The influence of global Risk Index on Chinese Stock Market
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Abstract. The development of stock market in China is immature compared to other stocks markets and vulnerable to the impact of international environment. This paper analyzes how the global financial risk affect the development of Chinese stock market in terms of global risk transmission. The goal is to offer policy suggestions about how to avert external risks and stock price fluctuations. Given the VIX index, an ordinary least squares model is created to examine which degree of variation the increase in VIX index brings to SSE Composite Index. The result of regression analysis indicates that one percentage change of VIX index generate a reduction of approximately 13 points in SSE Composite Index. In response to an increase in the level of global financial risk, the stock price of Chinese stock market appears to decrease and the stock market is more likely to experience depressions.

Keywords: VIX index; Chinese stock market; SSE Composite Index; Ordinary least squares (OLS).

1. Introduction

The VIX, an index presented by the CBOE (Chicago Board Options Exchange) in 1993, referred to the expectation of volatility by averaging the weighted prices for out-of-the-money puts and calls. When the value of VIX is high in the market, it indicates that market participants expect a higher level of future volatility and they tend to have greater degree of risk, fear, and uncertainty about the market. In contrast, if the value of VIX value is low in market, it implies that market participants’ expectation of future volatility and the level of fear come down. Thus, it is also called “The Investor Fear Gauge.” When the S&P 500 Index declines, VIX usually continue to move up. When that index rises, VIX usually drop. From another aspect, the unusually high or low value of VIX demonstrates that market participants who have extremely high fear levels will buy put options regardless of costs or be too optimistic to take any hedging actions, which is a signal of expectation of big swings in the market. The monthly trend of VIX index is shown in Figure 1. The X axis shows mean of VIX volatility index and the Y axis represents the time period of VIX trend from 2008 to 2020.

![Figure 1. Monthly trendline of VIX index mean](image-url)
In Chinese stock market, unreasonable spike and plunge are two common phenomena since shortcomings including late development, weaker foundation, and imperfection of laws, regulations and related policies still exist. From one aspect, these issues cause negative effects to the financial investment of stock market and the growth of Economy. From another aspect, these issues increase the difficulty of government’s policy making and regulation inspection. what's worse, this downward spiral interrupt the healthy development of a stock market and reduce its efficiency. Throughout the trade conflict between U.S. and China and the COVID-19 pandemic, external factors continuously present various challenges to Chinese stock market. In order to construct a more mature Chinese stock market, it is critical to find the solutions to these challenges.

SSE (Shanghai Stock Exchange) Composite Index is a stock market index that evaluates the overall performance of all stocks (A shares and B shares) that are traded at the Shanghai Stock Exchange. Figure 2 shows the monthly trendline of SSE Composite Index. X axis is a record of the SSE Composite Index value and the Y axis gives the time period of SSE Composite Index trend from 2008 to 2020. To avoid the influence of global risk factors, this paper conducts further studies on it. Given related research results, VIX provides an effective measurement of global market volatility. Choosing VIX as a core explanatory variable, this paper analyzes how the Chinese stock market is affected by the risk of global market.

![Figure 2. Monthly trendline of SSE Composite Index](image)

To be more specific, this paper studies the degree of VIX index’s influence on SSE Composite Index by establishing an OLS (ordinary least squares) model and examining the casual relationship between these two. To make a distinction, VIX index is explored in this paper to compute global financial risk. It demonstrates the guidance of global stock market risk on Chinese stock market and, in consequence, prevent stock market risk to support the substantial development of Chinese stock market.

2. Literature review

Most studies investigate the association between the stock market and macro-economic factor. Macro-economic factors mainly include interest rates, unemployment, and economic growth. Alam, M. D., & Uddin, G. (2009) reveal that there is an empirical relationship between stock index and interest rate in fifteen developed and developing countries [1]. They found that changes of interest rate have significant negative relationship with changes of share price. In addition, Gonzalo, J. & Taamouti, A. (2017) examined the nonlinearity in the stock market’s reaction to the unemployment
rate through nonparametric Granger causality and quantile regression-based tests [2]. They clarified that an increase in the anticipated unemployment rate leads to an increase in stock market prices. By using Vector Autoregressive (VAR) modeling, Marques, L. M., Fuinhas, J. A., & Marques, A. C. (2013) examined the relationship between stock market and economic growth in Portugal [3]. The results prove a driving force from stock market towards growth. Among these studies, VIX (The Chicago Board Options Exchange Market Volatility Index) is a factor that is often ignored but useful to indicate stock market volatility. Some literatures introduced definition, purpose, and Characteristics of VIX index. Whaley, R. E. (2009) introduced how understanding the definition of the index can be useful and avoid any misconceptions [4].

To investigate the effect of VIX index, studies mainly focus on its relationship to financial market especially the stock market. On the one hand, some researchers argue that there is no causal relationship between VIX index and stock market volatility. Auinger, F. (2015) emphasizes that the major weaknesses and sources of criticism VIX Index has in reflecting the future development of financial market volatility and proves that a statistically significant causal relationship does not exist between the VIX and the S&P 500 [5]. On the other hand, other researchers state that there is a strong correlation between these two variables. Ahoniemi, K. (2008) models the implied volatility of the S&P 500 index to help option trader gain a useful forecasting [6]. Then, Wang, H. (2019) showed that the HAR-RV-VIX model exhibits superior forecasting performance for 12 stock markets during the coronavirus pandemic by comparing it with EPU index [7].

Based on these findings, following research results further explains how VIX index is helpful to imply stock market volatility. VIX index is previously accepted as an effective measurement of stock market for investors in developed countries, but it became accepted as a measurement soon in developing countries. GÜRSOY, S. (2020) provides an examination about the impact of price movements in the VIX index on the stock markets of the developing (BRICS) countries and points out an unilateral causality relationship between the price movements in the VIX index and indices of India (BSESN) and China (SSEC) [8]. This unilateral causality relationship leads to more studies on that topic. Through analysis of timing strategy in corresponding to change in India VIX, Chandra, A., & Thenmozhi, M. (2015) finds that there is an asymmetric relationship between India volatility index (India VIX) and stock market returns and it is useful to keep positive returns on a portfolio by changing into large-cap (mid-cap) portfolio when India VIX varies by a certain percentage point. In addition, Ruan, L. (2018) explored the influence of market volatility (VIX index) on the stock market. In this paper, one representative case is the Chinese stock market index because of some issues such as Information asymmetry [10]. As a measure of trend, VIX index is a helpful way to for investors to predict risk and hedge in stock markets. To be more detailed, he declared that the future trend of stock market will be significantly impacted by volatility of investor sentiment in the market and illustrated the importance of building volatility index to Chinese stock market. The model used in that paper is called the time-varying dynamic Copula model (ST-VCopula model), which considered the influence of exogenous variables on Copula parameters. Although ST-VCopula model is well-constructed with details, there are more direct method to determine the relationship between VIX index and stock market volatility. Therefore, my paper will conduct linear regression analysis and build OLS (Ordinary Least Square) model to examine the effect of VIX index to the stock market volatility. In terms of stock index data, he analyzed empirically with the data of stock index across different countries. However, the time period of data is outdated for analysis and the dataset can be improved with a stock index data that is more relevant to the conclusion of Chinese stock market. While Ruan chosen data of VIX index and monthly S&P500 from 2011 to 2016, this paper will use 2008-2020 as the time period and focus on the monthly data of SSE Composite Index, which is a stock market index of the all stocks traded on Shanghai Stock Exchange. The reasons are that SSE Composite Index is more representative for Chinese stock market and the time period from 2008 to 2020 can keep the data up to date. In regard of the conclusion part, Ruan’s paper do not point out the specific sort of relationship between VIX index and trend of stock market. By building OLS model, my paper will mention which type of relationship between these two variables in more details.
3. Data and methodology

In this paper, VIX index and SSE Composite Index are included as two major variables to analyze. Following a time series from January, 2008 to December, 2020, the source of data is drawn from wind data service that is a leading financial data provider in China.

3.1 The VIX index

Figure 1 plots the trend of monthly VIX index levels, reflecting volatility of stock market from 2008 to 2020. The average VIX index contributes to expectation of future stock market volatility. The reason is that uncertainty, risk, and the level of investors’ fear can be inferred from VIX index. As a result of the Great Recession, the figure indicates a high level of VIX index on September, 2008. The impact of COVID-19 recession is proved with the VIX index on January, 2020 as well. So, it is difficult for investors to predict movement and hedge stock market risks in response to risk events.

3.2 The SSE Composite Index

The trendline of monthly SSE Composite Index in Figure 2 also follows a time series from 2008 to 2020. At the beginning of trendline, SSE Composite Index declines rapidly on January, 2008 and reaches minimum on January, 2009. In that period, the exact value of SSE Composite Index decreases from 4500 points to 1500 points. Composite Index begins to rise quickly on May, 2014 and reaches a peak on May, 2015. In that period, the exact value of SSE Composite Index increases from 2000 points to 4500 points. Despite great fluctuations from 2007 to 2008 and from 2014 to 2015, the SSE Composite Index value remain at the level of 3000 points.

3.3 OLS model

To further examine the relationship between the VIX index and the SSE Composite Index, this paper constructs an OLS (Ordinary Least Square) model. As a basic method of prediction derived from response variable and explanatory variable, it is used a lot in simple linear regression models. OLS model starts with minimizing the sum of the squares of the differences between response variable and explanatory variable and make the model possible for finding relationship between variables. A detailed expiation of this model given in the following equation:

\[ Stockindex_t = \alpha_0 + \alpha_1 VIX_t + \epsilon_t \] (1)

where \( Stockindex_t \) denote the SSE Composite Index, which is the response variable of this paper for calculating changes in stock price of Chinese stock market; and \( VIX_t \) denote level of global financial risk, which is the core explanatory variable; \( \alpha_0 \) is the constant term; \( \alpha_1 \) stands for the essential coefficient that can weigh up the degree of change in SSE Composite Index corresponding to the variation of VIX index. \( \epsilon_t \) represents the random error term.

4. Results

According to the model above, this paper takes regression analysis of OLS model and the regression result is provided in Table 1.
Table 1. regression results

<table>
<thead>
<tr>
<th>variable</th>
<th>stockindex</th>
<th>VIX_index</th>
<th>-13.72241</th>
<th>(4.465)</th>
</tr>
</thead>
<tbody>
<tr>
<td>constant</td>
<td>3092.731</td>
<td></td>
<td></td>
<td>(99.512)</td>
</tr>
<tr>
<td>F value</td>
<td>9.45</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p value</td>
<td>0.0025</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-squared</td>
<td>0.0578</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results from the table shows that one percentage change of VIX index generate a reduction of approximately 13 points in SSE Composite Index. It is consistent to a negative correlation between global financial risk and stock price of Chinese stock market. In correspond to an increase in the level of global financial risk, the stock price of Chinese stock market tends to decrease and the stock market is more likely to experience depressions. Some economic factors serve as reasonable explanations for that result. During financial crisis, the investor sentiment is responsible for the high level of volatility indicated by VIX index. Among investor sentiments, asymmetric information occurs when one of the borrowers and sellers have more information about the asset of the another. Also, it raises issues of uncertainty in a period of financial stress because investors who relied on financial indicator conduct less accurate prediction about the stock market. They are more willing to buy put options and consequently increase the value of VIX index.

5. Conclusion

Based on the regression analysis of OLS model and VIX index, this paper observed that one point of variation in VIX index cause the value of SSE Composite Index change, considering the influence of global market risk index on SSE Composite Index. Thus, the fluctuations of Chinese stock market are affected by the volatility of global financial market, which implies that it is necessary to prevent issues of external risk transmissions in the development of stock market. To address these concerns, this paper offered the following solutions for risk hedging:

First, for policy makers of stock market, VIX index can be considered as the most effective methods to deal with the global risk environment. Historical documents prove that relying on multiple indexes are misleading to policy making during financial stress. For example, Hakkio, C. S., & Keeton, W. R. (2009) mentioned that Federal Reserve monitors financial stress, which may generate mixed signals with improved financial conditions using different measurements so that it is beneficial for policymakers to have a single and comprehensive index to indicate financial stress. [11]

Therefore, choosing one index that can effectively reflect the influence of global financial risk to Chinese stock market is crucial. From the result of regression analysis above, the VIX index is closely correlated with the volatility of Chinese stock market, thus providing further evidence to support risk hedging policies. To find specific benefits of this index, COVID-19 pandemic is a representative case of financial crisis due to its duration and depth. It generates unusual high stock market volatility and a significant decline in market liquidity. Sadiq, M., Hsu, C. C., Zhang, Y., & Chien, F. (2021) displayed study result of nearly 580% increase of CBOE VIX index from from Januaryl to April, and the drop in liquidity in the market (caused by the rapid spread of the coronavirus) [12]. To predict the movement of future market fluctuations and make relevant policies, policy makers can make use of VIX index evaluate risk levels and give policy solutions to ensure the stability of market.

Second, for option traders of Chinese stock market, VIX index is an indicator used for risk management. Ahoniemi, K. (2008) simulates option trades with S&P 500 option market prices based on option pricing model and points out that option traders can exploit profits from a certain degree of predictability in the direction of change of the VIX index. On consideration of this predictability, the
use of VIX index can be helpful to option traders in expectation of put and call prices. For instance, if option traders expect that the market is turning bearish in a negative shock, there could be increases in input prices and decreases in call prices (Low 2004) [13]. If the comprehensive degree of price for put options jointly changes in a is greater magnitude than that of call options jointly, the additional influence on the VIX is an increase (Low 2004). Therefore, as more option traders participate in the risk management using VIX index, Chinese stock market is developed with greater resistance to external risk factors.

Third, for researchers in the field of finance, VIX index is a statistically significant variable in the study of investors sentiment. The OLS model constructed in this paper only captures a part of stock market volatility, which means the statistical behavior of VIX index can be excessed in more depth. In regard of theoretical explanation, the performance of VIX index is consistent to the result section of this paper. A variety of investor sentiments are good at explaining the variation of VIX index under the Chinese stock market and its correlation to stock price. In addition to that, the performance of VIX index is explained as a statistically significant variable in signaling investor sentiment. Through an analysis of sentiment proxies and the coefficient for the recession interaction term, Smale, L. A. (2017) finds that the recession interaction term indicates a close relationship with VIX index due to the same direction statistically significance in all cases. So, there will be more following researches that use the VIX index as a starting point of investor behavior [14]. Given the comparison between the Chinese and the US stock markets, it is expected that the gap between Chinese stock market and other mature stocks will be filled in the future.

References