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The Impact of Oil Price Shocks on Economic Policy Uncertainty of China: Evidence from Nonlinear Analysis

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Abstract. In this paper, we aim to explore the impact of global crude oil price on the economic policy uncertainty (EPU) of China with methods of the hybrid wavelet artificial neural network model (WANN) and the threshold vector auto-regression model (TVAR).The results show that in China the significant negative effect exists under the medium oil price change regime in the short run, while it turns to be positive under the higher fluctuation regime. Moreover, In the long run, the significant effect occurs under the medium fluctuation regime and shows an inverted U shape.

Keywords: Global crude oil price; Economic policy uncertainty; Nonlinearity.

1. Introduction

As a leading economic variable, crude oil plays a crucial role in the real economy and financial market (Chien Mei-Se et al., 2018). And the index of EPU is constructed by Baker et al. (2016) and can serve as an integrated indicator to measure the policy-driven economic power of a nation, which has been widely used in literatures (Dayong Zhang et al., 2019; Baker et al., 2014). As a main emerging economy, China has achieved a remarkable growth in the past forty years and become the world's largest importer of crude oil. Meanwhile, China's oil dependence has risen to 69.8% in 2019. Based on such fact, it is important and urgent to investigate the impact of the changes of global oil price on China economy development to outline a comprehensive and detailed understanding to reduce risks caused by international oil markets. With the aim of exploring the influence of global crude oil price changes on EPU, this paper investigates the effect of crude oil on EPU from the multi-scale perspective, and especially explores the nonlinear impact of international oil price on EPU of China under different time horizons. Such an in-depth investigation would provide much clear and detailed reference information for policy makers and other market participants, so as to enable policy makers to make an appropriate and timely response to oil price shocks, which would have important implications for the underlying economy.

In this paper, the EPU index of China is obtained from www.policyuncertainty.com with a sample from January 1995 to March 2019.And we adopt West Texas Intermediate (WTI) from the Federal Reserve Bank of st. Louis to represent global crude oil price global crude oil price. All of the data are in the form of logarithmic in our work.

2. Analysis Framework and Methodology

First, the hybrid wavelet artificial neural network (WANN) model is employed to decompose the global crude oil price into multi-scales to represent short-term and long-term changes of crude oil prices. Second, the TVAR model is introduced into the analysis of asymmetric influence of global oil price on EPU under different oil prices regimes from the perspective of different time horizons. We consider that the TVAR model will provide a more intuitive method to capture the nonlinear relationship between the oil price and EPU index, especially that during the regime transition. The threshold model with two regimes proposed by Hansen (2000) is as follows:

$$y_{it} = \begin{cases} \alpha_i + \beta_1 \cdot x_{it} + \varepsilon_{it}, q_{it} < \gamma \\ \alpha_i + \beta_2 \cdot x_{it} + \varepsilon_{it}, q_{it} \geq \gamma \end{cases} \quad (1)$$

Where y_{it} is the time series of the dependent variable, which represents EPU index of each country. i is the number of regimes, and x_{it} is the independent variable. γ as the constant vector, is the threshold value to be estimated , and q_{it} is the threshold variable. $I_{it}(\gamma) = \{q_{it} < \gamma\}$ is an indicator function that $I = 0$ when $q_{it} < \gamma$ and $I = 1$ when $q_{it} \geq \gamma$.

Then the equation can be written as:

$$y_{it} = \theta x_{it} + \rho x_{it}(\gamma) + \varepsilon_{it}, \varepsilon_{it} \sim iid(0, \delta^2) \quad (2)$$

Where $\theta = \beta_2, \rho = \beta_1 - \beta_2$, and $\varepsilon = [\varepsilon_{it}, \varepsilon_{it}]'$

3. Empirical Results

The decomposition results are shown in Fig. 1. The upper line demonstrates low frequency series that used to express the volatility of WTI in long run, and the lower line exhibits high frequency series which represent the short-term changes of WTI.

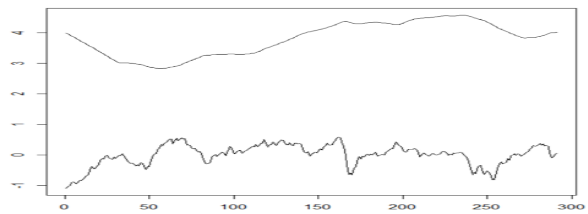

Fig.1. WTI decomposition for the sample of China

Furthermore, TVAR model is used to examine the impact of oil on EPU of China under different time horizons. For the short-term analysis, we conclude that the TVAR model with two thresholds is preferable for the analysis of the impact of WTI on EPU in the context of China. According to the AIC minimum criterion, the optimal lag number of the TVAR model is set as 3 in Table.1. And the results show that the influence of WTI on EPU in China is asymmetric. The impact of different time points depends not only on the changes of WTI price in the previous period, but also on the mechanism of the time point.

Similar with the short-term analysis, we can see that the impact of WTI on EPU in China turns out to be an inverted U shape under the medium fluctuations regime in Table.2.

Table.1.short-term of WTI oil price with EPU index TVAR result

dependent variable=EPU	China		
	Regime1 $WTI \leq 0.2962$	Regime2 $0.2962 < WTI < 0.3821$	Regime3 $WTI \geq 0.3821$
C	0.6892	2.7548	-1.0751
	(0.2365)**	(1.6998)	(1.1077)
Oil(t-1)	-0.1045	-5.5261	-0.1977
	(0.4017)	(3.6235)	(1.9181)
Oil(t-2)	-0.0134	2.1109	0.8718
	(0.6293)	(1.7844)	(1.7383)
Oil(t-3)	0.2284	-3.3343	2.6233
	(0.3826)	(1.3331)*	(1.3957).
EPU(t-1)	0.4289	0.6317	0.3739
	(0.0656)***	(0.1582)***	(0.1508)*
EPU(t-2)	0.0932	0.4610	0.1129
	(0.0713)	(0.1827)*	(0.1754)
EPU(t-3)	0.3387	-0.1742	0.4398
	(0.0639)***	(0.1991)	(0.2006)*

Table.2.Long-term of WTI oil price with EPU index TVAR result

dependent variable =EPU	China		
	Regime1 WTI ≤ 3.0217	Regime2 3.0217 < WTI < 3.9269	Regime3 WTI ≥ 3.9269
C	2.0323	0.2460	1.5971
	(3.4042)	(0.5792)	(1.0541)
Oil(t-1)	-10.1509	24.9744	-8.6867
	(11.9731)	(12.0102)*	(10.0982)
Oil(t-2)	7.0170	-46.8813	17.2412
	(22.3885)	(24.0382).	(19.7749)
Oil(t-3)	4.1082	22.0532	-8.8239
	(11.4604)	(12.0870).	(9.8841)
EPU(t-1)	0.1224	0.2861	0.5546
	(0.1200)	(0.0964)**	(0.0875)***
EPU(t-2)	-0.1677	0.3619	-0.1163
	(0.1257)	(0.0944)***	(0.1019)
EPU(t-3)	-0.1731	0.1814	0.4811
	(0.1311)	(0.0961).	(0.0891)***

Note: ***1%, **5%, *10%.

4. Conclusion

In this paper, we find a rise in the global oil price will result in a decline in EPU under the medium crude oil price fluctuation regime in the short run, but will cause an increase in EPU under the higher fluctuation regime and the negative influence is greater than the positive influence. In the long run, the significant impact occurs under the medium oil market fluctuation regime and shows an inverted U shape and the estimated coefficients are more than those in the short term.

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