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Demystifying the Oil Price Fluctuations and Mitigating Its Effect on the Nations

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Abstract

This paper studies the causes of oil price fluctuations in the last fifty years and critically analyses the factors affecting the oil price. It also put forth the business problem of loss incurred by the oil-importing countries like India due to oil price fluctuations and gives the solution to lower the severity of the loss incurred by them. The findings are based on the ANOVA test carried out using the prices of the three major crude oil benchmarks such as WTI, Brent crude and OPEC. The findings of this study can be beneficial to the oil-importing nations whose portfolio is less diversified, and they can mitigate the adverse effect of possible oil price fluctuations.

Keywords: Oil price fluctuations, Supply and Demand, Prisoners dilemma, Portfolio.

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1.INTRODUCTION

Oil represents one of the most important macroeconomic factors in the world economy, and the economic performance of countries is highly correlated with oil prices.[1] From the early20th century, and oil prices keep on fluctuating over time. Historically speaking, until the 1970s, oil prices remained stable. But due to many factors, there have beenfluctuations in oil prices.Crude oil prices not only impact the channels of oil revenue but also affect other markets and institutions in the economies of oil-exporting as well as importing countries. [2]

Brent crude, The West Texas Intermediate (WTI), Dubai/Omen (OPEC basket) are the major benchmarks for oil. About two-thirds of all the world's oil contracts apply to Brent Crude, making it the most commonly used marker of all. WTI refers to oil extracted from wells in the U.S. It continues to be the primary benchmark for oil consumed in the United States. Dubai/Oman or OPEC basket is the Middle Eastern crude that has a slightly lower grade than WTI or Brent. OPEC basket is the primary reference, followed by the Asian market.

2.Literature Review:

Numerous papers on oil price fluctuations have been published within the past years.[3] in their paper stated thatThe volatility of crude oil prices creates uncertainty, and therefore an unstable economy for both oil-exporting and -importing countries. [4] In their paper have given that, Oil prices and their importance upon macroeconomic factors and in particular their influence upon exchange rates has been subject to vast research over time, in which the focus has been turned to the potential channels by which crude oil finds itself to be a determinant of exchange rates. Also explained the factors which cause the volatility in the oil price. Geopolitical events such as the terrorist attacks on the World Trade Center in New York on September 21, 2001, and the rise to the Middle East unrest in 2012–2013 appear to yield similar correlations across all currencies and oil benchmarks. [5] In their paper mentioned clearly to tackle the price fluctuations in terms of geopolitics, For the oil exploration and exploitation sector and the oil equipment sector, the enterprises own a high proportion of overseas business, and they need to avoid being involved in foreign conflicts and take geopolitical risks as a priority in the cash-holding decision-making process. [6] In his paper has clearly explained the consequences of the oil price fluctuations both in the economic as well as industrial perspective. [7] In his paper states that nominal demand, real demand, supply, and oil price shocks are the four structural shocks observed in the economy of a country. So any fluctuations in the oil price can change the economy of the country. According to the Economic Times 2016 and Energy Information Administration (EIA), India has overtaken the third position with 4.1 million barrels per day (BPD). So a slight change increase in the oil price can affect an entire nation like India. According [8] to 1973/74 oil crisis arose when the price of imported oil nearly quadrupled over the course of a quarter, forcing substantial adjustments in oil-consuming countries.

So there are numerous reasons behind the oil price fluctuations, and that can affect the economy of a country.[8] In their paper says that We find strong evidence in support of the view that oil price fluctuations constitute a systematic asset price risk at the industry level as nine of the thirteen sectors analyzed show statistically significant relationships between oil-futures return distribution and industry excess return. Similarly, the weather is another critical factor in oil supply. Severely cold weather can stress product markets, as producers attempt to supply enough products, e.g., heating oil in a short period of time. This will result in higher oil prices.[9] The paper proposes a multi-objective optimization method to find the best route and speed to simultaneously minimize sailing cost and time,[10] considering the impact of ECA regulations and weather conditions. From this paper, the importance of the factor "weather conditions"is known clearly. We know that oil prices are mostly dependent on supply and demand. Even if oil prices are determined by demand and supply forces in the free market, substantial and sudden increases in oil prices, which do occur rather frequently, can considerably affect the state of the global economy as they can trigger inflationary trends, cause serious economic slowdowns, and bring about downturns in the world stock markets.[8] So these are the external factors that can cause loss to a country. But the nations can change some of the factors which are internal to decrease the severity of the loss incurred. [12] In their paper stated that,For diversification portfolio structure, the oil-importing countries are highly recommended to diversify their economies by encouraging other sectors such as tourism and heavy machinery exportation (more specifically for the case of Russia). So this is one of the possible internal factors.Similarly, there are many internal factors to decrease the severity of the loss incurred due to the volatility of the oil price. [13] in their paper explained that China should try to import from the countries with less risk within the same region. It should establish good political relationships with oil-exporting countries of high-risk regions via its friendly political image and the strong will of its economic operations. So the nations have to change some of their internal factors to overcome the loss due to the oil price fluctuations.

Despite the plethora of research done on the oil price fluctuations, it seems that the factors affecting the volatility of oil price with the past incidents are yet to be studied in more detail. This study is, therefore, an attempt to examine the factors affecting the oil price and suggesting a solution in order to make a profitable portfolio.

3.Government's role in controlling the price of the oil:

The Government's role in controlling the price of oil is very crucial. If the Government doesn't regulate the oil price, the suppliers will get benefitted. So in order to maintain the equilibrium between suppliers and consumers, the Government is involved in oil pricing by framing the price ceiling and price flooring.

4.Price ceiling:

It can be defined as the maximum price of a good which can be sold legally; when a supplier sells for a price more than the ceiling price, it will be considered illegal.

5.Price flooring:

It can be defined as the minimum price of a good which can be sold legally. The supplier won't reduce the cost below this because it is eventually considered a loss to him.

The below image represents the price ceiling of the Government. The Government usually fixes the price ceiling or flooring for a period of six months.

For example, take oil price, and the quantity demanded are in equilibrium. If the Government considered the price as high, they could implement the price ceiling below the equilibrium price. This change can lead to a change in demand and supply. The quantity demanded will be Qd which is high, and the quantity supplied is Qs which is low. So this obviously increases the shortage of oil.

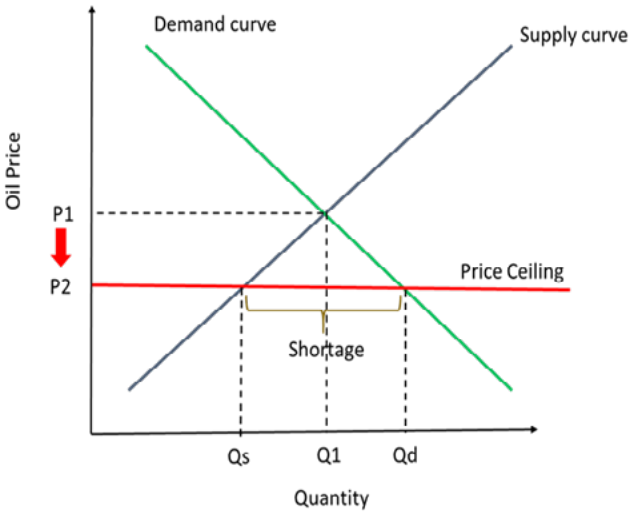

Fig4 Price ceiling of the Government

6.Oil Price Fluctuations for the last Fifty years:

The analysis of the oil price fluctuations for the last fifty years by taking the standard of WTI oil is as follows,

Fig5 Oil Price Fluctuations for the last Fifty years

There are eight significant fluctuations in the last five decades (which is indicated by the eight red dots). The significant eight fluctuations are,

7.1973 Oil crisis:

In retaliation for U.S support of Israel in the Yom Kippur War of 1973, oil-producing Arab nations cut off crude exports to the U.S. As a result, the price of crude oil soared from about $24 to $56 per barrel by early 1974(Kolakowski, 2020).

8.Iranian oil revolution:

In 1979 due to the Iranian revolution, the global oil supply had decreased to a greater extent, and therefore the price of the oil increased by double the price, which is from $56 per barrel to $13.[14]

9.1981 Oil glut:

Soon after taking office in 1981, The President Ronald Reagan signed an executive order abolishing price and allocation limits on the production and sale of domestic oil and gasoline. So this has led to an increase in the production of oil in the U.S. Crude prices dropped from about $113 per barrel in January 1981 to around $26 by mid-1986.

10.First gulf war:

Iraq invaded Kuwait in August 1990, sending oil prices rising from roughly $34 per barrel to nearly $77. After an early 1991 US-led military coalition succeeded in withdrawing Saddam Hussein's Iraqi forces from Kuwait, the price fell to around $37. [14]

11.1997 East Asian financial crisis:

Due to the collapse of Thai currency, the stock markets fall by more than 60%,and the oil demand has suddenly decreased. And it resulted in the fall of oil prices less than $6.31. Since then, Asian countries are dependent on each other; Indonesia, South Korea, and the Philippines are also hit.

12.2008 Oil price spike:

Geopolitics played a significant role in oil price hike in early 2008. The cutoff of sales of oil from Venezuela, the Iraq war, labour strikes in Nigeria, and mainly due to militants who blew up the oil pipelines and facilities in Nigeria are the main reasons which resulted in the hike of oil prices upto $165.

13.The great recession:

The great recession is mainly due to the 9/11 attack of the World Trade Center and Pentagon. Like dominoes, this has resulted in the falling of the share markets and the bankruptcy of Lehman and Brothers Company, which is still considered as one of the worst bankruptcy in history. These events have resulted in falling oil prices from $150 to $50.

14.COVID19 Pandemic:

This is the worst oil price drop in the last five decades. Dew to the COVID outbreak, the entire transportation got paused. But they never stopped the extraction of oil. So all the oil reservoirs have filled, and there is no place to store the oil. Even though there is no demand, they still supplied oil, which contradicts the law of supply and demand. So the price of the oil went negative to the extent of -$37. [15]

15.The objective of this study:

The primary purpose of this research is to find out all the critical factors that are affecting the oil price to fluctuate and also to reduce the loss incurred by India due to oil price fluctuations.

Factors affecting the oil price:

1. Supply and demand
2. Geopolitics
3. Shale oil production
4. OPEC output
5. Weather conditions
6. Prisoners' dilemma

16.Supply and Demand:

This is the most critical factor affecting the oil price. The oil price works based on the law of supply and demand. When the price of the oil increases, the supply of oil increases and vice versa. When the demand for oil increases, the price of the oil also increases, and vice versa.

The below figure indicates the supply and demand curve. For example, we can take the COVID pandemic as the situation. Due to the complete lockdown, the demand for oil decreases, which results in the leftward shift in the demand curve. But the supply of oil remained unaltered. So, the equilibrium price and quantity of oil also change. From Q1 to Q2, the quantity of oil demanded decreases, and from P1 to P2, the price of the oil decreases. So, according to the demand, the supply should also be reduced.

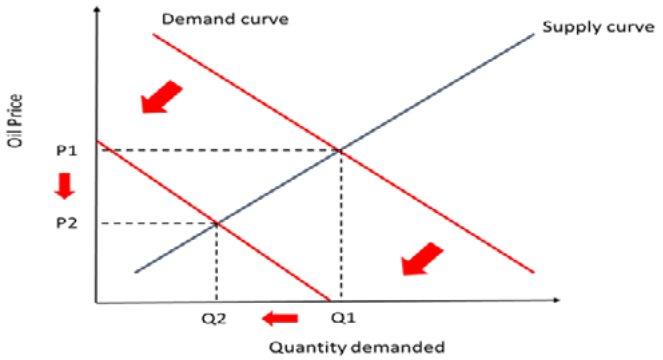

Fig1 Supply and demand curve

Geopolitics plays a significant role in the determination of oil prices. The relationship between the U.S. and Iran is considered in the fluctuation of oil prices. For example, Donald Trump's withdrawal from the Iran nuclear deal has raised concerns that the global supply of oil will be squeezed, pushing up the price of Brent Crude on Wednesday by almost 3% a barrel to $76.95. Another example is, if Iran threatens to close the Strait of Hormuz, the oil prices will change dramatically.

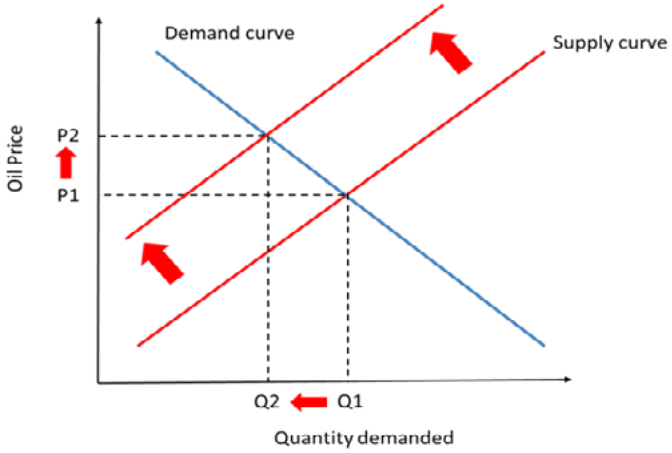

Fig2 Supply and demand curve

For example, we can assume that Government increases its tax on the oil, then the suppliers will directly get affected by this so that the supply curve shifts to the left side. Since there will be no change in demand, the demand curve remains the same. Due to the shift of the supply curve, the equilibrium quantity and price gets affected. So the new change will be a decrease in the quantity demanded and an increase in the oil price. Ultimately the end customers, who are the people, will be affected.

17.Shale oil production:

Shale oil is high-quality crude oil that lies between layers of shale rock, impermeable mudstone, or siltstone(AMADEO, 2020). America has advanced technology that uses advanced boring machines to extract shale oil. Due to the extensive extraction of shale oil, the global oil supply has increased. Since then, oil prices were keeps on fluctuating.

18.OPEC output:

42% of the world's crude oil is produced by the OPEC countries, according to the International Energy Agency's data. Since the cost of oil is also comparatively lesser than the other oil-producing countries, it has a very strong Asian market. Since it has the highest market share, a small change in the production cycle affects the overall price of the oil.

19.Weather conditions:

The demand for oil increases during the summer season. So the price of oil will get increased. Similarly, during the winter season, the demand decreases, and therefore the price will be reduced.

20.Prisoners' dilemma:

We know that the oil market is of an oligopolistic market structure. Oligopoly is a market structure in which only a few sellers offer similar or identical products. [17] In an oligopolistic market structure, it is necessary to maintain collusion among the oil-producing countries in order to survive in the market. So the fluctuations in the oil price in this oligopolistic market are mainly caused by prisoners' dilemma. It can be explained better with a diagram. We know that both Iran and Iraq are in the same cartel called OPEC. If both of them are agreed to produce the same amount of oil, then they will be in an equilibrium reaping equal profit.

Quantity (in gallons)	Price (in $)	Profit (in $)
0	120	0
10	110	1100
20	100	2000
30	90	2700
40	80	3200
50	70	3500
60	60	3600
70	50	3500
80	40	3200
90	30	2700
100	20	2000

Tabel1 The market demand schedule of oil

What if one country wants to get more profit than the other? Let's see the consequences.

The market demand schedule of oil is mentioned here (approx.)

Case-1:

Let us assume that market demand for oil is 60 gallons, and both Iran and Iraq producing equally 30 gallons each. In that case, both the countries will get the same amount of profit, i.e., $1800.

Case-2:

If Iran has decided to increase the profit, then it will produce 10 gallons extra, i.e., 40 gallons instead of 30 gallons. But Iraq will produce the same 30 gallons. But the market supply has increased to 70 gallons. So the price per gallon will decrease, and the profit for Iran will increase (40*$50=$2000) from $1800. Similarly, the profit for Iraq will reduce (30*$50=$1500) from $1800.

Case-3:

If Iraq has decided to increase the profit, then it will produce 10 gallons extra, i.e., 40 gallons instead of 30 gallons. But Iran will produce the same 30 gallons. But the market supply has increased to 70 gallons. So the price per gallon will decrease, and the profit for Iraq will increase (40*$50=$2000) from $1800. Similarly, the profit for Iran will reduce (30*$50=$1500) from $1800.

Case-4:

On seeing one another, both the countries are trying to gain profit which is the sequel of case-2 or case-3, then it will also produce 40 gallons, and now the market supply will be increased to 80 gallons so the price per gallon will be decreased to $40 from $50. So obviously the profit for both the countries will be $1600.

This point is called a Nash Equilibrium. A situation in which economic actors interacting with one another each choose their best strategy given the strategies that all the other actors have chosen(Mankiw, 2018)

So the net effect will be reduced in the oil price for customers and reduce in the profit for the suppliers.

21.Problem Definition:

India imports about 82 percent of required crude - which costs $87 billion. The Middle East accounts for 60 percent of all oil bought by India, followed by Latin America and Africa. So the portfolio of Indian imports majorly consists of OPEC, WTI, and Brent Crude. Due to many factors, fluctuations in the oil price can occur. But India's motive should be able to get the crude oil at the lowest price possible. Due to the limited portfolio, India can incur a loss if the oil price fluctuates. The motive of this research paper is to lower the severity of the loss incurred by India.

22.Determination of hypothesis:

Null hypothesis

H0: There is no significant difference in the oil price of WTI, Brent crude, and OPEC in the last 30 years.

Alternative hypothesis

H1: There is a significant difference in the oil price of WTI, Brent crude, and OPEC in the last 30 years.

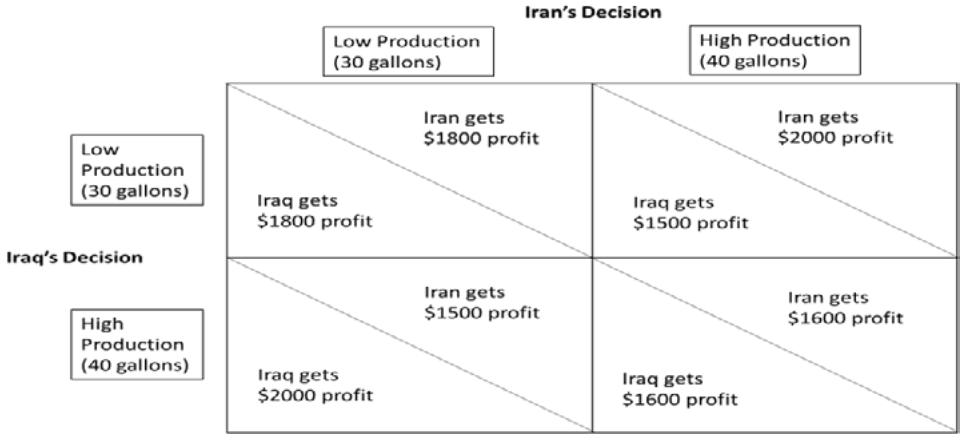

Fig3 Prisoners' dilemma explained

Oil Price of different standards in dollars:

Year	WTI (in $)	Brent crude (in $)	OPEC (in $)
2020	38.95	41.96	41.47
2019	56.99	64.3	64.04
2018	65.23	71.34	69.78
2017	50.8	54.25	52.43
2016	43.29	43.67	40.76
2015	48.66	52.32	49.49
2014	93.17	98.97	96.29
2013	97.98	108.56	105.87
2012	94.05	111.63	109.45
2011	94.88	111.26	107.46
2010	79.48	79.47	77.45
2009	61.95	61.51	61.06
2008	99.67	96.99	94.45
2007	72.34	72.52	
2006	66.05	65.14	
2005	56.64	54.38	
2004	41.51	38.1	
2003	31.08	28.83	
2002	26.19	25.01	
2001	25.98	24.45	
2000	30.38	28.4	
1999	19.35	17.9	
1998	14.42	12.8	
1997	20.61	19.1	
1996	22.12	20.8	
1995	18.43	17.2	
1994	17.2	16	
1993	18.43	17.1	
1992	20.58	19.4	
1991	21.54	20.1	

Table 2. Oil Price of different standards in dollars

hypothesis is 'not equal to,' it is a two-tailed test.

23.Findings, Recommendations, and Solutions:

As per the findings, there is a significant difference in the oil price of WTI, Brent crude, and OPEC in the last 30 years. If there is no significant difference in the oil price of WTI, Brent crude, and OPEC, then the portfolio doesn't matter. Since there is a significant difference in the last 30 years, the portfolio of the imports matters a lot. Currently, India's portfolio majorly consists of WTI, Brent crude, and OPEC. Western Canadian Select (WCS) is another standard of India's portfolio, and the current share of WCS is 1.3%. Canadian oil accounted for about 1.3% of India's imports (Verma, 2021). So as of now, WCS holds the lowest value when compared with the other three major standards. So India should increase the WCS share in the portfolio so that the overall import cost will reduce.

24.Future Scope:

India's consumption of WCS is less. The main cause can be the increased transportation cost. The future research can be how to decrease the transportation cost and what can be the sustainable model of transportation of WCS to India.

25. Conclusion:

This paper has analyzed the critical factors that are affecting the oil price fluctuations, industries that are affected because of this, and also the past fluctuations that happened in the last 50 years with the reasons. It also has analyzed the past 30 years' data of oil price of the three major standards and found out that diversification of the portfolio will reduce the loss incurred by India due to oil price fluctuations.

The rich-resource countries suffering from a weak and undiversified economic base without stabilizing mechanisms in order to cushion shocks would be so vulnerable to boom-bust cycles, incurring the costly instability.[6] Even the exporting countries find it difficult to overcome the fluctuations of the oil price. So for the developing countries, it is very difficult to sustain their economy. Though the oil prices are fluctuating, in the next upcoming decade, we can expect it to reduce since this is going to be the decade for Electronic Vehicles (E.V.). Electric vehicles represent an important opportunity for pursuing sustainable development not only for the transportation system but for the entire society. [18] Indeed their efficiency is indeed much higher than that of ICE vehicles, and this will allow a considerable step forward in the reduction of the overexploitation of resources. To reduce climate change and conserve resources, people are slowly moving to battery vehicles. By this alternative, the nations can manufacture the E.V.'s instead of importing the oil from the other countries so that the economy of the nation can be improved.[19,20]

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	30	1447.95	48.265	803.79775
Column 2	30	1493.46	49.782	1028.604527
Column 3	13	970	74.61538462	652.2961769

Table 3. Summary of price table

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	7032.55708	2	3516.27854	4.037243246	0.021908449	3.127675601
Within Groups	60967.22015	70	870.9602879			
Total	67999.77723	72				

Table 4. ANOVA table

The P-value of 0.021 is less than the alpha value of 0.05.
0.021 < 0.05
So H0 is rejected

Results:

There is a significant difference in the oil price of WTI, Brent crude, and OPEC in the last 30 years.

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Nill

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