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Economic Policy Uncertainty, Geopolitical Risks and International Crude Oil Price -A Study Based on Markov Switching and Time-varying Parameter Vector Auto Regressive Model

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Abstract:

Crude oil, as the essential basic raw materials of modern industry and important strategic resources of a country, its price will be effected by political and economic risks. In this paper, geopolitical risk index is used to represent political risk, economic policy uncertainty index is used to represent economic risk, and Markov Switching and Time-varying Parameter Vector Auto Regressive Model is used to study the shock of political and economic risks on oil price fluctuations. The results depict: 1) The shock of geopolitical risks and economic policy uncertainty on oil price fluctuations presents a complicated nonlinear relationship and can be clearly divided into three regimes: low stable regime, high stable regime and high fluctuating regime. Each regime has strong stability and long duration; 2) The shock of geopolitical risks on oil price fluctuations is generally negative in the short term, and effect is becoming stronger after the global financial crisis in 2008. In the long run, the impact is generally positive; 3) Before 2011, the shock of economic policy uncertainty on oil price fluctuations was generally negative, and the impact gradually decreased. After 2011, the shock has become positive and stronger. As the oil price strongly affects a country's macro-economy and people's life, the government and enterprises should always pour attention into the risk of geopolitical and economic policy uncertainty, and take measures in advance to avoid the impact of international crude oil price fluctuations on their own economy and enterprises.

Keywords*: Economic Policy Uncertainty, Geopolitical Risks, International Crude Oil Price.*

I. INTRODUCTION

Crude oil is an indispensable basic raw material for modern industry and an crucial strategic resource. International crude oil prices (hereinafter referred to as "oil prices") not only affect the world economic development, but also affect the world's political situation. Judging from the tendency of oil prices, the rapid decline and short-term sharp rebound of oil prices occur from time to time, and the determinants behind it are worth studying. Judging from the current pattern of world crude oil market, the majority of the chief crude oil production countries are areas with geopolitical instability. Geopolitical factors have become an important factor to affect the operation of the crude oil market and the evolution of its trade

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pattern. Through the control and utilization of crude oil resources, countries continue to strengthen reciprocal competition and coordination, so as to realize specific geopolitical advantages with power, interests and security as the core. [1] Geopolitical risks (GPRs) are undoubtedly one of the main causes of oil prices fluctuations, especially the tense geopolitical relationship in the oil-producing countries has an increasingly evident shock on oil price fluctuations. [2] At the beginning of 2020, under the background of COVID-19' s continuous spread and global economic downturn, the negotiations between Saudi Arabia and Russia on the reduction of crude oil output broke the sharp fluctuations of oil prices. The oil price shock is an obvious geopolitical game. On Feb. 24, 2022, Russian President Vladimir Putin announced a special military operation in the Donbas region, which led to a conflict between Russia and Ukraine. Affected by the conflict, oil prices rose sharply, with Brent oil prices rising by 3.39% and New York oil prices rising by 3.53%. Due to the high geopolitical tension and the rapid recovery of demand, there are concerns about the supply of raw materials, and the fact is that the oil price is rising accordingly. Therefore, how to objectively understand the shock of GPRs on oil price has become a key topic.

While GPRs are rising, economic policy uncertainty (EPU) is also changing. In the environment of intensified global uncertainty, the shock of price risks of crude oil on a country's macro-economy exists objectively. On the one hand, with the normalization of sharp fluctuations, oil prices have a greater impact on a country's macro-economy; On the other hand, with the expansion of the volatility of oil prices, abnormal oil prices are impacting the overall operation of macro-economy.

Under the influence of COVID-19, global uncertainty climbed to an all-time high in 2020. The expectation of weak demand caused by the impact of uncertainty further exacerbated the production reduction dispute between OPEC and Russia, leading to a surge in panic in the crude oil and financial markets. The game among oil-producing countries caused the price of crude oil to plummet, which triggered a violent shock in the crude oil market and the global capital market. [3] Along with the conclusion of the oil shutdown agreement and the implementation of ultra loose monetary policy in major global economies, the fluctuation of oil prices has stabilized, and the global uncertainty has gradually dropped. However, the future global crude oil market will still be in a high degree of uncertainty. [4]With the continuation of the conflict between Russia and Ukraine and the complexity of the global economic system, the uncertainty faced by oil prices will become more and more diverse. In this context, this paper uses Markov Switching Vector Auto Regressive Model (MSVAR) to capture the impact of EPU and GPRs on oil prices fluctuations under different regimes. At the same time, Time Varying Parameter Vector Auto Regressive Model (TVP-VAR) is used to capture the short, medium and long-term impact of EPU and GPRs on oil prices fluctuations in a time-varying environment, and to capture the impact of specific economic and geopolitical events on oil prices. The conclusion is conducive to a country to adopt energy security strategies correctly to avoid energy risks.

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II. LITERATURE REVIEW

2.1 Research on the Risks of Oil Prices Fluctuation

There are two main types of research on the risks of oil prices fluctuation: One emphasizes the impact mechanism of oil prices fluctuation on economic security. From the perspective of macro variables, indicators of economic security include: economic growth rate, [5]inflation, [6]exchange rates, [7]equity markets,[8,9] government expenditure.[10]The research on micro market focuses on the cross market contagion of oil prices fluctuation risk. These studies believe that the risk of oil price fluctuation is transmitted to the financial market through currency and other factors, affecting the financial security [3]. The other kind of literature focuses on the factors and mechanisms affecting oil prices fluctuations, and carries out oil prices prediction and risk management combined with its fluctuation characteristics. [11,12]

2.2 Impact of Uncertainty Shock on Oil Prices

In the field of international energy finance, concerns about the shock of uncertainty and the risk transmission of oil prices fluctuations have continued to rise in recent years. Many literatures highlight the complex effect of uncertainty shocks on oil prices, including EPU, financial market uncertainty and political uncertainty represented by GPRs. Some scholars have studied the nonlinear causal relationship between commodity futures and economic uncertainty index. The study has found that crude oil and other energy commodities are more vulnerable to EPU, and there is a two-way Granger relationship between them. [13]The correlation between WTI oil price and EPU is lower than Brent oil price. [14]In addition to EPU, GPRs usually have a significant negative impact on oil earnings, mainly because global economic activities lead to a decline in oil demand, and a higher GPRs index will increase oil prices. [15]Some scholars comprehensively consider the EPU, GPRs and financial market uncertainty of the world and other countries, and investigate the impact of multiple uncertainties on oil prices. Research demonstrates uncertainty at the economic policy level is the underlying driver of oil prices fluctuations. [16]

2.3 Impact of GPRs on oil Prices

Kesicki (2010) [17] compared the surge in oil prices from 2007 to 2008 during the two crude oil crises in the 1970s, and pointed out that geopolitical uncertainty is one of the reasons for the rise in international oil prices. On this basis, a series of quantitative studies have been carried out, which include: The first is to take geopolitical events as virtual variables. [18]The second is to extract information from oil prices and analyze whether GPRs are an important factor affecting oil prices. [19]The third is to use an index as the proxy variable of GPRs, and then construct various measurement and test models. [20]

In order to measure the GPRs, Caldara & Iacoviello (2018) [21] constructed the GPRs index. Subsequently, some scholars analyzed the impact of GPRs on oil prices according to the index above. Some scholars studied the dynamic shock between GPRs and crude oil market by using TVP-VAR model, and found that GPRs has an obvious negative shock on crude oil revenue. [14]However, other scholars

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believed that GPRs have no significant impact on crude oil returns. [22]Therefore, there are some disputes about the impact, and the academic circle has failed to draw a unified research conclusion. On the basis of these studies, some novel viewpoints have emerged. Some scholars believe that the impact of GPRs on the crude oil market mainly focuses on the fluctuation of price, rather than the price itself. [23]GPRs index and oil prices fluctuations show a significant positive interact. Special attention should be paid to the shock of GPRs on the crude oil market before and after the political crisis. [24]Some scholars believe that the shock of GPRs is mainly caused by geopolitical threat or geopolitical action, and geopolitical action has a positive and strong impact on the fluctuation of Brent crude oil price, but the impact of geopolitical threat is mild or even insignificant. [25]

The current studies generally have two problems: First, EPU means economic risk, GPRs means political risk, and the combined effect of the two affects the prices of crude oil. Current research focuses on the separate shock of GPRs or EPU on oil prices. Few studies consider the comprehensive impact of EPU and GPRs on oil prices. Second, the current research mainly adopts the MSVAR model. Although it can describe the changes and influencing factors of oil prices under different regimes, it can not describe the shock of EPU and GPRs on oil prices at different time points.

The marginal contributions of this study are as follows: firstly, comprehensively considering the uncertainty of economic policy and GPRs, and investigating the shock on the oil prices in the interaction of economic risk and political risk is conducive to a deep understanding of the external uncertain factors of the change of oil prices. Secondly, the MSVAR model is used to investigate the shock of economic and political risks on oil prices under different regimes. The TVP-VAR model is used to inspect the shock of EPU and GPRs in different lead times on oil prices, and the impulse response of oil prices to EPU and GPRs at a specific time point.

III. THEORETICAL MODEL

3.1 Markov Switching Vector Auto Regression Model (MSVAR)

MSVAR is a nonlinear econometric model, which is a compound of vector auto-regression and Markov chain, and has been widely used in the study of the relationship between variables. The general expression of MSVAR model is as follows:

$$y_t - \mu_t = A_1(s_t)(y_{t-1} - \mu(s_{t-1})) + \ldots + A_p(s_t)(y_{t-p} - \mu(s_{t-p})) + u_t \quad (1)$$

Where, $u_t | s_t \sim NID(0, \Sigma(s_t))$,parameter transfer functions $u(s_t)$, $\Sigma(s_t)$, $A_1(s_t)$, $A_2(s_t)$,…, $A_p(s_t)$ all depend on the system variation state of quantity:

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$$\mu_t(s_t) = \begin{cases} \mu_1 & s_t = 1 \\ \dots & \dots \\ \mu_p & s_t = M \end{cases}. \tag{2}$$

Where, regime variable $s_t \in \{1,...,M\}$ obeys the Markov chain process of discrete time and discrete regime. The transition between regimes can be expressed by transition probability. The transition probability from regime i to j is:

$$p_{ij} = \Pr(s_{t+1} = j \,|\, s_t = i), \sum_{j=1}^{M} P_{ij} = 1, i, j \in \{1,...,M\} \tag{3}$$

The transfer matrix is represented as follows:

$$p = \begin{vmatrix} p_{11} & p_{12} & \dots & p_{1M} \\ p_{21} & p_{22} & \dots & p_{2M} \\ \dots & \dots & \dots & \dots \\ p_{M1} & p_{M1} & \dots & p_{MM} \end{vmatrix}. \tag{4}$$

Where,P satisfies the regularity constraint.

3.2 Time Varying Parameter Vector Auto Regression Model (TVP-VAR)

Based on Primiceri (2005), [26] TVP-VAR can be written as follows:

$$y_t = B_{0,t} + B_{1,t} y_{t-1} + \dots + B_{p,t} y_{t-p} + u_t = \hat{X}_t \Theta_t + u_t \tag{5}$$

Where dependent variable y_t is a n-dimensional column vector. $B_{i,t} = A_{0,t}^{-1} A_{1,t}$ is a time -varying reduced coefficient matrix. $u_t = A_{0,t}^{-1} \sum_t \varepsilon_t$ is the prediction standard error of one period in advance. $H_t = (h_{1,t},...,h_{k,t})$ is the logarithms of the diagonal elements of the time -varying volatility matrix.

$$H_t = \begin{bmatrix} h_{1,t} & 0 & 0 & 0 \\ 0 & h_{2,t} & 0 & 0 \\ 0 & 0 & h_{3,t} & 0 \\ 0 & 0 & 0 & h_{4,t} \end{bmatrix} \tag{6}$$

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Each time -varying parameter follows random walk process as follows:

$$\beta_{t+1} = \beta_t + u_{\beta,t} \quad , \alpha_{t+1} = \alpha_t + u_{\alpha,t} \quad , h_{t+1} = h_t + u_{h,t} \tag{7}$$

$u_{\beta,t}$ $u_{\alpha,t}$ and $u_{h,t}$ are assumed to be a normal distribution with zero mean and diagonal covariance matrix $\sum\beta$, $\sum\alpha$ and $\sum h$. Assuming the structural shock is independent of time-varying parameters, there are:

$$\begin{bmatrix} \varepsilon_t \\ u_{\beta,t} \\ u_{\alpha,t} \\ u_{h,t} \end{bmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \sum_{\beta}^{2} & 0 & 0 \\ 0 & 0 & \sum_{\alpha}^{2} & 0 \\ 0 & 0 & 0 & \sum_{h}^{2} \end{bmatrix} \right) \tag{8}$$

IV. EMPIRICAL ANALYSIS

4.1 Data Sources

EPU. This paper uses the EPU index constructed by Baker et al. (2016) [27]to describe the EPU of 21 countries. The GDP of 21 countries accounts for about 71% of the global GDP on the basis of PPP adjustment and about 80% at market exchange rate. Then, the EPU index of these 21 countries is weighted average (with GDP as the weight), and finally the EPU index is obtained. The EPU index of each country reflects the relative frequency of domestic newspaper articles, which contain three terms related to economy (E), policy (P) and uncertainty (U). The data comes from the website of EPU.

GPRs. Dario Caldara and Matteo Iacoviello(2018)[28] constructed a new measure of adverse geopolitical events based on newspaper articles covering geopolitical tensions, and examined their evolution and economic impact since 1900. This paper adopts the GPRs index constructed by Caldara and Iacoviello (2018). [28] The data comes from the website of EPU. The specific construction methods are as follows: Firstly, the monthly number of articles related to GPRs from 11 major international newspapers are counted through text search. Secondly, divide this value by the total number of published articles in the current month to calculate the GPRs index. Finally, the index is standardized so that its average value in the 10 years from 2000 to 2009 is 100.

International crude oil prices. Texas light crude oil (WTI) and Brent crude oil (Brent) are the two most important benchmark crude oils in the international market. Texas light crude oil has become the leader in the trading volume of global commodity futures because of its good liquidity and high transparent quotation. Two thirds of the world's crude oil trading volume is priced with Brent crude oil as the benchmark oil, both have a pivotal position. In this paper, Brent spot price FOB in Europe is selected to represent the oil prices, and the data is from the U.S. Energy Information Administration.

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The sample data is from Feb. 1997 to Feb. 2022. The EPU index and GPRs index were processed by taking natural logarithm, and passed the stability test of 1%. According to Demirer (2019), [23]the relationship between GPRs and oil price is highly nonlinear and cannot rely on the linear test of Granger causality. GPRs affect the fluctuation of oil price, not the price itself. In addition, the oil price cannot pass the stability test. Therefore, this paper deals with the oil price by logarithmic difference. In order to see the corresponding relationship between the data more clearly, this paper expands the logarithmic difference of the original price by 10 times. Tab.1 shows the descriptive statistics of variables.

TABLE I. Descriptive Statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
lngprs (Natural logarithm of GPRs)	301	4.514	0.357	3.665	6.239
lngepu (Natural logarithm of EPU)	301	4.759	0.468	3.891	6.064
dlnprice (Ten times the logarithmic growth rate of oil price)	301	0.005	0.106	-0.555	0.469

4.2 MSVAR Model: the Regime Analysis of MSIAH (3)-VARX (2)

According to the maximum value of log likelihood ratio and the principle of minimizing the values of AIC, HQ and SC, the best model is MSIAH (3)-VARX (2) model with auto regressive parameters with three regimes, lag second-order, intercept and residual variance varying with the regimes.

According to the model results, regime 1, 2 and 3 correspond to the low stable regime, high stable regime and high fluctuating regime of oil price fluctuation respectively. Fig. 1 shows that the fluctuation of oil price is generally stable, with high fluctuation and low stability interspersed. From the perspective of the international crude oil market: at the beginning of 2003, the oil price exceeded US $30 / barrel; In September 2004, affected by the Iraq war, the price broke through $40 / barrel again; In June 2005, the price exceeded US $60 / barrel for the first time; In August 2005, Mexico was hit by Hurricane Katri, and the price exceeded US $70 / barrel for the first time; On September 12, 2007, the price exceeded US $80 / barrel for the first time, and then entered a high fluctuation; In 2009, affected by the financial crisis, the price fell sharply. On Jan. 21, the crude oil futures price on the New York Mercantile Exchange fell to US $33.20. The analysis shows that the division of the three regimes is more in line with the fluctuation of the international crude oil market and the fluctuation characteristics of the uncertainty of world economic policies and GPRs.

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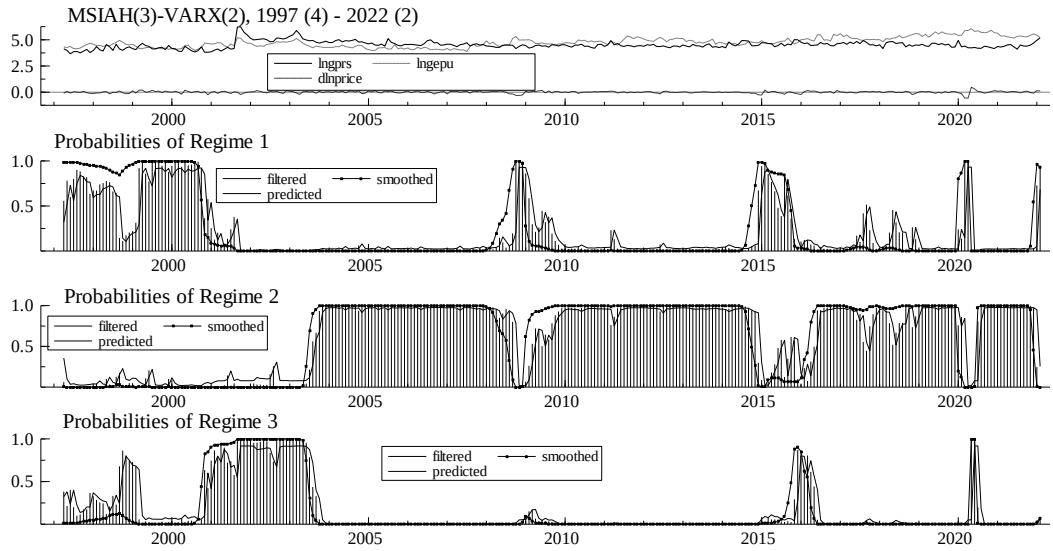

Fig 1: Regime probability diagram

Tab. 2 shows the transition probability and property analysis of each regime. The probability of maintaining the original state of each regime represents the stability of each regime. It can be seen from Tab. 2 that the larger the proportion of the regime in the sample, the longer the average period. In terms of stability, the stability of the three regimes is strong. Relatively speaking, the stability of regime 2 is the strongest, regime 3 is the weakest, and regime 1 is between the two.

TABLE II. Transition probability and nature of each regime

	Transition probability			Transfer property		
	Regime 1	Regime 2	Regime 3	nObs	Prob.	Duration
Regime 1	0.9313	0.01755	0.05111	66.3	0.2209	14.57
Regime 2	0.02271	0.9773	2.868e-006	192.0	0.6423	44.04
Regime 3	0.004235	0.07826	0.9175	40.7	0.1369	12.12

4.3 MSVAR Model: Impulse Response Analysis

Based on the regression results of MSIAH (3) - VARX (2) model, this paper uses impulse response function to analyze the response of oil price fluctuation to EPU and GPRs under three regimes, and compares the dynamic response under different regimes.

Fig. 2 shows： In regime 1, the impulse response of oil price fluctuations to GPRs changes rapidly from positive effect to negative. After six months, the effect gradually approaches zero. In regime 2 and 3, it gradually approaches zero from negative effect. The difference is: In the previous month, the negative effect of regime 2 is greater than that of regime 3, and regime 2 approaches zero faster than regime 3. In

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addition, in regime 2 and regime 3, the impulse response of the fluctuation of oil price to the EPU is negative, and quickly approaches zero after one month. The difference is that the negative effect of regime 2 in the initial stage is greater than that of regime 1. In regime 3, the impulse response of the fluctuation of oil price to the EPU quickly changes from positive effect to negative, and the effect gradually approaches zero after three months.

In general, the impulse response of oil price fluctuations to GPRs and EPU shows a complex nonlinear relationship. In this context, then it is necessary to use TVP-VAR model to investigate the impact of GPRs and EPU on oil price in a time-varying environment.

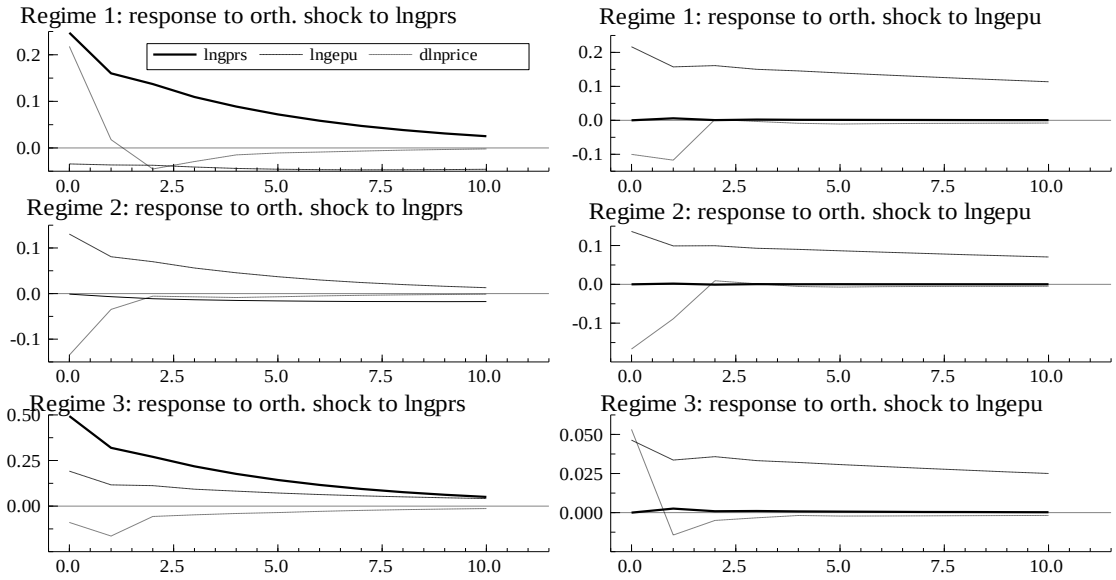

Fig 2: Orthogonal impulse response of different regime

4.4 TVP-VAR: MCMC Simulation Results

Since GPRs are exogenous to the economic system, the order of variables in the model is: lngpr, lnepu and dlnprice. On this basis, this paper constructs a TVP-VAR model including three variables. The sampling number of MCMC are 10000.

TABLE III. MCMC sampling simulation results

Parameter	Mean	Stdev	95%L	95%U	Geweke	Inef.
sb1	0.0231	0.0026	0.0186	0.2372	0.949	12.05
sb2	0.0224	0.0025	0.0180	0.0278	0.002	13.52
sa1	0.0606	0.0150	0.0376	0.0934	0.780	64.62
sa2	0.0475	0.0101	0.0324	0.0715	0.782	32.49
sh1	0.4299	0.0861	0.2751	0.6089	0.826	52.73
sh2	0.3585	0.0732	0.2372	0.5216	0.517	54.54

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Geweke convergence diagnosis value and invalid influence factor are important to judge the effect of MCMC simulation and estimation. Geweke convergence is used to determine the convergence of Markov chain, and invalid influence factor is used to determine the number of irrelevant samples generated by simulation. Tab.3 shows that all parameters do not reject the original hypothesis of converging to a posteriori distribution at the significance level of 5%, indicating that 10000 simulation times can produce effective samples. At the same time, the ineffective influence factors of all parameter estimation results are small, of which the largest is 64.62 (sa1), that is, at least 10000 / 64.62≈154 irrelevant samples can be generated. According to the diagnosis results of the two statistics, the model in this paper has achieved good estimation results.

4.5 TVP-VAR: Impulse Response in Different Lead Times

In this paper, 3, 6 and 9 lead times are used to represent the short-, medium and long-term impact respectively. Fig.3 shows:

1) Before 2002, all the shocks of GPRs on oil price fluctuations were negative, and there was no significant difference in different periods. After 2002, all the shocks were generally positive, and all the effects were obviously separated.

2) After 2006, the short-term impact of GPRs on oil prices fluctuations has shown a trend that is significantly different from the medium and long-term, from positive effects to negative, and the shock is becoming stronger.

3) Before 2011, all the shocks of EPU on oil prices fluctuations were negative, and there was no obvious separation in different periods.

4) After 2011, all the shocks of EPU on oil prices fluctuations have changed from negative effects to positive, and all the shocks have been significantly separated, and the short-term effect is more greater than other periods.

5) The mutual shocks of EPU and GPRs show a relatively consistent trend, and there is no obvious separation in different periods. From 2003 to 2014, the mutual shocks were negative, but in other years, the mutual impacts were positive.

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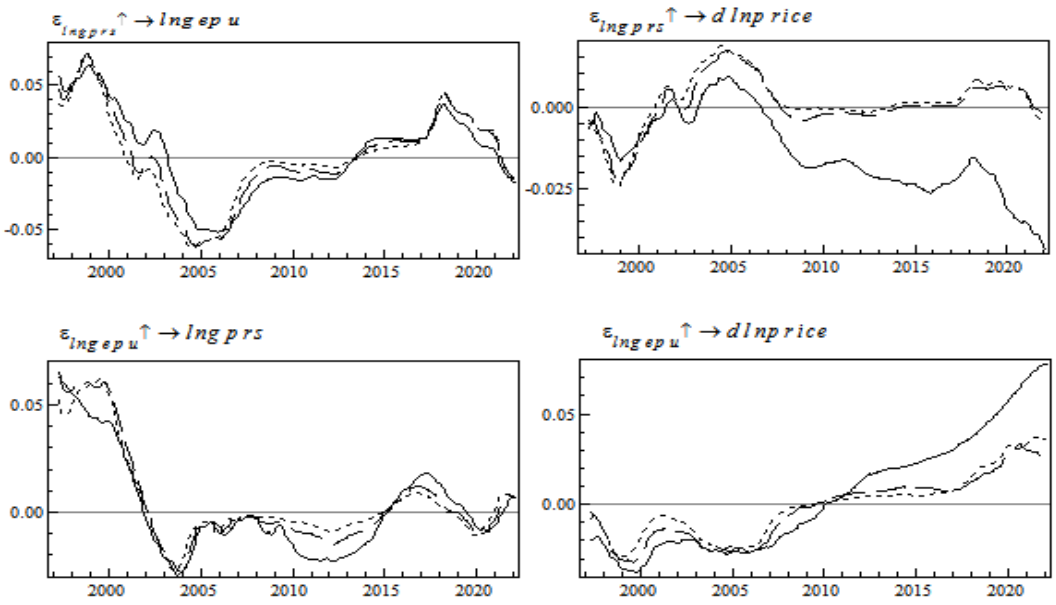

Fig 3: Impulse response of lngprs and lngepu in different lead times

Note:——— :3 lead times;- - - - - : 6 lead times;..... :9 lead times

4.6 TVP-VAR: Impulse Response Analysis Based on Specific Time Point

This paper selects three typical events to illustrate the shock of GPRs on oil prices fluctuations and EPU. The three events and their corresponding time are: Sept. 2001 (t=56,"911" Terrorist Attacks), Mar. 2003 (t=74, Iraq War) and Nov. 2015 (t=226,Terrorist Attacks in Paris). As can be seen from Fig. 4:

1) At t=56 and t=74, the shocks of GPRs on oil prices fluctuations quickly decrease to -0.025 in the period (0,3), rebound to more than 0, and then stabilized between (0, 0.015). The shock of EPU on oil prices fluctuations is generally positive, and the effect at t=74 is greater than t=56.

2) At t=226, in the period of (0,5), the shock of EPU on oil prices fluctuations is negative, and the negative effect gradually decreases. After the fifth period, it gradually approaches zero.

3) At t=56 and t=74, the shocks of GPRs on EPU have gradually changed from positive effect to negative, and the effect is becoming stronger. At t=56, the positive effect is greater than t=74, while the negative effect is significantly less than t=74.

4) At t=226, the shock of GPRs on EPU is generally positive, and gradually approaches zero after the tenth period.

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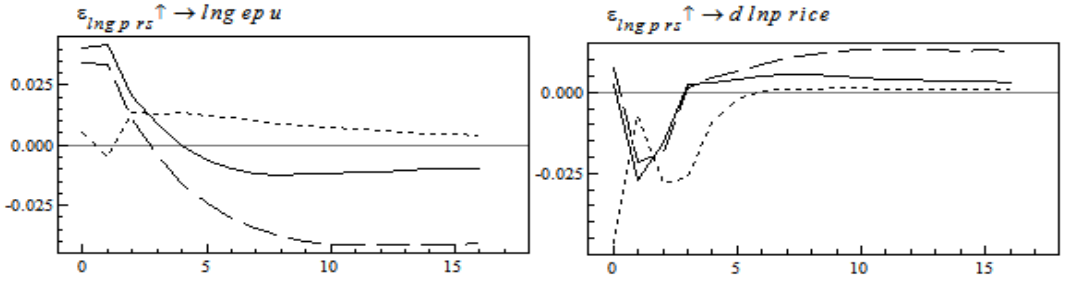

Fig 4: Impulse response of lngprs at specific time

Note:Note:——— : Sept. 2001(t=56); - - - :Mar. 2003(t=74); ..... :Nov. 2015 (t=226).

This paper selects three typical events to illustrate the shock of EPU on oil prices fluctuations and GPRs. The three events and their corresponding time are: Oct. 2008 (t=142, Global Financial Crisis), Nov.2012 (t=191,Replacement of Chinese Leaders) and No.2016 (t=239,Trump's successful election campaign and the political turmoil in Brazil, France and South Korea). As can be seen from Fig.5:

1) At t=142,t=191 and t=239, the shock of EPU on oil prices fluctuations has rapidly changed from negative effect to 0 in period (0,5).

2) At t=142 and t=191, the overall effect of EPU on GPRs is negative. In the period of (0,3), the effect expands rapidly, and then the negative effect decreases gradually, and approaches zero after the 15th period.

3) At t=239, The shock of EPU on GPRs is generally positive, showing an inverted "U" shape, reaching the maximum in the second period.

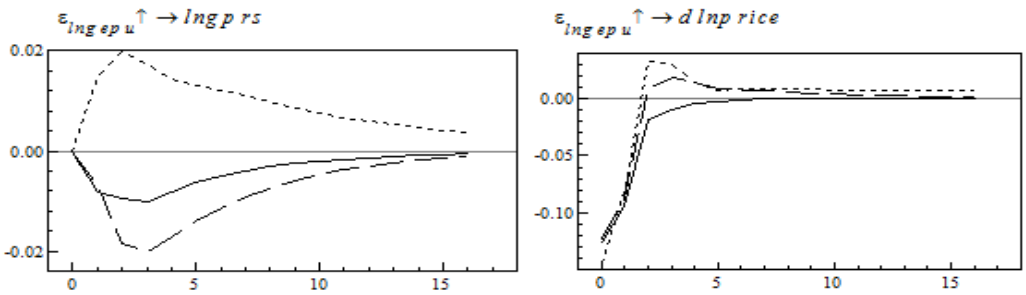

Fig.5 Impulse response of lngepu at specific time

Note:——— : Oct. 2008(t=142); - - - - - :Nov. 2012 (t=191); ..... :No.2016 (t=239).

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V. CONCLUSION

The conclusions are as follows:

1) The impact of GPRs and EPU on oil prices fluctuations can be clearly divided into three regimes: low stable regime, high stable regime and high fluctuating regime, which present a complex nonlinear relationship. Each regime has strong stability and long duration.

2) The impact of GPRs on oil prices fluctuations is generally negative in the short term, and the effect is becoming stronger after the global financial crisis in 2008. In the long run, the impact is generally positive. Affected by the Iraq war and Hurricane Katrina, the impact of GPRs on the fluctuation of oil prices in 2003-2008 was significantly higher than that in other years.

3) From the perspective of specific geopolitical events, this paper selected three specific events for impulse response analysis: "9 / 11" terrorist attack, Iraq War and Paris terrorist attack. The "9 / 11" terrorist attacks and the Iraq War had a negative shock on the fluctuations of oil prices in the early stage, then maintained a positive impact. In particular, the Iraq War had a strong and far-reaching shock on oil prices. The Paris terrorist attack negatively affected the fluctuation of oil prices in the initial stage, and then the influence gradually weakened and approached zero.

4) Before 2011, the shock of EPU on oil prices fluctuations was generally negative, and the shock gradually decreased. After 2011, the shock had become positive and stronger. From the perspective of specific events, this paper selects three specific events for impulse response analysis: the global financial crisis in 2008; change of Chinese leaders; Trump's successful election campaign and the political turmoil in Brazil, France and South Korea. The three events had a negative shock on the fluctuation of oil prices at the initial stage, but after half a year, the shock gradually weakened and approached zero.

This paper uses MSVAR and TVP-VAR model to study the shocks of EPU and GPRs on oil prices. The fluctuations of oil prices are affected by international economic and political factors, which show a complex nonlinear relationship. As the oil prices strongly affects a country's macro-economy and people's life, the government and enterprises should always pay attention to the risk of geopolitical and economic uncertainty, and take measures in advance to avoid the shock of oil prices fluctuations on their own economy and enterprises.

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