# Research and Analysis of International Crude Oil Price Law

*Hengyu Lyu , Yuwen Chang*
*PetroChina Research Institute of Petroleum Exploration & Development, Beijing 100083, China*

Abstract: As a basic energy product, petroleum currently accounts for about 40% of the world's total energy consumption. As an important kind of material resource, it is the main driving force of modern economic development. The twentieth century is called the century of oil. The rapid development of world economy in the 20th century is closely related to the large-scale development and utilization of petroleum resources. Modern life can not be separated from the consumption of petroleum. The economic growth of the modern society will inevitably bring about an increase in the demand for petroleum consumption. The status and role of oil are as follows: Oil is an important energy source; oil is an important driving force for the economic development of all countries; oil is an important guarantee for national security. This paper mainly uses the "three-factor analysis method", namely: supply and demand factors, cost factors, financial factors, a comprehensive analysis of the changing rules of international crude oil prices.
Keywords: WTI Oil Price; supply and demand factors; cost factors; financial factors

## 1. INTRODUCTION

International crude oil prices: In the international crude oil trade, crude oil prices have the following meanings: the spot market price, the futures transaction price, the official price of the Organization of Petroleum Exporting Countries (OPEC), the official price of non-OPEC organizations, Price of goods, net return value and price index. There are two kinds of crude oil spot market prices, one is the actual spot transaction price, the other is some agencies through the market research and tracking of some of the market price level valuation. Compared with other types of price types, the spot price of crude oil can more accurately reflect the current supply and demand changes as well as the crude oil production, refining costs and profits. It represents the trend of product prices in the entire oil market and therefore more economically discounted prices Meaning. The price used in this study is the spot market price.

In international trade, the overall level of crude oil prices in international markets is usually measured by the price level of three benchmark crude oil. The three benchmark crudes are: West Texas Intermediate Crude Oil (WTI) in the United States, Brent Oil in the United Kingdom and Dubai Crude Oil in the UAE.

WTI crude oil is a light sweet crude oil and is a more common class of crude oil in North America. WTI Crude is a New York Mercantile Exchange, a light sweet crude oil, is the United States oil industry benchmark crude oil. Due to the U.S. military and economic capabilities around the world, WTI crude oil has now become the benchmark for global crude oil pricing and its price trend has become the benchmark for other low-sulfur light crude oil prices.

Brent Crude is a low-sulfur and light-weight North Sea crude that is a benchmark grade in the crude oil market and is traded broadly as a contract unlike the New York Mercantile Exchange, a light sweet crude oil futures contract. Brent crude oil supply is generally stable, less affected by local factors. For the most part, Brent crude followed the trend of WTI crude oil with only a few data diverging or affecting WTI oil prices.

Dubai Crude is a high sulfur, heavy crude and is the main pricing benchmark for sour crude, especially for pricing crude oil exported to Asia from the Middle East. In this paper, WTI crude oil is used as the research object.

## 2. INTERNATIONAL CRUDE OIL PRICES IMPACT FACTORS

According to the analysis of the three elements, the specific influencing factors of international crude oil prices can be cost factors, supply and demand factors and financial factors. The factors that affect oil prices are not the same in all periods. In addition to the most important factor of supply and demand, the influence of other factors on the price of oil is variable and varies at different times. The modern pricing with financial attributes appeared in the 1990s. To ensure that the data can fully reflect the financial factors, the three factors of crude oil price after 2000 and the data of various influencing factors were selected.

First of all, from the basic principles of economics we can see that the total cost of production determines the lower limit of the international crude oil pricing mechanism. The cost of oil exploration is one of the factors that affect the oil price. The production cost of oil is the basis of petroleum price and the lowest bottom line of oil price. Oil production includes

systematic activities such as exploration, construction, development, transportation and marketing, and therefore oil prices will be directly affected by the costs incurred in the process.

Unit Discovery Cost = Total Expenditure for Exploration ÷ Added Proved Reserves for Exploration. Through the linear regression of the average found cost of six Chinese and foreign companies, it is found that the cost of unit discovery increases gradually.

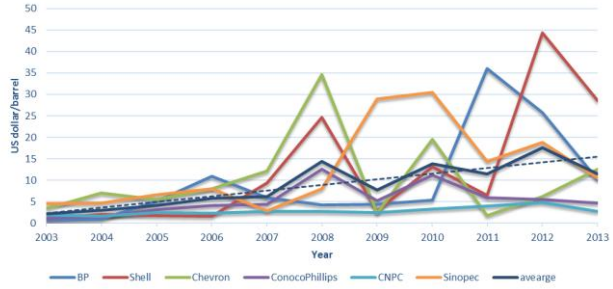


Figure 1. Unit Discovery Costs

Unit Exploration and Development Costs = Total Expenditure for Exploration and Development ÷ Added Confirmation of Developed Reserves. Through the linear regression of the average found cost of six Chinese and foreign companies, it is found that the exploration and development costs per unit have been decreasing slightly. (This may be due to the large or negative cost of exploration and development in a certain company during a certain year, resulting in a loss of the trend of average change.)

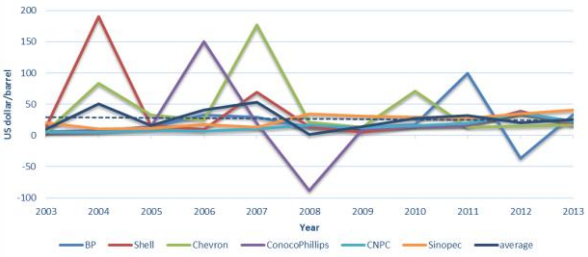


Figure 2 units of exploration and development costs

Unit Operating Cost = Total Expenditure on Oil and Gas Production Operations ÷ Total Commodity Equivalents for Oil and Gas Production. Through the linear regression of the average found cost of six Chinese and foreign companies, it is found that the cost of unit discovery increases gradually.

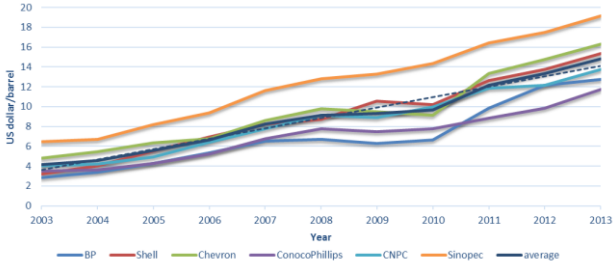


Figure 3 unit operating costs

Analysis of the cost factor data shows that the bottom line of international oil prices is based on the basic profits of the high-cost areas of the major oil companies in Europe and the United States. As the leading force in the international oil market, the United States is bound to safeguard the interests and competition of its national and oil companies status. So will tend to defend this price bottom line. In fact, the marginal cost is the lowest price required for commercial exploitation in the world's high-cost oil-producing regions that the major western oil companies are planning to invest now and in the future. The price by the integrated mining costs, contract model and tax model.

The development of alternative energy will also have an impact on oil prices. In the short term, oil will remain the main support for the world economic development and will play an important role in the economic growth of all countries in the world. However, in the long run, various countries and regions will adopt measures to save energy and reduce emissions, which will lead to more cleaner alternative energy sources. At this time, the market price of petroleum will be implemented according to alternative energy sources. However, the rate of development of alternative energy has a clear relationship with the oil price. If the price of petroleum rises sharply and surpass its alternative energy or its own value, it will inevitably accelerate the development of alternative energy.

Quotations on the seventh part of the PPT conclusion is: high-end marginal cost of crude oil prices determine the lower limit of large-scale alternative energy costs determine the crude oil price cap.

The total market demand for oil and market supply have a direct bearing on the fluctuation of oil prices. In the long run, if the oil supply is relatively abundant and the oil production capacity is relatively high and the market is in the buyer's market in this state, the demand will not fluctuate greatly due to the changes in oil prices. The oil price will be in accordance with market rules run. In the short term, if the supply is far greater than the market demand, the supply elasticity of oil is relatively small at this time, and the slight fluctuation of oil demand may also cause the oil price to fluctuate greatly. From the demand point of view, the short-term oil price elasticity of demand is relatively small, oil prices rise and fall fluctuations can not make the oil demand increase or decrease accordingly. If the decline in demand will directly lead to a sharp drop in oil prices.

Crude oil production as a major factor in supply has a very large effect on international crude oil prices. The world's crude oil supply, according to the region, can be divided into the Middle East, the EU, North America, Central and South America, Asia Pacific and Africa. According to 2015 data, the main area is the Middle East, followed by North America.

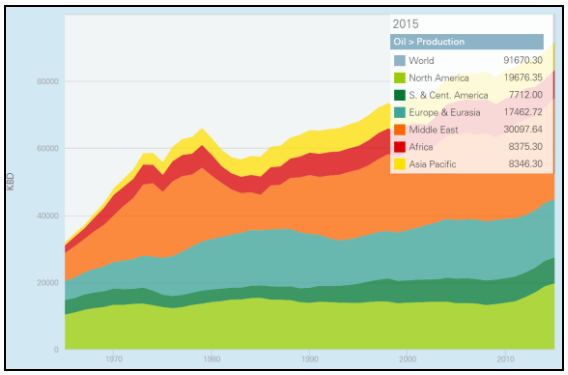


Figure 4 World Crude Oil Supply (BP)

World economic development needs

The level of world economic activity has a greater impact on oil demand. In general, as the world economy steadily increases, the demand for energy by all walks of industries has increased correspondingly as a result of the expansion of production. The economic development at the same time promote the growth of household income, making the demand for energy for life to further increase. Conversely, when the world economy stagnates or even regresses, the demand for energy for production and life energy will decline. For instance, the impact of the economic crisis on the demand for international crude oil is immediate.

The second quarter of 2016 economic data points to a slight rise in the global economy, especially thanks to the recovery of the U.S. economy's energy contribution. However, the global economy is still facing many challenges, and the danger of a downturn has not been lifted. An average growth rate of 2.9% over 2015. According to the data forecast, the economic growth forecast for 2016 will reach 3.1%.

The data show that in 2016, the global economic forecast growth rate (based on the data of the previous two quarters) increased from 3.1% in 2015 to 2.9% in 2015. In the OECD countries, the U.S. slowed in the first quarter of 16 in the following quarters, Japan's economy continued to show weakness, and the EU showed a slight upward trend. China and India are still enjoying strong economic growth. China's economy barely maintained its economic growth rate of 6.5% and India's economic growth rate of 7.5%, making the world a leader. Brazil's economy is still bad, the Russian economy is still in the recovery phase.

**Economic growth rate and revision, 2015-2016, %**

| | World | OECD | US | Japan | Euro-zone | China | India | Brazil | Russia |
|---|---|---|---|---|---|---|---|---|---|
| 2015* | 2.9 | 2.0 | 2.4 | 0.5 | 1.5 | 6.9 | 7.3 | -3.8 | -3.7 |
| Change from previous month | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2016* | 3.1 | 1.9 | 2.0 | 0.5 | 1.6 | 6.5 | 7.5 | -3.4 | -1.1 |
| Change from previous month | 0.0 | 0.0 | -0.2 | -0.2 | 0.2 | 0.2 | 0.0 | -0.5 | 0.0 |

*Note: * 2015 = estimate and 2016 = forecast.*

Figure 5 Economic Growth Rate Data (OPEC Secretariat)

Energy use of oil accounted for

The more types of petroleum alternative energy, the greater the development of energy development, the smaller the oil consumption, on the contrary, the greater the consumption of oil. In recent years, due to the impact of rising oil prices and global climate change, the development and utilization of renewable energy is increasingly valued by the international community. Many countries have set clear development goals and formulated laws and policies that support the development of renewable energy so that renewables With the continuous improvement of energy technologies and gradual expansion of the industrial scale, it has become an important source of energy for diversifying energy sources and achieving sustainable development.

In the long run, oil is still an important part of the energy structure that is not available, with more than half of the country's oil and gas resources coming in the future.

Crude oil consumption

With the rapid economic development, oil consumption changes with it. Judging from the global crude oil consumption, the overall trend of growth shows that the original consumption of OECD countries, the United States and other developed countries has not increased. The global increase mainly comes from developing countries. Since many developing countries are in a phase of relatively rapid development, the demand for and consumption of petroleum are enormous. Due to the fact that developing countries, oil and gas, and China and India do not have high utilization efficiency of resources for developed countries, the rapid development is costly Consumption of non-renewable resources. Developing countries still need to go through long-term efforts from developed countries, and the dependence on oil has long existed.

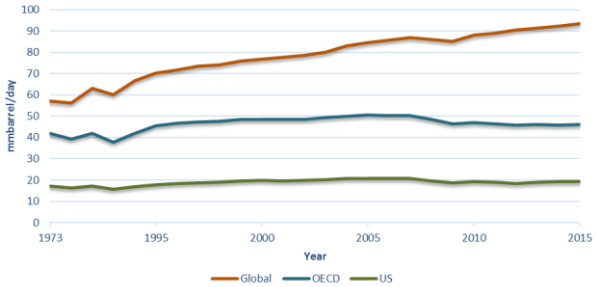


Figure 6 Crude oil consumption

From an economic point of view, money is a measure of the value of the goods, and when the intrinsic value of money changes (inflation), the same goods will appear as different prices. For oil, this change in oil prices from a weaker dollar is the dollar premium. In transnational oil trade, thanks to the international floating exchange rate management system. Therefore, for any oil importing country, the devaluation of the U.S. dollar will have two effects:

First, the devaluation of the U.S. dollar against the major currencies of the importing countries, such as the Euro, and the second is the inflation of the U.S. dollar. The international oil trade is denominated in U.S. dollars and the oil market is closely linked with the speculation in the foreign exchange market.

The dollar index shows the composite value of the U.S. dollar. A measure of the strength of various currencies is a comprehensive indicator of the exchange rate of the U.S. dollar in the international foreign exchange market. It measures the degree to which the dollar changes against a basket of currencies. It measures the strength of the dollar by calculating the combined rate of change in the dollar and the basket of selected currencies, thus indirectly reflecting the changes in the U.S. export competitiveness and import costs. The rise of the dollar index shows that the ratio of the dollar to other currencies rises, that is, the appreciation of the dollar. If the major international commodities are denominated in U.S. dollars, the corresponding commodity prices should fall. The appreciation of the U.S. dollar is good for the country's economy as a whole, increasing the value of its currency and increasing its purchasing power. However, some industries also have an impact. For example, in the import and export sectors, the appreciation of the currency will raise the prices of export commodities and thus affect the exports of some companies. If the United States refers to the decline, the opposite. The changes in the exchange rate of the U.S. dollar have a great impact on the oil price. The strength of the U.S. dollar is an important factor affecting the oil price. First, the U.S. dollar is recognized as a hard currency in the world. Second, the total U.S. foreign trade volume ranks first in the world and the world economy is greatly affected by it. The oil price is obviously no exception. Thirdly, the world oil market is usually priced in U.S. dollars so that a devaluation of the U.S. dollar will inevitably lead to rising oil prices. Crude oil prices and the dollar, seems to be the ends of the "seesaw." Therefore, the United States dollar index and the depth of oil prices linkage, both the price changes in the opposite relationship.

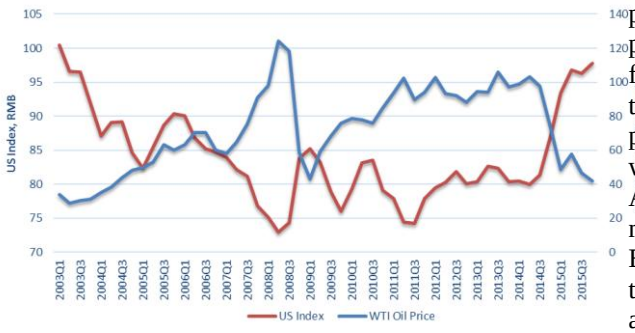


Figure 7 US dollar index and WTI oil prices

The measurement of inflation is mainly based on the CPI and the PPI index. Oil is also an important component of the CPI calculation. Therefore, when the price of oil rises, it can have an upward effect on the inflation index. The rise in oil prices can have an impact on every aspect of production and livelihood. First, higher oil prices can affect the corresponding products, raise their prices and further their prices on raw materials and fuels, Transportation services and industrial products, and the rise in oil prices will affect the prices of intermediate products such as plastics and chemical fiber, which in turn may affect the export prices of the corresponding products.

In the long run, unexpected major events have little effect on oil prices, but fuel the volatility of oil prices in the short term. For example, the unexpected "Hurricane Ivan" in September 2004 led to a cut in the Gulf of Mexico, a sudden event that pushed international oil prices to a new high. In addition, political premiums and rising spirits are also important drivers of high oil prices. After the war in Iraq, the pattern of internal turmoil in Iraq, the strike by oil workers in Nigeria, the political turmoil in Venezuela and the tax scandal of Yukos in Russia have caused the international crude oil price to contain a certain political premium while the oil market panic anticipation and other factors are also to some extent Promote higher oil prices. From the long-term oil price changes, political factors are also important factors affecting the international oil price changes. The so-called political factors that affect the fluctuation of oil prices refer to sudden political events such as the outbreak of war, mutiny, turmoil, revolution, coup d'état, etc.,

Geopolitics: Instability affects oil prices. Geopolitical risks in the oil-producing regions such as the Middle East have always existed. Geopolitical factors such as the terrorist attacks on oil facilities, the strike of oil workers and the turmoil in the oil-producing countries will all have an impact on the international oil price. At present, the frequent terrorist attacks in Iraq, instability in the Sudan, Libya and other countries have caused the oil facilities to be destroyed frequently. Local political turmoil or war will stimulate oil prices. And political actions taken to achieve a certain political and economic purpose, such as the oil embargo, changes in a country's oil policy, multi-nation joint price increases or cuts in production. By analyzing the political factors in the fluctuation of oil prices, we can accurately find out the direct causes of several ups and downs in the post-war international oil prices. The first oil crisis was caused by the outbreak of the larger war in Afghanistan and Israel on October 6, 1973. The oil minister of the Organization of the Petroleum Exporting Countries passed a resolution expressing the strong support for the Arab-Israeli war through oil and gas weapons. , And on many occasions unilaterally took actions on October 16, 1973 and January 1, 1974, to substantially raise oil prices and cut oil output, resulting in a crisis of shortage of oil supply. In more than three months, the price of oil

More than tripled. As another example, in the late 1970s and early 1980s, a political revolution took place in Iran, the Middle East oil producing country, followed by a fierce war with Iraq, another oil-producing nation that triggered the second oil crisis. Oil prices soared from crisis to crisis. The former $ 13 doubled in a year, from $ 26 in January 1980 to $ 32 in January 1981. By the end of 1981, it stabilized at about 34 U.S. dollars, which is almost 20 times the level of oil prices in the early 1970s.

The recent phase of the oil price plunge is not directly related to the OPEC's policy of no reduction in production, the US strategic policy of energy independence and the lifting of the Iranian oil export ban.

Climate conditions: Oil supplies can be disrupted, affecting international oil prices, by affecting the supply and demand of crude oil, such as weather anomalies that could damage oil production facilities. In addition, many countries in Europe and the United States use oil as heating fuel. When the climate changes abnormally, it will cause short-term changes in fuel oil demand and thus the prices of crude oil and other oil products. However, the impact of climate conditions on international oil prices is not long-term. Major events affect oil prices indirectly by influencing the three elements, and the degree of influence on the three elements is hard to quantify. Therefore, the quantitative factors of major events are not involved in the model prediction. Major events are still predominant in predicting the general direction and trends Reference basis and accurate assurance of the trend.

## 3. CONCLUSION

The study of the influencing factors of international crude oil price is a systematic study and is a complicated work. Through the analysis and research of three-factor analysis method, this paper collects, collate, plot and analyze related data, which can clearly show that the main factors affecting the international crude oil price are the cost factor, the supply and demand factor and the financial factor. The three factors are composed of a number of influencing factors, which restrict and influence each other. Supply and demand factors are the fundamental factors of international crude oil price fluctuations. Cost factors determine the long-term trend of international crude oil prices. Financial factors will cause drastic fluctuations in international crude oil prices in a short period of time.

## REFERENCES

[1] Zhu Runmin. Why do I accurately predict oil prices three times? [BP] PetroChina, 2015,01: 78-79.

[2] Zhang Kang, Lu Quanjie. The root causes of oil prices and far-reaching impact [J]. Chinese and foreign energy, 2015,05: 1-15.

[3] Dong Zhenyu, Feng Enmin, Yin Hongchao, Zhang Yuduo.A dual-layer random integer programming model, algorithm and application of international crude oil price forecast [J].

[4] Wang Shuping, Zhu Yanyun.Study on forecasting method of international crude oil price based on multi-scale analysis [J] .Proc., 2015,10: 1-5.

[5] Li Kangqi, He Miao.
BRENT Crude Oil Price Volatility and Forecast [J]. Modern Business, 2015,26: 44-45.

[6] Ji Qiang, Liu Bingyue, Xi Wenwen, Fan Ying. International crude oil market trend analysis and price forecast in 2016 [J]. Chinese Academy of Sciences, 2015,06: 818-823.

[7] Peng Peng. Study on the Linkage between the US Dollar Index and International Oil Price Fluctuation [J]. Theory and Practice of Price, 2016,02: 124-127.

[8] Li J. GA-BP algorithm in gold price forecasting [J]. Financial Economics, 2010,02: 73-74.

[9] Zhang Yinghong, Ma Baoling. Analysis of the main controlling factors of international crude oil prices [J]. Chinese and Foreign Energy, 2010,04: 12-17.

[10] Yang Yunfei, Bao Yukun, Hu Zhongyi, Zhang Rui. Chinese Journal of Management, 2010,12: 1884-1889 .An Approach to Predict Crude Oil Price Based on EMD and SVMs [J]. Chinese Journal of Management, 2010,12: 1884-1889.

[11] Zheng Junyan. International Crude Oil Price Prediction Based on Wavelet Transform and Support Vector [J]. Value Engineering, 2012,05: 140-141.

[12] Hu Aimei, Wang Shuping.Comparison and Analysis of International Oil Price Forecast Based on ARIMA and GARCH Model [J] .Journal of Economic Research, 2012,26: 196-199.

[13] Chen Minghua. Research on International Oil Price Fluctuation Based on Financial Factors [D] .Shandong University, 2012.

[14] Hu Shan. Hybrid neural network in oil price forecasting application research [D]. Nanchang University, 2013.

[15] Cheng Weili.Quantitative Analysis of Factors Influencing International Oil Price [J]. International Petroleum Economics, 2005, 08: 40-43 + 71.

[16] Cheng Yan, Liu Qingzhi.
Neural Network in the prediction of refined oil prices [J]. Journal of Shandong University of Technology (Natural Science Edition), 2005,05: 64-68.

[17] Li Cheng, Zhou Heng. Prediction of crude oil price based on neural network [J]. Statistics and Decision, 2013,08: 67-69.

[18] Qu Haixu. Cost prediction method and application in oil and gas field development [D]. Northeast Petroleum University, 2013.

[19] Liu Ning. International oil prices impact factors [D]. Huazhong University of Science and Technology, 2009.

[20] Pan Fei. Improved Gray Prediction Model in Sinopec Oil and Gas Cost Forecast [D]. China University of Petroleum, 2011.

[21] Huang Xuming. How to Pricing Overseas

Refined Oil? - He Manqing, Director of Transnational Corporations Research Center, Institute of International Trade and Economic Cooperation, Ministry of Commerce [J]. China Petroleum Enterprises, 2014,05: 49-53 + 4.
[22] ZHENG De-peng. Characteristics of upstream costs of Chinese and foreign oil companies during 2003-2013 and their implications [J]. International Petroleum Economics, 2014,07: 54-60 + 112.
[23] Zheng Depeng. Comparative analysis of upstream and downstream cost indices and costs between Chinese and foreign oil companies [J]. International Petroleum Economics, 2008,09: 33-39 + 82.
[24] ZHENG De-peng. Analysis of upstream cost and influencing factors of oil companies in 2008 [J]. International Petroleum Economics, 2009,09: 39-46 + 95.
[25] Zheng Depeng. Comparative study of Chinese and foreign oil and gas costs [D]. Dalian University of Technology, 2002.
[26] Gao Hongguang, Lv Anming factors affecting the cost of imported crude oil and control measures [J] Qilu Petrochemical, 2001,03: 239-242.
[27] Cui Qing, Liu Linwei, Sun Kaidong. Analysis of the influencing factors of international oil prices [J]. Neijiang Science and Technology, 2011,07: 22 + 42.