The impact of economic policy uncertainty on equity market volatility

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Abstract. This paper uses the monthly China Economic Policy Uncertainty Index as a proxy variable for China's economic policy uncertainty and the SSE Index volatility as a measure of stock market volatility to study the impact of economic policy uncertainty on stock market volatility. Data from January 2007 to October 2021 are studied, in addition to inertia factors, time breakpoints, macro factors and stock market factors respectively to facilitate the impact on stock market volatility. The findings of this paper expand the research boundary and provide a reference for ideas for macro policy formulation and capital market investment.

Keywords: Economic Policy Uncertainty Index; Stock market volatility.

1. Introduction

Currently, with the development of financial markets, financial risks have become more complex and diversified, leading to abnormal volatility and risk spillovers in the financial system in general and increasing the difficulty of financial risk management. Financial crises, monetary and trade policies, and public health emergencies are all prone to trigger financial risks. These endogenous or exogenous shocks place high demands on countries' financial risk management capabilities, of which the study of financial asset volatility is crucial for risk management. In China, financial markets are highly susceptible to volatility arising from the macroeconomic environment and economic policies. And the correct identification of stock market volatility is key to carrying out financial risk management activities.

Economic uncertainty refers to the inability to predict the likelihood that future events will occur in the economy or the extent to which the likelihood of the relevant economic events occurring is consistent with expectations. Economic uncertainty often leads to an unpredictable element in government economic policy, with both uncertain policy expectations and effects, and uncertain possibilities for policy adjustments or changes. Economic uncertainty influences and changes the behaviour of macroeconomic policy sectors and micro market players, with negative effects on macroeconomic operations and significant constraints on economic decisions such as production, consumption and investment.

Economic policy uncertainty is closely related to the stock market, and some scholars even refer to China's stock market as a "policy market". Therefore, we can study the impact of economic policy uncertainty on stock market volatility to gain a more comprehensive understanding of stock market volatility and provide investors and policy makers with a new perspective, which has important theoretical value and practical significance.

In order to quantify the degree of economic policy uncertainty, in 2013 Baker et al. compiled the Economic policy uncertainty (EPU) index for the world's major economies [1]. The Chinese economic policy uncertainty index was constructed by Baker et al. (2016) based on keywords from articles in the South China Morning Post (SCMP). (The South China Morning Post, started in 1903, is a Hong Kong English-language newspaper with a reputation for authoritative and independent pertinent reporting, and has been the most credible newspaper in Hong Kong, the Mainland and even Asia.) The index was constructed as follows: first, articles dealing with China's economic uncertainty were filtered from the articles in the South China Morning Post, and second, articles dealing with policy were filtered from the last filtered The number of articles that meet the requirements in the South China Morning Post each month is counted through the filtering rules, and then divided by the

number of all articles in the South China Morning Post in that month, and finally the monthly data obtained since 1995 is normalised to a mean value of 100, at which point the data is the China Economic Policy Uncertainty Index. In this paper, the China Economic Policy Uncertainty Index is used as a proxy variable for China's economic policy uncertainty, with a data interval of 178 monthly data from January 2007 to October 2021. The China Economic Policy Uncertainty Index is sourced from the Economic Policy Uncertainty website.

The paper consists of several sections, starting with an introduction, which explains the background of the paper and the relevant indices. The second part is a literature review, which provides a review of the literature on the correlation between economic uncertainty and the stock market and summarises the current findings on economic uncertainty. The third part is the empirical research section, which includes model building, variable selection and data processing. Then, the empirical results are analysed and conclusions drawn. Finally, there is a conclusion, which presents relevant recommendations based on the findings of the study.

2. Review of the literature

As Bakeretal introduced the Economic Uncertainty Index in 2013, which made economic uncertainty quantifiable, many scholars have subsequently conducted research on the subject. Most of the literature available so far is on economic uncertainty and economic growth, business investment and exchange rates. The literature on economic uncertainty and the stock market has focused on the correlation and causality between the two.

Pastor and Veronesi (2011) find that policy uncertainty enhances stock market volatility and quantify the reflection of stock market prices on policy uncertainty by constructing an empirical model. Jin Xuejun et al. (2014) chose the EPU index as a proxy variable and constructed a FAVAR model to conduct an empirical study, which ultimately found that the negative effects brought about by policy uncertainty in China would be transmitted to various economic levels in China through the expectations channel, bringing negative effects to the stock market and the real estate market. Chen Guojin et al. (2017) conducted an empirical study on the correlation between China's stock market and policy uncertainty and the two-way volatility spillover effect between these two by constructing a correlation model, pointing out that economic policy uncertainty does affect stock market price volatility and that this effect mainly affects stock prices by influencing government decisions, the book value of enterprises and the degree of risk aversion. It is also argued that a minority view is that the two are in fact non-linearly correlated. Antonakaki et al. (2013) argue that the correlation between stock market returns, implied volatility and economic policy uncertainty is time-varying and varies from period to period, and that changes in oil demand and recessions have a significant impact on the relationship.

In terms of the impact of economic policy uncertainty on the stock market, Shi Qiang et al. (2019) investigate the effect of monetary policy uncertainty on stock market volatility in China with the help of the GARCH-MIDAS model and find that the long-term impact of monetary policy uncertainty volatility on stock market volatility is more signficant than its horizontal value. It is also found that the impact of economic policy uncertainty on stock market volatility shows some variability across time, mainly related to the prevailing economic environment. As for the prediction of economic uncertainty and stock market volatility, less literature is available. Yu Jiang et al. (2018) analysed the predictive role of China's economic policy uncertainty on the volatility of the CSI 300 index by building a series of realized extreme variance volatility heterogeneous autoregressive model families and applying the out-of-sample forecasting method with rolling time windows. On the one hand, the results of the pooled model confidence tests indicate that China's economic policy uncertainty index can significantly improve the forecasting ability of stock market volatility; on the other hand, the results of the base-case economic value evaluation method also indicate that, at different lengths of forecasting intervals (1, 5, 10 and 20 days), volatility models incorporating China's economic policy

uncertainty index obtain a significantly higher economic value of the portfolio than other models without the index.This enhancement is robust to different levels of investor risk aversion.

Economic policy uncertainty can affect cash flows by changing the equity risk premium. There are also significant effects on asset pricing and equity returns. EPU can influence regional ayatematic risk in global equity markets. As equity markets can partly reflect economic conditions, policymakers can predict the economy and formulate policies based on equity markets. From this perspective, it affects EPU as well. Currently, the discussion on equity markets and EPU focuses on three levels: First, it examines the risk premium effect of EPU on equity markets from the perspective of returns. The second is to examine the volatility spillover effect of EPU on the stock market. The third part analyses the two-way spillover effect between the stock market and the EPU index.

3. Empirical Study

3.1 Modeling

Using the economic policy uncertainty index as the explanatory variable and stock market volatility as the explanatory variable; and referring to the study of Min Shiyun (2020), control variables were selected from four aspects: time breakpoint factor, inertia factor, macro factor and market factor, and the following model was established.

$$VolShang_t = \beta_0 + \beta_1 LPUSCMP_t + \beta_i Controls_t + u_t \tag{1}$$

where VolShang is the explanatory variable, LEPUSCMP is the explanatory variable, and Controls represent the selected control variables, i=2..., m, where m-1 is the number of control variables.

3.2 Variable selection and data processing

The variables used in this paper are the volatility of the SSE index, the economic policy uncertainty index, the Shanghai interbank 7-day interbank lending rate and the average P/E ratio of the SSE. The sample interval is from January 2007 to October 2021, with 178 observations.

Among them, in order to reflect the overall volatility of the Chinese stock market, the monthly standard deviation of the daily return of the SSE Index was selected to measure the volatility of the stock market in that month. The explanatory variable VolShang was used as the raw data for the daily closing price of the SSE Composite Index, the most representative index of the Chinese stock market (Data source: Shanghai Stock Exchange). The closing price was log-differenced to obtain the daily return, and then the monthly SSE Composite Index volatility by the following formula.

$$VolShang_t = \sqrt{\frac{\sum_{j=1}^{n}(r_j - i_r)^2}{n-1}} \tag{2}$$

Where $VolShang$ is the monthly volatility of the SSE Composite Index, r is the interval intra-day return, i_r is the average return and n is the number of days in period t of the interval. To harmonise the magnitudes of the variables, the raw data for SSE index volatility is multiplied by 100.

Control variables section: (1) Time breakpoint factor. Considering that the global financial crisis in 2008 triggered global stock market shocks that may change the structural characteristics of stock market volatility, dummy variables for FinCrisis were introduced as control variables. Also, given the high level of economic policy uncertainty during the financial crisis, these two factors may have an interactive reinforcing effect on stock volatility, hence the interaction term between LEPUSCMP and Fin-Crisis in the subsequent analysis. (2) Inertia factors. When the factors influencing stock prices change, the effect of these factors on stock prices tends to persist for a certain period time, which is mainly reflected in the fact that stock price volatility is related to prior period volatility, i.e., it has a

certain degree of inertia. This paper introduces the lagged one-period value of the explanatory variable VolShang_L1 as a proxy variable for inertia factors. (3) Macro factors. Shanghai Interbank 7-day Interbank Offered Rate (SHIBOR) is an arithmetic average interest rate calculated and determined by the RMB interbank offered rate independently quoted by banks with higher credit ratings, which is calculated based on the average of the quoted rates given by 18 commercial banks, which are composed of quotation banks every day. Short-term shibor has reference significance and can reflect the market situation more. Therefore, this paper chooses the Shanghai Interbank Offered Rate (SHIBOR) as the control variable to represent the economic development situation in China. (4) Stock market factors. The P/E ratio is an essential basis for stock value assessment and investment strategies. Changes in the P/E balance will affect investors' investment behaviour, which in turn acts on the degree of stock price volatility. Therefore, chose the SSE P/E ratio (PERShang) to control for stock market level factors.

Table 1. Variable selection and data processing

Type		Variable	Unit	Data treatment	Source
Explained variable		VolShang	——	The monthly standard deviation of daily returns on the SSE	Shanghai Stock Exchange
Explanatory variable		LEPUSCMP	——	Data subject to logarithmic variation	Baker et al.
Control **varia**bles	Time breakpoint factor	FinCrisis	——	September 2008-October 2014 assigned a value of 1, rest 0	——
	Inertia factor	VolShang_L1	——	One period lagged value of the monthly standard deviation of daily SSE index returns	——
	Macro Factors	SHIBOR	%	——	RESET Database
	Stock Market Factors	PERShang	%	——	RESET Database

3.3 Empirical analysis

(1) Descriptive Statistical Analysis

Table 2. Descriptive statistics results

Variables	Mean	Max	Med	Min	S.D.	Skewness	Kurtosis
VolShang	1.372	3.833	1.155	0.274	0.745	1.261	4.040
LEPUSCMP	5.381	6.878	5.348	3.264	0.828	0.036	2.142
PERShang	23.456	50.500	21.487	8.865	7.744	0.884	3.725
SHIBOR	3.647	5.250	3.486	1.588	1.010	-0.179	1.925
FinCrisis	0.416	1.000	0.000	0.000	0.494	0.342	1.117

Table 2 gives the descriptive statistics for SSE index volatility, economic uncertainty index, SSE P/E ratio, Shanghai Interbank 7-day Interbank Offered Rate and the period of a financial crisis. The skewness values of all variables are more significant than 0, indicating that the data series is right-skewed, with the peaks of the frequency distribution shifting to the left and the long tails extending to the right in a favourable skewed distribution; the skewness of the Shanghai Interbank Offered Rate is negative, indicating that it is left-skewed, with the peaks of the frequency distribution shifting to the right and the long tails extending to the left in a negative skewed distribution. Regarding standard

deviation and mean, the SSE P/E data are more discrete and more concentrated during the economic crisis. In terms of kurtosis, the kurtosis values of these variables are all greater than 0, which means that there are fewer extremes on both sides of the distribution. The distribution is higher and thinner than the normal distribution, with a sharp whistle peak distribution, which shows that these variables do not obey the normal distribution, and show the characteristics of "sharp peaks and thick tails".

(2) Correlation coefficient (multicollinearity) test

Table 3. Multicollinearity test results

	Volatility	EPU	P/E	Interest Rate	Economic Crisis
VolShang	1.000				
LEPUSCMP	-0.267	1.000			
PERShang	0.166	-0.223	1.000		
SHIBOR	-0.110	-0.217	-0.312	1.000	
FinCrisis	-0.076	-0.507	-0.219	0.158	1.000

The correlation matrix of the variables shows that the correlation coefficients between the variables are all less than 0.4, and can consider the model be considered free from multicollinearity.

(3) Analysis of model regression results

1. Baseline model

Table 4. Sample regression results

Variables	Coefficient	t-value	p-value
ntercept term	1.508***	3.515	0.001
LEPUSCMP	-0.166***	-3.261	0.001
P/E	-0.001	-0.639	0.523
Interest rate	-0.019	-1.518	0.131
Economic crisis	-0.190*	-2.703	0.008
Volatility lagged	0.664***	9.148	0.000
R^2 (%)	53.850		

A regression analysis of the model shows R^2 of 0.539. The coefficient on LEPUSCMP is -0.166 and passes the 1% significance test. This indicates that for every 1% increase in LEPUSCMP, VolShang decreases by 0.166, all else being equal. The possible reason for this is that when economic policy uncertainty rises, investors will be more cautious in their investment behaviour and avoid changing their investment strategies to reduce risk and losses, which also weakens the intrinsic factor of significant stock price volatility inherent to stock market volatility. Therefore, stock market volatility decreases as economic policy uncertainty increases. Regarding control variables, the SSE P/E ratio and the Shanghai Interbank 7-day Interbank Offered Rate failed the 10% significance test. The FinCrisis passed the 10% significance test, and the VolShang_L1 passed the 1% significance test. This suggests that stock market volatility is affected by the time breakpoint 2008 financial crisis (FinCrisis), as well as the inertia factor, lagged one-period SSE volatility (VolShang_L1).

2. Extending the model: adding interaction terms

Given the high level of economic policy uncertainty during the financial crisis, these two factors may have an interactive reinforcing effect on stock volatility, so the interaction term between LEPUSCMP and Fin-Crisis is added to the extended model, and regression analysis is conducted for this.

Table 5. Regression results for the sample (with interaction terms)

Variables	Coefficient	t-value	p-value
Intercept term	2.461***	3.515	0.001
LEPUSCMP	-0.278***	-3.261	0.001
P/E	-0.004	-0.639	0.523
Interest rate	-0.064	-1.518	0.131
Economic crisis	-1.659***	-2.703	0.008
EPU* Economic crisis	0.281**	2.464	0.015
Volatility lag	0.617***	8.331	0.000
R2 (%)	54.816		

The R^2 of the model is 0.548, which is higher than the R^2 value without the inclusion of the interaction term, indicating that the model considering the interaction of economic policy uncertainty and the LEPUSCMP * FinCrisis fits slightly better than the baseline model. FinCrisis passes the 1% significance test, which suggesting that the inclusion of the interaction term has increased the significance level of FinCrisis. The LEPUSCMP * FinCrisis passes the 5% significance test. For every 1% increase in economic uncertainty during the financial crisis, stock market volatility decreased by 0.278. This result suggests that our stock market volatility was more sensitive to policy uncertainty before the financial crisis than after the 2008 financial crisis, which reduced the sensitivity of stock market volatility to policy. The possible reason for this is that the onset of the financial crisis increased market uncertainty in the face of high policy uncertainty. Investors were more cautious in investing in the face of more significant uncertainty, thus reducing the degree of impact of policy uncertainty on stock market volatility.

4. Robustness tests

From the previous section, we conclude that as economic policy uncertainty rises, the stock market's volatility decreases, and this phenomenon became more pronounced after the financial crisis in 2008. This section will use the CSI 300 index to measure stock market volatility, i.e. the explanatory variable is CSI 300 volatility, as a robustness test.

Table 6. CSI 300 volatility regression results

Variables	Coefficient	t-value	p-value
Intercept term	1.166***	3.515	0.001
LEPUSCMP	-0.145***	-3.261	0.001
P/E	-0.002	-0.639	0.523
Interest rate	-0.014	-1.518	0.131
Economic crisis	-0.183*	-2.703	0.008
Volatility lagged	0.629***	6.435	0.000
R^2 (%)	47.879		

First, the baseline model is regressed, and the R^2 of the model is 0.479. The LEPUSCMP is -0.145 and passes the 1% significance test. This indicates that all else being equal, for every 1% increase in LEPUSCMP, VolShang decreases by 0.145. CSI 300 volatility also decreases as economic policy uncertainty increases. Consistent with the findings obtained in the previous section. Regarding control variables, the SSE P/E ratio and the Shanghai Interbank 7-day Interbank Offered Rate fail the 10% significance test. The FinCrisis passes the 10% significance test, and the VolShang_L1 passes the 1% significance test. These results are all consistent with those obtained in the previous section

Table 7. CSI 300 volatility regression results (with interaction term)

Variables	Coefficient	t-value	p-value
Intercept term	1.930***	3.040	0.003
LEPUSCMP	-0.237***	-3.007	0.003
P/E	-0.005	-0.860	0.391
Interest rate	-0.050	-1.274	0.204
Economic crisis	-1.408**	-2.432	0.016
EPU* Economic crisis	0.234**	2.185	0.030
Volatility lag	0.586***	5.611	0.000
R^2 (%)	48.765		

Next is a regression of the model with the interaction term included; the R^2 of the model is 0.488, again this R^2 is somewhat higher than the R^2 value without the interaction term, again suggesting that the model considering the interaction between economic policy uncertainty and the LEPUSCMP * FinCrisis fits slightly better than the baseline model. the FinCrisis passes the 1% significance test, which is consistent with the results obtained in the previous section, i.e., the inclusion of the interaction term increases the significance level of the FinCrisis. The LEPUSCMP * FinCrisis passes the 5% significance test. In times of financial crisis, for every 1% increase in economic uncertainty, stock market volatility decreases by 0.237. Again, the same conclusions as in the previous section can be obtained. And, the regressions using the CSI 300 Index and the SSE Composite Index volatility are very close, with only minor changes. In contrast, economic policy uncertainty has a slightly more significant impact on SSE Composite Index volatility.

5. Summary

This paper establishes a multiple regression model and introduces interaction terms to first empirically test the impact of economic policy uncertainty on the volatility of the SSE index, followed by a robustness test on the effects of economic uncertainty on the volatility of the CSI 300 index to verify the impact of monetary policy uncertainty on stock market volatility. The specific findings of the study are as follows.

(1) Regarding main effects, the higher the economic policy uncertainty, the lower the volatility of China's stock market.

(2) Regarding inertia factors, China's stock market volatility is significantly influenced by lagged volatility.

(3) Regarding structural breakpoints, there was a structural breakpoint in China's stock market volatility at the 2008 financial crisis.

(4) Regarding interaction effects, the interaction between economic policy uncertainty and the 2008 financial crisis on stock market volatility is significant. It reduces stock market volatility compared to the pre-interaction period.

(5) In terms of macro factors and the stock market, China's stock market volatility is unaffected.

Combined with the above findings, can provide the following reference ideas for macro policy formulation and capital market investment.

First, as economic policy instability will make investors too cautious and conservative, thus leading to a lack of vitality in the stock market and reducing stock market volatility, it is vital for government to continue to deepen financial market reform, continuously improve market order, try to maintain the stability and continuity of macroeconomic policies, improve the strength of economic policies, which in turn will reduce the uncertainty of economic policies and further improve Transparency of policies.

From investors' perspective, more investors should be motivated to turn to rational investment. With the increasing use of information technology by securities practitioners and investors, as well

as the expansion of China's securities market, such as the opening of the Shanghai-Hong Kong Stock Connect and Shenzhen-Hong Kong Stock Connect, the requirements for investors themselves will become increasingly stringent, and the need for investors to seek to learn and supplement their knowledge will also become increasingly vital. Therefore, investors need to improve their sensitivity to macroeconomic policies, enhance their ability to interpret them, and fully consider the lagging effect of stock price fluctuations to adjust their expectations and investment strategies on time to reduce investment risks.

Secondly, to address the failure of the stock market to respond to macro policy changes in a timely and effective manner and to give full play to its function as a macroeconomic "barometer", there is a need to improve further the adequacy of information disclosure and the accessibility of information, to enhance the effectiveness of the market and make China's stock market better reflect the economic performance.

Finally, should actively promote the institutional reform and construction of China's stock market. China's stock market has made significant progress after years of development. However, compared with developed markets in Europe and the United States, there are still problems such as excessive administrative intervention, a low degree of marketisation, an imperfect delisting system, an inadequate short selling mechanism, insufficient regulatory support measures and insufficient law enforcement, which will be detrimental to the healthy and stable development of the stock market. We should seize the opportunity of the amendment of the Securities Law and the reform of the registration system to improve further the market system, especially the establishment and improvement of the exit mechanism, to give full play to the functions of the stock market such as capital financing, price discovery and other rational allocation of resources, and reduce abnormal and violent market fluctuations.

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