

## A Study on the Factors That Affect the Oil Prices in the World

Shifen Wang<sup>1, a,\*</sup> and Xinru Pan<sup>2, b</sup>

<sup>1,2</sup>School of Economics, Shanghai University, No. 99, Shangda Road, Shanghai 200444, China

<sup>a</sup>shifenwang@shu.edu.cn

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**Abstract.** Oil is one of the most important resources of human life. Its value lies in its scarcity. In addition, oil has some financial properties, so that it is worthwhile to study the factors that affect the prices of oil. This article first introduces the background, meaning and the methods of the study. After that, we analyze the relevant theories in the literature reviews. Then, we set up empirical models to carry out ADF test, co-integration test and Granger causality test. We studied the relation among the USD index, world GDP, oil consumption and oil price. We find that the USD index was the cause, oil price was the result; the oil price and the amount of oil consumption were mutual causes.

### Background of Study

In 2018, the oil price was stable from the start, however, when the supply was affected by the OPEC output reduction agreement and US's restart of sanction against Iran, it began to rise substantially due to panic. After the oil price reached the peak in October, the output of crude oil by Saudi Arabia, Russia and the US had increased. At the same time, the US's sanction was apparently weaker than expected. The surplus of the oil supply drove down the oil price. In the whole year, although the oil price fluctuated greatly, it had a big increase compared with that in the previous years.

Oil price has substantial influence on economy. On the other hand, the economic development has impact on oil price too. This article aims to collect and handle the data of the world GDP, world oil consumption, the USD index and the Brent Crude Futures Price, and analyze the relations between them using the Granger causality test. This will be helpful for people to predict the change of oil price.

### Literature Review

Many scholars have studied the factors that influenced the oil price in the world, and predicted the trend of change of the price. XU Ling, LI Leiming and LI Jin (2014) thought that China was in the period of fast development, which had big demand for oil. This meant that the economy of China was sensitive to the price changes of oil. It was necessary for China to establish the complete strategic reserve system of oil to cope with the short-run big fluctuations of oil price. WANG Tianxiang (2019) suggested that we study the rule of the change of oil price, and intensify the anti-price cycle reserves of oil. We should pay more attention to the impact of world economic development on oil price. The fast economic growth of developing countries would push up the demand for oil, so that it was wise for China to increase the investment and reserve of oil when the price was low. HUANG Huiping, LU Chunfeng and WEI Long (2014) argued that compared with the demand, there were increasing gaps in supply. This gave the suppliers a louder voice in the market. However, empirical tests showed that both the instability of supply itself and the result of extreme events would weaken the voice of the supply side. It was unnecessary for us to exaggerate the power of the suppliers. MA Yong, PAN Dongtao and ZENG Zhaoxiang (2018) concluded that there were interactions between oil price and USD index. The two stimulated each other in the course of abrupt ups and downs. The asymmetry of the stimulus would lead to the abrupt changes of the USD index resulting from the same direct changes of oil price, but not surely vice versa.

## Data, Hypotheses and Empirical Tests

### Data

The data for the empirical tests are as follows:

Table 1. The Original Data for Tests

Years	World GDP (billion \$)	USD Indices	World Oil Output (million tons)	World Oil Consumption (million tons)	Brent Oil Prices (\$/barrel)
2007	631,93.92	76.69	3954.2	4007.3	72.39
2008	643,43.19	81.17	3999.1	3996.5	97.26
2009	632,25.27	77.92	3892.6	4167.8	61.67
2010	659,54.61	78.96	3981.4	4148.8	79.5
2011	680,49.90	80.22	4009.4	4077.6	111.26
2012	697,77.45	79.76	4120.9	4208.9	111.67
2013	716,03.82	80.20	4125.3	4252.4	108.66
2014	736,50.98	90.27	4223.1	4304.9	98.95
2015	757,54.09	98.70	4355.2	4359.3	52.39
2016	776,58.15	102.38	4377.1	4394.7	43.73
2017	800,94.86	92.26	4387.2	4475.8	54.19

Sources: World GDP and the USD Indices are from Wind Database. The output and consumption of oil are from the website of British Petroleum Company.

### Hypotheses

Oil is non-renewable so that its scarcity will become intensified with the increase of consumption. However, the price changes since 2007 didn't reflect the climbing trend caused by the increasing scarcity. On the other hand, there were apparent positive relations between the world GDP, oil output and oil consumption. From the judgment of the above data, we propose three "weak" hypotheses for the relations among the world GDP, USD index, oil consumption and oil price.

Hypothesis 1: world GDP is positively related to oil price. The world GDP is the causality, oil price the result.

Hypothesis 2: USD index is positively related to oil price. The USD index is the causality, oil price the result.

Hypothesis 3: oil consumption is positively related to oil price. The consumption is the causality, oil price the result.

### Empirical Models

In order to avoid pseudo regression, we will use the following models:

- (1). ADF test. The nature of the ADF test is to test the stability of the data series.
- (2). Co-integration test. The co-integration test is applied to those variables that in short term will be influenced by the stochastic disturbances but in long term have a stable relation. At the same time, co-integration can avoid the pseudo regression.
- (3). Granger causality model.

### Empirical Tests

We denote the world GDP, the USD index, world oil consumption, oil price as G, U, C and P respectively. The world GDP is in the constant price, while the world oil price is the Brent oil price. The time of the data is from 2007 to 2017.

Before the tests, in order to eliminate the covariance and the first-order non-linearity, we run logarithm on all the variables, which are lnG, lnU, lnC and lnP. Stata15.1 is applied for the tests.

#### *Augment Dickey-Fuller Test and the Co-Integration Test.*

First, we apply the ADF test to all the variables to see whether they are stable.

Table 2. The Result of the ADF Test

Variables	p-value	Stability	p-value for the First-order Variables	Stability
lnG	0.7184	N	0.0001	Y
lnU	0.2100	N	0.0001	Y
lnC	0.8669	N	0.0000	Y
lnP	0.7331	N	0.0000	Y

Second, we run the co-integration tests for lnP, lnG, lnU and lnC. The results showed that co-integration exists between lnP and lnU, and between lnP and lnC.

Table 3. The results of the co-integration tests

	lnP
lnU	No co-integration
lnG	Co-integration
lnC	Co-integration

That is to say that the oil price is influenced by the USD index, because oil is priced by the US dollars. The oil price is also influenced by the volume of consumption of oil.

#### *Granger Causality Test (VAR method).*

Table 4. P-value of the granger causality test

Result \ Cause	lnP	lnG	lnU	lnC
lnP		0.095	0.006	0.040
lnG	0.389		0.037	0.000
lnU	0.059	0.010		0.198
lnC	0.004	0.000	0.275	

According to the above result, at 5% critical level,

Table 5. The result of granger causality test

Cause \ Result	lnP	lnG	lnU	lnC
lnP		N	Y	Y
lnG	N		Y	Y
lnU	N	Y		N
lnC	Y	Y	N	

To sum up:

The world GDP and the USD index are the Granger causes mutually.

The world GDP and the oil consumption are the Granger causes mutually.

The USD index is the Granger cause of oil price; oil price is not the Granger cause of the USD index.

The oil consumption and the oil price are the Granger causes mutually.

Of course, the results above are based on the 5% critical level. If the critical levels were changed to other percentages, such as 1% or 10%, the results would be different.

## Conclusions

The ADF test shows that the four variables we select all satisfy the first order integral, which is in accordance with the usual case of the variables calculated in constant prices.

In the co-integration test, the oil price has no co-integration with the world GDP. The subsequent Granger causality test also shows that no apparent causal relation exists between the two (5% critical level). This confirms the result of the co-integration test.

The co-integration relations between the USD index, oil consumption and the oil price are confirmed by the co-integration test, which can eliminate the pseudo regression resulted from the same or similar trends of the variables themselves.

The most important conclusions come from the Granger causality tests. We draw four conclusions from the tests.

(1). The world GDP and the USD index are the Granger causes mutually.

(2). The world GDP and the oil consumption are the Granger causes mutually.

(3). The USD index is the Granger cause of oil price; oil price is not the Granger cause of the USD index. Almost all the oil products are priced in the US dollar, the changes of the dollar value will have the direct and full impacts on oil prices. But, on the contrary, the changes of oil prices will have very limited impacts on the dollar.

(4). The oil consumption and the oil price are the Granger causes mutually.

This complies with the principle of the supply and demand of a market. Although to certain degree the oil market is a seller's market, it does not escape the rule of supply-demand. The change of consumption relies on the change of price while the change of price relies on the change of consumption. But if the change of oil price is big, the voice of the sellers becomes louder. The big producers in the mid-east will control the oil price by limiting output or quota to create the price alliance.

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