

The Impact of the Corona-virus Pandemic on Oil Supply and its Price Stability in International Markets

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Abstract: This study explores the critical role of oil as a driver of economic and social development, highlighting its significance as a strategic commodity within global trade frameworks. The research addresses the challenges posed by the volatile nature of oil markets, particularly in light of the rapid economic growth since the late twentieth century and the unprecedented disruptions caused by the Corona-virus pandemic in 2020. The primary research problem focuses on identifying the factors that influence oil prices and understanding the pandemic's impact on global oil supply and pricing dynamics. To achieve these objectives, the study identifies key determinants of oil supply and analyzes their correlation with price stability in international markets. It also investigates the specific effects of the pandemic on oil supply volumes and pricing structures. The significance of this research lies in its potential to inform stakeholders about the intricate relationship between oil consumption, economic growth, and market volatility, particularly during crises.

Employing a mixed descriptive-analytical methodology, the study synthesizes data from various sources, including scholarly articles and reports from organizations such as OPEC and the International Energy Agency. By examining the dual axes of oil supply and pricing alongside the pandemic's repercussions, this research aims to contribute valuable insights into the resilience and future stability of oil markets in an increasingly unpredictable global economy.

Keywords: Oil supply; Oil demand; Corona-virus pandemic; Oil markets; Global economy.

JEL codes: Q43; Q41; Q35

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Introduction:

Oil is a fundamental factor in driving economic and social development, used in operating factories, powering various means of transportation, and other purposes contributing to humans' material production. It represents a global strategic commodity and a fundamental raw material in industry and agriculture, as well as being used in daily human life, giving it an important position within international trade frameworks. Oil is a vital commodity and a strategic asset whose importance extends to all dimensions of economic, social, political, and military activity.

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The global economy has developed rapidly since the second half of the twentieth century. Its growth is linked to an overall increase in energy consumption, particularly oil, due to its extensive use in the world. Sudden fluctuations in oil prices generally lead to a reduction in global economic growth rates. On the other hand, oil demand is affected by several factors, including the price of crude oil, the level of gross domestic product, and the technological progress and structural changes. The year 2020 showed that the global oil supply and demand were greatly affected by the spread of the Corona-virus pandemic. Oil markets are among the most volatile markets globally, making it difficult to predict oil prices within them. Given the volatile nature of the oil market and its implications on the global economy, it is necessary to address the research problem through the following questions: What are the factors determining oil prices? And, what is the impact of the Corona-virus pandemic on oil supply and pricing?

This study aims to identify a set of objectives, including the following:

- Identifying the most influential factors on oil supply.
- Analyzing the relationship between oil supply and price stability in international markets.
- Studying the impact of the Corona-virus pandemic spread on oil supply volume and pricing in international markets.

Oil consumption is directly correlated to economic growth rates. Therefore, the possibilities of economic recovery or recession will directly impact the increase or decrease in oil consumption rates. The importance of this study lies in understanding the extent of the Corona-virus pandemic's impact on oil supply and price stability in international markets. Oil serves as an engine for the global economy, being essential for most industries and increasingly relied upon by people worldwide to meet their daily needs.

This study adopts a mixed descriptive-analytical approach, using the data collected from specialized books, research papers, and available journals. Data from regional and international organizations such as OPEC and the International Energy Agency will also be referenced. The study is divided into two axes: oil supply and its pricing in international markets, and the Corona-virus pandemic and its impact on oil supply and price stability in international markets.

Literature review:

1. Oil Supply and Pricing in International Markets:

The supply curve of any product represents the arrangement of all possible quantities, from the lowest cost to the highest cost, and the competitive supply price in the production cost barely equals the market price. Competitive supply includes this point and what is cheaper than it. Anything priced above this point is considered uneconomical and not worth using, according to economic theory and under the assumption of full competition.

The supply curve is generally positively sloped, which means that, to induce producers to offer more of a commodity, a higher price must be provided. This is because the marginal cost of production generally increases with the increase in the produced quantity. In fact, the market supply curve of a commodity represents the upward portion of its marginal cost curve. Therefore, in order to determine the supply curve of a certain natural resource, we must identify the marginal cost borne by society with the increase in the quantity exploited from that natural resource over a specific period of time.

In general, it can be said that the cost of extracting natural resources increases with the increase of the extracted quantities at increasing rates. This increase in cost is attributed to two factors (Mostafa, Ramadan & El-Siriti, 2007, p.43)

- The increase in the marginal cost, with an increase in the production rates “diminishing returns law”;
- The cumulative effect of production resulting from asset depletion.

Adelman (1991) was the first to point out that the oil industry is a rising cost and diminishing returns industry in his book "The World Petroleum Market." He exposed his view through the following points:

First, research and exploration expenditure, in the process of oil exploration, the best places are usually selected first. As the targeted oil output increases, its prices rise, leading to increased exploration in high-cost regions. Generally speaking, research and exploration move from the more promising places to the less promising ones, and this is where the expenses increase. Then, Development Expenditure, in reality, it has been observed that the estimated quantities of the “Proved Reserves” of oil are not always accurate and can be increased through investment and development. Development is defined as an operation which determines the horizontal and vertical boundaries of the oil reservoir. Generally speaking, the oil field is limited in reality, but with its development, the likelihood of reaching or surpassing its boundaries increases, and therefore the risks or expenses increase when approaching these boundaries or reaching thin and scarce layers or when there is no absolute return. Finally, Extraction Expenditure, as production increases, the cost per barrel rises, and even when not taking into account the extra works and expenses of the oil well, such as the separation of water or others, the fundamental fact of oil production is the downward slope of the production curve of the reservoir. Thus, there is a need to determine the expected production quantity to obtain from the well or reservoir before reaching “The Economic Limit”, and that is the point where unit cost starts to rise above the price.

The activities above can be classified by time duration into three types: short-run expenses, intermediate-run expenses, and long-run expenses. Short-run oil expenses represent the cost of extracting it from existing wells and are relatively constant due to the limited production capacity of oil fields in the short run. Only a few direct inputs, such as labor and fuel costs, can cause changes in production expenses. Intermediate-run production expenses include the

costs of well development and reservoir capacity recovery. Long-run expenses represent the costs of Research and Exploration for new unknown oil reservoirs. (Bijan, Jesse, 1977, p.87)

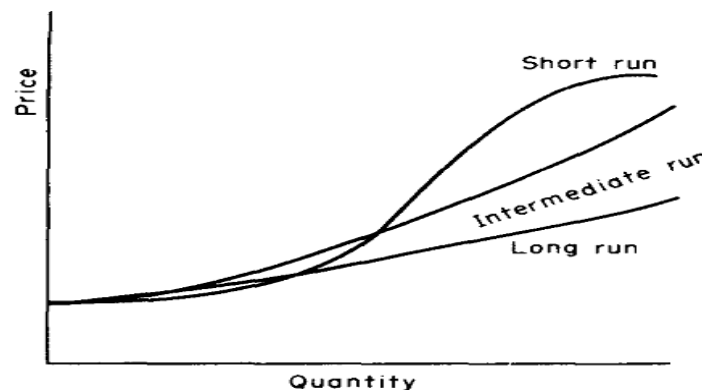


Figure 1. Oil Supply Elasticity in the Short, Intermediate, and Long Run

Source: Bijan, Jesse, 1977, p. 88

Figure 1 illustrates the impact of rising oil prices on the produced quantities, reflecting a high production elasticity of oil supply in the short-run. This elasticity is reduced as it approaches the Optimum Production Rate, and the production continues until it does not cover the costs. Eventually, when prices reach very high levels, allowing for capacity expansion, oil supply becomes sensitive again to price changes. (Bijan, Jesse, 1977, p. 87)

In the intermediate-run, the production capacities are expanded, making the supply function more elastic. The upward slope in the oil supply curve in the intermediate-run indicates that an increase in prices will lead to an increase in oil production, by developing the existing unexploited oil fields. No field is developed unless the expected price covers both extraction and development costs. Therefore, supply elasticity in the intermediate-run is greater than in the short-run.

In the long-run, the accessible oil reserves can be increased through new discoveries, but such discoveries are not made unless the expected price covers the costs of exploration, development, and extraction. Consequently, the price elasticity of supply in the long-run is greater than in the intermediate and short runs.

The amount of oil reserves that exist in the nature is considered the most influential factor affecting oil supply, as it is an exhaustible resource and susceptible to exhaustion in the future as production quantities increase to meet the growing demand. The American geologist M. King Hubbert was the first to write about this subject in an article he published in 1969, regarding his predictions about the world's future oil production. Hubbert predicted that the annual oil production would follow a Bell-Shaped curve, which later became known as the "Hubbert Peak". His most optimistic estimation among his two estimations of 1969 put the total world oil wealth at 2.1 trillion barrels and identified the year 2000 as the peak of oil production (Davis, 2009, p. 25)

Hubbert built his theory on two fundamental assumptions about oil production in the United States: firstly, he assumed that oil production would start from zero, then decline back to zero at some point in the future due to oil being an exhaustible resource. He further assumed that production would reach its peak somewhere between these two points, approximately falling in the middle. Secondly, Hubbert assumed that the decline in oil production is a mirror reflecting the increase in oil production. In other words, the US oil production would follow a bell-shaped curve. (Sylvia, 2005, p. 18)

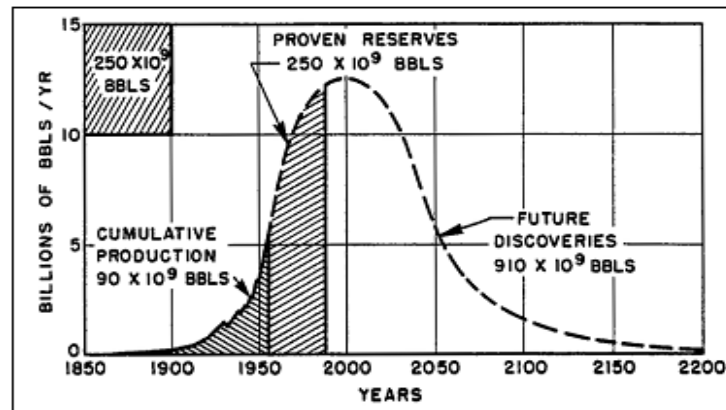


Figure 2: Hubbert's Original Curve for the United States

Source: Patrick, Rossiaud, 2010, p. 03

The Figure 2 represents Hubbert's estimation of the United States' oil production reaching its peak in the early 1970s as a maximum before starting to decline. According to his estimations, by the year 1970, the United States had produced approximately half of its oil reserves, and these predictions were indeed verified as US oil production peaked in 1972. However, the development of oil fields in Alaska allowed for an extension of the peak period until 1985 before oil production rates started to decline again. (Patrick, Rossiaud, 2010, p. 03)

In addition to the proved reserves size, oil supply depends on several other factors, the most important of which are: oil prices and their relation to the prices of the other alternative resources, as well as government policies concerning taxation and investment systems for the production of oil and its alternatives. It also depends on the production conditions, technological development, and political stability in production regions. On the other hand, the supply of oil products depends on investment conditions in refining facilities, which, in turn, depend on the prices and uses of these products, environmental regulations, and the return on investment in those facilities, among other factors.

Oil differs from other commodities as it is a depleting resource. This characteristic has several effects, especially regarding its production and pricing decisions. The American economist Harold Hotelling was the first to mention this concept in an article titled "The Economics of Exhaustible Resources" in 1931. His theory included several strong arguments countering economists who claimed that a company could continue production indefinitely and that it would produce from renewable or renewable-based sources. Hotelling believed that this

economic expectation was not valid and that the basic principles regarding this matter needed to be modified. Depletion leads resources to become more valuable over time as scarce resources demand higher prices compared to abundant ones. Therefore, their prices tend to increase over time (Al-Marzouk & Salem, 2010, P .140)

Hotelling proposed his theory based on the following relationship (Hotelling, 1931, p. 141):

$$P_t = P_0 \cdot e^{rt}$$

P_t : The price of the resource at time t ; P_0 : The initial price of the resource (raw) ; r : A given and constant rate of discount; t : Time.

P_t is interpreted as the net received price (revenue) after paying the cost of extracting the exhaustible resource and transporting it to the market. The value of P_0 at time $t=0$ is determined based on the overall supply and demand for the exhaustible material. Hotelling's model leads to an important conclusion that the price of the exhaustible resource increases over time at a rate of interest r , and both grow together under competitive industry conditions (Al-Sheikh, 2007, p. 106). The duration of resource exhaustion under competitive conditions is limited and bounded between two times (0, T), where 0 represents the beginning of the resource exhaustion period, and T represents the maximum time for final exhaustion. It is also assumed that interest rates remain unchanged from the start of resource consumption until exhaustion. Even if interest rates change, their effects will result in minor adjustments to oil prices. (Hotelling, 1931, p. 141)

In his article "The Monopolistic Producer," Hotelling gave the exhaustible resource a duration between zero and infinity (Al-Hiti & Al-Abadi, 2009, p.151). The price of the exhaustible resource under monopoly is determined by the growth of marginal revenue with the marginal cost of extraction at an interest rate, where the present value of marginal revenue is equal to the marginal revenue discounted by the interest rate for all time periods.

Hotelling emphasizes also that a competitive producer does not have the ability to control the market through prevailing prices, which will lead to the exhaustion of the resource within a specific time frame. The competitive producer sells his output at the given market price. If this producer wants to maximize profits (when the market price is higher than the average cost), he needs to increase the level of production. However, the situation is different for a monopolistic producer, who can extend or shorten the exhaustion period of the resource base, either by increasing production with reduced prices or vice versa, depending on market conditions and their control of this exhaustible material. The monopolistic producer also tends to produce at a rate lower than the optimal production rate, imposing high prices on consumers to maximize profit.

Hotelling considered the upward trend of the exhaustible resource's price as a guiding force that motivates the current generation to optimally use the resource and preserve what remains for future generations. The utilization of the exhaustible resource is not limited to the current period only but extends across different time periods. This fundamental point forms the basis

for all economic analyses aiming to conserve and regulate the use of exhaustible resources. (Merton et Al., 1985, p. 02)

To sum up the above, oil supply is characterized by increasing expenses and diminishing yields due to its nature as an exhaustible natural resource. Its supply elasticity positively correlates with its prices, as higher oil prices lead to increased supply elasticity. This elasticity increases over time, where long-term supply elasticity is greater than medium and short-term elasticity.

2. The Corona-virus Pandemic and its Effects on the Supply and Prices Stability of Oil in International Markets:

In December 2019, there was a significant decline in global oil demand due to the Corona-virus. This virus spread as a severe acute respiratory syndrome in the city of Wuhan, China, for the first time, with the first reported case of a 55-year-old patient on November 17, 2019. The number of infected cases increased to twenty-seven by December 15 and reached sixty within five days thereafter. It was later identified as a viral zoonotic disease and was named COVID-19. (Aloui et Al., 2020, pp. 2-3).

On January 30, 2020, China declared a state of emergency due to the virus causing 3,373 infections and 811 deaths. This virus emerged as a contagious and severe disease, leading to a significant increase in fatalities, necessitating strict containment measures worldwide. On March 11, 2020, the World Health Organization declared it a pandemic after its rapid spread in many countries and regions, resulting in border closures and a sudden economic downturn, accompanied by a stock market crash on March 12, 2020.

The Chinese government took strict measures to contain and prevent the spread of the pandemic, including the closure of cities, facilities, factories, and traffic restrictions, among other actions. As a result, many experts predicted a 25% decrease in oil consumption. Oil markets saw the decline in Chinese demand as a warning sign, marking the beginning of a new phase of market surplus and price decline. In response to this development, Saudi Arabia, the de facto leader of the Organization of the Petroleum Exporting Countries (OPEC), called for a meeting in Vienna on March 5 and 6, 2020, with OPEC members, Russia, and other oil-producing countries, to discuss additional cuts in oil supply to halt the price decline (Arab Studies Unit, 2020, p. 20), 2020, p. 1). During the second quarter of 2020, OPEC reduced its production by 1.5 million barrels per day, while Russia refused to cooperate, causing a 10% drop in oil prices. In response, the Kingdom of Saudi Arabia retaliated by reducing its oil price and increasing production to pressure Russia to return to negotiations. (Aloui and others, 2020, pp. 2-3), which contributed to the decline in crude oil prices. The reason that led Russia to reject OPEC's proposal was its reluctance to lose market share, leading to a phase known as the "war of shares and prices" between Russia and Saudi Arabia. (Arab Studies Unit, 2020, p. 20), 2020, p.1). Both Saudi Arabia and Russia increased their production and reduced prices to gain more market share from each other. This sudden increase in oil production, coupled with the decreased demand due to the COVID-19 virus, led to plummeting oil prices. Saudi

Arabia was able to take this step due to its lower production costs, estimated at less than 10 US dollars per barrel, while Russia increased its supply and pushed oil prices lower, relying on its production costs, also estimated to be less than 18 US dollars (Stewart and Al., 2020, p. 01).

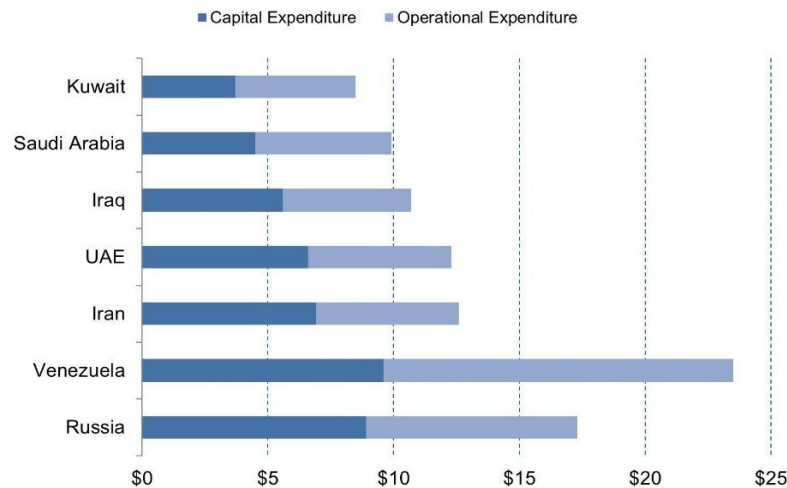


Figure 3: The production cost of crude oil and some of the prominent OPEC members.

Source: Stewart and Al, 2020, p. 02

The Figure 3 represents the production cost of crude oil for Russia and some prominent OPEC member countries. Most of their costs range between 8 and 25 dollars per barrel. Oil plays a crucial role in the economies of these countries, as they heavily rely on its export revenues to finance their development projects. Rising oil prices have a positive impact on their economies, while falling prices have a negative impact. The increase in oil prices has a positive impact on the economies of the producing countries, through higher revenues from the export process. However, a portion of these profits later goes to compensate for the losses resulting from reduced demand from trading partners (IEA, 2004, p. 05).

Many oil-rich countries use the surplus money from oil sales to establish sovereign wealth funds, which can be utilized during times of financial difficulty. By dividing the total value of the sovereign wealth fund in a country and forecasting its budget deficits, one can estimate how many years this fund can cover the deficits. (Stuermer ,Dhaliwal, 2015, p. 17)

Both the Kingdom of Saudi Arabia and Russia have managed to accumulate cash reserves to avoid budget deficits in case of oil price declines and crises. This allows them to reduce oil prices by increasing their supply. The last time Saudi Arabia adopted this strategy was in 2014 and 2015 when it removed one million barrels of American production, making some wells uneconomical to operate. Unconventional oil fields require significant capital investment, and the cost of a single unconventional well can be five times higher than a conventional well. (Melek, Cakir, 2015, pp. 51-52) The Kingdom of Saudi Arabia needs an oil price of about 80 US dollars per barrel to balance its budget, while Russia requires about 42 US dollars per barrel. (Stewart and others, 2020, p. 02) This supported the position of both

countries in rejecting production cuts as they do not want to lose their market share, leading to an oil market conflict between them.

Before the spread of the COVID-19 virus pandemic, Asia was the world's main oil importer, with Saudi Arabia being its largest supplier, accounting for over 70% of its crude oil exports. Consequently, the Asian market became the main arena of dispute between Saudis and Russians. Due to the severe impact of COVID-19 on Asian demand, both Russia and Saudi Arabia concluded that the only way to gain a market share is by lowering oil prices through increasing their supply. (Escribano, Lázaro-Touza, 2020, p. 06)

COVID-19 and the containment measures had a significant impact on commodity markets, causing severe economic disruptions and a sharp decrease in travel. The World Energy Agency warned of a global demand decline in 2020 due to COVID-19, leading to economic shutdowns in most countries and affecting travel, transportation, tourism, entertainment, and other sectors. Consequently, there was a surplus in the oil market estimated at 25 million barrels per day (Arab Studies Unit, 2020, p. 20), 2020, p. 20). For instance, passenger flights in China decreased threefold in March compared to normal levels, and subway trips in New York City dropped by one-third during the same month. There was also a decline in shipping volume due to reduced global trade. As a result, the International Energy Agency expects global oil demand to decrease by approximately 10% in 2020, more than twice the decline seen in 1980. (Commodity Markets Outlook, 2020, p. 07) The quantity of oil demanded is generally linked to the level of economic activity and oil prices in international markets. Higher economic activity leads to increased oil demand (positive relationship), while higher oil prices reduce the demand for it (inverse relationship). (Fattouh, 2007, p. 09).

The major disruption of the means of transportation caused the collapse of oil prices was due to the sharp decline in demand, especially for fuel, resulting from quarantine measures. Oil demand consists of several types, with crude oil demand and petroleum product demand being the main ones. Although they appear separate, they are interconnected. Assuming that the cost of crude oil represents half the cost of retail gasoline, a 10% increase in crude oil prices would lead to a 5% increase in gasoline prices. In this case, the elasticity of crude oil demand would be about half the elasticity of gasoline demand. (Hamilton, 2009, p. 190) This led to a 6% decrease in oil demand in the first quarter of 2020, and the International Energy Agency expects a 23% decrease in the second quarter of 2020. Many countries adopted quarantine measures, especially the United States (the largest oil consumer). This is mainly attributed to the significant importance of the transportation sector and the relatively high living standard of the American citizen, advanced infrastructure, and the American citizen's strong penchant for travel. The transportation sector accounts for 70% of the total crude oil consumption in the United States.

As the global economy experienced a significant blow due to precautionary measures to prevent the spread of the COVID-19 virus, various industrial, tourism, and commercial sectors were closed, logistics and travel networks were disrupted, and economic activities were paralyzed. The fears of an economic recession spread panic in global oil markets (Arab

Studies Unit, 2020, p. 20), 2020, p. 6). The COVID-19 virus led to a reduction in global industrial production, resulting in a decline in global oil consumption. On February 15, 2020, the International Energy Agency announced that global demand could decrease by 425,000 barrels per day after a significant drop in Chinese consumption. China accounts for about 14% of global oil production, being the world's most populous country. (Bloch and others, 2015, p. 105) The rate of oil consumption in China is closely related to economic growth rates and individual income. The majority of China's increased oil demand is driven by the ongoing population shift from rural to urban areas. The population increase in urban areas leads to more cars and roads, which in turn increases energy demand in the transportation sector. Moreover, industrial growth increases the demand for naphtha-based petrochemicals, including those based on naphtha. (Farmer, 2006, p. 01)

The noticeable trend of declining industrial production is evident across all fuel grades, ranging from gasoline to diesel, which also declined by 2.9% and 3.8%, respectively. Industrial production is heading towards decline due to the halt in manufacturing candles, perfumes, dyes, shaving creams, shampoos, and conditioners that rely on petroleum products due to the pandemic. As a result, both Brent and West Texas Intermediate crude oil prices fell by 24.59% and 30% to \$31.13 and \$30 per barrel, respectively, on Monday, March 9th. Quarantine measures and social distancing led to a reduction in manufacturing in most advanced economies, resulting in a significant drop in oil prices. (Kingsly and others, 2020, pp. 1-2)

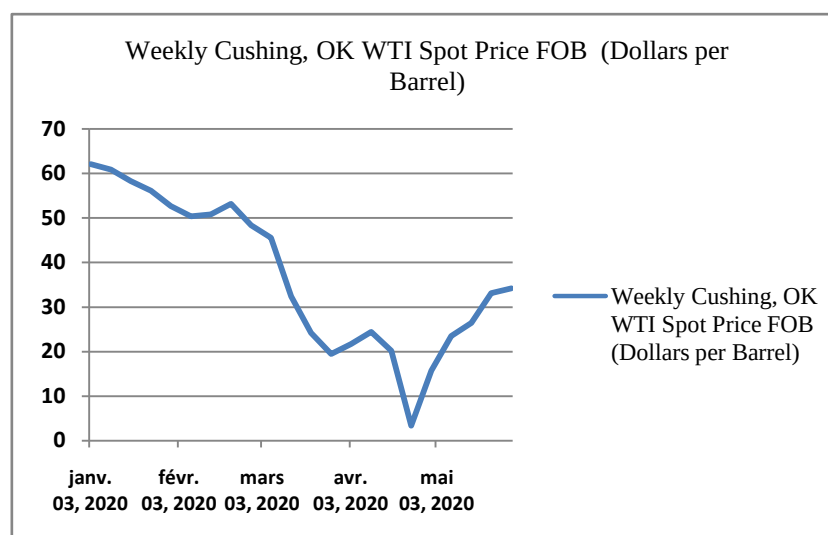


Figure 4 illustrates the impact of the spread of the COVID-19 virus on oil price fluctuations.

Source: Elaborated by the researcher based on information from the International Energy Agency.

The Figure 4 illustrates the fluctuations in West Texas Intermediate (WTI) crude oil prices. With the official announcement of the COVID-19 virus outbreak by the World Health Organization in January 2020, WTI prices dropped to around \$50 per barrel during that month, leading to a new phase of market surplus and price decline. Despite OPEC's call for its members and other oil-producing countries to discuss additional cuts to halt the price decline

on March 5th and 6th, 2020, the meeting failed, resulting in a sharp drop in oil prices, recording the worst performance since 1991.

Monday, April 20th, 2020, is considered a black day in the history of the oil industry, as WTI prices collapsed by 300% during the day's trading. This collapse shook global markets and had a profound psychological impact, affecting regions from Texas in the United States to the North Sea, the Arabian Gulf, and eastward to Japan. With the shrinking and expensive storage capacity in the United States, it became cheaper for producers to get rid of their production for free or offer financial incentives to customers to take the oil and bear the shipping and storage costs. This happened with the May delivery contracts, as owners rushed to resell and dispose of them at the lowest prices to avoid shipping and storage costs. Bloomberg described the price collapse as the "worst crisis in the oil market in a long time," noting that this crisis resulted in oil prices falling below zero (Arab Studies Unit, 2020, p. 20), 2020, p. 20).

As mentioned above, the emergence of the COVID-19 virus as a contagious and severe disease led many countries to implement home quarantine measures to contain the virus, resulting in decreased oil demand due to reduced mobility and a global economic recession, leading to a decline in oil prices. What exacerbated this decline and caused oil prices to collapse was Russia's and OPEC's decision to increase their crude oil production despite the reduced demand to gain more market from each other and increase their share.

Conclusion:

In conclusion, this study underscores the pivotal role of oil as a fundamental driver of economic and social development, illustrating its significance as a strategic commodity within the global trade framework. The findings highlight that fluctuations in oil prices are not merely market phenomena; they have far-reaching implications for economic growth, stability, and social welfare across nations. The analysis of key determinants influencing oil supply and prices reveals a complex interplay of factors, including geopolitical dynamics, technological advancements, and economic policies. The unprecedented disruptions caused by the COVID-19 pandemic further exacerbated the volatility of oil markets, leading to significant shifts in supply and demand. These shifts have emphasized the need for robust risk management strategies to navigate the uncertainties inherent in oil markets, particularly during global crises.

As the world grapples with the dual challenges of energy transition and economic recovery, the insights from this research serve as a critical resource for policymakers, industry stakeholders, and researchers. Understanding the intricate relationship between oil consumption, economic growth, and market volatility is essential for fostering resilient economic systems that can withstand future shocks.

Ultimately, the resilience and stability of oil markets will be crucial in shaping the trajectory of global economic recovery and development in the years to come. By recognizing the lessons learned from recent disruptions, stakeholders can better prepare for the complexities

of an evolving energy landscape, ensuring that oil continues to play a vital role in supporting economic prosperity and social progress.

There are several factors that determine oil prices, including oil supply, oil demand, and speculation. Oil supply is characterized by increasing expenses and decreasing yields, and its supply elasticity is negatively related to its prices. As oil prices rise, the quantity supplied increases, and this supply elasticity increases over time, with long-term elasticity being higher than short-term and medium-term elasticity.

Oil markets were also significantly affected by the spread of the COVID-19 virus due to the suspension of transportation and travel resulting from home quarantine measures adopted by most countries. Oil markets witnessed an unprecedented collapse in oil demand as its price continuously declined in global markets since the virus first spread in China. With oil producers continuing to pump crude oil from their wells, especially following the price war between Russia and OPEC, this led to the collapse of oil prices.

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