

A Review Study of Models that Address how Economic Policy Uncertainty Affects Financial Markets

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Abstract. In today's complex and changing economic environment, economic policy uncertainty has become one of the key factors affecting the stability and development of financial markets. The purpose of this paper is to sort out the impact of economic policy uncertainty on the financial market, study the time-varying characteristics and persistent repercussions of economic policy uncertainty on systemic financial risk by other scholars, expose its intrinsic mechanism of action and potential law, and highlight the research models therein, such as the use of TVP-FAVAR model to construct the financial stress index and the econometric model GARCH-MIDAS. The results of research combining show that economic policy uncertainty not only increases financial market stress, but also has obvious heterogeneity in risk transmission among different markets. In addition, the results of this paper can also provide reference for future research in terms of model selection and research progress, which can help to further improve the relevant theoretical system, provide valuable references for policy formulation, and help to prevent and manage systemic risks in financial markets.

1 Introduction

In recent years, the increasingly complex and volatile global political and economic situation, frequent geopolitical conflicts, escalating international trade frictions and the far-reaching impact of epidemics have led to a significant increase in the uncertainty of national economic policies. The financial market, as an important part of economic operations, has inevitably been subjected to the strong impact of uncertainty in economic policy, causing sharp fluctuations in the financial market and further exposing a series of problems in the financial system, increasing the risks faced by market participants and posing new challenges to financial regulation.

Against this background, studying and rationalizing its impact on financial markets and research tools is of great theoretical and practical significance. From the theoretical point of view, the existing compendium mostly focuses on the exploration of a single dimension and lacks a systematic and comprehensive framework of veins. By illustrating the understanding of the financial stress index and combining it with econometric modeling,

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the mechanism of the impact of economic policy uncertainty in place on financial markets can be more clearly understood. From a practical point of view, grasping the particular influence of economic policy uncertainty on financial markets and scrutinizing the analytical approach will help financial institutions and regulators to formulate more effective risk response strategies and enhance the robustness and resilience of the financial system.

2 Measures of overall financial risk in the system

The measurement of overall financial risk in the system is a central issue in macroprudential regulation and financial stability research. Existing studies have mainly adopted the following two broad categories of methods to measure the level of systemic financial risk.

2.1 Risk Stress Index (RSI) methodology

A series of indicators reflecting financial market stress are selected and weighted and aggregated using statistical methods to obtain a comprehensive index. For example, The body text constructed a composite index to measure financial risk stress using a variety of techniques including factor analysis, econometric benchmarking, and generalized autoregressive conditional heteroskedasticity (GARCH) modeling to extract information about financial stress from a wide range of financial variables [1]. They used the TVP-FAVAR model to construct a financial stress index [2]. They also used the model to construct a financial stress index to measure China's financial situation in their study [3]. The paper used principal component analysis to construct a financial risk composite index and introduced an index correction mechanism for risk measurement [4]. They constructed a financial stress spillover effect model for risk assessment based on the global vector autoregressive model (GVAR) from the perspective of correlation network [5].

2.1.1 Methodology and model for constructing the financial stress index

The financial stress index is an significant tool for measuring systemic financial risk. In order to accurately capture the overall stress situation in the financial market, they used the TVP-FAVAR (Time-Varying Parameter Factor Augmented Vector Autoregression) model to construct a financial stress index [2].

The TVP-FAVAR model is founded on the traditional factor augmented vector autoregression (FAVAR) model. The model allows factor loadings and regression coefficients to vary over time and is suitable for capturing dynamic changes and potential correlations in financial markets. The fundamental form of the model is as follows:

$$X_t = B_t X_{t-1} + F_t \theta_t + \epsilon_t \quad (1)$$

Where X_t is an $n \times 1$ dimensional column vector representing n financial variables, B_t is the matrix of regression coefficients for the lagged terms, F_t is the factor loading matrix, θ_t is a $k \times 1$ dimensional vector of unobservable factors, and ϵ_t is the error term obeying a normal distribution with zero mean and covariance matrix Σ_t .

This method synthesizes the advantages of principal component analysis and variable weighting method, which can overcome the defects of the traditional method that contains less information and fails to reflect the time-varying characteristics of the macroeconomy, and more accurately reflect the real-time changes in the financial market and the impact of the macroeconomic environment.

2.1.2 Modeling Financial Stress Spillovers under Affiliated Networks

The paper used the Global Vector Autoregressive (GVAR) model to study the construction of financial stress spillover models and examined the transmission of stress and its dynamic evolution among different countries and markets in five financial submarkets, including the market for credit, the market for capital, the market for foreign exchange, the market for bond, and the market for money [5].

In an extension to the traditional vector autoregressive (VAR) model, a GVAR model is formed by constructing a VARX* model for each sample country's financial market according to certain correlation rules. The basic structure of the model is as follows:

$$X_t = G^{-1}a_0 + G^{-1}a_1t + G^{-1}HX_{i,t-1} + G^{-1}\psi_0d_{t-1} + G^{-1}\psi_1d_{t-1} + G^{-1}\varepsilon_t \quad (2)$$

Where Φ_i is the $k_i \times k_i$ dimension matrix of the lagged term of the home country variable, Λ_{i0} is the $k_i^* \times k_i^*$ dimension matrix of the current term of the other country variable, and $\gamma_{i,j}$ is the other country variable $k_i^* \times k_j^*$ dimensionality matrix for the lagged term, Ψ_{i0} is the $k_i^s \times k_i^s$ dimensionality matrix for the current term of the global exogenous variable, and $\Psi_{i,j}$ is the $k_i^s \times k_j^s$ dimensionality matrix for the lagged term of the global exogenous variable. ε_{it} is a k_i -dimensional vector representing heterogeneous shocks across countries, assuming that the shocks obey an independent homogeneous distribution with mean 0 and covariance matrix Σ_{ii} .

Based on the perspective of correlation network, the dynamic transmission of financial market stress and its evolution law among financial submarkets and different countries are portrayed from a dynamic perspective, which complements the related research on the characteristics of financial stress spillover among financial submarkets within the financial system and the stress transmission mechanism in international financial markets.

2.2 Formatting the text Mathematical modeling approach

In addition to the risk stress index, scholars have proposed a series of mathematical models for measuring systemic financial risk. They put forward a method for detecting overall financial risk in the system: CoVaR[6]. They measured the systemic risk of financial institutions based on CoVaR and established a model to predict systemic risk [7]. The paper improved the CoVaR model based on extreme value theory and ARMA-GARCH model to more accurately assess the impact of tail risks on financial institutions[8].

2.2.1 Study of financial institutions are affected by tail risk spillover under Improved Asymmetric CoVaR Modeling

They further improved the CoVaR model to calculate the dynamic VaR series based on the extreme value theory and ARMA-GARCH model fitting for the optimal estimation of the extreme insured value of financial institutions [8]. The underlying form of the model is as follows:

$$\mu_{i,t} = \phi_i + \sum_{x=1}^m \phi_{i,x}\mu_{i,t-x} - \sum_{j=1}^q \theta_{i,j}\alpha_{i,t-j} + a_{i,t} \quad (3)$$

$$\alpha_{i,t} = \sigma_{i,t}\tau_{i,t} \quad (4)$$

$$\sigma_{i,t}^2 = c_i \sum_{x=1}^p \omega_{i,x}\sigma_{i,t-x}^2 + \sum_{j=1}^q K_{i,j}\alpha_{i,t-j}^2 \quad (5)$$

Where $\mu_{i,t}$ represents the stock return of institution i in period t , $\sigma_{i,t}^2$ represents the conditional variance of institution i in period t , $\mu_{i,t-x}$ represents the return of institution i lagged by x periods with respect to period t , $a_{i,t}$ represents the information of the return perturbation term, and $\tau_{i,j}$ is an independent, identically-distributed random variable that satisfies a white noise process.

The study concludes that there is a significant link between the insured value of financial institutions and risk spillover intensity, and financial institutions with smaller absolute values of VaR tend to have greater risk spillover intensity; there are significant differences in the contribution of different types of financial institutions to the systemic financial risk of the financial market; the greater the contribution of systemic financial risk, the greater the fluctuation of the risk contribution of the financial institutions in general; the systemic financial risk of financial institutions contribution of financial institutions shows prominent time-varying characteristics in the temporal dimension, and the trend of changes in financial institutions have a similar systemic financial risk contribution, and so on.

3 Researching the link between the uncertainty of economic policies and overall financial risk in the system

Economic policy uncertainty is recognized as one of the important factors affecting systemic financial risk. Existing studies have mainly explored the relationship between the two in terms of causality and channeling mechanisms.

3.1 From Causality and Interaction

In their study of the international oil market, the GARCH-MIDAS model was introduced for the calculation of CoVaR and it was shown that economic policy uncertainty and overall financial risk in the system in the oil market share a significant causal relationship[9].

3.1.1 The crude oil market is an example of systemic financial risk caused by economic policy changes

An empirical study by them Specified the models used while analyzing the traits of commodity market indices, Brent crude oil prices, and WTI crude oil prices using GARCH and MIDAS models[9].

$$r_{i,t} = \mu_i + \sqrt{m_{i,\tau} \cdot g_{i,t}} \delta_{i,t}, \forall t = (\tau - 1)N + 1, \dots, \tau N, \forall \tau = 1, \dots, T. r_{i,t} = \mu_i + \sqrt{m_{i,\tau} \cdot g_{i,t}} \delta_{i,t}, \forall t = \tau N_v^i, \dots, (\tau + 1)N_v^i \quad (6)$$

Where denotes each asset, $\tau = 1, \dots, T$ denotes months, and $t = 1, \dots, NT$ denotes trading days.

The study offers three main insights: i. Systemic risk is not a significant factor in economic policy uncertainty, but it exerts a substantial influence on it. II. Systemic risk's presence in the crude oil market should be a concern for investors, as the total net correlation of systemic risk is positive over the sample period. iii. Despite the positive correlations observed across all pairs in the study throughout time, the decrease in correlations in the period of the 2008 financial crisis, implying the necessity to pay attention to concurrent exogenous risks outside the VAR system.

3.2 Analysis of adoption channels and mechanisms

Many studies have shown that economic policy uncertainty can affect systemic financial risk through multiple channels. For example, the paper point out that the financial cycle is one of the important channels through which international policy uncertainty affects domestic systemic financial risk based on the empirical model TVP-SV-VAR [10]. Based on the research method of nonlinear correlation network, they found that international

economic policy uncertainty is not only a nonlinear Granger cause of financial market turbulence, but also one of the important channels of market risk contagion, and there is an asymmetric contagion effect between the two [11].

3.2.1 Analysis of the role of financial cycle transmission based on the TVP-SV-VAR model

They use the empirical model TVP-SV-VAR with time-varying parameter characteristics to investigate the impact and mechanism of economic policy uncertainty on the financial cycle and through the financial cycle on the real economy [10].

$$Y_t = X_t * \beta_t + A_t^{-1} * \sum_t^* \varepsilon_t \quad (7)$$

Where $X_t = I_k(y_{t-1}, y_{t-2}, \dots, y_{t-s})$, represents the Cronecker product. The coefficients, stochastic fluctuation coefficients, and the covariance matrix of stochastic fluctuation (Σ_t) in the above equation are set to change over time. According to the model setting of Daisuke Nakajima (2011), A_t is the lower triangular matrix, and the non-0 and non-1 elements are stacked into a column vector. Meanwhile, the band bone parameters are characterized by random wandering, $\beta_{t+1} = \beta_t + \mu_{\beta t}$, $\alpha_{t+1} = \alpha_t + \mu_{\alpha t}$, $h_{t+1} = h_t + \mu_{ht}$. and the random fluctuation term conforms to the symmetric matrix characteristics, with fixed expectation and variance. Subsequently, the model further samples the posterior distribution according to the Markov chain Monte Carlo method.

According to the authors, the paper should be the first domestic research paper to investigate the influence of economic policy uncertainty on macroeconomic development through passing on the financial cycle. According to the research data, the financial cycle has a substantial and non-neutral impact on macroeconomic output and price volatility and affects output and producer prices on the supply side and gradually affects consumer prices on the demand side, pointing out that the financial cycle is an important transmission channel for China's macroeconomic impacts, which are shifted from the supply side to the demand side.

3.2.2 Cross-market contagion under nonlinear correlation network studies

Based on the research method of nonlinear correlation network, they constructed a nonlinear correlation network of “financial market and economic policy uncertainty” by using (i) nonlinear Granger causality test and frontier network topology to study between the uncertainty of economic policy and overall risk in the system contagion in 19 major countries (regions) around the world [11].

$$(i) \hat{J}_T = \sum_{i=1}^{kT} \omega_i \hat{\alpha}_i^2 \quad (8)$$

Where $\hat{\alpha}_i = 1/\sqrt{T} \sum_{t=r}^t \hat{v}f(X_{t-1}) \hat{h}_i(G_{T-1})$, ω_i is a non-negative weight function.

It is found that risk contagion is more obvious during the crisis, and EPU plays an important role in risk contagion; at the same time, the stock market is the source of risk, and has a strong spillover effect on foreign exchange and EPU. And from this, it can be concluded that the contagion of stock and foreign exchange market has bidirectional asymmetric spillover effect, in which the stock market has a greater impact on the foreign exchange market; economic policy uncertainty has become an important channel of risk contagion, and the U.S. EPU is an important factor leading to the global financial market shock and other important revelations.

4 Conclusion

This paper examines the consequences of economic policy uncertainty on financial markets and models that are related to them, and draws the following conclusions: systemic financial risk is substantially increased by economic policy uncertainty, and there is significant heterogeneity of this impact across markets; the financial stress index more accurately reflects the degree of stress in financial markets at different times; economic policy uncertainty affects financial market stability through multiple channels, such as changes in the financial cycle; the data analysis shows that when uncertainty events occur, market sentiment and investor behavior can change significantly as a result, which in turn affects financial markets. These findings provide new perspectives and empirical evidence for understanding the influence of economic policy uncertainty on financial markets and validating the usefulness of related models.

Moreover, the aforementioned studies have made important progress in their respective fields, yet most of them focus on a single market or a single type of uncertainty and lack a comprehensive analysis of the overall impact of the political economy. Second, the number of relevant studies that combine high-frequency data and advanced econometric models to characterize the dynamics of the two is slightly insufficient. Meanwhile, further in-depth research is needed on the channels of shocks and the transmission mechanism of economic policy uncertainty, with comprehensive consideration of the various elements and the interactions between them.

There are still limitations in this paper's review of models that address how economic policy uncertainty affects financial markets: the scope of data selection can be further expanded to cover more countries and regions to improve the universality and representativeness of the study; the construction of models used in the study can be further optimized by combining more advanced methods to improve the accuracy and reliability of the analysis; exploring other potential influencing factors and inter-factor effects such as technological progress, natural disasters, etc., on economic policies, and then on financial markets, to comprehend the total effect of multiple factors, it's necessary to comprehend them individually; further refine the study of the transmission mechanism of the impact of uncertainty, and reveal the interaction between different channels and their relative importance. In-depth research in these directions can provide more comprehensive and scientific guidance for future financial market stabilization.

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