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Exploring the Transmission of Market Volatility between the US and Mainland China Stock Markets

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Abstract: This study investigates the transmission of market volatility between the United States and Mainland China stock markets, particularly in the context of extreme events like the 2007 subprime mortgage crisis and the 2020 COVID-19 pandemic. It underscores the increasing interdependence between these markets and the role of government intervention and regulation in shaping their development. This research offers valuable insights for stakeholders, including regulators, policymakers, and investors, as they navigate the complex landscape of systemic financial risks arising from the interconnectedness of these two major financial markets.

Keywords: Stock market, Extreme event, Stock market fluctuation.

1. Introduction

The 2020 COVID-19 pandemic left a profound imprint on the global financial landscape, accelerating the spread of tail risks across financial markets. Such rapid spread could readily ignite systemic financial vulnerabilities. In response, international financial institutions and regulatory bodies have employed a suite of fiscal and monetary measures to anchor financial market stability and stave off the ripple effects of systemic financial hazards at the global level.At the third G20 Finance Ministers and Central Bank Governors Meeting in July 2021, leaders emphasized that even as the global economy shows signs of recovery, it remains paramount to uphold financial stability. They urged vigilance against negative spillovers within the financial system and potential economic downturns. A prevailing question in the minds of regulators and researchers alike is: How can we shield financial markets from major unforeseen events, mitigate systemic financial risks, and yet ensure sustained economic growth?

Since the 2007 U.S. subprime mortgage crisis, the international financial landscape has been punctuated by a series of upheavals. Incidents such as the 2010 European debt crisis, the UK's 2016 "Brexit" decision, the policy shifts under Donald Trump in 2017, and the 2020 COVID-19 pandemic have all injected a degree of unpredictability into the global financial scenario.Parallel to these developments, Mainland China's burgeoning economy has seen its financial sector evolve and reform. As a significant trade partner and U.S. government bondholder, Mainland China shares an intricate economic tapestry with the United States, marked by mutual cooperation and robust growth dynamics. Standing as the world's second-largest economy and a major U.S. investor, Mainland China plays an instrumental role in America's economic progress.

The intertwining of the U.S. and Chinese financial sectors has deepened over time, and their respective stock markets, with their quick information reflexes and accessible data metrics, have become focal points of interest. An increasing number of academics are delving into the volatility dynamics of both stock markets, eager to discern the intricate interplay between their respective fluctuations.

2. Stock Market Volatility in The Us and Mainland China Under Extreme Events

In the 1930s, the Wall Street stock market plunged in the United States, and then spread to the world to form the "Great Depression" economic crisis. After the economic crisis, Western governments intervened to overcome the market failure and alleviated part of the crisis through fiscal policies and monetary policies. However, as financial innovations proliferate in the global capital market, more subtle and complex financial crises continue to emerge. The "stock market crash" in the United States in 1987, the subprime mortgage crisis in the United States in 2007, the Wall Street financial crisis in 2008 and the European debt crisis in 2010, after these financial extreme events, the domestic stock market plunged and the stock market fluctuations were transmitted to other countries. The impact transmitted through stock market fluctuations is different from the impact of physical trade in the past, and its transmission speed and scope are far more than the impact of the real economy. In 1997, Mainland China experienced the Southeast Asian financial crisis. Because the Chinese government adopted the protective policy of the financial market at that time, it had little impact on the domestic stock market. After Mainland China's accession to the World Trade Organization in 2001, Mainland China's economy began an unprecedented deep integration with the global economy. In 2002, the Chinese government convened the Second Financial Work Conference, which introduced important reforms in Mainland China's financial sector. In 2003, Mainland China's financial market entered a period of rapid development. At that time, Mainland China's stock market experienced a relatively steady growth rate along with the development of Mainland China's real economy. However, in 2008, after the Wall Street financial crisis in the United States, Mainland China's stock market fell to about 30% of the peak of that year. The plunge in Mainland China's stock market is directly related to the plunge in the US stock market.

Before the subprime crisis, the stock market indexes of the two countries rose all the way and developed rapidly. The Shanghai Composite Index reached 6124 points; After the subprime crisis, the stock market composite index of the two countries showed a downward trend. Under today's interconnected financial market trading rules, when certain fluctuations occur in one market, they can quickly affect other markets. In this process of communication, some of them are the effective transfer of financial resources that must be realized in the adjustment process of financial markets themselves; However, more financial information is transmitted to the stock markets of other countries through the "butterfly effect" caused by abnormal fluctuations in the stock market. The volatility of Mainland China's stock market is related to Mainland China's own economic development, but it is also related to the volatility of the US stock market. In the face of the deepening of the relationship between the stock markets of the United States and Mainland China, the stock markets of the two countries have obvious linkage under extreme financial events.

3. Research on The Development Status of The Us Stock Market

3.1. Introduction to the American stock market

When the United States was founded, the country did not establish an official domestic stock market. The first stock in the United States was stock in the Bank of the United States, issued by Hamilton, the first Secretary of the Treasury, to pay for war bonds. In the early days of the nation, the government needed a great deal of financial investment. Drawing on the experience of European securities financing, the US financial department began to encourage domestic residents to trade stocks, and improve the activity of stock trading through this government-guided way. In May 1792, the first stock exchange agreement in the history of the United States was signed by a group of early stock investors. The official stock market in the United States can be traced back to the New York Stock Exchange, which was operated by brokers under the Sycamore Agreement in 1811. This move realized the prototype of the US stock market guided by the US government and dominated by private investors, and also marked the legalization and regularization of the US stock trading. At the beginning of the establishment, there were great differences in the understanding of the American government on the stock market. On the one hand, Treasury Secretary Hamilton emphasized the leading role of the market, and the government should create a legal environment and implement the supervision responsibility. On the other hand, Jefferson emphasized that the stock trading should be laissez-faire policy, and the government did not need any management and supervision. Considering the size and trading of the US stock market at that time, many Treasury secretaries after Hamilton followed Jefferson's "laissez-faire" policy of the government on the stock market. On the one hand, the laissez-faire trading system played an important role in stimulating investors' trading vitality and promoting the development of the stock market. On the other hand, due to the lack of market supervision, speculation and insider trading are prevalent in the stock market. In the case of market prosperity, stock trading is active, investors actively buy stocks and sell them at high prices, the stock market has a large profit space, and investors make more profits. However, in the lack of effective government supervision in the financial market, speculation pervades, which makes the financial market contain huge financial risks. In 1907, the Canadian speculator Hinds failed to speculate and the stock plunged, which triggered a bank run and plunged the American stock market into a financial panic. At that time, the US government not only had no financial supervision department, but also had no central bank, so it had no coping strategy in the face of the financial panic. At that time, J.P. Morgan acted as a central bank by actively intervening in the stock market through its Morgan Bank and its prestige and credit in the American financial circle, thus resolving the financial panic.

The US financial authorities realized that the stock market crisis would have serious consequences, and in view of the predicament of the financial panic of 1907, they began a plan to reconstruct the US financial market. In 1913, the central bank of the United States adopted the Federal Reserve System, the first central banking system in American history. In 1929, the Great Depression occurred in the United States, which led to the realization that the securities industry needed to be completely overhauled and regulated. In 1934, the United States established the United States Securities and Exchange Commission (SEC), as an institution to supervise the capital market, which declared that the United States financial market said goodbye to the past laissez-faire era, and the government supervision force officially entered the United States stock market. In 1987, the US stock market crisis, when the stock market suffered panic, the Federal Reserve by providing funds to banks, increase market liquidity, in order to reduce or even eliminate financial panic. In 2007, the subprime mortgage crisis broke out in the United States. Because the government authorities underestimated the harm of the crisis and did not take targeted rescue measures, it escalated into a financial storm on Wall Street and swept the global stock market in 2008. At that time, former US President George W. Bush signed the US $300 billion housing market assistance plan and US $700 billion financial rescue plan, and the Federal Reserve also implemented corresponding plans, which made the financial crisis under control to some extent.

The development of the US stock market into the world's largest stock market is directly related to the supervision of the US stock market on the one hand, and the establishment of different types of transactions on the other hand. The American stock market was the first to adopt the exchange system. The New York Stock Exchange (NYSE) is an important stock exchange in the United States. It is an important part of the Stock Exchange market in the United States. The other part of the U.S. stock market is the over-the-counter (OTC) market. Companies that listed on U.S. exchanges in the early days needed strict approval. For this reason, many companies needed to raise capital by trading outside the exchange, also known as over the counter. The American Association of Securities Dealers established the NASDAQ Stock Market in 1971 in order to make up for the shortcomings of stock exchange trading, reduce the approval conditions for corporate listing, and improve the efficiency of corporate financing. Now the NASDAQ stock market has become the world's largest over-the-counter market. The NASDAQ Stock Market is also responsible for the OTCBB and the Pink Sheets. The establishment of the NASDAQ Stock market marked that the American stock market has two different trading methods: on-exchange trading and off-exchange trading, so that the American stock market has become a stock market with complete trading methods.

With the development of Mainland China's economy and a large number of outstanding domestic companies listed in the US stock market for financing. On May 7, 2007, NASDAQ Corporation announced NASDAQ Mainland China IndexSM, which is composed of 30 Chinese companies listed on the NASDAQ Stock Market and the New York Stock Exchange. The index is the second stock index of listed companies in a single country launched by NASDAQ Stock Market after the NASDAQ Israel Index. In 2007, Mainland China had 41 companies listed on the NASDAQ stock market with a market value of $30 billion. On the one hand, the NASDAQ Mainland China Index reflects global investors' recognition of the development potential of Chinese companies listed in the United States; On the other hand, the launch of the index is also conducive to the international investment market's macro understanding of the development of the Chinese market, so that foreign investors can have a preliminary understanding of the development of Mainland China's investment market through the index. At the same time, listed companies included in the index can enhance their own visibility on the one hand; On the other hand, it can serve as a reference for other companies in the industry, making it easy for investors to evaluate and invest in them.

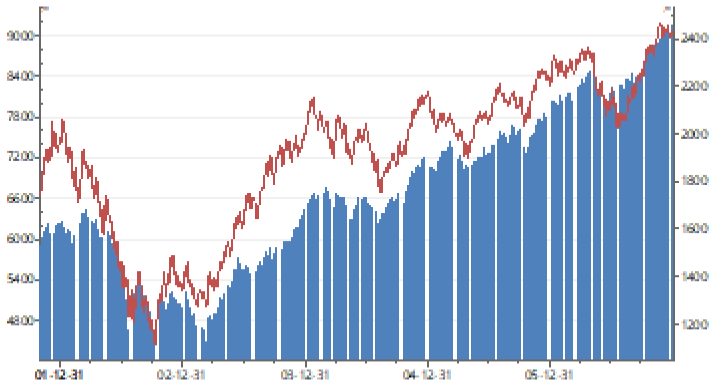
The NASDAQ Mainland China Index is an index constructed by the Nasdaq Stock Market Corporation, which publishes the performance of Chinese companies listed in the United States. It is an important measure to track the performance of Chinese companies in the US stock market. It is for this reason that the index is closely related to the fluctuations of the Chinese market economy. The SSE Composite Index and NASDAQ Mainland China Index fluctuated very much in line during the financial crisis. For U.S. and Chinese investors, watching the volatility of the two market indexes is an important guide to investing.

3.2. Analysis of volatility of the US stock market

Since the US stock market concentrates many high-quality listed companies in the world, its stock market fluctuations will have an important impact on the global financial market. At the same time, the economic fluctuations of various countries will also be reflected in the listed companies in the United States. International political turmoil, local hotspot conflicts, new technology, new energy and trade frictions and other global events will be reflected in the form of stock price fluctuations in the US stock market. The stock market fluctuations caused by such international events started from the Gulf War in the 1990s and continued to the period when the new economy of the United States was developing strongly. Against the macro background of growing global trade, the US stock market has experienced fluctuations, but stock prices have shown a long-term trend of growth.

In 2000, the "Internet bubble burst" in the United States, and the NASDAQ stock market began to fall from the highest of 5132 points. By October 9, 2002, it fell to 1108 points, a decline of 78.4% in two short years. At the same time, stock prices on the New York Stock Exchange also continued to fall.

Figure 1. Chart of the NASDAQ Composite Index (January 2000 - October 2002)
(Data source from WIND database)

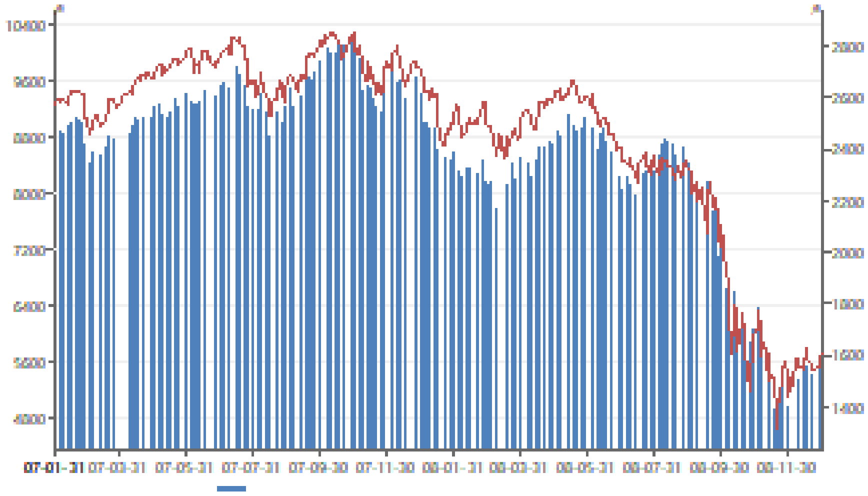


Blue vertical bars represent the NYSE index
Red line graph represents the NASDAQ index
Figure 2. Chart of the NYSE and Nasdaq Index (November 2001 - December 2006)
(Data source from WIND database)

In the wake of the Sept. 11 terrorist attacks, the Enron bankruptcy, and the Worldcom financial scandal, the U.S.

stock market took a major hit. In view of the plummeting stock market at that time, the SEC issued timely policies to stabilize investor confidence in the market. These included the Sarbanes-Oakley Act and the Federal Reserve's massive cash injection into the market to increase liquidity. At the same time, in order to increase their profitability and avoid financial regulation, major financial institutions developed a large number of financial derivatives.

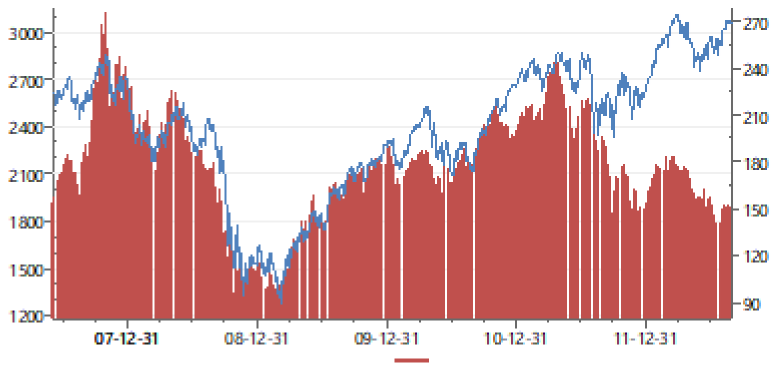
As is shown in the chart, after 2002, stock price indicators continued to rise, investor confidence was restored, and market transactions rose rapidly. However, these rescue measures did not really solve the problems of the US stock market itself. Instead, they covered one bubble with another. Finally, the subprime mortgage crisis caused by the proliferation of financial derivatives in the United States evolved into a serious financial crisis. Before 2007, most domestic and foreign investors overestimated the regulations, supervision and market transparency of the US market. As a result, before the outbreak of the current crisis, a large number of international financial institutions bought American financial products, which not only caused losses to American investors, but also caused huge losses to many investment institutions in the international market.



Blue vertical bars represent the NASDAQ index
Red line graph represents the NYSE index
Figure 3. Chart of the NYSE and Nasdaq (January 2007-December 2008)
(Data source from WIND database)

As is shown in the chart above, in 2007, the American stock market began to fluctuate greatly. In 2008, the US stock market began to plunge, and the volatility was quickly transmitted to the stock markets of other countries, which triggered the global stock market turmoil.

The listed companies selected by the NASDAQ stock Market are representative companies of various industries in Mainland China listed in the United States, and these companies disclose information in accordance with the listing rules and financial disclosure rules of the Nasdaq stock Market. The NASDAQ Mainland China Index is closely related to the NASDAQ Composite Index.



Red vertical bars represent the NASDAQ Mainland China index
Blue line graph represents the NASDAQ index
Figure 4. NASDAQ Mainland China Index and NASDAQ Index Chart (May 2007-April 2012)
(Data source from WIND Database)

From the graph of NASDAQ Composite Index and NASDAQ Mainland China Index, the volatility of the two indexes is more consistent. It can be seen that although the main business of the listed companies on the NASDAQ stock market is in Mainland China, under the background of the financial crisis, more American investors and even global investors will incorporate their volatility into an investment product under the rules of the US securities market. On the other hand, it also shows that the volatility of the US stock market has an important impact on the stock prices of Chinese listed companies in the US. This kind of investment relationship in the capital market makes the stock market of the United States and Mainland China more closely connected.

4. Research on The Development Status of Mainland China's Stock Market

4.1. Introduction of Mainland China's stock market

In the middle of the 19th century, Shanghai Ocean Bank issued the first stock in Mainland China. In the 1870s, the Westernization movement of the Qing government set up many large enterprises. At that time, the government finance could not afford the huge financial investment, so it drew lessons from foreign experience and pushed the enterprises to the stock market for financing. At the end of the 19th century, a regional financial crisis broke out in Shanghai, which resulted in the collapse of the stock market and the bankruptcy of a large number of banks (banks). At the beginning of the 20th century, Mainland China's stock market entered a brief period of prosperity. In 1922, Chinese people found that stocks could bring huge spread arbitrage and get rich quickly, so there was a large social demand for stock trading. There were more than 200 exchanges in Nanjing, Suzhou, Guangzhou and Shanghai alone. Subsequently, stocks suffered a large number of investors to sell, the stock market ushered in the second crisis, banks went bankrupt, trust companies closed, the exchange closed, this crisis is called the "trust and exchange wave".

After the reform and opening up, in order to activate the vitality of Chinese enterprises, the competent government departments began to set up joint-stock companies by learning from the advanced management experience of foreign companies. In 1984, Feile Audio Co., Ltd. became the first domestic enterprise in Mainland China to issue shares for financing. In December 1990, the Chinese government established the Shanghai Stock Exchange and the Shenzhen Stock Exchange. Marking the official establishment of Mainland China's stock market, large domestic companies went public to raise capital. The Shanghai Stock Exchange mainly serves large companies and is called the Main Board Market. The Shenzhen Stock Exchange mainly serves small and medium-sized companies and innovative companies, namely the "small and medium-sized Board market" and the "Growth Enterprise Market". In April 1994, the competent authorities compiled the Shenzhen Composite Index, which reflects changes in the share prices of companies listed on the Shenzhen Stock Exchange. In July of the same year, the competent authorities compiled the Shanghai Composite Index based on changes in the share prices of companies listed on the Shanghai Stock Exchange. The market capitalization of stocks on the Shanghai Stock Exchange is much larger than that of the Shenzhen Stock Exchange. The sample stocks of the Shanghai Composite Index are all listed stocks (including A shares and B shares), and the trend of the Shanghai Composite Index is highly consistent with the market. Since the SSE Composite Index can better reflect the price changes of Mainland China's stock market, it has attracted much attention from investment institutions and government departments.

At the beginning of the establishment of the stock market, the Chinese government took into account the small scale of the Chinese stock market itself and the system was not sound, so it strictly controlled the capital account. This kind of protection system, which is to a certain extent isolated from the outside world, did play a certain role in protecting the domestic financial market during the 1997 Southeast Asian financial crisis. However, with the development of Mainland China's economy, this kind of closed financial market has been unfavorable to the development of Mainland China's stock market, and Mainland China's capital market has gradually opened to the outside world. In February 2001, Mainland China opened a B-share account for foreign investors to invest in the Chinese stock market for the first time. Residents who open the account must be residents who trade in Mainland China using legal foreign exchange. Although the opening of B-share trading is limited, it is an important step for Mainland China to break through the closed trading of its domestic stock market. Since then, Mainland China has traded A mix of A shares bought in yuan and B shares bought in foreign currencies. In December 2001, Mainland China officially joined the World Trade Organization (WTO). Under the background of the gradual opening up of trade, Mainland China's financial market also ushered in a golden period of rapid development. In 2003, Mainland China's securities market began to implement the Qualified Foreign Institutional Investors (QFII) system, and overseas investment institutions led by Swiss banks have entered Mainland China's securities market one after another. While bringing capital into the Chinese market, these excellent investment institutions have also brought advanced investment concepts and financial market management systems, which have greatly promoted the development of Mainland China's securities industry. In June 2007, Mainland China's securities market implemented the Qualified Domestic Institutional Investor (QDII) system, which allows qualified domestic institutional investors to invest their domestic capital in the world and realize international asset portfolio allocation. Such a move can both increase the profitability of investment institutions and diversify risks at the same time. In December 2011, Mainland China began to implement the RMB Qualified Foreign Institutional Investors (RQFII) system, under which qualified foreign institutional investors can invest their approved foreign exchange quota in Mainland China's domestic securities market. After the introduction of RQFII, Mainland China's stock market is speeding up the pace of integrating with the international stock market.

The implementation of QFII system in Mainland China can improve the investment level of domestic investors on the one hand, and realize the integration of Mainland China's stock market with the international process on the other hand. At the same time, QFII invests a large amount in the stock market and holds it for a long time. This investment strategy makes most of the investment targets blue-chip stocks with good development prospects, large scale and strong liquidity. Once these target companies themselves or their future development prospects have problems, this part of the funds will be quickly withdrawn. At the same time, the QDII system has made Mainland China's large financial institutions more closely linked to foreign capital markets. With a large number of overseas assets in their portfolio, they can enhance capital returns and diversify risks on the one hand; On the other hand, once the overseas assets are damaged, the domestic listed parent company's shares will cause wild fluctuations. The implementation of RQFII system, on the one hand, will accelerate the internationalization of RMB in Mainland China, on the other hand, it will make the connection between

Mainland China's stock market and the exchange rate market more closely. The fluctuation of the exchange rate market will inevitably lead to the changes of RQFII investment, and also have an impact on Mainland China's stock market to some extent.

4.2. Analysis of volatility of Mainland China's stock market

It has been 26 years since the Shanghai Stock Exchange was established in December 1990. This period has also been a period of rapid economic development and positive transformation of Mainland China. Mainland China's stock market has realized the process from scratch to existence, from closed to open, and from vague to sound system. Foreign financial markets have a history of hundreds of years of development, although Mainland China's stock market and the stock market of foreign developed countries have different time, but in the past 26 years, Mainland China's stock market has experienced 11 bull market and 11 bear market. As Mainland China's stock market was relatively closed in the early stage, most of the bull and bear markets in the international stock market had little to do with the domestic market at that time. In 2007, with the introduction of Mainland China's QDII system, Mainland China's stock market has more and more frequent contact with the international stock market, and the connection is also closer.

The Shanghai Composite Index of Mainland China's stock market rose from 998 points on June 6, 2005 to 6124 points on October 16, 2007, which lasted for two and a half years, with a growth rate of 513%. Then the Shanghai Composite Index began to fall sharply, falling from 6124 points to 1664 points in one and a half years, with a drop of 73%.

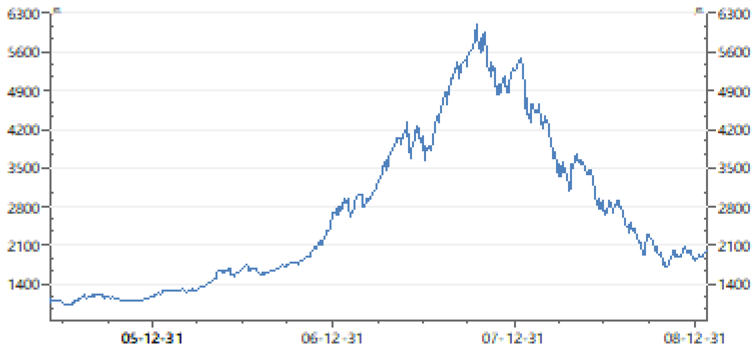


Figure 5. Shanghai Composite Index Trend chart (June 2005 - October 2007)
(Data source from the WIND database)

From 2009 to 2014, the Shanghai Composite Index had a brief rebound, rising to 3,478 points; Then the index began to fall, rebounded slightly, and then fell. The stock market as a whole is moving on this constant shock. From 1974 points on March 12, 2014, the Shanghai Composite Index rose all the way to 5166 points on June 12, 2015, which lasted one year and three months, an increase of 162%. After the sharp rise, the stock market fell rapidly and began a long bear market.

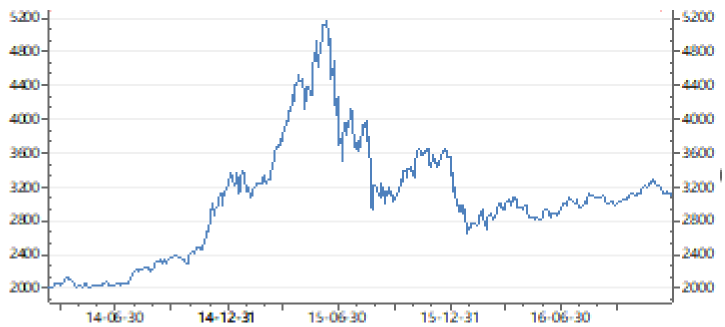


Figure 6. Shanghai Composite Index Trend chart (March 2014 - December 2016)
(Data source from the WIND database)

Amid the alternation of bull and bear markets in Mainland China's stock market, Mainland China's securities market has also undergone a reform from the inside out, with continuous improvement of laws and regulations on the securities market, strengthening of enforcement, and active top-down reform of financial institutions and securities departments. Mainland China has implemented the new securities law, set up a daily limit to limit the excessive fluctuation of domestic stock prices, and implemented non-tradable shares. The issuance of new shares has also been improved constantly. The quality and quantity of employees in domestic financial institutions have been continuously improved, and a large number of overseas financial talents have returned to work in the financial industry, which has indirectly driven the overall quality of securities practitioners. With the development of Mainland China's securities market and the stock market alternating between bull and bear markets, the investment mentality and investment level of stock investors have been greatly improved. Foreign financial institutions continue to invest in Mainland China, and these excellent overseas financial enterprises have also played an important role in the construction of Mainland China's securities market and personnel training. Affected by the current economic situation at home and abroad, although Mainland China's stock market has not reached the previous peak in 2017, the regulations of Mainland China's securities market are becoming more and more perfect, the transactions of financial institutions are becoming more standardized, the professional quality of practitioners is rapidly improving, and investors have a deeper understanding of the stock market. Mainland China's stock market generally shows a good trend of development.

5. Correlation Analysis of Us-mainland China Stock Market Volatility

There is a huge trade relationship between the United States and Mainland China. In 2016, Mainland China's exports to the US amounted to $462.813 billion, while Mainland China's imports from the US amounted to $115.775 billion.

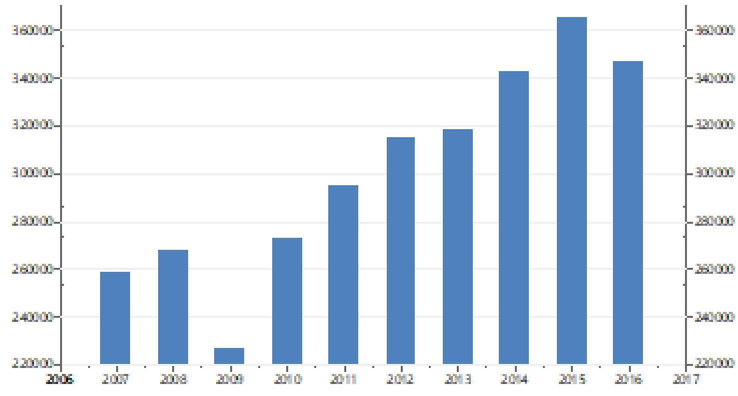
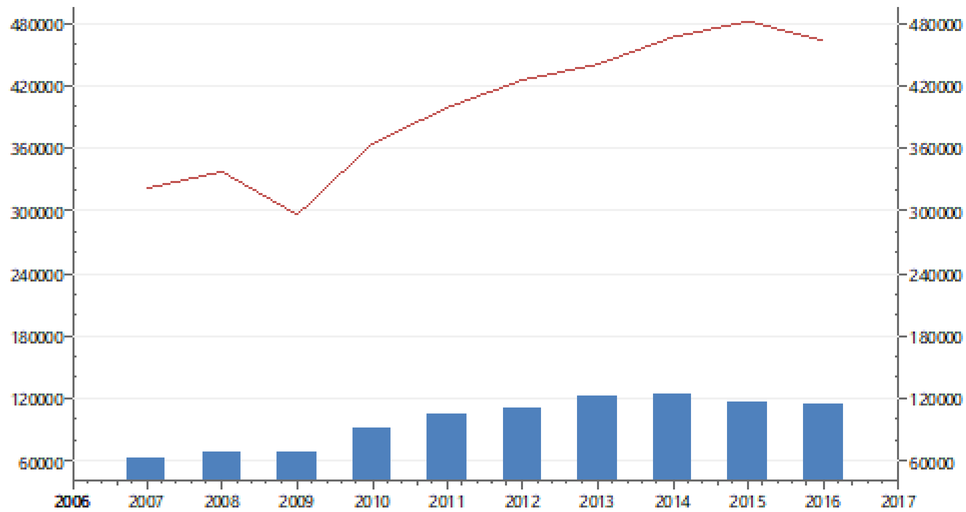


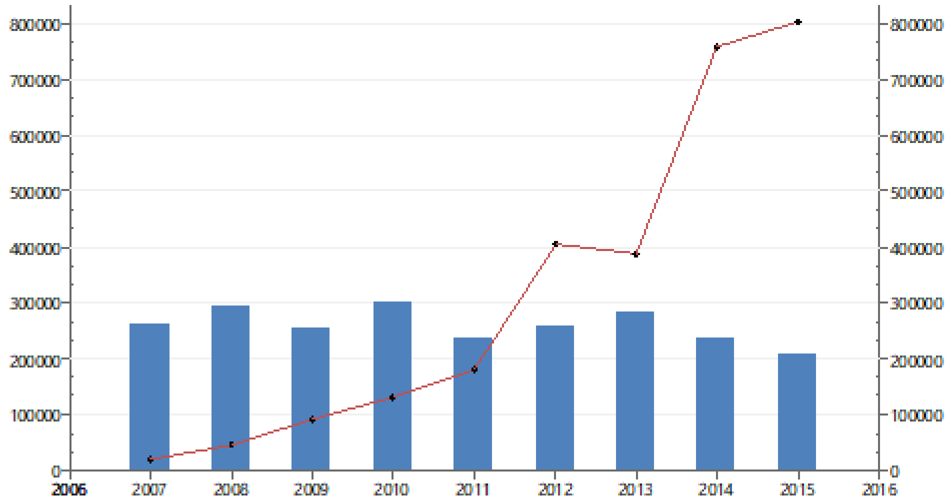
Figure 7. Mainland China's trade surplus with the United States
(Data source: WIND database, unit: millions of US dollars)

As is shown in the chart above, the US-Mainland China trade deficit has continued to widen over the past nine years, from US $342.632 billion in 2014 to US $365.694 billion in 2015; In 2016, the US-Mainland China trade gap decreased to $347.038 billion. The trade surplus remains huge.



Blue vertical bars represent the Mainland China's exports to the United States
Red line graph represents the Mainland China's imports from the United States
Figure 8. Annual chart of China's total imports and exports from the United States
(Data source from the WIND database, unit: millions of US dollars)

The trade relationship between the US and Mainland China is close. Take 2015, the year with the largest trade value between the two countries, as an example, Mainland China's import and export volume to the US reached 598.066 billion US dollars, accounting for 15.13% of Mainland China's annual import and export volume and 11.90% of that of the US. In 2015, exports to the US accounted for 16.09% of Mainland China's total export market, and imports from the US accounted for 6.91% of Mainland China's total import market. Us exports to Mainland China accounted for 5.13 percent of the total US export market, and imports from Mainland China accounted for 17.4 percent of the total US import market. In 2015, the US exported US $116.2 billion worth of goods to Mainland China, 30 times the amount in 1985. That made Mainland China the United States' third-largest trading partner, more than double that of fourth-place Japan. Mainland China's exports to the United States reached $481.9 billion in 2015, a 123-fold increase from 1985.

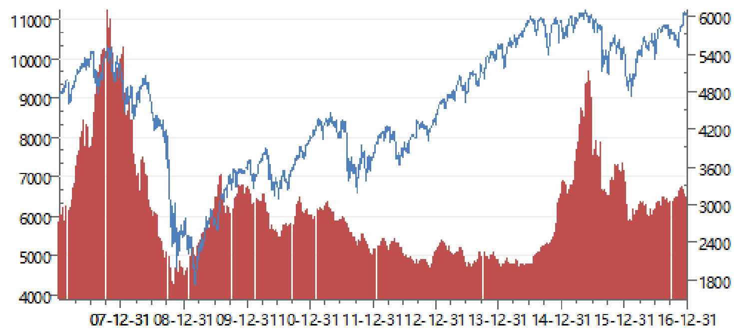


Blue vertical bars represent US direct investment in Mainland China
Red line graph represents Chinese direct investment in the US
Figure 9. Comparison of mutual investment between the US and Mainland China
(Data source from WIND database, unit: $10,000)

Bilateral investment between the United States and Mainland China increased significantly from 1990 to 2016, with changes in industry and geography. As is shown in the figure, from 2007 to 2015, US FDI in Mainland China was in the range of US $2 billion to US $3 billion, and Chinese FDI in the US continued to rise, especially after 2011, Mainland China's total FDI in the US continued to increase. In 2016, the Think Tank for Mainland China and Globalization (CCG) and the National Committee on U.S.-Mainland China Relations released a joint report, which pointed out that U.S. investment in Mainland China, mainly in communications technology, chemicals, metals, and energy, peaked in 2008, but has been on a downward trend since 2012; Chinese investment in the US, mainly concentrated in energy, real estate and hotels, and communications technology, has grown sharply since 2010 and surpassed US direct investment in Mainland China in 2015.

Trade and investment between the United States and Mainland China is mostly done by listed companies. Due to the close connection between the real economy and the virtual economy, trade and investment between the two countries are increasing, and the stock markets of the two countries are becoming more closely linked. According to the needs of economic development at that time, the Chinese government launched the Chinese stock market. This also determined that the government played a strong leading role in Mainland China's stock market. Most of them were large state-owned enterprises, and blue-chip stocks had a large market value and a large weight in the stock index. There are many differences between the development history and management philosophy of the US stock market and the Chinese stock market. Hamilton, the first Treasury Secretary of the United States, created the concept of "market-led, government-regulated" of the American stock market, which became the theoretical basis for the development of the American stock market. The American stock market has a history of more than 200 years, but its development is not smooth, and stock investors have experienced too many market fluctuations. The American stock market has finally reached the position of the world's largest stock market through the thinking mode of "if there is a problem, solve the problem".

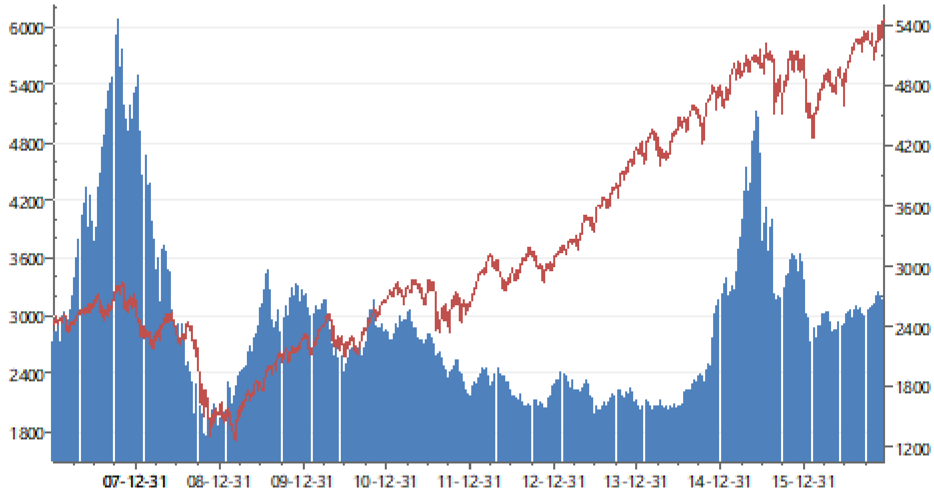
In the ten years from 2007 to 2016, the stock markets of the United States and Mainland China have conducted in-depth cooperation in trade, finance and investment, and achieved many important achievements. During this process, Mainland China's stock markets have also been undergoing continuous reform and gradually integrating with international stock markets. As the two countries with the largest GDP in the world, the two countries have cooperated in many fields, and their cooperation in the financial field has gradually strengthened. There is a close relationship between the stock markets of the two countries, so it is of great significance to study the volatility relationship between the stock markets.



Red vertical bars represent the NYSE index
Blue line graph represents the SSE index
Figure 10. Shanghai and NYSE Index chart (January 2007 - December 2016)
(Data source from WIND database)

The New York Stock Exchange in the United States has accumulated nearly 80 Chinese listed companies such as Alibaba, Mainland China Life Insurance and Mainland China Mobile. Most of these companies' main business is concentrated in Mainland China. From the above chart of the New York Stock Exchange Composite Index and the Shanghai Composite Index in the United States from 2007 to 2016, it can be clearly seen that although the volatility of the two indexes is different, the overall trend of the indexes is similar.

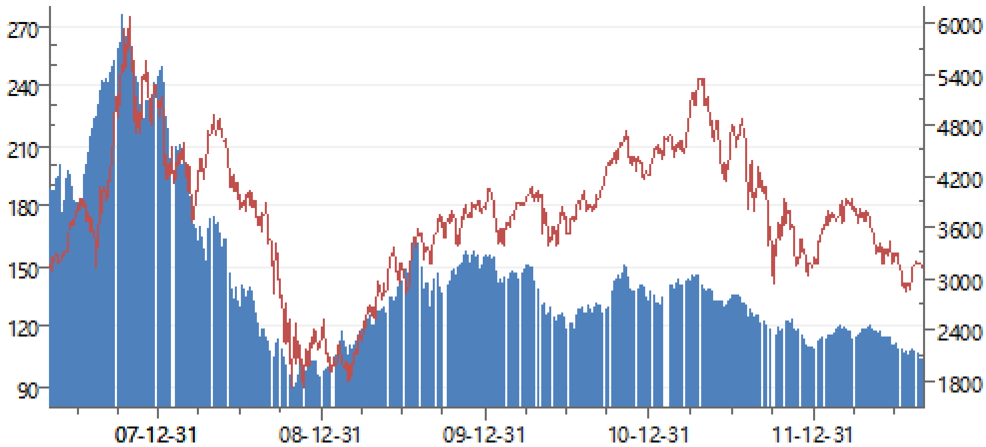
The Chinese companies listed on the NASDAQ stock market in the United States are a group of Chinese local science and technology innovative enterprises represented by Baidu, Sohu, Zhongxing Microelectronics, Mainland China Pharmaceutical, etc.



Blue vertical bars represent the SSE index
Red line graph represents the NASDAQ index
Figure 11. Shanghai Composite Index and NASDAQ Composite Index (January 2007 - December 2016)
(Data source from WIND database)

As shown in the chart, the stock index of the NASDAQ Stock Market during 2007-2016 fluctuated considerably compared with the SSE Composite Index, but the overall trend was consistent. Since most of the enterprises listed in the listed company are Chinese high-tech enterprises, these enterprises are affected by the future development expectations, and there is a larger fluctuation range compared with the New York Stock Market index.

The indexes that make up the NASDAQ Mainland China Index are screened from Chinese companies listed on NASDAQ Stock Market and New York Stock Exchange in the United States. The index includes outstanding enterprises in various industries such as Mainland China Mobile, petroMainland China, Baidu and New Oriental. Since there are only NASDAQ Mainland China index data from 2007 to 2012 in the wind database, the index data of NASDAQ Mainland China index in this paper are all data of this period.



Blue vertical bars represent the SSE index
Red line graph represents the NASDAQ Mainland China index
Figure 12. Shanghai Composite Index and NASDAQ Mainland China Index (May 2007-July 2016)
(Data source from WIND database)

It can be found from the fluctuation situation of NASDAQ Mainland China Index and SSE Composite Index in the above figure that the direction and amplitude of volatility of the two indexes are consistent, and the consistency of volatility trend is better than that of NYSE Composite Index and NASDAQ Composite Index. It can be seen that NASDAQ Mainland

China Index and SSE Composite Index may be better than the other two stock indexes in terms of volatility transmission.

As can be seen from the chart of the index volatility of listed companies in the US and Mainland China, although the volatility range of the stock market indexes in the two countries is not consistent, the volatility trend is still relatively consistent. Therefore, it is necessary to conduct detailed empirical analysis in the following paper to judge the volatility transmission of the stock markets in the United States and Mainland China.

6. Summary

From the beginning of the 21st century to the present, many public health emergencies have broken out in countries around the world, from SARS to influenza to the current novel coronavirus pneumonia epidemic. These outbreaks have had a subsevere impact on all countries. In addition to affecting global social stability, they have also brought serious impact on the economic development of countries. Public health emergencies will not only pose a threat to people's production and life, but also have a huge impact on the economic operation system, squeezing demand and supply in both directions, significantly increasing the pressure on payments and payments, causing long-term negative impacts on both a country's economy and the world economy, and greatly increasing the uncertainty of the macroeconomic environment. This has led to a series of vicious cycles. In this process, the impact on economic production is easily transmitted to the capital market through the industrial chain and other mechanisms, which will also lead to significant shocks in the financial market.

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