

Research On Oil Price's Influential Factors and The Dynamic Relationship Among Them

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Abstract—In order to clarify the oil price's fluctuation phenomenon in the long term, researchers construct SVAR model with these five factors - aggregate supply of crude oil, economic growth rate of China, American commercial inventory for crude oil, US dollar index, and financial speculation ratio. The result shows that the economic growth rate of China, US dollar index, and aggregate supply of crude oil are significant in long term. There is bidirectional granger causality relationship between the Chinese economic growth rate and oil price. The US dollar index is the granger cause of China's economic growth rate. Consequently, it is so pressing for China to achieve the security of both energy and economy. The contribution of this paper is taking the Chinese economic growth rate as a dependent factor.

Keywords- Oil Price; Economic Growth Rate of China ; US Dollar Index; SVAR; Granger Causality Test

I. INTRODUCTION

As is known to all, China is the largest oil importing country in the world, so the fluctuations of international oil price will inevitably have an impact on China's economy. At present, China has no controlling power over the oil pricing, so it is necessary to study the factors that affect the international oil price. The results could provide theoretical reference for determining the price trend of oil. Since the oil & dollar system's establishment in 1970s, the oil and dollar have been firmly bundled together, that means, any political and economic problems related to US dollars or America will lead to volatility in oil's price. Therefore, for the research on the oil's price, just considering the supply and demand factors is not enough, and it is essential to take into account of the U.S. dollar and financial derivatives etc.

A. brief review

From 2003 to 2014, the oil's price fluctuated fiercely. It exceeded \$140 per barrel in July 2008 (as shown in Fig. 1&2), then fell to about \$40 in December 2008, in 2014 it reached \$107 in June and fell to \$60 in December. Such violent fluctuation could not be interpreted by the fundamental imbalances.

The current fall of oil price in 2014 has great relationship with the political and economic game among the United States, Saudi Arabia and Russia. Saudi intends to attack the American shale oil industry by the low price, and America tries to hit Russia's economy that is over-relying on oil.

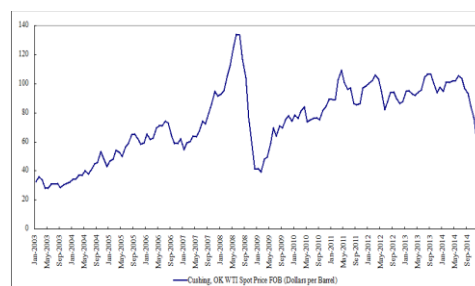


Figure 1. Oil price trend from Jan-2003 to Sept-2014

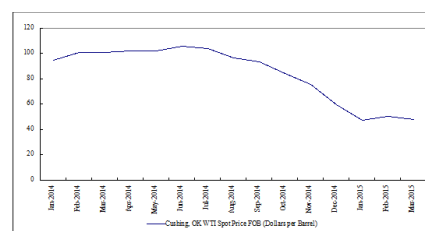


Figure 2. Oil price trend from Jan-2014 to Mar-2015

In addition, in recent years Western Europe and Japan suffers from poor economy, and the economic slowdown in emerging economies such as India and China directly reduces the demands for oil. Meanwhile, the American economy is getting better, as the U.S. Department of Commerce's final data displayed that the real GDP of 2014:Q3 was at an annual rate of 5%. This is the highest rate since the third quarter of 2003. Many market participants predicted that the first rate hike would occur in the mid 2015. The strength dollar is bound to mire the oil's price in decline. Moreover, with the maturity of the shale oil's technology, the production growth of shale oil is accelerating.

B. Review of the literature

There are a lot of literatures related to the influencing factors of the oil's price. About the sample selection, Hong Li et al(2011) adopted the monthly data in 2002 ~2010^[1]. Feifei Zuo et al (2015) selected the 1999~2012's monthly data^[2]; Jinsuo Zhang et al (2015) investigated the weekly data in 1986 ~2012^[3].

Regarding the research's method, Hong Li et al (2011) used the Co-integration theory and error correction model^[1]. Jinsuo Zhang et al (2015) studied the oil price based on the jump diffusion model to fit the dynamic process, and

also referred to the structure change point test and cumulative estimation method^[3]. Feifei Zuo et al(2015) constructed the SVAR model that reflected the volatility with the main influencing factors^[2].

About the conclusion, Hong Li et al (2011) identified that the demand from emerging markets had become a significant factor in the world oil pricing system^[1].

Dengke Ma (2010) found that the excess liquidity was essential reason for the violent fluctuation, and the virtual economy had seriously departed from the real economy^[4].

While Feifei Zuo et al (2015) believed that demand shocks was important factor for the oil price's volatility both long-term and short-term^[2].

Hui Bu et al.(2011) held that inventory changes, non commercial traders trading and the dollar exchange rate changes had a significant effect on oil price, and the fluctuation rate of crude oil futures in the downward trend was much larger than the rising trend^[5].

Levent Özbek et al (2010) found that shocks to trend were more persistent recently and global economic activity contributed also to the previous oil price shocks^[6].

With regard to the crude oil demand, Anders Aslund (2014) held that the credit and bulk commodities boom had arrived terminal. For China, India and other emerging economies, their demands for crude oil are reducing, so the boom in the oil market is excessive too^[7].

For speculative factors, Kaufmann et al (2009) tested the dynamic relationship between the futures and spot prices, and found that speculation increased the volatility of futures prices, especially the rise^[8].

Marek Kolodziej et al (2014) discussed that more and more investors are holding the crude oil as financial assets, rather than commodity, by examining the relation among daily returns to crude oil prices, equity prices, and commodity markets^[9].

Lutao Zhao et al. (2015) considered that since 2008, the strengthening of financial supervision had weakened the impact of speculation on oil price^[10].

II. EMPIRICAL RESEARCH

A. sample and variables

Researchers adopt the quarterly data from the 1st quarter of 2003 to the 3rd quarter of 2014. Regarding the dominant position of the United States in pricing, the spot price of WTI crude oil is taken as the sample of oil price. The futures and options positions are obtained from the CFTC. The computational method for speculative factors is the ratio of non-commercial net long positions to total positions (Dwight R. Sanders et al, 2004)[11]. The processing steps are making seasonal adjustment firstly, and then taking the form of logarithm, lastly taking the first order difference. All the processed data is stationary in 1% confidence level by ADF test.

TABLE I. VARIABLES AND DATA SOURCE

Variable	WTI	SUPP	GOC	USCS	USDX	SPE
Meaning	WTI spot price	The global crude oil output	China's economy growth	Americans Commercial Inventory of oil	The dollar index	Futures and options of WTI oil's speculative positions
Data sources	EIA	EIA	WIND	EIA	Federal Reserve	CFTC

In Table 1, SUPP represents the supply factor. The Chinese quarterly economic growth rate (GOC) represents the demand factor, and the quarterly data of WTI spot price is calculated from the monthly data. The quarterly dollar index is average value of Price-adjusted Broad Dollar Monthly Index. Although the samples' period covers 2008 financial crisis, the speculative factor and the dollar index have covered the financial factor, so our research doesn't refer to 2008's specific situation.

American oil daily production rises from 5 million barrels in 2003 to 9 million in 2014. The global oil daily output increases 15 million in 2003~2014, and the share of OPEC's output basically maintains at 40% of the total. The dollar index has a negative correlation with oil's price, and it hits 90 at the end of 2014, while the price of oil continues to go down. The change in the oil price lagged behind the changes in China's economic growth before 2008.

B. model

VAR is the most common model that is adopted in a lot of literature discussed the oil price.

In this paper, researchers estimate the VAR model firstly and then execute SVAR modeling with the six variables as shown in Table 1.

III. RESULTS

According the VAR modeling's result, there is negative relationship between the current oil's price and prior dollar index, and the coefficient is -2.78, so the strength of the current dollar index will greatly depress the next quarter's oil prices. Increasing the current America commercial crude oil inventories will lower the oil's price too. The higher growth rate of China will push up the current price of oil too. Moreover, there is co-integration relationship among these six variables due to Johansen test.

TABLE II. SHOWS THE RESULT OF THE SVAR MODELING.

coefficient	a_{01}	a_{02}	a_{03}	a_{04}	a_{05}
value	4.74	0.50	-1.52	-3.24	0.0048

A. impulse response

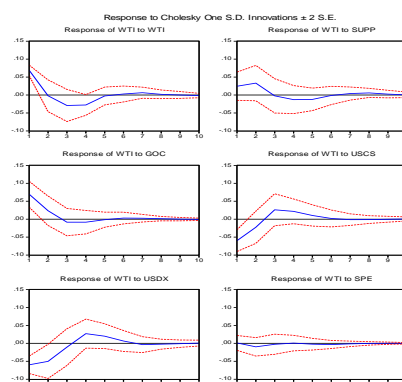


Figure 3. Impulse response

As shown in Fig. 3, a positive shock on Chinese economic growth rate generates positive impact on the oil price in 1~3 period. The dollar index and U.S. commercial oil inventories have negative impact on oil's price. The

impact of speculative factor on oil's price is very little. After the 6th quarter, the five factors' effect is close to zero. Table 3 shows the data of impulse response.

TABLE III. IMPULSE RESPONSE 'SRESULT

variable	WTI	SUPP	GOC	USCS	USDIX	SPE
largest positive effect	1 st (0.069)	2 nd (0.033)	1 st (0.07)	3 rd (0.026)	4 th (0.027)	1 st (0.0011)
largest negative effect	3 rd (-0.029)	4 th (-0.013)	4 th (-0.008)	1 st (-0.06)	1 st (-0.06)	2 nd (-0.0097)

B. Granger test

The result shows that in the 10% confidence level, only China's economic growth rate (GOC) is granger reason for the oil's price, while the other 4 factors are not. In the 1% confidence level, the international oil price and the U.S. commercial crude oil inventories, the U.S. dollar index is the granger reason for China's economic growth rate. Therefore, oil prices, U.S. commercial oil inventories, and dollar index will affect China's economic growth in the long-term, and this is disadvantageous for China's economy.

For any emerging economic entity, not just China, subject to external factors is universal problem. This makes their economic systems are very fragile, for instance, Russia's ruble crisis occurred in end 2014 and stagflation that is happening in Brazil.

C. Variance decomposition

Table 4 shows that the dollar index's contribution to oil's price increases from 0 to 9.5% in ten quarters, China economy's contribution to oil prices increases from 0 to 2.2%. The global oil output's contribution increases from 0 to 2.1% in ten quarters. The maximum contribution of U.S. oil commercial inventories' to oil prices is 0.6%. The contribution of speculation to the oil price is only 0.4%. So the dollar index, the growth rate of China's economy, the output oil have remarkable influence on oil's price, and the little impact of speculative factors and U. S. commercial inventories can be neglected.

TABLE IV. VARIANCE DECOMPOSITION 'SRESULT

period	WTI	SUPP	GOC	USCS	USDIX	SPE
1	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	89.9272	2.2085	0.4258	0.1415	6.8732	0.4238
3	86.5194	2.1657	0.5423	0.6240	9.7378	0.4108
4	86.4487	1.9957	1.6418	0.6001	8.9347	0.3809
5	85.5322	2.0398	2.0773	0.5641	9.3652	0.3914
6	85.2933	2.0352	2.1379	0.5969	9.5037	0.4330
7	85.2565	2.0439	2.1504	0.6281	9.4804	0.4407
8	85.1818	2.1173	2.1665	0.6286	9.4656	0.4402
9	85.1625	2.1331	2.1706	0.6286	9.4646	0.4405
10	85.1599	2.1356	2.1705	0.6292	9.4640	0.4408

IV. CONCLUSIONS

Through empirical research, researchers find that the main factors that affect the international oil's price are the economic growth rate, the dollar index, the global crude oil production in the long term. But only China's economic growth rate is the unidirectional Granger reason for the oil's price, and it has a positive impact on international oil price. In other words, China's economic growth will

accelerate the rise of oil price. These conclusions are also consistent with the reality that has occurred in recent 12 years.

The dollar index and the oil's inventories of the United States will lower the current price, and the oil production's negative effect on oil's price will lag. In the long term, the speculation factor's impact on oil price is very small. There is co-integration relationship between the five influential factors and the international oil price.

By the end of 2014, due to the rapid growth of the shale oil's production, the United States has been achieved self-sufficiency in energy. Latin America's oil is begin to be shipped to east Asia, because American don't need it anymore. This change of market behavior also reduces the share of Saudi Arabia in East Asia. Meanwhile, the market demand and supply relationship has also shifted from the seller's market to the consumer's market.

However the economy of emerging economies is still poor, so the market participators forecast that the oil's demand will decrease, so oil price may still be low in 2015.

The low oil price will have different impact for all sorts of stakeholders. The residents and non-energy enterprises will benefit from it, but new energy enterprises will be negatively affected.

With the low price, the cost of energy imports can be reduced for China, India etc, thus the growth of China's economy can be promoted. In addition, due to the existence of excessive dependence on imported crude oil, once oil price goes up again, that will inevitably have huge negative impact on the China's economy.

How to eliminate or weaken the dependence and how to achieve energy security are crucial problems for China. In addition, with the increase in the U.S. dollar interest rate approaching, a large number of capitals are bound to return from China etc emerging countries to the United States. It will have a negative impact on China economy.

In order to achieve energy security and economic stability and growth, China must increase the development investment for new and alternative energy and accelerate the RMB internationalization. To adjust and improve its economic and financial structure is crucial for China too

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