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A Study on the Relationship between Economic Policy Uncertainty and Stock Volatility

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Abstract

As an important part of economic operation, financial market has been playing an indispensable role, whether positive or strong negative impediment. If the financial market runs steadily, it will undoubtedly benefit the good operation of the economy, but the transition fluctuation of the financial market will easily lead to major difficulties in economic development. Therefore, the government has been committed to adopt different policy measures to regulate the healthy development of the economy and even the financial market, but the frequent introduction of policies will inevitably lead to policy uncertainty, which itself will lead to financial market volatility to a certain extent. Taking stock market as the representative of financial market, this paper studies the correlation between China's economic policy uncertainty and China's stock market. Using monthly data from 1995 to 2019, so as to trigger in-depth thinking，this paper mainly uses VAR model to explore whether there is a structural mutation in the relationship between the two, and to find out the reasons behind the mutation.

Key words: EPU; Stock volatility; Change-point

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INTRODUCTION

In the research of stock market, volatility is a constant classical theme, which has attracted the close attention of scientific researchers and institutional investors, it has become one of the core issues of modern financial market and academic research. Volatility is the uncertainty or risk faced by the stock market. As a reflection of the effectiveness of the stock market, volatility is a reflection of the incomplete information market. It is often measured by the annual standard deviation of the daily return of the stock market. It reflects the overall range of change over a period of time, rather than the trend of the stock price. The moderate volatility of the stock market helps the stock market to better play its role in financing and resource allocation, it has a positive impact on the standardization and healthy development of the stock market. However, the excessive volatility of the stock market has not only caused tremendous impact on the market itself, disordered the market, and led to the proliferation of speculative activities, but also to a certain extent led to the fragility of the financial system, affecting the stable development of macro-economy. It is found that the relationship between stock market and macro-economy is uncertain. The barometer function of stock market always fails, while the policy market often occurs, which leads to the asynchrony and even deviation between stock market and macro-economy. In the past, scholars have devoted themselves to the influence of national policies on stock market fluctuations. But since the outbreak of the world financial crisis, the increase of uncertainty in economic policies has gradually become an important factor hindering economic recovery. The imperfection of the stock market system and the irregular operation of the stock market in China have magnified its negative effects, and the uncertainty of economic policies has begun to lead to. It has attracted worldwide attention.

In 2008, a global financial crisis hit the world economy badly, and the development of countries was

in a deep depression. To this end, many countries and regions have issued a series of rescue policies aimed at accelerating economic recovery and stimulating the market. For example, the United States tried to avoid further economic recession by injecting liquidity through ultra-low interest rates and multiple rounds of quantitative easing policy; Japan relied on "emergency comprehensive countermeasures to achieve reassurance" and "emergency countermeasures to life defense" to alleviate the impact and stabilize the people's hearts; China was in a comprehensive pullback of trade policies, 10 major industrial revitalization plans and 4 trillion government stimulus plans. Under this effect, the economic structure has been improved. However, with the increasing complexity of the macroeconomic environment and market dependence on economic policies, the market can't adequately regulate itself under the frequent government intervention in the economy, so the uncertainty brought by policy changes will increase, which will lead to more intense macroeconomic fluctuations. Specifically, when policymakers try to directly or indirectly influence the operating environment of the economic sector through fiscal, monetary, exchange rate and regulatory policies, there will be uncertainty arising from two aspects, the external causes mainly include the outbreak of force majeure events such as war, natural disasters, global economic crisis, etc. The internal causes are manifested in the fact that the policy itself causes the economic entities not to market. Beneficiary actions or reactions, deviations in decision makers' expectations of future prospects, etc. Throughout China's stock market, the development process is relatively short, and there are frequent phenomena such as ups and downs that deviate from economic development, irrational responses to market information and policies, and lack of effective feedback regulation on the impact of economic policy uncertainty. In fact, policy expectation behavior under uncertain conditions is one of the core factors causing stock risk, that is, stock risk may not originate from the actual policy effect, but the expected response to potential policy changes. Looking back on the abnormal fluctuation of China's stock market in 2015, looking at the stock market plunge in 2018, and corresponding to various coping policies frequently issued, we should not only reflect on whether frequent policy changes have stabilized the stock market as scheduled to achieve the purpose of reducing volatility, but also imperceptibly intensify the counter-promotion fluctuation. In the face of high policy uncertainty, both sides of the stock market participate. That is, whether the listed companies and investors have increased their confidence in investment or just increased their fear of uncertainty. This series of thinking makes us realize the great necessity and urgency of studying the dynamic relationship between the uncertainty of economic policy and the volatility of stock market.

1. LITERATURE REVIEW

In the research process of policy uncertainty and its main impact, scholars measure the variable of "Economic policy uncertainty" from the following three perspectives. The first is to measure policy uncertainty by changing leaders. In Europe, the Americas and other countries, each election leads to a good measure of the uncertainty of leadership turnover policy, because not only does the fierce election process itself represent the turnover and retention of leaders in power, but also the staffing itself has greater uncertainty. Moreover, new leaders are likely to have different policy preferences and value orientations from their predecessors. Based on the new political background, the uncertainty of elections and results itself represents a great degree of policy uncertainty. In the measurement of policy uncertainty in China, the change of local officials similar to the Western election system mainly comes from the tenure system and the system of exchange between different places. The second is to measure policy uncertainty by major events. Because the occurrence and impact of major events are unpredictable, and often after major events will inevitably lead to instability in the situation and policy emergency response, it is reasonable to use the occurrence of major events as a measure of policy uncertainty.

The third is the economic policy uncertainty index. Baker et al (2016), from Stanford University and the University of Chicago, creatively proposed the Economic Policy Uncertainty Index (EPU index) to measure the uncertainty of economic policies in major global economies (Baker, Bloom, & Davis, 2016). Baker et al. defined the uncertainty of economic policy as the economic risk caused by the uncertainty of government's future policy. Its research team has constructed economic uncertainty indices for 12 large economies, including the United States, Europe, Japan, Russia, China and other economies, but in the process of conducting economic policy uncertainty indices for each economy, Baker and others have adopted different channels of combing. Regarding the measurement of China's economic uncertainty index, Baker et al. took Nanhua Morning Post, Hong Kong's largest English newspaper, as the object of analysis. By searching for key words related to economy such as "economy", "uncertainty", "legislation", "rule system" and "deficit", they normalized the mean and standard deviation of the target and gave weight according to the corresponding probability. Then, the EPU index of China is constructed by data synthesis method. Through the construction of this index, we can see that the EPU index covers monetary policy, fiscal policy and other economic policies related to economic operation, and it has a strong comprehensiveness. It has an important advantage compared with the index of official turnover and the major event Law mentioned above. The following chart shows the economic uncertainty indices of China and Europe from 1995 to 2019.

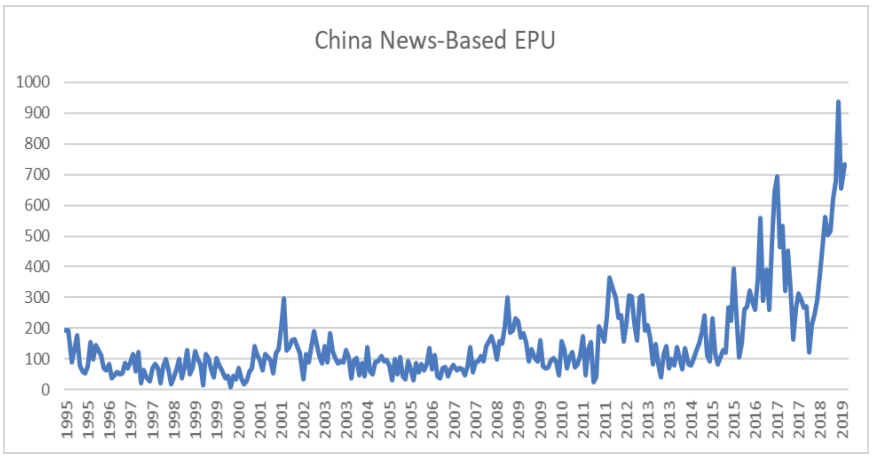

Figure 1
China news-based EPU

Figure 2
China's Shanghai composite index closing price

At present, many scholars are devoted to studying the relationship between the uncertainty of national economic policy and stock market volatility, and even some scholars are studying the correlation between the uncertainty of national quality control economic policy and stock market. Mazouz & Li (2007) used VAR model and set the change of money supply and fluctuation of stock price as representative variables to study the relationship between the two in American market, and drew a series of conclusions, such as the impact of monetary policy changes on stock market through portfolio effect channel (Mazouz and Li, 2007). Chen Guojin et al. (2014) made an empirical study and found that there is a negative correlation between economic policy uncertainty and China's stock market, and there is a two-way spillover of volatility in a short period of time (Chen, 2014). Cui Xin et al. (2018) based on the data of A-share in Shanghai and Shenzhen stock markets from 1997 to 2017, combined EPU index with the latest Fama-French five-factor model, the study found that in A-share market, "the uncertainty of economic policy" is a very important speculative factor, and its exposure will lead to investors' speculative behavior, thereby exacerbating the risk of stock price crash. In addition to the above studies, scholars also devote themselves to the study of the correlation between policy uncertainty index and individual stocks (Cui, 2018). The Bogaard & Detzel (2015) study found that stocks with greater exposure to uncertain risks of economic policy would be more affected. Now we have to look at the data of nearly 20 years as a whole (Brogaard and Detzel, 2015). Looking at the relationship between the two as a whole, but we know that with the constant changes of the world economy and political environment and the continuous development of globalization, China's policy uncertainty has changed a lot. From the figure above, we can see that the economic policy uncertainty at all stages presents different characteristics, at the same time. Stock market returns also show different amount characteristics, so we should think deeply whether the relationship between the two is changing at different stages. Therefore, based on the classical VAR model, considering the existence of structural mutation in the relationship between the two, this paper studies the characteristics of the relationship between the two at different stages in the presence of structural mutation.

2. DATA AND MODEL

In the literature review above, scholars draw a conclusion that there is a certain relationship between economic

policy uncertainty and stock market volatility, but so far there is no unified conclusion, whether the two are completely positive or negative correlation. Based on the monthly data from January 1995 to February 2019, 296 data were collected in each category. The reason why the Shanghai Composite Index is chosen as the main research object is that in China, the Shanghai Composite Index is the most representative stock index in the Chinese stock market. In order to facilitate comparison, the Shenzhen Stock Index and Shanghai-Shenzhen 300 Index are also selected in this paper. China's economic policy uncertainty index comes from the EPU index formulated by Baker et al. The data of stock market volatility comes from WIND. It is calculated by dividing the closing price difference of nearly two months by the closing price of more than one month, then taking the absolute value. From the following figure, we can't see the clear relationship between them intuitively. In some years, it seems that there is a positive correlation between the two, but there are also some years, the relationship between the two is not clear, or not obvious. So that we need to think deeply about whether the relationship between the two is changing.

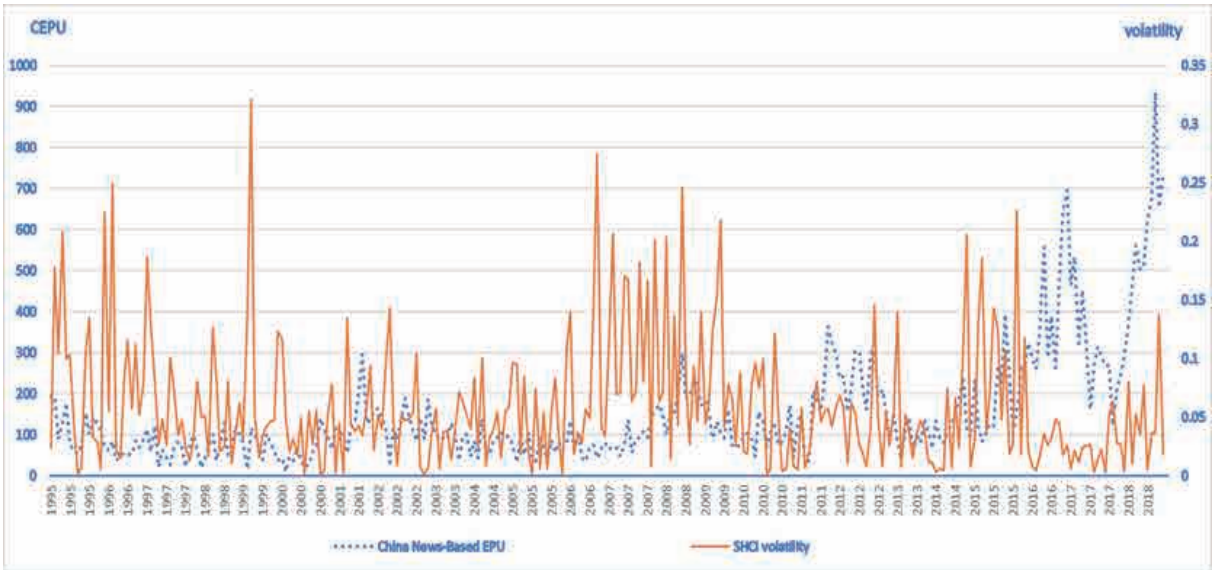

Figure 3
China's Shanghai composite index stock volatility and EPU comparison
Source: CEPU is from http://www.policyuncertainty.com/, and Shanghai Index is from wind.

This paper chooses Pierre Perron (2007) VAR model (Qu and Perron, 2007), which is suitable for studying the relationship between two variables. The following is the basic form of VAR model:

$$y_{1,t}=\beta_{1,j}+y_{1,t-1}\beta_{2,j}+y_{2,t-1}\beta_{3,j}+u_{1,t} \quad (1)$$

$$y_{2,t}=\beta_{4,j}+y_{1,t-1}\beta_{5,j}+y_{2,t-1}\beta_{6,j}+u_{2,t} \quad (2)$$

In the subsequent empirical studies, we need to focus on the values of each parameter. Considering the relationship between economic policy uncertainty and stock market volatility, y_1 represents stock market volatility and y_2 represents economic policy uncertainty, the third coefficient is the most important observation value, that is, beta 3. The number of structural mutations and the nature of the variation of coefficients after each mutation are observed through its changes.

$$\begin{pmatrix} y_{1,t} \\ y_{2,t} \end{pmatrix} = (I_2 \otimes (1 \quad y_{1,t-1} \quad y_{2,t-1})) \begin{bmatrix} 1&0&0&0&0&0 \\ 0&1&0&0&0&0 \\ 0&0&1&0&0&0 \\ 0&0&0&1&0&0 \\ 0&0&0&0&1&0 \\ 0&0&0&0&0&1 \end{bmatrix} \begin{pmatrix} \beta_{1,j} \\ \beta_{2,j} \\ \beta_{3,j} \\ \beta_{4,j} \\ \beta_{5,j} \\ \beta_{6,j} \end{pmatrix} + \begin{pmatrix} u_{1,t} \\ u_{2,t} \end{pmatrix} \quad (3)$$

When we use VAR model to analyze the time series with structural catastrophe, we first need to know that there are four different situations about the catastrophe: the first is the stable process in which the mean value catastrophes; the second is the trend stationary process in which the mean value catastrophes; the third is the trend stationary process in which the mean value remains unchanged and the slope changes; and the last is the mean value and the trend stationary process in which the mean value changes. Both slopes undergo a steady process of sudden change. The so-called change of slope means that the coefficient beta which needs to be paid more attention to changes obviously. According to the empirical results in the following paper, the situation studied in this paper refers to the sudden change of slope. That is to say, the VAR relationship between the time series involved in this paper is a sudden change of slope. Another important problem is that there are several different situations of structural break

point itself. There is a known break point. Firstly, the break point is pointed out, the time series is artificially divided into several parts, and then the different stages are studied. Another is that before the study, it is not known how many structural mutation points exist, or the number of structural mutation points is known, but the location of structural mutation points is not clear, which requires special algorithms to find the exact structural mutation points. In the following research process, we assume that there are two structural mutation points in order to find the mutation point, which is suitable for the time series of this length.

3. EMPIRICAL ANALYSIS

The premise of using VAR model to analyze data is that the time series is stable, because the first thing we need to do is to test the unit root of the data. When we use unit follow test to judge the stability of time series, we need to master the main stationary process and trend stationary process. The so-called stationary processes are unit root processes (DS), yt~I (1), . But there are also time series which are trend stationary processes, i.e. $yt = \alpha + \beta t + \mu t$, where $\mu t \sim I(0)$, i.e., residual is stationary, then the original sequence YT is called trend stationary process. In addition, the stationary process can also be divided into first-order stationary and second-order stationary, that is, the original time series is not directly stationary, but after first-order difference or second-order difference, it is stationary. The above mentioned conditions can be used as stationary sequences, which meet the basic conditions of VAR model. The time series in this paper conform to the condition of stationarity, so it is suitable for VAR model. According to the uncertainties of China's economic policy and the development of the stock market, we assume that there are two structural break points. We use Pierre Perron's structural break point test method. The results are shown in the following figure. First, in order to eliminate the problem of heteroscedasticity, on the basis of not changing the relationship between economic policy uncertainty and stock market volatility, two sets of data are logarithmized. The relationship between the two sets of data after logarithm is shown in the following figure.

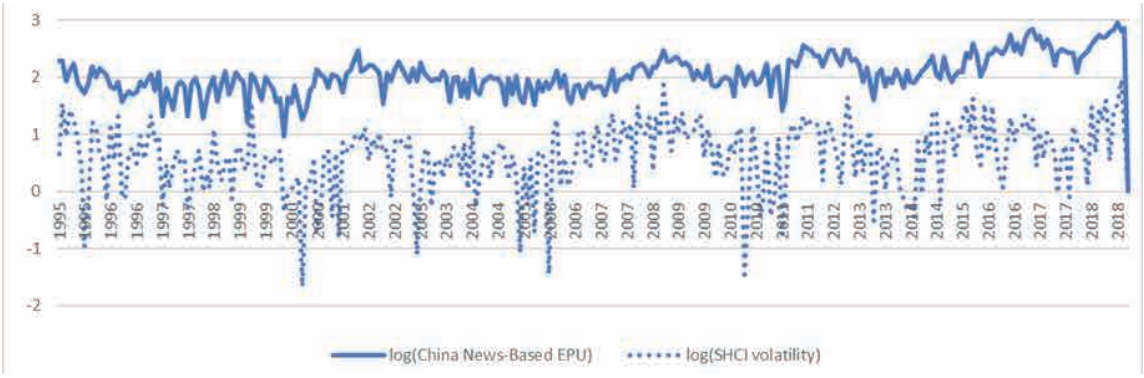

Figure 4
The stock volatility of China's Shanghai composite index is logarithmically correlated with EPU

As can be seen from the above chart, there is a positive relationship between the uncertainty of China's economic policy and the fluctuation of Shanghai stock index, and the general trend is similar. Moreover, the fluctuation of Shanghai Stock Index has its own rules. Using the characteristics of the time series itself, it can also be divided into four parts according to several points of sharp decline, while the uncertainty of economic policy can be divided into three parts. Among them, in 2000, 2008 and around 2015, great changes have taken place.

The Table 1 is the result of structural break point test for the volatility of China's economic policy uncertainty index and Shanghai Stock Exchange Index. Through calculation, we can see that there are two structural break points, 191 samples and 255 samples, respectively. Since the data began in 1995, the corresponding time points for these two mutation points are November 30, 2010 and March 31, 2016. During the period from January 1, 1995 to November 30, 2010, the value of major coefficient beta 3 was 0.141. However, after a significant structural mutation, the value of beta 3 was 0.359 from November 30, 2010 to March 31, 2016. Between March 31, 2016 and February 1, 2019, the value of beta 3 decreased to 0.170.

Table 1
Shanghai Index Structure Breakpoint

Shanghai composite index
The estimated breaks are: 191 (2010-11-30), 255 (2016-03-31)

For the 1.000 th regime:	0.156	0.116	0.141	-0.182	-0.001	0.563
For the 2.000 th regime	-0.101	0.135	0.359	0.106	0.107	0.591
For the 3.000 th regime	-0.933	-0.088	0.170	0.706	0.303	0.804

In order to facilitate comparison, this paper chooses Shenzhen Composite Index as the research object, besides the Shanghai Composite Index, which can best represent the Chinese stock market, to study the changes of the relationship between China's economic uncertainty index and Shenzhen Composite Index volatility. After structural mutation test, we can see that there are two structural mutation points, 155 samples and 256 samples, respectively. Since the data began in 1995, the

corresponding time points for these two mutation points are December 28, 2007 and April 29, 2016. During the period from January 1, 1995 to December 28, 2007, the value of major coefficient beta 3 was -0.070. However, after a significant structural mutation, the value of beta 3 was 0.298 from December 28, 2007 to April 29, 2016. From April 29, 2016 to February 1, 2019, the value of beta 3 decreased to 0.259.

Table 2
Structural Breakpoint of Shenzhen Composite Index
SZSE Component Index
The estimated breaks are:155 (2007-12-28), 256 (2016-04-29)

For the 1.000 th regime:	0.050	0.029	-0.070	-0.277	-0.006	0.432
For the 2.000 th regime	0.035	-0.091	0.298	0.036	0.098	0.646
For the 3.000 th regime	-1.307	-0.545	0.259	0.600	0.068	0.795

Table 3
Structure Breakpoint of CSI 300 Index
Hushen 300 Index
The estimated breaks are:161（2015-05-29）

For the 1.000 th regime:	0.200	-0.038	0.355	-0.125	0.013	0.666
For the 2.000 th regime	-0.184	0.124	-0.086	0.389	0.062	0.817

The Shanghai Composite Index mainly represents the situation of most B shares in Shanghai Stock Exchange, while the Shenzhen Composite Index mainly represents the situation of Shenzhen Stock Exchange. In addition, there is a stock market can be used as a comprehensive situation of all stocks in Shanghai and Shenzhen Stock Exchange, namely, the Shanghai and Shenzhen 300 Index. In order to emphasize comprehensiveness, the Shanghai and Shenzhen 300 Index is chosen as the research object. Through the structural mutation test, we found that there is only one structural mutation point, that is, the 161st value, which corresponds to May 29, 2015. Before May 29, 2015, the beta 3 value is -0.038. After May 29, 2015, the beta 3 value rises to 0.124. It is worth noting that the mutation time of the third table seems to be inconsistent with the first two tables, mainly because the data of Shanghai-Shenzhen 300 Index have only been obtained in recent years.

4. CONCLUSIONS AND POLICY IMPLICATIONS

In conclusion, we can draw the following conclusions: Firstly, the relationship between economic policy uncertainty and stock market volatility is not invariable. We can not simply say that they have a positive or negative correlation. The relationship between them changes with time and is not limited to a certain nature. Secondly, for different periods of China's stock index, the uncertainty of economic policy and its correlation are different, and the number and location of structural change points are also different. From the above research results, there is only one structural mutation point in the Shanghai and Shenzhen 300 index, and there are two structural mutation points in the Shanghai Composite Index and Shenzhen Composite Index, showing that the number of mutations is different, and the location of each mutation is different.

The reason behind the in-depth thinking is that different stock indexes represent different types or nature of enterprises. The nature of enterprises is different. When faced with frequent changes or unchanged economic policies, the reflections are different, some reflections are faster and some reflections are slower. Moreover, changes in economic policies may have different policy preferences, which may lead to different results. The third point is that in general, the impact of economic policy uncertainty on stock market volatility is relatively large, and the coefficient is significant. As an important part of the financial market, the stock market has a very important impact on the overall economic operation of China. Under the pressure of adjusting the direction of economic operation, the government has to issue various adjustment-oriented policies frequently in an attempt to guide the stock market to play its positive role. However, excessive policy intervention or frequent changes in policies themselves cannot maintain policies. Unity, on the contrary, will cause the panic of shareholders and the retreat of enterprises. Therefore, on the premise of guaranteeing the normal operation of the economy, the government should try its best to play the regulatory role of the market itself, and that maintain the consistency and coherence of policies.

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