

Forecasting the Crude Oil Prices and their Effects:

A Numerical Approach

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Abstract

Crude oil, one of the world's incredibly salient fuel is a price determinant for various commodities in the present scenario. It has effects on the economic growth and stability, foreign currency and import and export rates. Forecasting crude oil prices are beneficial for the companies, policy makers of the government and even for the individuals. Considering all these, researchers have been using diverse methods to study fluctuations in crude oil prices. In this paper, we put forward a numerical approach - forecasting using extrapolation by collecting a large set of available market data of crude oil prices in the Indian context.

Key Words: Extrapolation, spot prices, freight on board, inflation.

1. Introduction

Crude oil is a naturally occurring dark sticky liquid found beneath the rocks. They are named according to their origin and contents, and are classified according to their per unit weight (specific gravity). Heavier crudes yield more heat upon burning but have a lower gravity and market price in comparison to light crudes, which are also termed as sweet crude. Due to its price and immense demand, it is often termed as 'BLACK GOLD' and is refined to produce diesel, kerosene, gasoline, heating oil, jet fuel and literally thousands of other products called petrochemical products. For instance, the transportation fuel is refined from crude oil.

As a part of transportation, goods needed to be imported or exported from one place to another. As the crude oil price increase, this fuel price also increases. This will force the company to increase the cost of each commodity, as the cost of transportation increased. In effect, crude oil becomes a price determinant for various commodities. If the crude oil price decreases the import bill will lower, which will help to save the foreign currency. Even reduction in 1\$ will help to save foreign currency over 40 billion rupees. So, the country should be able to take adequate measures to cope up with the variations in crude oil prices.

It is clear that crude oil price affects the Indian market and influence global situations. High crude oil prices in international market causes a drain in the foreign exchange. The rise of crude oil price has a crumbled effect on share market. As the crude oil price increases, correspondingly there will be a change in the price of fuels such as petrol and diesel, which leads to the slow pace in economic growth. It is essential to know the long term trends in crude oil prices to ensure economic growth. Predicting oil prices will help the government and other policy makers to plan accordingly. In future, it will be beneficial for economic stability, in knowing when to stockpile or when to sell off.

Crude oil can be burned to generate energy. Thus, in winter season use of crude oil is more than in summer. As a result, the price tends to increase during winter season. There are many factors that affect the price of crude oil-production of oil, exchange rates, and increase in oil demand and currency fluctuations. The net increase of oil price would have led to a decrease in industrial production of crude oil. India, one among the largest consumer of oil, is a big beneficiary of falling oil prices. In this position an analysis on the oil prices would be appropriate.

2. Literature Review

Many studies had taken place in the area of crude oil prices and its fluctuations. Crude oil is the most essential and traded commodity in our country. Oil and gas industry is a major part of India's six cores industries[4]. India is the 3rd largest consumer and stands 24th in production of crude oil. We depend on other countries in oil importing, and the import rate has reached 80%. So, when oil price increase, our country's economy comes under severe pressure. Interest rates, exchange rates and money define Indian macro economy.

The relationship between these exchange rates and crude oil prices has been subjected to observation in recent times[3]. The fluctuations in the exchange rates determine the economic performance of a nation mainly through importing and exporting. To design an appropriate strategy it is necessary to evaluate such variations.

Bayesian normal regression model is used for forecasting oil prices on short term basis rather than long term[5]. This is an alternative model for accurately estimating crude oil prices using large set of market data. Bayesian model forecasts more accurately than traditional time series analysis which is generally used.

A drop in oil prices will create a sequence of budgetary problems for oil exporting as well as importing countries[1]. There are many other sectors which depend on forecasting oil prices, such as airline industry and automobile industry. Even house owners get the benefit from forecasting crude oil prices as they can decide the timing of heating oil purchase. There is a strong correlation between crude oil prices and spot prices and they fluctuate constantly. The concept of autoregressive models is used to indicate the fluctuation patterns of crude oil prices[2]. It is studied by constructing transmission networks, dividing crude oil price time series into segments using sliding time windows and then define autoregressive models.

3. Analysis of the Data

Mathematics is an elegant and precise subject. There are many problems in mathematics whose solutions are beyond our current state of knowledge and also problems that are tedious to solve manually. Sometimes one needs to rely on approximate methods to obtain answers. In such situations we can use numerical methods on finding the solution as it helps in error reduction. Here we are using one of such numerical method extrapolation, for the analysis of the problem using the help of the software Matlab. Extrapolation is the method of estimating outside the known values of dependent variable. It is used for short term or long term forecasting. In this paper, we forecast the crude oil prices using

linear extrapolation and polynomial extrapolation.

The study is mainly focused on estimation of the crude oil prices and its effects on the economy. Crudes are classified as light/heavy crudes and sweet/sour crudes. The terms 'light' and 'heavy' describes the density of crude oil and its resistance to flow, known as viscosity. The crudes are categorized as 'sweet' or 'sour' based on their sulphur content. American petroleum institute gravity (API gravity) is a measure that describes how light or heavy a crude oil is when compared to water. If API gravity is greater than 38 degree, it is classified as light crudes otherwise heavy crudes. If the content of sulphur is less than 0.5% per weight, then it is sweet crude and if greater than 1.0% per weight it is sour. On commodity market, light crudes receive higher value than heavier crudes. Heavy crude produces a higher amount of gasoline and diesel when transformed into products. It has negative impact on the environment than the light crude oil. The production, transportation and refinement of heavy crudes are challenging. Hence, we have considered lighter crudes and collected the data of the same.

We have used the data of crude oil spot price series obtained from Indian Oil Company limited (IOCL) as the sample data, which includes the prices from March 2013 to June 2017. We have considered three types of crudes Murban, Agbami, and Arab XL for the analysis.

Murban is a light crude oil with an API gravity of 40.2 degree and it is sweet crude since its sulphur content is 0.79%. Agbami is light crude with API gravity of 47.2 and its sulphur content is 0.05. It is classified as sweet crude. Arab XL is sour crude which is commercially produced crudes in Saudi Arabia and its API gravity is 46.9.

Contrary to the usual statistical methods in prediction, here we are using the numerical approach. In our perspective, the method of extrapolation stands close to our study since it is used for getting values outside a particular range of observation. Thus we plotted the graph of these crude oil prices against the time period with an interval of 10 months.

Light crudes are the much imported and produced, thus studying their variation is significant in the present scenario.

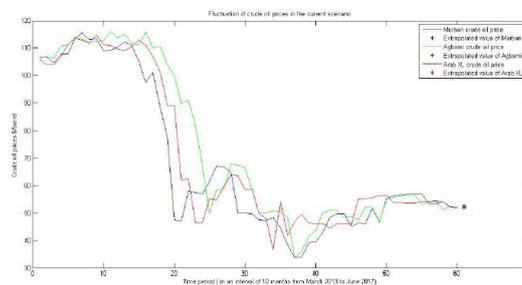


Figure 1

Figure 1 is the graphical representation of fluctuation in the prices of light crudes murban, agbami and Arab XL and very next extrapolated value using linear extrapolation. The extrapolated values of the three crudes lie within a range, which shows that they fluctuate almost uniformly.

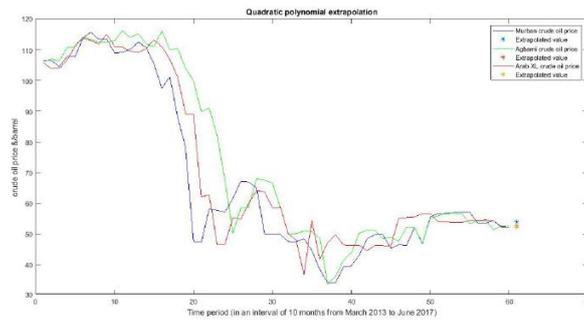


Figure 2

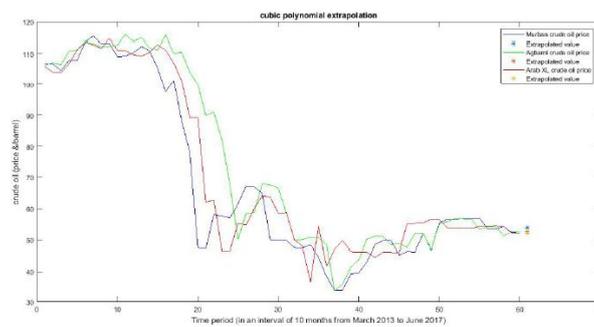


Figure 3

Figure 2 represents the price fluctuation of the light crudes murban, agbami and Arab XL along with the very next extrapolated value using quadratic polynomial extrapolation. And figure 3 represents the light crudes with the extrapolated value using cubic polynomial extrapolation.

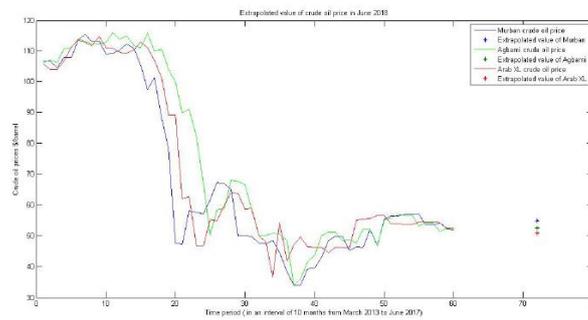


Figure 4

In figure 4, we have forecasted the crude oil price in 2018 June. Extrapolation is done at the time interval which corresponds to June 2018. Agbami and Arab XL crudes vary almost uniformly whereas the murban crude oil price falls rapidly.

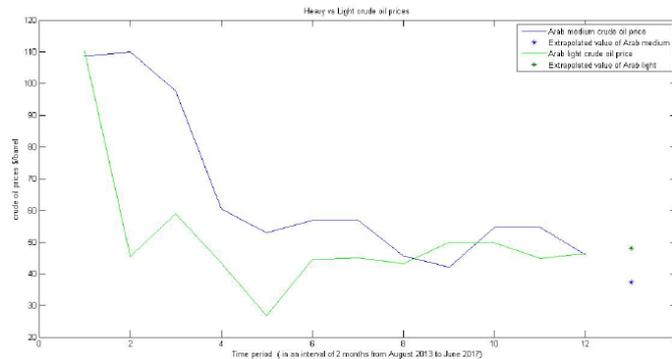


Figure 5

Figure 5 demonstrates the variation in the price of heavy crude (Arab Medium) and light crude (Arab Light) along with the time. We then extrapolated the price of heavy and light crudes. Since lighter crudes have higher price, extrapolated value shows a higher price in future also.

4. Effects of the Price Fluctuation and Factors

India is the third largest consumer of crude oil. The oil price affects the Indian economy and its rise will create a global crisis. The total oil consumption of India is about 2.2 million barrel. The major fact is that oil import is about 70% of the total crude oil consumption. India’s oil reserves are scarce, thus we have to depend on other countries for oil importing.

Major share of India’s oil is consumed by the transport sector. Most of the goods and consumer durables are shipped by road. As the crude oil prices increase, petrol and diesel price increases resulting to hike in commodity prices.

Thus the fluctuation in crude oil price extends to various commodities and services. The variation in the price of crude oil has been a main reason for inflation in India. It prominently influences the price of essential merchandises and badly touches the common people. There are many factors that affect the crude oil price volatility. The major factors include weather conditions, production, supply and demand, currency fluctuations and exchange rates.

Weather play a considerable role in oil supply. 2011 was a historical year of weather disasters where the damages include a combination of winter storms, weather outbreaks and floods. Another case is that of Hurricane Katrina, a deadly cyclone which had a major impact on the production of oil in US, 2005. A small damage in the oil pipeline system affected the price of the crude oil whereas market was affected by the rate at which the storm and the resultant damage are reported. In winter seasons, the use of crude oil is more than in summer which results in rise of oil prices. But severe cold weather can only strain the crude oil markets. So the traders eagerly await the weather forecasting models as millions of dollars are lost. The producers of crude oil has to supply products such as heating oil to consumers in a short span of time. The point is that, market is affected by the reports and timing of weather information.

Exchange rates influence the import and export of crude oil. Exchange rates and oil prices are complementary, one is necessary to forecast the other. Even 1% shrink in the value of dollar will result in an increase of 0.73% of crude oil prices. So, Americans need to pay more dollars to buy oil. The exchange rate of oil importing country is being affected since money flows from the oil importers to the exporters with increase in the oil price. US dollars exchange rate badly affect the oil prices as it is commonly expressed in USD. In particular, exchange rates have a major effect on oil prices, supply and demand.

The demand and supply influence the oil industry by determining the oil price. Crude oil price increases in correspondance with the demand in the market, which usually happens at the beginning and end of the year. Supply disruption also causes a hike in oil prices. Individuals and business firms may focus on conserving energy, as a result it reduces the demand. In order to maintain an equilibrium with supply and demand, the crude price should rise. Freight on board (FOB) is the cost of delivering goods to the nearest port. The oil flows through retailers, who would charge excess price to the next party in the chain. This creates a profitable approach for retailers but negative impact on common people. The retailers intentionally creates an artificial scarcity in the open market, which push up the prices.

With the increase in oil consumption in a global level, the demand also rise up and is atmost at the peak in developed countries. When an oil producing country is influenced by political condition, its production will be distracted. Venezuela oil strike 2002 had a determining effect on the supplies, caused a worldwide scarcity and thereby inconsistency with demand increased the oil price. The terrorist attacks and military conflicts in Iraq is another example where the nation's oil production was affected.

Thus the increase in oil price inversely affect the economy of any nation.

5. Conclusion

Estimating crude oil prices is a challenge due to its inconsistency in the global market. In this paper we use numerical approach for forecasting crude oil prices along with the various factors affecting the prices. In future, we can update the study by incorporating further more spot prices. Frequent variations in crude oil price can be a significant implication for future inflation and growth.

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