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Oil and Gas Markets and COVID-19: A Critical Rumination on Drivers, Triggers, and Volatility

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Abstract: The paper endeavours to explore and analyse some critical issues in the oil and gas market that cropped up around the spread of COVID-19 and tries to identify the key drivers and triggers pertaining therewith. The spread of the first wave that began in March 2020 is crucial because of the global economic downturn that ensued due to lockdown and imposed restrictions coupled with a protracted oil price war that began between Saudi Arabia and Russia. The paper tries to address some key research questions to understand the triggers and drivers around the pandemic. These are: (1) whether the behaviour of OPEC or its key players around the pandemic could be considered uniquely different; (2) what could the triggers be for the increased volatilities that cropped up in both physical and financial markets during the pandemic; (3) what was really different about the oil market crisis around the pandemic that transformed it to an unprecedented storage crisis; (4) what really went wrong with the much-hyped U.S. shale boom during the pandemic that led to the bankruptcy of several oil and gas companies, followed by huge job losses. The paper relies on a structured review of relevant secondary literature to address these exploratory questions and builds upon a retrospective rumination on the world oil market from 1960 to 2020. This is complemented by an analysis of supporting data and evidence obtained from various sources. Considering the intertwining of oil and financial markets around the pandemic, the lessons and findings from the paper would not only be highly relevant for policymakers and stakeholders in the oil and gas sector but would be equally relevant for those in the financial markets.

Keywords: OPEC; crude price; COVID-19; volatility; storage crisis; futures; shale

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1. Introduction

As per the International Energy Agency (IEA), oil accounted for 46% of the world's energy needs as of 1971 and a decade back in 2010, the figure stood at 31%. The share has remained steady since then, and oil continues to dominate as the most important fuel, and as predicted by IEA, it will continue to be the leading component in the world's energy consumption [1].

For a commodity that is consumed so heavily worldwide, there is no second thought that any price shock and volatility that ensues therefrom would invariably have serious repercussions for global economic growth. The presence of volatility and associated price fluctuations is not new in the oil market and has existed since the discovery of oil in 1859. The historical evolution of oil markets could be divided into two phases—the phase before OPEC was formed as an entity (1859–1960) and the phase after that (1960 to present). Some of the oil shocks that shook the world in these two phases include the Suez Crisis (1956–1957), the Arab oil embargo (1973–1974), the Iranian revolution (1978–1979), the Iran–Iraq War (1980), and the Persian Gulf War (1990–1991) [2,3]. However, the more recent events in the last decade that have significantly heightened the oil price volatility include the global financial crisis of 2008, the shale gas revolution, the increase in penetration of renewable energy in the energy mix and the uptick in the growth of electric vehicles. The manifestation of this increased volatility could be observed in the form of extreme oil prices (highs and lows), often causing turmoil and stress on the budgets of major oil nations [4].

For instance, the global economy countered a phenomenal 70 per cent price drop during the period 2014 to 2016. This drop was reportedly considered one of the three biggest and longest drops in oil prices since World War II [5]. However, the unprecedented fall in prices that ensued in March 2020, triggered by a lethal double bout of COVID-19 pandemic and a protracted battle between Saudi Arabia and Russia for oil market share, was one of its kind and belied all expectations [5].

Although the key OPEC player Saudi Arabia and the non-OPEC giant Russia came to terms in April 2020 due to pressure from the U.S. and G20's intervention, the oil market had already been bruised enough by then so as not to return to normalcy very soon. This was largely caused by the crude oil market glut and a sharp drop in global fuel demand of 30% triggered by prolonged lockdowns, frequent travel bans, little or zero vehicle usage, and a downslide in the economic activity [6]. Eventually, the WTI crude oil futures price landed in the negative zone on 20 April.

To understand the movements in the oil market around pandemic time, it may not be appropriate to ignore the oil price crash as a one-off event, but one may need to take cognisance of the evolution of the World oil market, explore the dynamics of the strategy of the key players such as OPEC or its lead members such as Saudi Arabia, and the interplay of other potential drivers in determining the oil price trajectory. The volatility in oil prices usually has an adverse fallout on the real economy [7,8] but could also trigger the formation of a speculative bubble with a potential spillover on the financial markets [9].

The adverse market conditions that emerged with the rapid spread of COVID-19 only made the situation worse for the financially weak and vulnerable oil and gas companies and pushed them towards bankruptcy [10]. The business of shale emerged as the worst casualty, with their very foundation getting rattled, bringing Saudi Arabia and OPEC back as swing producers responsible for balancing the world oil market [11]. Furthermore, the unprecedented bundling of the demand and supply shocks not only roiled the oil market, but the storage capacity of surplus crude oil became completely exhausted and transformed the oil crisis into one of a kind storage crisis.

In light of the above backdrop, this paper endeavours to explore and analyse key developments in the World oil market, including the causes and triggers of the paradoxes that evolved around the pandemic, with a particular focus on the role of OPEC and the U.S. shale business. OPEC's role has been considered critical in oil's history because, since its formation in 1960, OPEC and its major producer Saudi Arabia had often exercised a balancing role in fostering stability amidst short term volatility in the world oil market.

Section 2 singles out the research problems that have been addressed in the paper and goes on to describe the approach that has been adopted to explore these research questions. The subsequent sections address the identified research questions in a sequential manner. Section 3 ruminates in detail on the evolution and variation in the behavioural psyche of OPEC in retrospect and identifies the relevant causal drivers or triggers that emerged therefrom. Section 4 goes on to delineate the volatility that cropped up in the crude and financial markets around the spread of COVID-19. Section 5 explains the price war that ensued between Saudi Arabia and Russia around the outbreak despite a deep recession that ensued in March 2020 due to the pandemic outbreak. Section 6 explores the triggers and drivers that literally transformed the oil crisis into an abnormal storage crisis around the pandemic time. Section 7 eventually moves on to elucidate the development of the shale gas market that evolved around COVID-19, given that natural gas is the next best low carbon alternative to oil. This is followed by concluding remarks.

2. Methodology/Approach

Considering the research questions, the paper tries to investigate, foremost, whether there has been any pronounced change in the OPEC's role and dominance as the oil market evolved over the years and if developments around COVID-19 made any significant dent in that. To address this research problem, the retrospective rumination has been considered essential as it may not be appropriate to judge the behaviour of OPEC and its key members based on a just one-off shock event such as the spread of COVID-19. In fact, empirical studies on oil markets carried out in the span of the last two decades raised question marks on the traditional thought process and beliefs on the drivers and fallouts of oil price shocks [12]. The author identified some key research terms, namely 'OPEC', crude price, oil price, Saudi Arabia, 'OPEC behaviour', and 'oil companies', to identify relevant research papers, books, working papers, discussion papers, policy briefs, and reports that have addressed the role of OPEC in determining world oil prices over the years. The papers that have not considered OPEC or its key players' role in any form have been excluded from the list. The authors relied on databases such as Science Direct, EBSCO, JSTOR, and Google Scholar to single out the relevant papers. Table 1, presented in the next section, provides a detailed schematic representation of the papers that the authors have found relevant and befitting. The period that has been considered for the retrospective review to reflect on variation in OPEC behaviour in World Oil Market is from 1960 to 2020. In cognisance of the retrospective analysis, the paper tries to provide an explanation of the price war that ensued in March 2020 between Saudi Arabia and Russia. The data and information to substantiate the elucidation have been collected from monthly oil markets reports of OPEC, IEA, and DoE.

A critical element that came to the fore while analysing the triggers and drivers of oil price volatility is the intermingling of the oil market, especially the crude market, and the financial markets. This link became more evident in the post financial crisis of 2008. The paper tried to explore whether this link and volatility intensified during the spread of COVID-19. The author tried to classify the select literature that focused on the interlinkage of oil and financial market around the period of spread of COVID-19 by combining the key search terms- 'oil market', 'financial market', 'speculation', 'commodity market', 'COVID-19', 'pandemic' and could identify a set of most recent literature that talks in detail about the volatility and linkage of commodity and financial markets around COVID-19. The data and information on volatility have been collected from the annual and Monthly Oil Market Report (MOMR) for March 2020 brought out by the U.S. Department of Energy (DoE), which focused on the historical values of volatility indices for both crude and financial markets since 2007.

Another startling issue that came to the fore while investigating the movements in the oil market around the spread of COVID-19 is that the oil crisis consequently took the shape of a severe storage crisis [13]. The paper takes a deep dive into the triggers and drivers behind the storage crisis. The analysis of the section relies heavily on the media reporting and illustrations from Bloomberg, Financial Times, and Wall Street Journal. This is coupled with data collected from the U.S. MOMR of DoE, IEA, and OPEC.

The paper eventually moves on to elucidate the development of the shale gas market that evolved around COVID-19. As natural gas is considered a promising and a low carbon fuel alternative to oil, and given that the U.S. has a demonstrated abundance of proven shale gas reserves and has been relying on shale for the past two decades, the nation has been in the rat race with OPEC to capture the biggest pie in the global oil and gas market. The rapid growth in the shale gas business enabled the U.S. to change its position as a net importer of oil and gas and emerge as a net exporter in 2019 [14]. However, as the pandemic broke out and the recession started nullifying all fundamentals, the U.S. shale slid into its worst patch that not only turned them into a net importer of oil and gas in 2020 but also triggered the bankruptcy of several companies in shale gas business. The outcomes were huge job losses in the oil and gas industry and bruising of the financial institutions that provided the much-needed impetus to the growth of the shale gas business in the U.S. [15]. In light of these developments, the paper tries to analyse the triggers and drivers behind the collapse of shale and gauge whether the dramatic collapse during a pandemic could be considered as just another shock impact or does this also raise moot questions on the foundation, resilience, and the sustainability of shale gas business in the U.S. The analysis of this research problem is largely based on relevant secondary literature culled out by combining search terms, namely 'shale gas', revolution, bankruptcy, COVID-19, pandemic, and complemented with data and information collected on bankruptcy compiled by Haynes and Boones.

3. OPEC and World Oil Market: A Retrospective Review

The fundamentals of the world oil market are based on demand and supply. In a simple parlance world, crude oil demand could be conceived as a function of price and income (proxied by the real GDP). The modelling of world crude oil supply, however, is not so straightforward and hence is an area of concern [16]). Several empirical studies that have been conducted to understand the functioning of the world oil market indicate that crude oil supply modelling is much more complex and does not resemble a linear form where supply is a function of the cost of production and price. This is because the oil supply can neither be considered fully competitive nor fully monopolistic. Crude oil is primarily supplied by OPEC, which is endowed with the largest pool of reserves (79.4 per cent as of 2018) while accounting for 37.1% of world production [17]. Before one takes a deep dive into the historic oil market crash that ensued at the onset of COVID-19, it would be worthwhile to briefly understand the evolution of the oil market in retrospect, and the role played by different players on the supply side in determining the world oil prices. This would also enable a better understanding of any changes in market situation or volatility that have already been building up in the oil market prior to the pandemic.

From the review of various models that have endeavoured to understand the role of OPEC (for more details, see Table 1), it becomes evident that it is not possible to explain the actions of OPEC by any single model because OPEC as an entity has rarely acted in a cohesive and deterministic manner. The wide variation in models that were constructed to explain the behavioral psyche of OPEC and its key producers after 1973, the year of the Arab oil embargo, bears ample testimony to that. The reasons for variation in OPEC or its members do include not only economic incentives but also political and geopolitical considerations [18,19]. Furthermore, there are major differences between OPEC and non-OPEC in various dimensions that could potentially have an influence on the differences in their intent. These include public vs. private ownership, extraction of crude oil reserves, the significance of oil exports as a source of (government) revenues, and the intent of amassing foreign exchange [20]. Whereas OPEC might respond differently to an increase in oil demand to sustain higher oil prices and maintain their profitability [21,22], non-OPEC producers have mostly been responding to market prices that are usually set by OPEC.

OPEC was originally established as an organisation during a meeting in Baghdad in September 1960. The five founding members were Iraq, Venezuela, Saudi Arabia, Kuwait, and Iran. Qatar, Libya, Indonesia, United Arab Emirates, Algeria, and Nigeria joined later. Gabon joined in 1975 but left in 1994. Ecuador joined in 1973 and left in 1992 (https://www.opec.org/opec_web/en/about_us/24.htm (accessed on 5 January 2022)). The main purpose of the formation of OPEC, as identified in the meeting, was to coordinate petroleum policies between member countries and to safeguard their interests. In a way, OPEC acted as a trade union to ensure that the income of member countries did not decline [23].

OPEC had the first major say or dominance in the pricing of crude oil in world markets in 1973 during the Arab–Israeli War when it successfully raised the price of crude by 70 per cent initially in October 1973 to USD 5.11 per barrel and subsequently raised it unilaterally to USD 7 per barrel in December 1973. The Arab members within OPEC imposed an 'embargo' in 1973 on the U.S. as a retaliation against their decision to support the Israeli military. The embargo was further extended to Netherlands, Portugal, and South Africa for the same reason. As part of the embargo, petroleum exports to the targeted nations were banned, and a production cut was initiated along with a price rise (https://www.csis.org/analysis/arab-oil-embargo%E2%80%9440-years-later (accessed on 6 January 2022)). The embargo was finally lifted towards the beginning of 1974 (https://www.csis.org/analysis/arab-oil-embargo%E2%80%9440-years-later (accessed on 6 January 2022)).

Between 1975 and 1978, OPEC policies were centred around stabilising demand and increasing prices in a moderate manner. Between 1979 and 1981, however, OPEC policies were largely influenced by several disruptive events that significantly enhanced crude prices volatility. These include the Iranian revolution followed by the Iran–Iraq war. Oil production stalled in the affected countries; prices climbed from USD 24/bbl. in 1979 to USD 34/bbl. in 1981; and was followed by a global transmission of shock waves [24].

After this, the crude prices started to nosedive and eventually crashed in 1986, triggered by a big oil glut and a growing pattern of shifting consumption away from oil. It was only in 1982 that OPEC started allocating formal production quotas. The group production ceiling imposed by OPEC and distributed among member countries as quotas somehow could resist the price fall. Although timely intervention by OPEC also lessened the effect of the Gulf War on the oil market in 1990–1991, excessive volatility and price weakness continued to rule the latter half of the 90s. This was largely due to the fallout of the southeast Asia currency crisis plus the economic meltdown in 1997–1998. The mild northern hemisphere winter of 1998–1999 added to that, and the price again tumbled down to the 1986 level.

In fact, in the early eighties, OPEC behaved in a noncohesive manner and was referred to as a 'clumsy cartel' [25]. The tendency of defection was more prominent among the OPEC members with relatively lower crude reserves (Qatar, Algeria, Indonesia, and Venezuela). The defection and decision to produce more than the allocated quota was triggered largely by a volatile crude market and the apprehension of these members that they might suffer heavy losses when oil prices would tumble down afterwards [26]. In other words, they wanted to make hay while the sun was shining, i.e., crude prices were on the higher side.

In contrast, producers with a large pool of reserves, such as Saudi Arabia, could manage the production of less oil even when prices were higher. However, due to the persistent defection tendency within OPEC at the beginning of the 80s, the burden of adjustment largely fell on Saudi Arabia, which ended up bearing the brunt by producing the residual amount. Given that the residual production was unplanned, it did not serve Saudi Arabia's interest in the best possible manner when it comes to profitability [21]. Finally, in the mid-eighties, Saudi Arabia refused to comply as a residual or a swing producer and started producing the amount that would help them serve their best interests by producing profitably.

The defection within OPEC raised doubts on the cohesive capability of OPEC as a combined producing entity and its ability to execute market power through adjustment in its production levels. The lost confidence was restored somehow after OPEC could manage to successfully carry out two production cuts, one after the other when the oil prices skydived to a nadir during the 1998 oil crisis. However, the unprecedented price hike of 2004, when crude price crossed USD 50 a barrel and the failure of Saudi Arabia to arrest that spike through output increase, disrupted the restored confidence once again. Some of the empirical research studies that tried to investigate the causal factors behind OPEC's failure to resist the price spiral evinced that this occurred largely due to the loss of spare capacity to produce crude [27–31]. OPEC's spare capacity is usually considered a benchmark of resilience against the impact of any crises that could potentially reduce oil supplies.

Since the early 1990s, OPEC's spare capacity was progressively exhausted [32]. Between 2003 to 2008, OPEC's total spare capacity was below 2 million barrels per day which is below 3 per cent of the global supply. This meagre spare capacity provided hardly any cushion for supply variation when the demand had been growing at a very fast pace [33]. The decline in spare capacity for both periods was due to accelerating global demand for crude coupled with low growth in non-OPEC oil supply. Although OPEC came out with an oil price band mechanism in 2000 that facilitated stabilising crude prices somehow, erosion of spare capacity and changing expectations and speculation made the situation worse, jacking up prices and increasing volatility in crude markets.

Another critical factor that usually acts as a balancing wheel between supply and demand is the stocks or inventories held by countries. During the time when production exceeds consumption, crude oil and petroleum products can be stored as inventories for future use. For instance, during the recession around 2008–2009, the significant decline in world oil demand led to stockpiles at a record level in the United States and other OECD countries. In contrast, when the demand and consumption exceed current production, supplies can be supplemented by drawing on the inventories. However, given the uncertainty of supply and demand in the oil market, limited stocks/inventories might have a serious impact on exacerbating the volatility of crude prices. (for more details see [12,34–37]).

Going by the series of developments that emerged in the world oil market at different periods historically [38], it could be aptly inferred that OPEC as an entity rarely followed a uniform strategy. After the first major oil shock in 1973, several research studies were conducted to examine the structure of the world oil market, and the role played by OPEC. As already explained in the preceding section on the methodology or approach of the paper, Table 1 tries to capture and classify this entire spectrum of studies that have focused on OPEC behaviour at a different juncture in history.

Table 1. Studies on Oil Markets and Role of OPEC.

Nature of OPEC's Behaviour over Different Time Slices	Description of the Approach/Models	Authors
OPEC as a single producing entity	Monolithic cartel model: This set of studies that evolved in the mid to late seventies considered OPEC as a single producing entity without any competition among its members. Non-OPEC suppliers were considered price-takers. 'Monolith' means the residual producer	[39–41]
Saudi Arabia's role has been recognised separately within OPEC	Two block or three block cartels: This set of studies that evolved from mid-seventies to the late eighties assumed OPEC as either a two-block cartel comprising of 'savers' and 'spenders' or a three-part cartel comprising a core, price maximiser, quantity maximiser. Saudi Arabia is considered a major part of the cartel core. This is also to account for the fact that OPEC consists of members with divergent political, economic, and social interests.	[42–48]
	Saudi Arabia as a swing producer: This set of studies that evolved around the early 80s to early 90s considered Saudi Arabia as playing the role of a balancing wheel to absorb demand and supply fluctuations to maintain a high price or Saudi Arabia is considered a leader in consonance with the well-known leader-follower model of Stackelberg.	[24,26,49–56]
OPEC's lack of effectiveness in determining world oil prices	This set of studies contended that OPEC did not have any perceptible market impact and that oil prices were the product of other market factors. These scholars have questioned OPEC's efficacy as a cartel and price maker.	[57–64]
Focus on the political reasons pertaining to OPEC behaviour	This set of scholars believes that economic analyses of OPEC preclude crucial political variables, and thus the results are largely biased. The studies contend that OPEC and its members get political mileage through international cooperation in carrying out their decisions.	[18,19,65–69]
Property Rights Model	This set of studies tried to give credence to OPEC in influencing the oil production and prices due to the transfer of ownership from international oil companies to the governments of the oil-exporting countries within OPEC towards the beginning of the 70s decade. The transfer of property rights to the governments from companies led to applying low discount rates, which was not the case earlier.	[20,57,70,71]
Target Capacity Utilisation Model and Role of Spare Capacity	This set of studies conceived of OPEC as a residual supplier of the world oil market. The set of studies presumed that OPEC's prices are influenced by the gap between its current capacity utilisation and some target level of capacity utilisation. Some of these scholars have also focused on the role of spare capacity and its link to OPEC's ability to control oil prices	[27–30,72–74]

Table 1. *Cont.*

Nature of OPEC's Behaviour over Different Time Slices	Description of the Approach/Models	Authors
Fiscal Constraint/Target Revenue Model	This set of studies accounted for different absorptive capacities of OPEC member countries. The studies contended that the conduct of OPEC member countries depended on the expectation that when oil revenues would surpass the requirement of an OPEC member country, the output level would also be restricted by the member country to make the oil revenue match its needs.	[75–80]
Target Price Model	This set of studies either assumed or inferred that OPEC aims for a certain price level or a price band and then complies with it by making necessary adjustments in the output level.	[81–83]
Signalling the Role of OPEC and coupling it with financial markets	With the growing participation of financial investors and coupling of the financial market with the commodity market, especially in and around the first decade of the millennium and especially around the period of the financial crisis of 2008, analysts tend to point towards the potential existence of signalling role of OPEC to the financial market through changes in production behaviour. The changes often also influence the shaping of expectations and provide impetus toward speculative behaviour in the financial markets, causing turmoil.	[23,84–90]
Other econometric and simulation models for investigating OPEC behaviour	This set of studies uses different types of advanced econometric models and simulations to test OPEC's behaviour in the World oil market	[21,57,91–102]

4. Volatility in Crude and Financial Markets around COVID-19

The volatility of crude oil prices has increased substantially in the past three decades. The increased volatility could be attributed to multiple factors that include the limited spare capacity of crude, limited inventory of the OECD countries, geopolitical disturbances, and complex market structure. The situation became more complex after crude oil became increasingly used as an asset class through crude oil futures, and paper barrel trading started ruling the roost. One of the serious fallouts, as one could see from these developments, was the skyrocketing crude prices to a record level of USD 147 a barrel in mid-2008, before collapsing eventually. The collapse was triggered by the financial crisis and accompanying economic recession. Some of the researchers also observed that in the long run, the volatility of the financial markets had a restraining impact on oil prices [103–105].

The oil market movements around COVID-19 did show all the vulnerabilities and volatilities that cropped up over the last three decades, and this is clearly revealed by the movements of benchmark indices of volatility. The Chicago Board Options Exchange (CBOE) Volatility Index (VIX) is considered one of the financial markets' most followed indicators with elements of credibility and reliability. The index is considered a benchmark indicator of volatility in equity markets (variation in S&P 500). OVX is usually considered a benchmark indicator of implied volatility in crude oil markets. Both the indices registered a phenomenal increase around the spread of COVID-19.

VIX climbed up to a value of 82.7 on 16 March 2020, which was significantly higher than the value that was recorded during the financial crisis of 2008–2009. OVX, on the other hand, climbed to a value of 190 on 20 March 2020, which was considered then the highest since the index started functioning in May 2007 [106]. More recent studies also demonstrated an interconnectedness and co-movements between volatility in the equity market (VIX) and crude oil markets (OVX) around the COVID-19 crisis period identified as the span from 14 February 2020 till 6 August 2020 [107].

It all started with the Declaration of Cooperation (DoC) that was signed at the OPEC ministerial meeting by OPEC plus members (OPEC and Russia) in Vienna in December 2016 to foster market stability and prevent a rapid slide in crude oil prices [108] but eventually it turned out to be futile. The crude price exceeded the USD 70 a barrel mark in 2018, triggered by the U.S. sanctions imposed on large oil producers such as Iran and Venezuela [109].

The year 2020 began with the tumbling of crude oil prices owing to compounded effect of (1) the collapse of the DoC due to the defection of Saudi Arabia and Russia in the battle for maintaining market share and (2) the deceleration in global economic growth caused by the outbreak of COVID-19. The impact could be immediately seen through a pronounced drop in the price of Brent and WTI in March 2020. The daily Brent crude price nosedived to USD 24.9/barrel on 18 March 2020, from USD 51.9/barrel on 2 March 2020, and WTI plummeted to USD 20.4/b from USD 46.8/b in the same time span, thus effectively recording more than 50 per cent drop in both the benchmark crude prices.

The drop in demand for crude oil due to the worldwide recession triggered by the pandemic made Saudi Arabia decide to cut production. However, the largest non-OPEC producer, Russia, driven by the worry of losing out on its own market share, defected, and this eventually resulted in the collapse of the DoC, rattling the oil market stability. Saudi Arabia also defected and decided to expand its crude oil production despite a falling demand exacerbating the disequilibrium further. The resulting price war led to prolonged instability in the crude oil market. Although Saudi Arabia and Russia agreed to come to the negotiating table under pressure from the U.S. and intervention by G20, the oil market had already been roiled enough by then. Under the negotiated terms of the agreement, oil-exporting countries had planned to prune an aggregate of 9.7 million barrels a day of crude supply from being released over a span of two months beginning from 1 May till the end of June [110].

However, questions began to be raised by experts and analysts on whether such a strategy would eventually turn out to be effective. The doubts in their minds were largely triggered by the glut in the crude oil market combined with a sharp drop in global fuel demand of 30 per cent due to lockdown, travel bans, grounded flights, and economic collapse [7]. Their impending fears of the lack of effectiveness in the negotiated cooperative agreement turned real with WTI crude oil futures price landing in the negative zone on 20 April. A barrel of WTI crude valued at USD18.27 a barrel on 17 April that was due for delivery in May tumbled to a nadir of USD40 a barrel on 20 April. Oil producers and traders started panicking, leading to the dumping of a large volume of futures contracts [111].

This historic drop in crude prices has also motivated researchers to examine the impact of COVID-19 on oil price volatility. Most of these studies opined that the pandemic has sucked out the global aggregate demand for oil due to the globally announced lockdown and economic downturn that ensued thereafter. The market uncertainty was exacerbated further by the adverse impact on the global supply chain [112,113] with negative repercussions on the commodity prices [114–119]. Other select studies [120–123] found a statistically significant impact of reported deaths or infections on oil price and stock market volatility.

The uncertainty is further compounded by the extensive media coverage of COVID-19. Several research studies conducted around the pandemic time delineated that media played a vital role during the crisis that resulted in a substantial impact not only on oil and stock prices but also on the environmental, social, and governance (ESG) indices [114,119,124,125]. Empirical findings by [126] further show that the media coverage of the COVID-19 pandemic had a positive impact on the dynamics of the commodity markets. Other than media coverage, high Google search volumes for COVID-19 have also been observed to influence high stock market volatility [127].

5. Price War: Calculated Move by OPEC or Unabated Quest for Market Share?

The advocates of the mean field game theory [128] tend to believe that the unabated production and subsequent price war initiated by Saudi Arabia post Russia's noncompliance with OPEC plus deal (DoC) is nothing but a battle for market shares [129]. However, there is hardly any second thought that such a retaliatory move against defection was initiated at a critical juncture when the entire world had been reeling under the severe blow that had been dealt by the pandemic. Global lockdown and related restrictions and containment measures had by then eroded substantially the effective demand for end-use petroleum products, namely gasoline, diesel, and ATF, because of abysmally low passenger travel and grounded flights. The impact of the shock was pervasive with the transmission of contagion from the oil sector to the financial sector and real economy with widespread spillovers on all associated sectors.

As already mentioned before, it would be crucial to understand whether the behaviour of bigger oil producers such as OPEC or its key player, Saudi Arabia, should be assessed in this context based on just this one-off contagion or is it equally significant to gauge whether the observed change in behaviour is fallout from increased vulnerabilities and volatilities in the oil market in the more recent years and the factors pertaining therewith. With reference to the discussion carried out in the preceding section on the volatility in the oil and financial markets, there is no second thought that the behaviour of OPEC and its key player should be analysed from an evolutionary perspective. To add to this, the retrospective review of the role of OPEC that has already been carried out in this paper clearly shows that OPEC rarely acts in a deterministic or linear fashion, and its behaviour is circumstance specific. Of course, the entire battle around COVID-19 and Saudi Arabia's unabated increase in production is to ensure that their market share does not deteriorate as it may not otherwise serve their interest in the best possible manner (in line with the thoughts of [21].

Geopolitical challenges are almost part and parcel of oil-exporting countries in the Middle East and North Africa (MENA). However, over the last two decades, several structural and deeper policy-related drivers have compounded the risk perception and volatility in oil markets. Some of these drivers are (1) stringent climate or environment-related regulations and the risk of stranded assets for the oil and gas companies (stranded assets are assets that have "suffered from unanticipated or premature write-downs, devaluations, or conversion to liabilities"); (2) increase in investors' conscience and consciousness regarding environmental, social, and governance (ESG) issues [130]; (3) improved corporate governance practices and increased accountability of board members; and (4) primacy of stakeholders' interests over those of shareholders within the corporation and in board-level decisions making [131,132].

The 2015 Paris Climate Agreement also gave a big push to climate change as a part of broader ESG issues within consideration and have increasingly been internalised as part of the board-level discussion along with other corporate agenda. With growing pressure from investors, companies have started to re-envision themselves in a climate constrained world, and even executive compensations have started to become linked with meeting climate targets. As an illustration, climate metrics now account for 8% of CEOs' incentive plans in the short run in some of the celebrated energy companies [133]. All these factors, taken together, have made the investment decisions in the fossil fuel industry a bit jittery, adding further to the volatility. The contagion of COVID-19 has only exacerbated the situation by causing a great degree of uncertainty about health and the economy with a negative impact of this changing risk perception on the oil market [134].

Given the increasing volatility in the oil market and the uncertainty involved therewith, it is not unusual for Saudi Arabia and Russia, which are low-cost producers, to change their strategic position more frequently in the quest for maintaining their market share and profitability. In line with this thought process, there is little room for a surprise if Saudi Arabia chooses the highly unlikely path of monetising its reserves faster to take advantage of the market situation, produce more, and offer more discounts to disadvantage and corner the high-cost producers. In other words, it may not be correct to think that Saudi Arabia, the dominant producer within OPEC, always acts in a stereotyped manner as a residual swing producer and responds only to the amount of oil demanded from them unless that action really serves their own best interests [31]. A parallel of this behaviour could also be observed in the current pandemic struck situation when both Saudi Arabia and Russia decided to produce more and bring down the price. The high-cost shale producers in the U.S. were eventually in a difficult situation, finding it challenging to break even and compete on a level playing field with Saudi Arabia and Russia.

Russia did not comply with the production cuts proposed by Saudi Arabia. This is because their aspirations and concerns were quite different from those of Saudi Arabia and other major oil exporters. Russia's exports cater to only a few discrete markets. The lion's share of their shipments goes to Europe, and an insignificant proportion is transmitted via pipeline to China [135]. Hence, the spillover of the pandemic could only be felt in Russia's principal export outlets. Saudi Arabia, on the contrary, has a much bigger network of global customers. A rather different justification for Russia's noncompliance with the deal comes from the sanction imposed by the U.S. on completing the Nord Stream 2 gas pipeline in the Baltic Sea and on Rosneft because of trading Venezuela's crude [129].

With Saudi Arabia clinging to the decision of producing more crude, the situation went out of control in the pandemic-afflicted world already straddling an oil slosh due to an economic downslide. Collection of oil revenues came down phenomenally because of the price crash and compounded the plight of the big oil producers. The price crash led to erosion of their economic freedom, created mounting hurdles for upstream investments, and made it challenging to sustain their production capacity [129]. Recognising the criticality of maintaining the producer–producer relation in such an uncontrollably adverse situation of free price fall that was only adding to the oil exporters' miseries, Saudi Arabia and Russia eventually decided to come to terms. A warning issued by the U.S. on imposing a tariff on Saudi and Russian crude exports to the U.S. in case of their refusal to come to the negotiating table, and intervention by other G20 members, gave a big push leading eventually to brokering a new deal. However, the unprecedented drop in demand due to containment measures had exceeded the proposed contraction in output, making the new deal ineffective in the short term and pushing down the WTI crude price further to the negative zone in April 2020 [136].

6. An Oil Crisis or a Storage Crisis?

As the contagion continued to spread and led the world to a downturn, the unabated price war compounded the glut further. With heavily oil import-dependent economies such as China and India on a staggered path of recovery [13], the entire excess oil had to be sent for reserve and storage. However, with all the onshore and offshore storage facilities becoming full to the brim with globally announced lockdown, abysmally low movement of people and grounded flights [110], a new storage crisis came to the fore. The erosion of effective demand for fuel due to lockdown and global slowdown also forced refineries to temporarily stop the process of refining crude oil into petroleum products for final use, compounding the problem further.

It deserves to be mentioned at this juncture that crude oil can be traded physically as well as in the financial markets. In physical trading, liquid oil is physically traded by different entities [114]. In the financial market, crude oil is traded through futures contracts agreed upon by buyers and sellers to take or make deliveries of barrels of crude oil at a certain designated time in the future and a pre-decided agreed price. A buyer of a crude oil futures contract shall be under obligation to buy and take delivery of crude oil when the futures contract expires. As an alternative, the buyer may choose to opt out of taking physical delivery by selling the futures contract before its expiry [114].

Speculation of crude oil prices reigns the financial market. The speculators usually enter the crude oil market when prices are lying low but are expected to look up soon. Speculators who had invested in WTI futures contracts were looking for buyers to take possession of oil barrels in May that were expiring on 21 April. However, the investors in WTI crude future were not willing to take physical delivery of WTI crude oil and were closing out of long positions in WTI May futures contracts a few days before the contracts expired on 21 April 2020 [137]. However, because of a severe glut situation coupled with a lack of effective demand for oil, there was literally no buyer because of storage challenges of excess oil. The WTI crude futures price eventually crashed to a sub-zero level on 20 April, a day before the expiry of the contract. WTI May crude futures dropped by more than 300% to USD 40 a barrel. This is also the first time in history that prices nosedived to the sub-zero level. Going by the economics of trading, this essentially means that the oil seller had to pay the buyer to offload the oil. This is almost like a pathological case in the economics of commodity trading.

Going by the commodity trading terminology, the severe blow of the pandemic and other factors made the market change its position from backwardation to contango [138]. A contango structure usually shows up when the price of commodities in futures contracts offsets their price in the spot market. The reverse situation is called backwardation. The contango structure allows traders to exercise the option of purchasing oil cheap today and then sell it off dear at an agreed point of time in future in the futures market. As for crude oil, the profitability of trading in a contango situation depends on whether the profits derived from trading are higher than the cost of storing oil. If storing cost is cheaper, the contango provides an incentive for hoarding. However, in an oversupplied market, a supplier whose stocks are accruing because of a steep dip in demand is left with no other options but to offer a discount to cajole a buyer who is otherwise not willing to buy the crude and shows up with the spot price trading at a discount to the forward. If the glut situation persists, prices will tumble further, leading to a deepening of the contango and distress in the market. This is exactly how the market looked in April 2020 [139], and the slide was primarily caused by the market stress that arose due to the timing of the May 2020 contract expiration of WTI crude futures coupled with storage concerns [140].

The financial crisis of 2008–2009 bears ample testimony to deepened contango structure and storage crisis. However, the profit that could be earned from trading crude futures during 2008–2009 was more than adequate to cover the cost of buying charter tankers for storing oil offshore. The pandemic situation was far worse than that because of a serious shortage of both onshore and offshore storage [141–143]. The excess demand for storage increased the land storage costs worldwide and hiked the cost of maritime shipping as alternate offshore storage [144]. Chartering costs for Very Large Crude Carriers (VLCC) have more than doubled since February 2020 [140].

It would also be crucial to understand the terms and conditions that were stated in the settlement procedures of the May 2020 WTI crude contract to have a clearer picture of the reasons behind the steep price slide. When the expiry date becomes closer, a contract holder could either settle the contract position by choosing an 'Exchange for Physical (EFP) contract with a counterparty transfer of the contract in exchange for cash or other futures contracts with later expiration dates' (for more details see: https://www.cmegroup.com/trading/energy/crude-oil/light-sweet-crude_quotes_settlements_futures.html (accessed on 23 October 2021)). Alternately, the contract holder may choose to take physical delivery of the crude oil and the delivery is expected to occur at a pipeline or storage facility in Cushing (for more details, see https://www.eia.gov/petroleum/weekly/includes/analysis_print.php (accessed on 20 October 2021)).

In a normal situation in Cushing, there would not be any challenges to transfer oil into the storage facility or pipeline. However, the situation became extraordinarily abnormal due to the double blow of the contagion, which left little or no option but to send all the surplus oil to the storage. On 17 April, i.e., only three days prior to the historic slide, 76% of Cushing's storage capacity was already full. Other storage facilities were either leased out or committed and left no space for uncommitted storage. With an excess demand for storage, the cost of storing oil became sky dabbing.

Given the nonavailability of uncommitted storage, deep contango and an abnormally high storage cost, it became impossible for the market participants to go for physical delivery (for more details, see: https://www.eia.gov/petroleum/weekly/archive/2020/200422/includes/analysis_print.php (accessed on 5 November 2021)). The inability to take physical delivery implied that the May 2020 WTI contract had to be settled by selling and transferring ownership of the contract to a buyer prior to the expiry date, even if that means selling at a negative price. This is exactly what has happened. As there was literally no space to store oil, supplies eventually had to be stopped to keep pace with the dramatic downturn and demand losses globally [145].

The rapid spread of the pandemic created an abnormal situation with energy contracting parties failing to respect predetermined contracts due to restrictions imposed by the government. Frequent announcements of lockdowns for a prolonged period disrupted the supply chain and affected routine operations of critical infrastructure such as ports and terminals. Soon after, energy companies began receiving force majeure notices [146]. Running factories and commercial establishments became difficult due to lockdowns, further eroding energy demand. Several refiners chose to halt their operations because of little or no demand. Apprehensions were building up that jamming of pipelines and halt to refinery operations would make it next to impossible to store excess oil because of the inadequate storage capacities. The oil market crisis got eventually transformed into an unprecedented storage crisis. With exorbitant storage costs, it appeared more profitable to build up oil storage space than to possess a futures crude contract.

7. U.S. Shale Collapse: Time to Get Back to Fundamentals

Shale fracking helped the U.S. emerge as the largest oil producer in 2019, overtaking Saudi Arabia [147]. However, soon after the bout of the pandemic started unfolding, the EIA and the U.S., in their monthly oil market report in April 2020, expressed serious doubts on whether the U.S. would be able to maintain this position, as production had been projected to tumble down by 0.5 million barrels a day in 2020 [148]. The drop was predicted in spite of the renegotiated OPEC plus agreement that was brokered after the price war.

Although the shale business was considered a boon for the U.S. and consistently registered high production levels in the initial few years, serious doubts began to be raised by noted experts and specialists on the sanctity of the business model of shale in the U.S. that eventually led the business to go bust with phenomenal adverse repercussions on their financial health [149]. What the noted energy economist, Paul Stevens, said about the shale business in the U.S. way back in 2010 in an intriguing Chatham House Report [150], even when shale was booming, came true as the shale business started showing weaknesses and vulnerabilities towards the beginning of 2020. The report, foremost, raised serious doubts on the very fulcrum of the 'shale revolution'. Concerns have also been raised about the adversity and magnitude of environmental impacts, and high depletion rates. The General Accounting Office Report on Shale Development [151] further highlighted the adverse impact of fracking on the health of the communities living in the proximity due to deterioration in the quality of water and air because of groundwater contamination and rising air pollution. In addition, seismic vulnerability increased due to an increase in the frequency of earthquakes. Other challenges that came to the fore include growing concerns for climate change through methane leakage at the sites and facilities for processing coupled with the burning of fossil fuels [152], the rising proneness of water deficit hotspots to water stress due to usage of the large volume of water in conducting fracking activity [153].

Although the investors were initially lured by the shale gas business considering it to be a good bet, all the above challenges raised questions on shale's social license to operate and compounded the uncertainty in their minds [150]. The uncertainty was further triggered by the unleashing of vulnerabilities in the U.S. shale business towards the end of the decade that began in 2010. Fracking is a resource-intensive and large cost-incurring activity in the U.S. Furthermore, there is no uniformity in performance and yields across wells. Thus, in case a cost-intensive well fails to perform and generate adequate yields, mounting losses might accrue [154]. To remain profitable, shale producers' capital and operating expenses, along with total return, should be higher than the commodity price. Furthermore, this should also be able to make up adequately for all the ongoing capital expenditure, which includes discovery and development expenses. However, weakness started to show in the shale business, with costs falling marginally short of the trading price of WTI crude in 2018 as well as in 2019 [154]. Declining yield and meagre returns deterred the investors from putting any more money into the shale gas business.

With several social and environmental disasters coupled with lapses in corporate governance being increasingly brought to the limelight, a stakeholder centric approach to business has become an imperative [155]. Over the last decade, the environmental, social and governance (ESG) criteria have become more material in the corporate as well as investment decision-making. This is coupled with a worldwide call for divestment of fossil fuels [130]. The boardrooms progressively became more vocal as more investors and shareholders started to raise concerns about whether the profits of the companies whose boards they represent were coming at the cost of primary stakeholders, namely customers, workers, and the environment. Questions started to be increasingly raised on the health and safety issues of workers as well as on the environmental and social benignity of the products besides the impact of the company on the overall health and safety of the society at large [131] and the consciousness has only increased during the pandemic time.

The adverse environmental and climate impact of shale business brought the business of fracking under scrutiny and influenced the decisions of major lenders that have been backing the shale business in the U.S. As a last resort, these big lenders even became ready to don the mantle of independent operators of oil and gas business to shield themselves from mounting losses of impending bankruptcy. This is a one of a kind event in a generation of oil and gas businesses where lenders became business operators to save their loans. Notable among these big lenders are J P Morgan Chase & Co., Wells Fargo & Co., Bank of America Corp., and Citigroup Inc., who got themselves into this new groove [7].

Plagued by mounting challenges due to erosion of effective demand and price war during the pandemic, it became next to impossible for several shale producers to break even [156]. The crisis became so deep in 2019 that even big shale producers such as Occidental had to extend a hand for government support asking the state to "provide necessary liquidity to the energy industry" as reported by Bloomberg News on 9 April 2020. (See https://oilprice.com/Latest-Energy-News/World-News/Shale-Giant-Calls-For-Federal-Help-As-Oil-Prices-Fail-To-Bounce-Back.html for more details (accessed on 2 September 2021)). Occidental Petroleum's debt rating also got downgraded by Moody's investor [157]. Another noted upstream company, Whiting Petroleum, had gone bust and went ahead with filing Chapter 11 bankruptcy, the first one to do so [158]; Callon Petroleum Company and Chesapeake Energy got into a messy soup with multibillion-dollar debts [159]. Other major players such as Noble Energy (NBL), Halliburton (HAL), and Marathon Oil (MRO) lost a substantial chunk (around 66 per cent) of their market capitalisation. Oklahoma-based noted shale driller Unit Corp. also filed for bankruptcy [160]. Losing around 40 per cent of its value in 2019–2020 [161], Exxon (XOM), which was trailing behind Chevron in market capitalisation, went ahead with deep layoffs [159].

An estimate by the University of Chicago, however, points out that drilling and fracking could only be profitable if the price hovers around USD 40 per barrel [162]. Morgan Stanley, the leading U.S. Multinational Investment Bank, estimated that USD 51 per barrel would be needed by shale business just to provide for the capital expenditure budgets in 2020 and excludes the amount that would be required for paying off debts or sending money to shareholders (https://oilprice.com/Energy/Energy-General/The-Great-US-Shale-Decline-Has-Already-Begun.html (accessed on 3 September 2021)). Yet another calculation depicts that to profitably carry out exploration and production activity, an average WTI crude price of USD 30 a barrel would be necessary to meet the opex for existing wells and USD 49 a barrel for preparing a new well for production respectively [163]. With WTI sliding to a historical low of −USD 40 a barrel, revenues tumbled down steeply, and assets experienced massive erosion of value. Several struggling oil and gas companies raised their hands in despair as they were not able to pay back their debts [7]. Going by the list maintained by Haynes and Boone from August 2015 to the end of August 2020, 244 producers went ahead with bankruptcy filing that amounted to an aggregate debt of nearly USD 172 billion. Of these, 36 companies went ahead with a bankruptcy filing in and around the pandemic period till August 2020 as they grappled with a steep drop in prices [164]. A generous support package from the government turned out to be the only option left to bail the industry out.

In sum, the oil crisis has turned the air and hype around America's shale revolution into a bubble. Some of the noted oil and gas experts, however, expressed confidence in the resilience of the U.S. shale [165]. They continued to hold the expectation that more solvent shale operators with a relatively superior grip on their finances would be able to manage themselves out of the crisis and chart a new course for the shale industry in the U.S. [166].

8. Conclusions

The volatility of oil prices in the international market, especially since the 1990s, has been a cause of worry and headache for policymakers globally. The increased volatility could be linked to several factors. These include erosion of the spare capacity of the key producer OPEC, limited inventory, especially of the OECD countries, frequent geopolitical disturbances, complex and chaotic market structure, plus disturbances or troubles inside individual member countries, political or otherwise. This is, coupled with the trading of crude oil futures, side by side with physical trading that made the situation more volatile, linking the commodity and financial markets. The oil market movements around COVID-19 revealed all these vulnerabilities and volatilities that have crept in over the last three decades and were compounded with the blow of the pandemic. This was clearly delineated by the movements of benchmark indices of volatility, namely OVX and VIX. The paper explored some of the triggers and drivers in the movement of the oil and gas market around the pandemic.

During the wild spread of COVID-19, the policymakers and businesses worldwide have countered a unique situation of the double blow. First, oil demand kept on sliding down due to a lack of passenger travel demand and grounding of flights coupled with the global downturn. Second, despite the rising volatility, Saudi Arabia and Russia were themselves entangled in an unabated quest for market share that eventually led to a price war. The increase in output volume when demand is already in free fall could not, however, be considered a right move by OPEC as it was hardly expected to yield any desirable positive outcome for itself as well as for the rest of the world. The price war only made the economics of the oil and gas industry jittery, with more stress on the financial resources of the oil exporters. From the survey of various models carried out in this paper, economic or otherwise, it becomes evident that OPEC has rarely acted in a linear and deterministic manner. The pandemic afflicted period is no exception. The retrospective rumination also underscores that there is no single model (economic as well as noneconomic) that could provide a comprehensive explanation of OPEC behaviour as the interests and behavioural psyche of OPEC and its key players kept on varying with the changing scenario of the world oil market. Although Saudi Arabia and Russia, with the aim of stabilising the bleeding crude market, eventually proposed to withhold their production, triggered further by the pressure of the U.S. or mediation of G20, the unabated drop in demand for oil could hardly offer any immediate relief. Consequently, turmoil and disruptions continued in the oil markets for the entire period of 2020–2021.

As a takeaway lesson, however, one could infer that despite the inherent vulnerabilities and volatilities that have crept up over again, including the one that arose during COVID-19, whether a stable world oil market is going to prevail or not would continue to be dependent on the fundamentals. These include, foremost, the spare capacity of the member countries in OPEC and the coalition, including those of the key players, and the cohesive capability of the coalition to respond by altering their output in volatile demand situations during disruptions caused, say, by a pandemic or due to geopolitical disturbances. The sooner the member within the coalition realises that, the better it is for the greater good of world oil markets. The stability would additionally depend on the strategic management of the inventory of crude reserves that could facilitate averting any unprecedented or unforeseen circumstances arising in world oil markets with a potential negative fallout for the financial markets and the global economy.

Another critical reason why the supply of oil could not be stopped in the immediate short run during the pandemic despite the urgent need for the same is because of the high cost involved in capping production from a high temperature, high pressure running well, which may lead to irreversible losses [167]. This essentially meant that there were no other options than to produce more oil even at a very low price leading to an unprecedented slosh in the market. Eventually, the excess oil went into reserves and storage. However, when storage was full to the brim, capping of wells and stalling production in refineries became inevitable.

By sucking out the minimum essential demand for fuels, the market situation was adversely impacted by the pandemic and followed by a steep decline in crude prices roiling all the crude benchmarks, with WTI crude becoming the worst casualty. The volatility in WTI crude was aggravated further by the speculators in the futures market. The situation was exacerbated due to inadequate storage facilities and led the WTI crude future price to an unhealthy negative zone defying all fundamentals and raising question marks on the sanctity of WTI as a benchmark. The betting behaviour of the commodity traders and speculators, massive global oil glut, unprecedented price war, and a massive storage crisis, all these factors, as explained in the paper, rattled the very foundation of the oil and gas business in a compounded manner. For the policymakers and other stakeholders of the oil and gas markets, this is great learning as the pandemic reinforced the need for shifting from a more linear predictive and deterministic modelling to modelling of chaos and uncertainty while approaching the market dynamics for the future.

The pandemic period also rumpled the American energy dominance. The sudden fall of the shale business from the acme conveys great learning for other shale players, policymakers, and stakeholders worldwide on how a hollow and shaky foundation could demonise a much-hyped boom with just a single lethal blow. The shale business could manage to have a smooth ride in the eighties and nineties only because of the reasonably high price of crude and petroleum products that enabled them to maintain the breakeven and still earn a decent supernormal profit. However, the bout of the pandemic has reversed the situation. In other words, the period of free riding was almost over as oil and gas markets became highly volatile. Unless the U.S. shale business comes to terms with this grim reality, there will be continued disruption in strategy, planning, consolidation, and the course of action as the situation keeps on changing erratically in future. Post pandemic, the expectation is that of a lean shale industry with financially solvent players who could manage to straddle through the worst pandemic period, with or without the support of the state.

Given that the entire world is now getting used to working from home, how the future policies are going to shape up would largely be contingent upon the attitude and behaviour of the commuters regarding short distance travel and long overhaul. It is obvious that people would have a second thought before travelling, and even the organisations would be conducting cost-benefit analyses to assess whether there is a scope for reducing physical travel in the post-COVID world. With many organisations already announcing permanent work from home arrangements, the impact would invariably fall on the demand of one of the major contributors to oil demand, namely the transport sector. The requirement of cooling and heating offices would also come down concomitantly. In other words, the dependence on oil is expected to come down with a potential fallout through augmented volatility and fluctuations in oil prices.

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