize a two-way selection of long and short crude oil trading tools. As market makers, BOC needs to hedge by maintaining a trading account on the CME exchange. Thus, "Crude Oil Treasure" trading area is divided into internal and external parts.

Internal trading is the onshore trading between individual investors and Chinese banks. As the transaction object of individual customers, the bank is the counter-party relationship between the two sides. The bank quotes investors based on the CME 's futures contracts, combined with the daily central parity rate of the yuan against the dollar. BOC sets the offer price and bid price of "Crude Oil Treasure" products and investors can choose their own long and short positions. The transaction details between clients and banks of "Crude Oil Treasure" are automatically generated through the internal trading system. The transaction involves only both parties, and do not include the transaction settlement between banks and CME. In fact, the internal trading is a virtual trading, investors simulate investment in crude oil futures, the actual investment is done by BOC and CME in the external trading.

External trading is the trading between BOC and CME in the overseas crude oil futures market. After receiving investors' trading orders in the internal market, the bank shall summarize and calculate them daily, and carry out several operations in the external futures exchange to hedge position risks and provide liquidity for the market. If the customer buys long crude oil futures, the bank sells crude oil futures on the outside market; Instead, if client buys short crude futures, the bank buys crude oil futures on the outside market. BOC acts as market makers, whose income comes from fees and do not earn profits from market rises and falls.

1.2. Process and Result of the Case

Due to the interference of external factors such as the COVID-19 epidemic and the decrease of crude oil production reduction negotiations, crude oil prices in the international market changed greatly. CME Group revised its trading rules in 2020 for the first time on April 3 (local time), allowing crude oil futures to trade negatively from April 5 (local time).

As shown in Figure 1, on April 20, WTI crude oil futures went negative for the first time since its listing, falling to minus $40.32 USD per barrel. After the closing bell on the final settlement day, CME announced that it would settle the WTI crude oil futures May contract at minus $37.63 USD

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/barrel. The price of minus $37.63 is the average price in three minutes before settlement. The purpose is to prevent price manipulation.

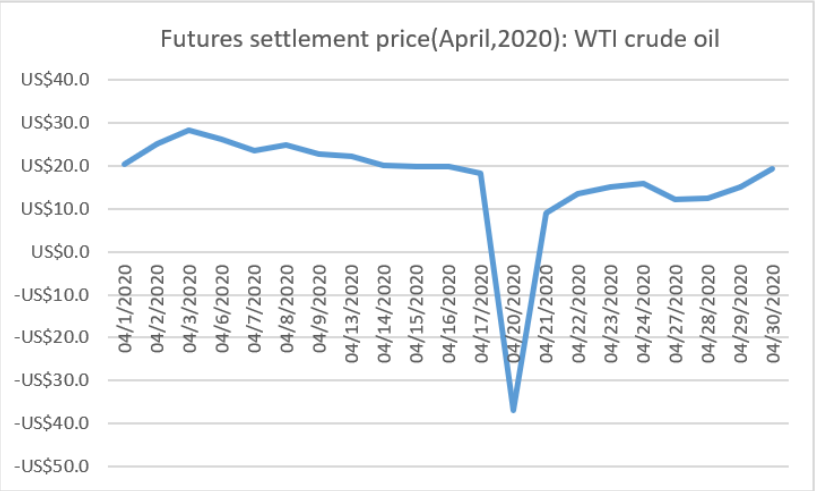


Figure 1: Futures settlement price: WTI crude oil (unit:$/barrel) [3].

More specifically, from April 16 to 20, BOC issued price changes alerts to "Crude Oil Treasure" investors online. The WTI May contract fell sharply in the days leading up to delivery, plunging into negative trading on April 20, closing at minus $37.63 a barrel; At 7 p.m. Beijing time on April 20, the price of WTI crude May contract began the first wave of collapse, falling to $11 per barrel; At 10 p.m. Beijing time, BOC stopped the trading of "Crude Oil Treasure" due to its own rules; In the early hours of April 21 Beijing time, the May WTI crude oil contract fell for the second time, from around $11 per barrel to $0 per barrel. At 2 a.m. Beijing time, the third wave of decline began, from around $0 per barrel quickly to minus $40.32 per barrel, before recovering slightly to close at minus $37.63 per barrel [4].



Figure 2: Timeline of the issue (Beijing Time).

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On April 21, BOC stopped the trading of "Crude Oil Treasure" for a day; On the morning of April 22, BOC suspended the trading of new "Crude Oil Treasure" products, Repetitive announcing that the settlement price of "Crude Oil Treasure" May contract was minus $37.63 per barrel, and long investors faced huge losses. On the evening of the same day, BOC explained the business situation of "Crude Oil Treasure" to investors. First, "Crude Oil Treasure" is not a leveraged transaction. Second, BOC announced the contract settlement price. Third, BOC announced plan for forced liquidation [5]. On April 24, under public opinion and regulatory pressure, BOC again stated that it would strictly inspect product design, comprehensively control risk operations, and offer to bear corresponding legal responsibilities. However, BOC still insisted that "Crude Oil Treasure" customers pay for product losses; With the continuous fermentation of the crude oil treasure incident, under the pressure of the public, on May 11, 2020, BOC finally issued an agreement, stating that the loss of negative oil prices shall be borne by the BOC, and the money deducted from the deposit after the event will be returned, and the principal will be refunded 20%; In December 2020, the China Banking and Insurance Regulatory Commission fined BOC and its branches a total of 50.5 million yuan in response to the "Crude Oil Treasure" incident, and took corresponding regulatory measures to BOC.

2. Cause Analysis

2.1. Shifting of Trading Rules in CME

The announcement pointed out that if the WTI crude oil futures contract settlement price for any month falls to $8-11 per barrel, CME Clearing may replace the existing pricing model with the Bachelier model (*On April 8 2020, the CME Group posted the note CME Clearing Plan to Address the Potential of a Negative Underlying in Certain Energy Options Contracts, saying that after a threshold on price, it would change its standard energy options model from one based on Geometric Brownian Motion and the Black–Scholes model to the Bachelier model. On April 20, 2020, oil futures reached negative values for the first time in history, where Bachelier model took an important role in option pricing and risk management. The implied volatility under the Bachelier model can be obtained by an accurate numerical approximation*), which could allow negative prices. On April 15, CME continued to issue an announcement stating that recent market events have increased the likelihood that certain NYMEX energy futures contracts may be traded at negative or zero trading prices. If this occurs, all CME trading and clearing systems will continue to work as usual [1] [4] [6].

2.2. Problems in the Design of BOC's "Crude Oil Treasure"

2.2.1. Problems in Product Promotion

Before the "Crude Oil Treasure" product was released, China's gold and silver futures markets were relatively mature. In late 2004, Bank of China launched the personal gold investment business, the "Gold Treasure", a paper gold trading product. Other commercial banks have also successively launched similar products in following years. Data show that from 2015 to 2021, the total turnover of China's gold futures has exceeded 77.9 trillion yuan. It can be seen that the gold and other precious metal futures markets have had huge trading volumes after years of development, with the rules and systems in all aspects being relatively complete.

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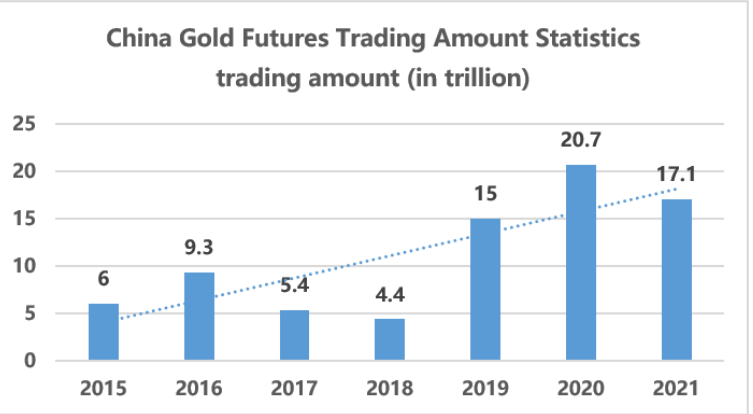


Figure 3: Yearbook of Gold in China, 2021.

Therefore, Bank of China launched crude oil treasure products in 2018, based on the previous experience of paper gold and paper silver transactions and the long-term participation of consumers. Bank of China may have overestimated the traders' understanding of such financial products, thus misjudging the risk of the product. It should be pointed out that the difference between Crude Oil Treasure and the precious metal futures trading is the presence of storage risk of crude oil. Although most products such as paper gold in China cannot be physically delivered, most banks still have the ability to store gold in their vaults. For crude oil products, only some large oil depots can be stored. Therefore, the trading risk of crude oil treasure itself is much greater.

Furthermore, in the "Crude Oil Treasure" products, the trading methods include over-the-counter trading, online banking and mobile banking, with convenient operation methods and low entry barriers. This makes it easy for investors without the relevant expertise to trade, thereby misjudging the risk. In the United States, however, relevant futures trading requires basic knowledge of stock index futures and passing relevant tests. At the same time, one must have more than 20 simulated transaction records of stock index futures for 10 trading days, or more than 10 transaction records of commodity futures in the past 3 years. In fact, compared with trading products such as paper gold, the threshold for Crude Oil Treasure is relatively low. For example, in gold futures, the underlying index of the contract is the CSI 300 index, and the contract value is 300 yuan per point. That is to say, if each contract is 1.7 million yuan, the minimum margin is 170,000 yuan. This is a high requirement for individual investors. In the "Crude Oil Treasure" product, investors could invest as little as $73 to buy only one barrel of oil. In this contrast, the number of investors for "Crude Oil Treasure" products has increased significantly, laying the uncertainties for subsequent events.

2.2.2. Time Difference in Domestic and Foreign Trading Markets

At 10:00 p.m. on April 20, the "Crude Oil Treasure" product stopped trading in China while the trading in the U.S. WTI crude oil futures market continued. For the WTI crude oil futures May 2020 contract, it was in the morning of April 20 local time when most domestic investors were banned from trading at 10 p.m. on April 20. At this time, the May 2020 contract price of WTI crude oil futures linked to this product had dropped to $11/barrel. According to the agreement signed by Bank of China and investors, the bank needs to settle after 10:00 pm. The closing time of crude oil futures market trading was 2:30 am of the next day, and the Bank of China did not directly liquidate.

The Bank of China's explanation for this was that the time when the crude oil price fell to 20% was outside the tradable time range and did not fit the initially set trading hours. Therefore, based on this standard, Bank of China did not immediately take liquidation measures.

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After 10:00 pm, the price of WTI crude oil futures fell all the way. Even after 2:00 am of the next day, it fell into negative price for the first time, and the lowest fell to more than $-40/ barrel.

Besides, investors were banned from trading. Faced with the falling prices of WTI crude oil futures, they could do nothing. As a wealth management product advertised by the BOC, although“Crude Oil Treasure”is linked to the international crude oil futures price, the time difference between the two countries should be considered when the product is launched. The position of “Crude Oil Treasure” was locked at 10:00 pm while the settlement price time of WTI crude oil futures was 2:30 am of the next day. And most investors were unable to make timely adjustments to the changes of market. Unluckily, it is obvious that the daily price of futures market can make huge fluctuations. Unluckily, during the time difference of these four hours, it was highly possible for the investors to undertake the great loss if they cannot respond to the market quickly.

2.2.3. Liquidity Risk of Products on Delivery Date

According to the instructions of *Fact Sheet on "Crude Oil Treasure”* by the Bank of China [5], "Crude Oil Treasure" is linked to the price of the U.S. WTI crude oil futures contract. With reference to the official settlement price of CME, the position would be roll over or liquidate on the day before the last trading day. The delivery date of the WTI crude oil futures May 2020 contract in the international market was April 21, so the position transfer date for the May contract of “Crude Oil Treasure” was April 20. According to the normal operation of the market, the bank would need to liquidate the WTI crude oil futures May 2020 contract, which were still held in the hand on the rollover date. After that, the bank would set up a position to buy the next WTI crude oil futures June 2020 contract. Thus, on April 20, the trading volume was quite small. Unless the counter-party was given a satisfactory price, it would be difficult for the Bank of China to achieve all normal liquidation on the day.

Generally speaking, it needs to take basic consideration of product liquidity factors in the time selection of inter-period rollover date. When the number of contracts in hand is appropriate and does not affect the transaction price, futures investors will choose a suitable time to roll over futures position with the aim of reducing cost to a minimum. Therefore, experienced investors rarely wait until a few days before the actual delivery, they will roll over or liquidate when the current number of futures contracts is the most active. However, according to the "Crude Oil Treasure" trading agreement signed by Bank of China and investors, the product relocation and month-to-month operation will be carried out on the day before the last trading day of the corresponding crude oil futures, with smaller trading volume and fewer counterparties.

The setting of "Crude Oil Treasure" to move positions on the day before the delivery date does not fully consider the liquidity risk of the market. It is unreasonable for the investors who do not actively participate in the delivery. In the circumstance of extremely poor liquidity, transaction prices are often pushed down. More importantly, if the position cannot roll over before the delivery date, it will face to the physical delivery. And there is no doubt that the launch of "Crude Oil Treasure" is not for the purpose of physical delivery.

Compared to the China Construction Bank as well as the Industrial and Commercial Bank of China, which also develop paper crude oil products, they have considered relatively comprehensive on the issue of liquidity risk on the product delivery date. As shown in the table 1 below, Bank of China, China Construction Bank, the Industrial and Commercial Bank of China are the three largest banks in domestic paper crude oil trading volume. They have similar design methods for paper crude oil products, but there are still some key differences.

DOI: 10.54254/2754-1169/17/20231129

Table 1: The introductions of design about Paper Crude Oil in BOC, CCB and ICBC.

	BOC	CCB	ICBC
Launch time of the product	2018	2015	2013
Rollover date	One day before the final settlement date	Five days before the final settlement date	Five-seven days before the final settlement date
Time to adjust	Freeze from 10pm to 8am on the next day	Freeze from 12pm to 9am on the next day	Freeze from 12pm to 9am on the next day
Forced liquidation rules	Early warning when the margin is less than 50%, and forced liquidation when it is less than 20%	Early warning when the margin is less than 60%, and forced liquidation when it is less than 50%	Early warning when the margin is less than 50%, and forced liquidation when it is less than 20%

As can be seen from the Table 1, for the WTI crude oil futures May 2020 contract, April 14 was the date of rolling over the futures position. Both ICBC and CCB had completed the contract in advance from April 14 to 15 (5 working days in advance), by rolling over or liquidation. On the other hand, BOC had not roll over until April 20. Therefore, it was inevitable to encounter irrational liquidity risks when the rollover date was approaching the delivery date, as the open interest had reduced so that it was not easy to finish the May contracts. This kind of transaction pattern sometimes even give short sellers an opportunity.

Since investors cannot operate on the system after ten o'clock, Bank of China set up the system program to operate automatically based on consideration of cost and benefit. However, if there is no corresponding counterparty in the market at the time, the automation will trade at a lower price. It will seriously be harmful to the interests of customers. Besides, it also shows that there are drawbacks in this automated procedure, which is lack of intelligence and failure to take the most reasonable measures when the risks arise.

In this incident, Bank of China failed to balance the relationship between risk and return and paid more attention to attracting customers to increase the bank's profitability while ignoring issues such as transaction time difference, rollover date and the risk of liquidity. It is not advisable to compromise long-term strategic goals and the company's reputation for the sake of short-term performance.

2.3. Problems in the BOC ’s Management of Risk

2.3.1. Unreasonable Determination of the Risk Level

Most investors do not have much trading experience, and they believe that products sold by futures companies have higher risks, while financial products purchased through banks would have relatively lower risks. When Bank of China promotes "Crude Oil Treasure", it is classified as a balanced wealth management product, and all kinds of investors can participate. The operating principle of "Crude Oil Treasure" is similar to that of futures contract trading. But due to the lack of risk hedging design, it should be classified as high-risk product.

However, after "Crude Oil Treasure" was defined as a wealth management product by the Bank of China, investors mistakenly thought it was a low-risk product because of the lack of professional information and experience in futures trading [4,7].

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2.3.2. Lack of Risk Judgment

When CME announced that futures prices could be negative, Bank of China did not take corresponding urgent measures. Since the Bank of China did not roll over contracts earlier, there was a time lag between the time when BOC ended trading at 10PM and the delivery date of the product, which provided conditions for large losses. According to Bank of China Co., Ltd. Personal Account Commodity Business Transaction Agreement", it only reminds investors of the possibility of losing the primary principal, but it does not mention the loss of extra funds other than the principal. At the same time, the minimum margin requirement for forced liquidation is set at 20% in the agreement. The bank's statement is that when the margin adequacy ratio of the margin account falls below the minimum ratio of 20% (inclusive) specified by our bank, the system will follow the principle of "single loss ratio in descending order". Open contract products will be forced to liquidate one by one until the margin adequacy ratio rises to more than 20%. This gives investors the information that bank is able to monitor the margin adequacy ratio at any time. However, on April 20, the bank closed personal transactions at 10:00 pm, and investors could not close their positions on their own. At this time, the reminder of the margin adequacy ratio lost its effect.

2.3.3. Information Gap Between Investors and Bank of China

According to the self-definition of Bank of China, it provides quotations and risk management for clients in “crude oil treasure” product. However, according to the rules and requirements of CME, a market maker is the customer who is authorized to quote buyers and sellers in a given market, and its main function is to provide liquidity to the market. Bank of China is not in the CME ’s market maker directory, while its wholly-owned subsidiary BOCI Commodities Futures (USA) LLC (BOCI) is one of the directories. It can be figured out that Bank of China is not a market maker of CME but at the same time provides investors with a virtual trading platform, and then, through its subsidiary BOCI to hedge its net position as a counter-party in the "Crude Oil Treasure" product. Therefore, investors cannot directly affect the settlement price, with investment behavior aggregated in the Bank of China and netted, but the result of the final offset between longs and shorts is calculated and traded on CME. This also makes it impossible for investors to close or move positions by themselves when the delivery is approaching.

2.3.4. Increasing Risks Caused by TAS Trade Mechanism

According to CME data, the wholly-owned subsidiary of Bank of China used the Trade At Settlement (TAS) mechanism at the time of delivery, which allows the use of settlement price to trade at any time of the day without knowing the settlement price. According to CME, the delivery settlement price is the settlement price of the last trading day, while the settlement price of the last trading day is calculated according to the weighted average price of transactions from 14:28 to 14:30 in New York time. While this mechanism avoids transaction congestion, it increases the possibility of settlement prices being manipulated. Under normal circumstances, price manipulation is difficult due to the sheer volume of daily transactions. Even in the last three minutes of the trading day, the number of transactions is still large enough to prevent manipulations. When the futures contract is about to expire, however, most shorts and longs will choose to close their positions in advance and switch to trading in the next month's contract. This leads to a significant reduction in the number of traders in the current month's futures contract so that the price will be more easily manipulated. In the case of Crude Oil Treasure, it is convenient and effective to use the TAS trading mechanism under normal circumstances. Because whether long or short profit, the bank does not bear the loss. This is also the normal process performed by the operator after the investor's trading was closed at 10:00 p.m. on that

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day. However, due to the already mentioned factors: negative futures prices, fewer traders, etc., futures prices were easily manipulated in the last few minutes, resulting in huge losses [8,9].

3. Suggestions

Under the influence of COVID-19, the uncertainty in the market has increased and the volatility in the international financial markets has become even more dramatic. People's demand for crude oil shrank and the difficulty of storing it increased as the space for storage became smaller and smaller. In such an environment, customers who bought Crude Oil Treasure suffered huge losses. Since Crude Oil Treasure was a product launched by a bank, this incident hit the bank very hard. The following are suggestions for commercial banks in the Crude Oil Treasure incident as well as countermeasures [10].

3.1. For the BOC

3.1.1. Strengthen the Monitoring of Market Risks as Well as Early Warning

Before launching financial products, banks should fully anticipate all kinds of market risks and extreme situations that may occur. They should have high risk identification and handling ability to improve the risk control ability of such products. For financial products linked to foreign assets and not limited to such financial products, banks should always pay attention to the changes in international financial markets. In the case of Crude Oil, the CME's revised trading system announcement that allowed futures prices to appear as negative numbers was a clear warning sign. Banks should be sensitive to such information and inform investors in a timely manner.

3.1.2. Rational Design of Financial Derivative Products and Attention to Their Liquidity

Crude Oil Treasure is linked to international crude oil futures contracts, and the returns of such products are highly correlated with the price of the underlying asset. CME has introduced the volatility of its crude oil futures contracts under the influence of macroeconomic, pipeline and weather conditions. Banks should design their products with a clear understanding and assessment of the risks, market developments and trading rules of the underlying asset to which the product is linked, and use this to develop the rules of the product. In the case of Crude Oil, the bank should consider the demand for crude oil and liquidity to determine how to reduce losses for customers in the face of unforeseen circumstances and severe negative shocks.

3.1.3. Reasonable Rules and Risk Assessment

After knowing the estimated risks and response strategies of financial products, banks should formulate reasonable trading rules and agreement terms to protect the interests of investors. When marketing to customers, they should be fully informed of the potential risks of the products and the specific circumstances. It is important to determine whether the risk of the product matches the investor's ability to bear it, and investors who meet the conditions should be given timely risk warnings and information about changes in the risk of the product.

3.2. For the Investors

In addition to the bank's supervision and risk control of the product, investors should also have the appropriate investment cognition:

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3.2.1. Avoid Blind Investment, Improve Risk Prevention Ability and Awareness

Investors should have a certain degree of knowledge about the products they invest in, blind speculation is not sensible. Investors should always pay attention to the market dynamics of the products they invest in, and should pay more attention to the risks of product trading, to improve risk prevention awareness to deal with extreme or unexpected situations.

3.2.2. Having Relevant Investment Knowledge and Experience

In the case of Crude Oil, the investors who did not understand the operation principle of the product, blindly followed the trend of investment but ignored the risks of the product and suffered huge losses should give a warning to most of the clients that ordinary investors without certain professional knowledge are not suitable to invest in complex financial derivative products. Investors should have a certain level of financial knowledge and investment experience in order not to blindly believe in the "speculative behavior" of the institutions selling the products. Investors should have their own investment logic. They should have a plan for when to buy and sell the product, how much to buy and sell, and how much they can afford to lose. In order to avoid losses, investors must know the trading rules of the product and the potential risks.

3.2.3. Facing the Loss of Investment Correctly

Due to the lack of professional knowledge and awareness of risk prevention, most investors are unable to accept large losses. When making investments, it is important to set acceptable loss thresholds for yourself and exit promptly when expectations are exceeded. Investors should also be conscious of the fact that the higher the return, the higher the risk, and face losses rationally when investing

4. Conclusion

To conclude, this article mainly discusses the event of the “Crude Oil Treasure” of Bank of China with its background and development. This event caused serious negative results and some causes are analyzed. This includes the shift of rules in CME, problems in product design together with BOC’s inappropriate risk management. thus we give advice for both the Bank of China and investors. The bank should strengthen the monitoring of market risks and develop the derivative product more rational. For investors, it is suggested to avoid blind investment and equip themselves with relevant knowledge fitted for investment.

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Game Analysis on the Problem of the Pollutant Emissions in Chinese Neighboring Province

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Abstract: With the continuous development of Chinese economy, the accompanying environmental problems have become a matter of great concern. Due to the spatial connection of neighboring provinces in China, pollution from one province can easily be discharged into the jurisdiction of the other province, which will inevitably cause interest damage of the later province. China's provincial governments have limited jurisdictional areas, the game exists between different provincial governments due to different interest demands. This paper analyzed the conflict of interests between local governments in Chinese neighboring provinces due to the emission problem, constructed a game model, analyzed the impact of the cost of pollutant treatment and economic compensation for pollutants on the emission decision made by neighboring provincial governments, and propose reference suggestions for Chinese neighboring provincial governments to deal with the pollution emission problem by combining the results of game analysis. The results of the study show that the two sides of the game can reach a synthetic win-win decision when the right to discharge is clear.

Keywords: cross-region, environmental regulation, government cooperation, game theory

1. Introduction

The development of the industrial economy has led to increasingly severe environmental problems and a series of environmental pollution problems were caused by factory emissions. The protection of the environment is related to the sustainable development of the economy and will have a profound impact on future generations. China's decentralization reform and the competition among Chinese provincial governments to promote local development together with the negative externalizations of the environment itself as a public good will lead to a "market failure" in which the market cannot allocate resources efficiently, resulting in a fragile horizontal relationship among local governments. Local governments in China focus on immediate short-term interests, and in order to seek near-term development and enhance their own development, there are different interests among local governments, so the cooperation of horizontal local governments is weak [1]. If one government discharges pollution into the jurisdiction of the other government, there will be a game between the two governments regarding the environmental discharge [2]. In cross-regional cooperation, local governments always adopt the speculative behavior of free-riding due to rationality and information asymmetry, leading to the final "prisoner's dilemma", ignoring the collective rationality[3].In this paper, the decisions made by neighboring provincial governments in China based on their own interests are mod-

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eled to analyze the corresponding decisions made by local governments under the condition of maximizing the interests of their own provinces, and based on this condition, reference suggestions are made to better solve the pollution emission problems between neighboring provinces.

2. Literature Review

2.1. Existing Research on Local Government Cooperation in Cross-Area Environmental Governance

Environmental problems cannot be solved by one local government independently and effectively. Cross-administrative environmental governance is a category of regional public goods and public affairs. Regional public goods need to be jointly provided by two or more local governments, and their consumption will generally spill out of their territorial boundaries, and other administrative regions will benefit or suffer as a result. Therefore, cross-administrative environmental governance, as a public pond resource, is characterized by both non-exclusivity and competition [4]. Environmental resources within a fixed area are limited, and when one user uses a portion of the resources, the available resources for other users are reduced. The polluting province pollutes the environment of the receiving province, and the resources of the polluted area are occupied by the polluting area, and the resources available to it are thus reduced, and its own interests will be damaged as a result.

The interaction between the two sides of the game can be either betrayal or cooperation. In the case of local government relations, the inter-regional environmental governance is also characterized by either conflict or coordination. Conflict, in the case of limited allocation of environmental resources, means that if each local government believes that other local governments will take care of pollution, they can discharge pollution from their own region to other regions and let other governments take care of it for them. Coordination means that the local governments can communicate and reach an agreement to deal with the regional environmental pollution problem together. In cross-regional environmental management, local governments are reluctant to invest high costs in environmental pollution due to information asymmetry and opportunistic considerations for their own interests [5].

The further development of fiscal decentralization has made local governments as independent interest subjects, and in the current economic performance appraisal system, GDP is very important, because of the high cost and long payback period of environmental pollution treatment, and has a great negative impact on the development of pollution-intensive industries, and has a certain inhibitory effect on economic growth, so local governments mostly prefer to choose to reduce the investment in environmental treatment and choose rapid Therefore, most local governments prefer to reduce investment in environmental management and choose rapid economic development to meet the performance aspirations of local officials. The lack of effective constraints among local governments often leads to speculation [6]. The administrative district administrative model has cut the common interest structure among local governments and presented the independent local interest situation. "The pursuit of self-interest, especially direct economic interest, has become a fundamental motivation for local governments' behavioral choices [7]. The main manifestations are the differences in regional environmental governance goals of local governments, the differences in local governments' perceptions of collaboration, and the asymmetric information and insufficient trust in environmental governance among local governments. Uneven economic development leads to differences in environmental governance goals among local governments in the region, which is reflected in the differences in environmental governance capital investment and environmental management efforts among local governments. In actual pollution control, local governments still take local economic development as their main priority, and each of them will be willing to transfer pollution to other regions as long as the pollution does not occur in their own regions. In cross-regional environmental governance,

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the trust between local governments is greatly reduced due to differences in the perceived benefits and costs of collaboration and the impact of information asymmetry, and the lack of trust also affects the sustainable development of local government collaboration [6].

2.2. Existing Analysis of the Game of Economic Compensation Arising from Environmental Pollution

Many studies of games are based on an optimization basis, in which they assume that the marginal benefits and marginal costs of pollution control are known, proving that full cooperation should be the optimal solution in terms of the overall welfare of the big picture. At this point, the cost of controlling environmental pollution and the damage caused by pollution are minimal. However, when the overall welfare is optimal, it does not mean that the welfare of each region is optimal, and some regions will have their welfare reduced accordingly due to pollution control. Therefore, the fully cooperative solution proposed by Samuelson will hardly be an equilibrium solution [8]. Consequently, the beneficiary regions should compensate financially for the regions whose welfare is impaired. However, such economic compensation is for the polluted region to compensate the source region financially, which is contrary to the polluter pays principle. Furthermore, the payment of financial compensation from the polluted region to the source region will alleviate the costs and expenses required to treat the pollution in the source region and increase its tendency to release more pollutants to other regions, which will not achieve the initial purpose of reducing pollution emissions.

3. Introduction of the Game Model

In the first place, in the game model, the government of the polluting province A and the government of the polluted province B are established. n represents the cost that the government of province B needs to pay to deal with the pollution in its jurisdiction, r is the benefit that the government of province a will gain by discharging the pollution to the neighboring province nearby, i is the cost of coordination and cooperation between governments (the amount of cooperation cost is less compared with the economic compensation), p_1 is the economic compensation from the polluting province to the polluted province under the cooperation condition, and p_2 is the economic compensation from the polluting province to the polluted province under the non-cooperation condition (assuming that p_1 is much larger than p_2), q is the benefit obtained by the environment when the polluted province is not polluted or q is the economic loss caused by pollution.

3.1. Basic Assumptions

First, the two provincial governments (provincial government A, provincial government B) are allowed to pollute emissions according to their own interest claims, the other provincial government has no right to interfere.

Second, the emissions from province A to province B will cause economic interests damage to province B.

Third, the governments of both provinces are rational participants, and the goal of each participant is to minimize the cost of pollution control and the damage to economic interests suffered by the province. Because the regions are connected, the emissions are convenient, and there is no need to solve environmental pollution by themselves, etc., the cost of discharging pollutants from province a to province b is much smaller than that of treating pollutants by province a itself [9].

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3.2. Modeling and Analysis

According to the assumptions, it can be concluded that, as a rational participant, the provincial government A is bound to discharge pollution to province b in order to minimize the cost of pollution control and the economic benefits suffered by the province. Thus, according to the set parameters, the benefit functions of the two provincial governments under different combinations of strategies are determined, and the game process between the two provincial governments can be analyzed, resulting in the game matrix in Table 1.

Table 1: Game matrix between the provincial government A and the provincial government B.

		Provincial Government B	
		Cooperation	No cooperation
Provincial Government A	Compensation	$(r-i-p_1,n-i+p_1-q)$	$(r-p_2,n+p_2-q)$
	Non-compensation	$(r-i,n-i-q)$	$(r,n-q)$

3.3. Solution of Pure Strategy Nash Equilibrium

By analyzing the game matrix, for province government B, when province government A chooses to make corresponding financial compensation for polluting the environment of province B, province government B will choose to cooperate because the cost of cooperation is smaller in amount for financial compensation and p_2 is much smaller than p_1. When province government A chooses not to compensate, province government B will choose not to cooperate.

For province government A, province government A will choose not to compensate no matter what decision province government B makes. Based on the choice of province government A, province government B will choose not to cooperate, then the analysis yields a Nash equilibrium in which province government a does not compensate province B financially and province government B does not cooperate with province government A.

The analysis shows that the final decision of province A and province B is essentially the classic "prisoner's dilemma". Each local government, in pursuit of maximizing its own interests without considering the interests of others or the whole, will eventually choose not to cooperate or make concessions. The premise of this conclusion is that province B has no right to interfere with province A's pollution emissions in its own province, as assumed earlier. The conclusion of the analysis proves that if province B does not have the means to effectively stop province A's emissions, province A will make the convenient and effective decision of directly discharging pollution to another province out of concern for maximizing its own interests. In order to get out of the "prisoner's dilemma" problem and make the two sides move toward a cooperative outcome, the following assumptions can be made.

If province government B has a proven means of preventing province government A from freely discharging pollutants into province B, so that province government a has to spend m to dispose of its pollutants under the condition that province government A does not cooperate, i.e., under the condition that province government B does not cooperate, the benefit function of province government A is $(r - p_2 - m)$ under the compensation condition and $(r - m)$ under the non-compensation condition. And the provincial government B can make the pollutant of province A cannot be discharged to province B by this means under the condition that the provincial government A does not make financial compensation, i.e., the provincial government a need to treat the discharge of the province by itself. According to the assumptions listed in Table 2 game matrix [10].

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Table 2: Game matrix between the provincial government A and the provincial government B.

		Provincial Government B	
		Cooperation	No cooperation
Provincial Government A	Compensation	(r-i-p_1, n-i+p_1-q)	(r-p_2-m, n+p_2-q)
	Non-compensation	(r-i-m, n-i-q)	(r-m, n-q)

Analyzing the game matrix in Table 2, for province government A, if province government B chooses to cooperate, when $m>p_1$,since the two provinces are adjacent to each other, the cost of discharging from province A to province B is much smaller than the cost of treating its discharge by province A due to the convenience of discharge and the small repair work required, province government A will choose to compensate province government B; if province government B chooses not to cooperate the choice to not compensate is conditional on the province government B choosing not to cooperate. For province B, province B chooses to cooperate when province A chooses to compensate, and chooses not to cooperate when province A chooses not to compensate. At this point, there are two Nash equilibrium outcomes, namely (Compensation, Cooperation) and (Non-compensation, No cooperation).

When $m>p_1$, assumed that i is relatively small and can be roughly ignored, (r-i-p_1)>(r-m), so province government A will choose to cooperate with province government B and compensate province government B financially, while province government B will choose to cooperate with province government A under the condition that province government A chooses to compensate. Therefore, both sides will choose the strategy of (Compensation, Cooperation).

4. Suggestions

Based on the above assumptions and the analysis of the game, in order to promote cooperation between local governments in neighboring provinces, two proposals are proposed for different subjects.

In the case of the central government, it should implement the innovation of administrative policies. Foster a consensus on cooperation among local governments and improve the operation mechanism of local government cooperation. Increase the share of environmental protection in the performance evaluation of local officials, so as to encourage local government officials to pay attention to the promotion of environmental protection and increase the investment in environmental protection while trying to develop the regional economy. Only when local governments pay attention to local environmental protection will they solve the speculative behavior of local governments and fundamentally solve the problem of environmental pollution.

For the local governments, each local government should adopt a policy of economic compensation. The province that emits pollutants should pay the corresponding economic compensation to the polluted province. The pollutant-emitting province pays a certain amount of money to the polluted province to compensate for the loss of the polluted province when it discharges pollutants into the polluted area, causing economic loss to the polluted area and environmental damage to the area. In the long run, if a polluting province feels that the amount of money needed to discharge to a neighboring province and pay financial compensation for the countermeasure is more than the cost of upgrading its own emission technology and applying it to the province's emission treatment, the polluting government will make efforts to upgrade its own pollution emission treatment technology to reduce emission and promote environmental protection out of consideration of long-term interests.

5. Conclusion

As people's awareness of environmental protection increases, the issue of regional pollution emissions is becoming more and more important. In dealing with the pollution emission problem between

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two regions, the best outcome is undoubtedly the cooperation between the two governments towards a win-win situation. The purpose of this paper is to investigate the conditions for cooperation between neighboring provincial governments in China on the issue of environmental pollution emissions, and to establish a game matrix under two different assumptions to explore the conditions for the two governments to move from non-cooperation to cooperation. Through the analysis of the model, it is found that the problem is essentially a "prisoner's dilemma", and further study reveals that it is possible to "get out of the dilemma" by determining the ownership. Ultimately, the key to cooperation is the importance of local environmental issues in the region. This study provides a simulated game analysis of local government departments in two neighboring provinces with pollution emission problems, and makes recommendations for the relevant government departments to refer to when making decisions. The shortcoming of this study is that the research on this issue is still superficial and has not explored the deeper causes to give more constructive suggestions. In the future, by understanding the factors influencing the environmental game between local governments and combining more knowledge of game analysis, we can further analyze the fundamental conditions that enable the cooperation between the two governments and promote environmental protection.

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Exploring the Application Value and Path of NFT in the Artwork Industry

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Abstract: With the continuous development of blockchain technology and the epidemic situation, the offline art market continues to decline. At the same time, the popularity of the nft market has attracted the attention of many art lovers. For this article, focusing on the combination of nft technology and art, this paper hope to solve various problems in the current market of nft art transactions through this introduction. The article is mainly divided into four parts. The first part describes the overview of blockchain development and the Chinese government's promotion of blockchain technology development. And introduce other literatures that focus on nft technology. The second part describes the current market structure and selects the first industry as the case. The third part uses swot analysis to analyze the feasibility of this technology in the market. The fourth part proposes the concept of 'a blockchain based digital artwork rights confirmation and circulation system' as a solution to the problem based on the above contents.

Keywords: NFT, blockchain technology, Opensea, SWOT

1. Introduction

1.1. Background of Blockchain and NFT

The current development of blockchain technology is gradually improved. Blockchain is a new application mode that combines multiple existing computer technologies. It has the characteristics of decentralization and trusted process, which also establishes a trust foundation for the openness and transparency of its information. Therefore, blockchain can build trust at a very low cost in various scenarios involving multiple agents. Now the core of blockchain technology is to establish a decentralized, secure and reliable database [1].

NFT, non fungible token, translated as non homogenous token, is a certified storage unit on the blockchain. It is unique and cannot be separated and replaced. At present, it is mostly the source files of artistic creation in the form of electronic documents, not limited to painting, music, games, etc., and its value is reflected by virtual cryptocurrency.

Blockchain technology does bring new ideas to the art industry, but how to effectively tap the problems of the art trading market and use blockchain to enable it is a major challenge for the future development of the "blockchain+art" trading model.

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1.2. Precedent of Combination of Blockchain Technology and Artwork

Works of art can be well combined with this technology. A new transaction mode of "blockchain+artwork" has gradually come to the public's attention. Due to its decentralized and tamper proof characteristics, blockchain is very suitable for the artwork trading market. There have been many precedents in China and abroad in applying blockchain technology to the artwork market.

For example, in London, in June 2018, Maecenas publicly auctioned 49% of the shares of the famous painting "14 Small Electric Chairs". Buyers can pay through the special art currency issued by Maecenas, or digital currencies such as Ether and Bitcoin, or track digital certificates through the blockchain. At the same time, some art trading platforms, such as Ant Chain, Kbean, Opensea, also use blockchain technology to achieve NFT art trading and file storage.

1.3. Chinese Government's Support for Blockchain Technology

The Chinese government great importance to the development of the blockchain industry.

In October 2018, in China, China Capital Copyright Industry Alliance launched the "BiG Artworks Global Artworks Blockchain Plan" to promote the combination of art trading market and blockchain technology, protect art copyright and transaction security, and promote the development of China's art market [2].

In 2021, more than 60 blockchain related policies have been issued by various ministries and commissions, and blockchain has been written into the "Fourteenth Five Year Plan".For example, “the Fourteenth Five Year Plan for National Economic and Social Development of the People's Republic of China and the Outline of Vision Goals for 2035” mentioned promoting blockchain technology innovation such as smart contracts, consensus algorithms, encryption algorithms, and distributed systems.

1.4. Another Literature Cases Focusing on NFT Technology and Its Combination with Artworks

Many other articles also discuss the combination of artworks and nft. I will take Professor Guo Quanzhong's article as an example [3]. In this article, the author believes that the basic features of NFT, such as indivisibility, irreplaceability and uniqueness, can better protect the rights and interests of creators and create a more healthy ecosystem. At present, the application scenarios of NFT are expanding and deepening in various fields. As one of the important infrastructures of the meta universe, NFT can not only solve the problems of identity authentication and right confirmation, but also realize the value transfer between the meta universe. It is also a bridge between the real world and the meta universe to accelerate the arrival and maturity of the meta universe.

2. SWOT Analysis

2.1. Status Quo in China and Abroad

At present, according to the data of Dappradar, a market research agency, NFT sales will reach 24.9 billion US dollars in 2021, hundreds of times more than the sales of NFT in the previous year. NFT assets will be hyped up in 2021. The hot NFT market has not only attracted many investors, but also attracted some of the world's top brands, including Coca Cola and Gucci. Fig.1 shows the transaction volume of NFT in Opensea. The popularity of the NFT market has increased a lot [4].

In China, there are nearly 1000 digital collection platforms in China, but at the end of last year, the number of platforms was less than 100. It can be seen that the digital collection industry in China has developed rapidly. At the end of 2021, large Chinese Internet enterprises began to create digital

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collection platforms. The platform side regularly releases high-quality IP digital collections. The market is in short supply, and the digital collections sold are often sold out in one second [5].

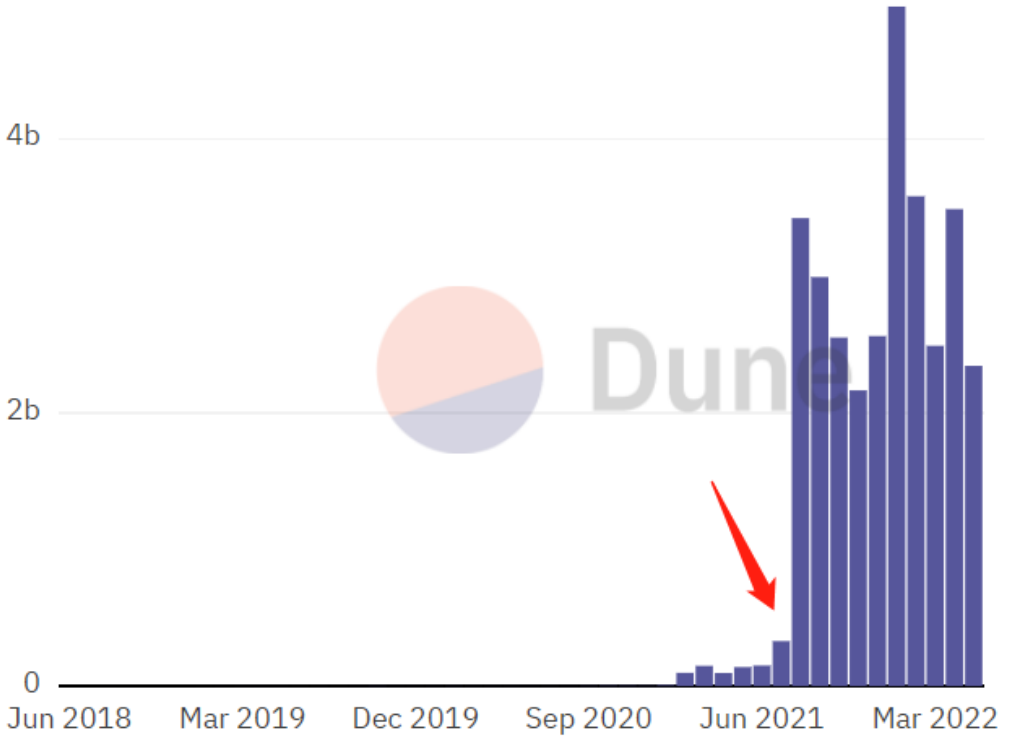


Figure 1: Transaction volume of NFT in OpenSea.

2.2. Strengths

(1) Validity of evidence. It ensures that the blockchain uses hash algorithm and value transmission protocol to ensure the consistency and integrity of data and meet the inherent needs of the public. The decentralized value transmission protocol makes the uplink data tamper proof in the actual situation, thus ensuring the authenticity of the data.

(2) Management convenience. Ensuring the flexible use of customized smart contracts in the blockchain can improve the management efficiency and achieve programmatic, automated and refined management. It can not only simplify the management process of file opening, but also save a lot of labor costs.

2.3. Weaknesses

(1) The technology is not mature. Decentralization, security and scalability of the promotion cost high block chain cannot be considered at the same time. With the increasing number of nodes and data volume, the operational efficiency of blockchain in high-frequency request scenarios will be affected.

(2) The research is at an early stage. Most institutions are still in the stage of theoretical verification and preliminary exploration. The application cases based on blockchain technology available for reference are extremely limited [6].

2.4. Opportunities

(1) The Chinese government attaches importance to it. In October 2019, the Chinese General Secretary emphasized at the 18th collective learning of the Political Bureau of the CPC Central

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Committee that "taking blockchain as an important breakthrough for independent innovation of core technology" and "accelerating the innovation and development of blockchain technology and industry". The emerging policies show China's support for this technology.

(2) Potential demand increases. The implementation of the Regulations on the Disclosure of Government Information, which has broad market prospects, has made citizens increasingly aware of the right to know and eager to obtain more information and participate in public decision-making. The information sharing features of the blockchain are in line with citizens' needs for information openness, and are also in line with the development direction of openness and transparency of the government agencies. With the new blockchain technology, the government and the market can stimulate their unlimited potential and effectively respond to the information needs of the public.

2.5. Threats

(1) Lack of corresponding regulations and standards. In the field of blockchain, the Ministry of Industry and Information Technology has actively organized the development of standardization. However, most of the existing standards are concentrated on the basic standards. The relevant research on process standards and method standards with important guiding significance has not been carried out yet. The progress of standard development is far behind the requirements of industrial development, which restricts the development of blockchain applications [7].

(2) Trust concept and usage habits are difficult to change. The public has been accustomed to the original working mode, and is naturally cautious about new things. The promotion and operation of blockchain still faces many challenges.

(3) Nft is easy to become a money laundering tool. NFT is often purchased with virtual currency. As virtual currency has the characteristics of disintermediation, border removal, non face-to-face, anonymity, and transaction rapidity, it is difficult to identify the source of virtual currency capital injection, while virtual currency transactions do not require the real name of the trader, and its global liquidity is large, and there are various cross-border and transnational transactions. Therefore, as the object of virtual currency transactions, NFT is easy to become a money laundering tool.

3. The Case of Opensea

In recent years, many scholars have actively explored the application of blockchain in various fields. "Blockchain+artwork" is one of them. At present, many blockchain plus artwork certification projects have sprung up and landed. Due to the short time of acceptance and development in China, there are few mature platforms in China. Compared with foreign countries, foreign achievements in this area are more prominent and the system and market development are more mature [8].

The following one is a successful case of art transaction using blockchain in foreign countries.

3.1. Opensea is the World's Largest NFT Trading Platform

Opensea has developed into an undisputed leader in the NFT market, with a market share of more than 97% and a turnover of 12 times that of its largest competitor. Since its launch, its historical sales have exceeded $10 billion.

3.2. Opensea Products

The main product of opensea is nft. All these successes cannot be separated from the services provided by the platform. The superiority of the product are mainly reflected in the convenient list, global products and powerful search system.

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3.3. Types of Opensea Products

Types: art, music, domain name, virtual world, transaction card, collection, sports and functional assets. Fig.2 shows Types of nft products.

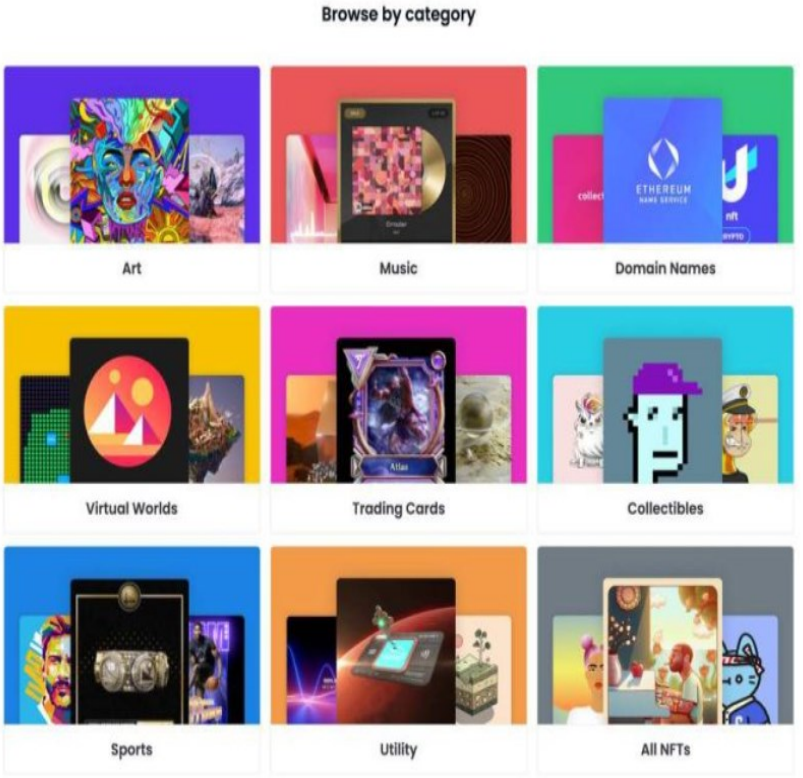


Figure 2: Types of nft products.

3.4. Advantages of Opensea

Low entry threshold: launch NFT on Opensea, whether images or songs, with only a few clicks. Alex Gedevani of Delphi Digital, an encryption research institute, described it as one of the decisive factors behind Opensea's market dominance.

Opensea emphasizes to become a licensing free market for all users who love nft. Due to the lower entry threshold compared with other platforms, more creators of nft can register and upload their own works. This approach expands the supply of creators in order to attract more users and capital in the primary and the secondary markets.

The number of huge collections and collectibles that can be purchased immediately: there are more than 1 million collections on the platform and more than 34 million personal NFTs available for purchase, so Opensea has high market liquidity that other websites do not have.

Strong screening mechanism: Opensea has made a very detailed classification of the products on the website. The value of each essential feature is different. Opensea excels in capturing, cataloging, and allowing users to search for this information. Through opensea's filtering and search tools, users can quickly find their favorite products. The prominent filtering elements include fur color, whether apes are eating pizza, and whether there are luminous eyes. Fig.3 shows the Filtering mechanism of Opensea.

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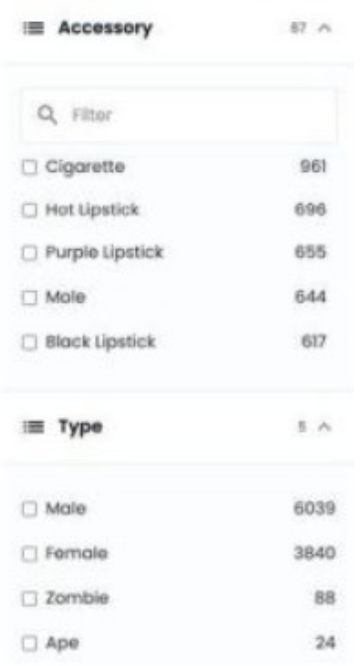


Figure 3: Filtering mechanism of Opensea.

3.5. Development Status of Opensea

2021 is the year of NFT market explosion. According to the data of Dune Analytics, the market share has also soared from 61% in July 2021 to 95% at the end of December 2021, ranking first, while the total transaction volume and user volume of the second SuperRay are only 1/24 and 1/6 of Opensea respectively.

In 2022, Opensea continues to rise. On January 9, the daily trading volume exceeded 260 million dollars, the peak in more than three months. As of January 10, the cumulative trading volume of Opensea in January had reached nearly US $2 billion, about 61% of that in December last year. On January 4, Opensea announced that it had completed round C financing of $300 million with a post investment valuation of $13.3 billion, and the valuation had increased six times since the previous round of round B financing of $100 million.

3.6. Opensea's Competitors

Because opensea is still in the blue ocean market. This leaves room for various competitors, including centralized NFT market, decentralized market, vertical market and cryptocurrency exchange. Fig.4 shows the Opensea Competitor Map.

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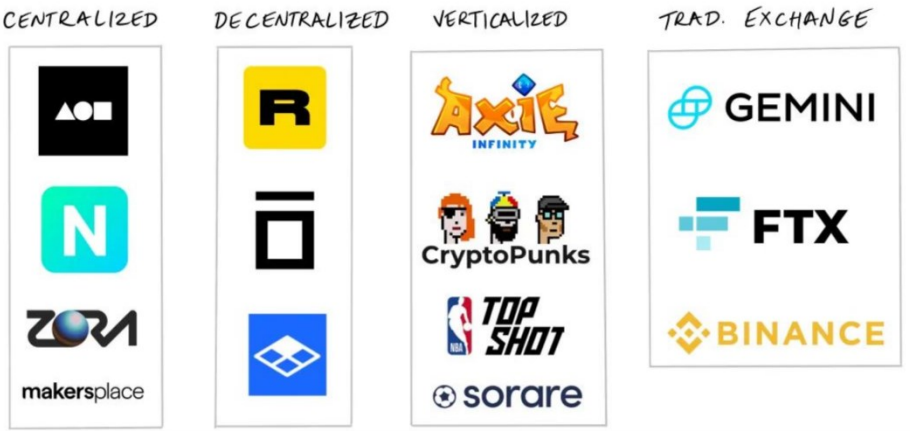


Figure 4: Opensea competitor map.

3.7. Current Problems Faced by Opensea

(1) This company which owns a huge market is still a young company with dozens of employees and has developed for only a few years. From the perspective of enterprises, its maturity and integrity cannot be compared with that of Internet companies of the same size.

(2) The popularity and satisfaction of Opensea platform among target users are not ideal. Users are dissatisfied with the company's costs, the high gas fees incurred from using Ethereum blockchain, and the lack of decentralized functions such as tokens.

(3) The positioning of NFT itself is ambiguous. If the U.S. regulatory authority determines that NFT is a security, Opensea's business model will be greatly affected, because the entire platform will be forced to comply with new laws and regulations which will be more strict. Therefore, opensea must be prepared for what may happen in the future [9].

4. A Blockchain Based Digital Artwork Rights Confirmation and Circulation System

The status of artwork in the era of highly developed economy and society is constantly improving. With the continuous improvement of people's cognitive ability of artwork and the continuous change of art appreciation methods, there is an unprecedented vacancy in the artwork market. The current problems are mainly the following:

(1) The network anti-counterfeiting technology is not perfect;

(2) The existing blockchain based digital artwork right confirmation and circulation system for artworks has problems of centralization, easy tampering and traceability;

(3) It is difficult to achieve effective and rapid offline transactions under the epidemic environment;

(4) The offline transaction costs are too high and the information circulation is poor.

The above problems have also led to the inability of various art trading and storage platforms in the society to directly address the pain points of the industry and accurately address and meet consumer needs.

Therefore, this paper puts forward the concept of digital artwork right confirmation and circulation system based on blockchain. As a new application mode that uses computer technologies such as distributed data storage, point-to-point transmission, consensus mechanism, encryption algorithm, etc., blockchain has the characteristics of decentralization, tamper resistance, traceability, and information change traces, In addition to effectively responding to the high requirements of product identification, transaction and information storage, the blockchain based digital artwork right

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confirmation and circulation system is feasible in terms of technology, economy and management, and has great social and economic significance.

The core concept of blockchain based digital artwork right confirmation and circulation system design is to realize a management system and platform integrating product identification, transaction and information storage management. Based on the problems existing in the existing art trading platforms and methods in China, the platform aimed at meeting consumer needs and focusing on security and identification functions was established through innovative ideas and initiatives [10].

As for the information storage methods of offline artworks currently available, most of them store information by adding QR codes to real paper artworks. The QR codes only contain the painting information, which only includes the address and ID information of the dynamic link database, and it is difficult to meet the growing consumer demand. QR code has the risk of personal information disclosure. Without more perfect encryption measures, it is difficult to maintain the security of the information in the QR code. If you want to obtain data, you must meet the two conditions of having a QR code and a decoding device at the same time. You can only obtain data under specific conditions. It is difficult to complete the operation when the QR code is damaged or lost.

5. Conclusion

To sum up, a blockchain based digital artwork rights confirmation and circulation system that is highly reliable, easy to preserve, easy to falsify, and also cares about privacy protection has become an inevitable demand. These users' basic performance requirements, which is the source of the so-called "blockchain based digital artwork rights confirmation and circulation system". Compared with the current NFT trading platform, such as OpenSea, which was established in 2017, as the largest NFT trading market, its trading products include encryption art, virtual world assets, cards, digital collections, domain names, etc. The scale of OpenSea is the largest in terms of the number of collections and creators. However, OpenSea's review of NFT uploaders and their works is not strict, or even loose. Without identity authentication, anyone can publish various forms of NFT works on the platform, which also leads to the existence of a large number of low value junk works on the platform. At this stage, the NFT market has a false boom. Because NFT works at the initial stage are rare and of epochal significance, they themselves have a certain added value. However, scarcity often makes items have financial attributes, causing people to "hype". Therefore, the value judgment of NFT works will gradually become rational with the improvement of technology. NFT works with low creativity will gradually reduce their value. The value recognition of virtual works may gradually decline, while real works of art that are more widely recognized in terms of value have not yet fully integrated into the current NFT market.

Easy preservation is a highly reliable extension requirement. When the system carries a large amount of user information, there will be a demand for the storage system to realize information query, and this system can fully meet this requirement.

Easy falsification is the core requirement of the system. Blockchain technology has the characteristics of decentralization, traceability, and information change traces, which can effectively solve the problem, ensure the authenticity and uniqueness of the authentication certificate, ensure the ownership of online works, and achieve a high degree of anti-counterfeiting and preservation.

The privacy protection is also one of the major problems in the existing blockchain based digital art right confirmation and circulation systems at home and abroad. In order to ensure the data security and privacy protection of users, third-party authentication services are provided off the chain and the original data information of users and works is stored, while verification information is stored on the chain. Nodes in the chain participate in the verification to eliminate the possibility of fraud to the maximum extent and improve privacy protection and data information management.

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Therefore, the blockchain based digital artwork rights confirmation and circulation system has become an important method to solve the issues of artwork trading and information management.

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The Application of Soft Law in We Media Governance

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Abstract: The we media is in a dilemma of management under the influence of online rumors, vulgar pornography and false propaganda. In such a situation, soft law provides a practical way to manage the disorder of news media. This paper focuses on the application of soft law in the governance of we media through literature review, and provides a practical way with soft law through the latest achievements of soft law in current legal profession, as well as comprehensive analysis of the situation of China's we media industry.

Keywords: we media; soft law governance; hard law; industry self-regulation

1. Introduction

With the continuous development of the Internet, traditional media such as newspapers and TV are gradually compromising to, and replaced by online media, such as Wechat, Weibo, and TikTok, which indicates that the media is changing from traditional media to new media and media modernization. Undeniably, the rapid development of online media has broken the limitations of time and space, making each person the subject of cultural exchange. This has greatly facilitated the transmission of information. However, due to the lack of strict regulation and controls, the cost of spreading rumors and vulgar videos is gradually declining, which in turn leads to confusion in online media. For a long time, the legal regulation of online infringement in academic and legal circles has been conducted from the perspective of hard law, so it lacks the construction of a soft law management model for online platforms, as well as the correct integration of soft law and hard law for online platforms. In the network society, soft law plays the most basic role of order, so in the Internet era, it needs to be managed by "soft law".

2. Soft Law

Soft law is used as a symmetry to hard-law. In most cases, the soft law is discussed by scholars referring to the definition of soft law made by Francis Snyder in 1994, that is, soft law is a rule of conduct that is not binding in principle but has practical effect [1].

The most basic system of the law is to provide a way for human behavior to become less free and disciplined. Therefore, in order for this behavior to be carried out, it needs to be to accompanied by a constant and stable punishment system.

Both law and social norms belong to the category of norms and coordinate the actions of the population by means of rules in order to achieve a certain social order and social consensus. However, as the number of partners increases dramatically, there is necessarily a compulsory public right.

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Although formal justice is aimed at the pursuit of substantive justice, it also gives rise to formal justice.

"Soft law" is a social effect that can be achieved without the government's compulsory guarantee. According to Luo, the extension of soft law is divided into three major types: first, legal instruments of declaratory, call and encouragement; second, outlines, plans and methods formulated by the government, and the third is the self-regulatory documents formulated by "communities", such as the and "Management Regulations of the Weibo Community". In addition to the self-regulatory documents of network companies, the proposals issued by relevant social organizations are also civil soft laws, such as the "Initiative to Protect Miao" issued by Wuhan New Media Industry Federation. These self-regulatory codes first define the interests of individuals and thus form an important force to maintain the order of public opinion [2].

As a whole, the innovation ability of soft law is not enough. From the perspective of administrative law, it turns to national legislation and other areas without enforcement capacity, and replaces social norms with "soft law". Thus, it challenges the traditional legal theory and defines the "soft law" category..

3. We Media Governance

3.1. Concept

Academic research on online media mainly focuses on three aspects: infringement of copyright by online media and online platforms, including copyright issues related to manuscript laundering and plagiarism, infringement of reputation rights, and privacy rights; value orientation of public opinion in news media; and governance structure and strategies of news media.

Hu pointed out that a multi-dimensional and multi-level government management system should be built on four levels: government, media platform, society, and individual citizens [3]. Wang proposed the concept of "degeneracy", which means that one thing lags behind another in the process of social change and was used to demonstrate the high disconnect between the current media management model, and information and media technology [4]. For a long period of time, the government's remedial media management model for emerging problems has been both delayed and inefficient, which depletes the government's credibility. Lian analyzed the current dilemma faced by the press and advocated "soft law governance" approach, which means strengthening the regulatory function of industry organizations [5].

The news media industry is often governed by many parties, including the government, society, and individuals. Therefore, media governance requires needs to improve laws and regulations, and also needs to fully mobilize all parties of society to participate in the governance process.

3.2. New Changes in the Self Media Governance Environment

Capital involvement.

Content misconduct in we media is not a new problem. Super public opinion platforms, such as Weibo and Wechat, have been unsurprisingly serving as pressure relief valves for the public, strange arguments, scoldings and even lies circulating. However, with the power of capital, we media has rapidly transformed from a grassroots expression channel to a public opinion business. Due to low threshold and high profit, a large number of people have joined the industry of we media communication industry by "we media entrepreneurship". "Making numbers", "100,000+" and "headline party" has become the main content of their work. Since the income of the online platform is directly related to the number of readers and comments, most of we media outlets publish articles that violate public order to draw attention. So far, the logic of we media communication has changed fundamentally, from the spontaneous expression of opinions to traffic-oriented business [6].

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Internet communication basic logic change.

The most visible manifestation of online media chaos is information that violates public order and morality of society. This is because of the bad content released by the authors of we media accounts and the ineffective management of the platform.

Driven by Internet technology, the initiative for information production and dissemination has shifted from specialized media organizations to social media. Although not completely transformed, the monopoly of mass media information has been broken. One of the biggest changes is the change of the subject of network communication, that is, the decentralization of network communication. As a result, the role of traditional government control has been weakened, further resulting in the dual effect of "failure" and "loss of control" [5].

The development trend of we media platforms

The Internet is the main communication channel of we media, Microblogs, WeChat, Crypto, and Jitterbug are all we media that have developed rapidly in the last two years in China. The development of online communication allows democratic rights to be realized in new ways. Everyone is a news disseminator, so the regulation of public power will become stricter and stricter. The diversification of the organizational structure of the platforms also increases the expansion of the we media platforms, which is mainly reflected in the plurality of users and the diversity of media. However, because of the nature of the information itself, its fragmented approach makes it fast and complex to disseminate. This fragmented and incomplete presentation can easily cause misunderstanding among the public and create great obstacles to the management of online media [6].

3.3. Reviewing the Dilemma of Hard Law Regulation

Currently, China's legal documents on the governance of we media platforms include the General Emergency Response Plan for National Public Emergencies, Opinions on Deepening the Openness of Government Services and Strengthening Government Services, Interim Provisions on the Administration of Internet Publishing, Provisions on the Administration of Internet News Information Services, Provisions on the Administration of Internet Electronic Announcement Services, and Decision of the Standing Committee of the National People's Congress on Safeguarding Internet Security. In stark contrast to the rapid development of we media platforms, China has not yet formulated laws and regulations directly regulating we media [7].

Due to the low level and and insufficiency of the regulations above of Chine’s legislative, most of legislations only consider the convenience of management in the sector, resulting in a narrow scope of application of the law and the management measures imperfect. Moreover, the lack of adequate consultation during the formulation process is likely to lead to legal confusion, which will result in a non-uniform legal system.

Secondly, the current legal documents are not clearly targeted and the legislative language is ambiguous. Compared with traditional network expressions, online media is richer in content and more complex in form, which requires unique legal language and legal boundaries. However, in practice, there are still some ambiguities in the specific provisions for online media in the laws and regulations that are in place.

4. The Role of Soft Law in We Media Regulation

4.1. The Functional Advantages of Soft Law

Compared with traditional media, network media has a new characteristic, which is the virtual nature of network media makes the spatial distance between users shorten. The openness of online media makes the role of "gatekeeper" played by traditional media in information transmission greatly diminished, and everyone can become a "news publisher". Moreover, the speed of dissemination, the

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network media can produce and disseminate instantly, which is incomparable to the traditional paper media and TV media.

Strict legal regulation of we media platforms by government coercive means alone is bound to produce legal vacuums and regulatory loopholes due to its inherent lag and the cumbersome formulation process. As a kind of soft law regulation in the form of self-regulatory conventions, it has shown good adaptability in regulating self media infringement because it has fully considered the flexibility of self media platforms from the very beginning, leaving a certain space for flexible treatment when it was formulated and referring to the governance measures in related fields [8].

4.2. The Limitations of Soft Law System

Inadequate soft law making procedures

Private soft law is often developed by private institutions, which has little credibility and lack rigidity. Self-regulation by industry bodies carries the "risk of being captured by regulatory interests", a "risk" that can benefit industry and the profession rather than serve the public interests. Without the intervention of public authority, companies and firms that may dominate the market may be in a position of absolute superiority to establish rules that benefit themselves to the detriment of vulnerable users, without truly achieving self-regulation and without defending the interests of those who truly deserve to receive protection [9].

Immaturity of the soft law regulatory path

Since most of the current media platforms have not yet established a dispute resolution mechanism, the handling of disputes is usually a passive attitude; they usually do not take the initiative to deal with disputes; on the other hand, people still have doubts about the credibility of the law and the results lack credibility.

Currently, the lack of regulation of soft law in China when formulating soft law has led to conflicts between soft law and hard law. For example, the exclusion clauses entered into by online media platforms to reduce tort liability can contradict the Law of the People's Republic of China on the Protection of Consumer Rights and Interests and other relevant regulations. There is also the question of whether the power of civil soft law to punish industry groups is legal and whether it violates the provisions of the Law of the People's Republic of China on Public Security Administration Punishment [9].

4.3. Soft Law Governance Path for Self Media Platforms

The greatest strength of soft law is its broad participatory power, and its legitimacy has often received a great deal of attention. In practice, soft law often becomes a means to protect the interests of a private interest group. This requires procedural rationality in the formulation of soft law. This paper proposes to build a mechanism of "professional consultation" and "public participation" based on the principles of "hard law". In addition, government officials and university scholars can be encouraged to form advisory groups to provide practical evidence for the formulation of soft law.

Moreover, while the traditional hard law system is based on the government as the lawmaker, the concept of "soft law" breaks with the idea that only a government can be the lawmaker. This requires a proper approach to government intervention and soft law making. Soft law should follow the autonomy of citizens and focus on the supporting role of the government. The government should achieve regulation of laws and regulations through communication and consultation with we media platforms and industry associations, thus preventing direct government interference in law-making.

In addition, the formulation of soft laws and regulations should be more open and democratic, while the we media platforms and industry associations should promptly publish the legal texts of "soft laws" through websites, newspapers and other media, and solicit feedback from the public.

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Furthermore, the democratization and public formation of soft law can guarantee its rationality, but it still has to follow the legality of the law without violating the hard law. Therefore, it is necessary to construct a system of soft law registration review. Some punishment systems can be established to maintain the order of press and public opinion by timely correcting those soft laws with private preferences and against public interests through warnings and interviews [10].

5. Conclusion

Nowadays, public communication has entered a new era, but it also brings unprecedented challenges to the government's management of communication media and information security. Cyberspace is not a place outside the law, and it is important to deal with the chaos of online media based on both "hard law" and "soft law" to provide a flexible operating mechanism for the media. This paper argues that the current soft law management model should be reformed to promote the soundness of soft law in the online media.

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