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Energy markets respond to Covid-19 pandemic

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ABSTRACT

This paper aims to detect the sensitivity of the Oil market to different Covid-19 outbreak periods. To test its haven propriety, and its sensitivity to the study phase, our research investigates the Covid-19 indicators explanatory power. Using the OLS regression, our results reveal that new pandemic wave announcement declines the Oil market demand. It doubts its safe-haven property. In parallel, we detect that this market responds to the determining factors of the Covid-19 Pandemic. At this level, we found that the number of the reported cases has lost its explanatory power since the emergence of the second pandemic wave. On the contrary, mortality following this virus has become a significant explanatory factor.

1. Introduction

The December 31, 2019 is a date that marked humanity with the emergence of the coronavirus pandemic diseases in Wuhan in China. The fast contagious nature of this epidemic constitutes its particularity, which necessitated the resort to lockdown decision in a large number of countries. This precaution action sent shock waves and generated the major global crisis ever known within generations. This health disaster caused economic, social, and health crises all over the world. Governments were committed to finding a balance between health measures application to reduce the pandemic’s impact on the health sector and to search means of supporting economies already precarious by previous financial crises.

Commodity markets were also affected by the pandemic, but the magnitude of the impact is different according to commodity types. Indeed, concerning the Agricultural Price Index of the World Bank, it has declined at the beginning of the coronavirus propagation and it regained 6% in the third quarter of 2020. Agricultural commodities prices are higher than their level of the same period of last year, which is due to USD devaluation, on the one hand, and supply gap of some meals and oils and raw materials demands increase. As for grains, their prices continued roughly stable.

The third quarter of 2020 has also known a rise of 19.5% of the metals and minerals demand. It doubts its safe-haven property. In parallel, we detect that this market responds to the determining factors of the Covid-19 Pandemic. At this level, we found that the number of the reported cases has lost its explanatory power since the emergence of the second pandemic wave. On the contrary, mortality following this virus has become a significant explanatory factor.

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for totally confined countries and on average by 18% for partially confined nations. This energy demand shock is estimated as the most important in the last 70 years ago and seven times greater than the financial 2009 crisis.

Given the uncertainty about the future situation of this disease, especially its duration and virulence, and next to economic activity decline due to confinement decisions oil-producing countries needed to get decisions of production decrease to avoid price decrease. However, the negotiations between OPEC members and Russia at the beginning of March did not achieve an arrangement to cease production since Russia disagreed with Saudi Arabia to a deeper production cut to allow price stabilization. Consequently, prices decline by 25% after negotiations achievements and continue their deterioration during lockdown decisions of several countries. Indeed, Brent Price reached its lowest level on the 21st of April with 19$ per barrel. Since OPEC and non-OPEC countries found an agreement on the 12th of April to cut production by 9.7 million barrels per day that permitted to counteract the price deterioration. Accordingly, although the continued upward trend of the disease energy prices increased by one third during the third trimester of 2020.

Several studies focused on studying the impact oil markets price variations during the COVID-19 crisis on various economic factors (E. Apergis and Apergis, 2020; Fu and Shen, 2020; Gil-Alana and Monge, 2020; Jyke, 2020; Liu et al., 2020; Narayan, 2020; Qin et al., 2020). However, the nature, magnitude, and longevity of impact of this pandemic on crude oil markets have not yet been deeply investigated by researchers.

Among researchers interested on the impact of Covid-19 pandemic on energy markets, Dutta et al. (2020) that demonstrated that crude oil assets became extremely volatile during February and March 2020, and consequently, investments in this market caused considerable losses and induced higher probabilities of tail-risks in the oil-derived assets. Furthermore, these researchers empirically examined the time-varying correlations between gold and oil markets to examine whether gold is a safe asset haven for the international crude oil markets during the COVID-19 period. Their results of the time-varying correlations attained through the DCC-GARCH model proposed that gold serves as a safe asset haven to both WTI and Brent crude oil markets amongst the COVID-19 epidemic.

Besides, using a panel Vector Autoregressive, Salisu et al. (2020) suggested a larger initial impact of own shocks of stock markets post-COVID-19 announcement with a greater impact on the crude oil market than the stock market. However, Albulescu (2020) studied the reaction of the WTI crude oil price to new COVID-19 new cases during the period January 21, 2020 to March 09, 2020 using the ARDL estimation and demonstrated that even if the direct negative impact of pandemic new infection cases on crude oil prices is rather limited, the indirect effect through the volatility of financial markets cannot be ignored.

To identify short-run and long-run relationships between time series variables, Nyga-Lukaszewska and Aruga (2020) applied the ARDL approach to investigate the impact of the number of COVID-19 cases of US and Japanese on crude oil and natural gas markets for the period from January 21, 2020 to the June 2, 2020. Their results revealed that crude oil and natural gas markets were affected in the US in the short and long run by the COVID-19 pandemic. Really, the cumulative number of COVID-19 cases had a negative impact on the crude oil price, but it positively influenced the natural gas price. However, for Japan, only a short-run shock with a lag impacted crude oil market, and there is no visible influence of the pandemic shock on the natural gas market.

Furthermore, Mzoughi et al. (2020) explored the impact of COVID-19 pandemic on oil prices, CO₂ emissions and stock market volatility over the period January 22, 2020 to March 30, 2020 using an unrestricted VAR and found that although an increase of the number of COVID-19 cases caused a decrease in the crude oil price, the negative response of the oil market is short-lived. Besides, a stronger impact on equity market volatility than on crude oil prices and CO₂ emissions in response to this pandemic had been detected.

Dutta et al. (2020) detect that all the major oil markets have become very volatile, and investments in these markets could lead to substantial losses. This paper will therefore test the two pioneer oil markets (Brent and WTI) to conceal the impact of the framework of the Covid-19 crisis on the oil market as a whole. On the other hand, we are trying to detect the most sensitive market to this pandemic. Our results can direct investors in the energy market to the safest investment destination in this precarious framework.

This health crisis presents such as all previous crisis phases under periods of different levels of severity. Therefore, this study proposes ambitious and innovative research into the impact of the various pandemic outbreaks on the oil market and its impact on the safe-haven properties. Indeed, we seek to detect fluctuations in the explanatory power of the two major indicators of the covid-19 Crisis: the number of declared cases and mortality. Previously, several studies considered these indicators as proxies for the analysis of the framework of the covid-19 Crisis. The originality of our research is that it tests them to see the most relevant indicator according to the evolution of the pandemic. This analysis makes it possible to disclose the informational power of the two crisis indicators and the weight that the market gives them according to the studied period. This approach allows us to focus on the most appropriate investment decision-making variables according to the evolution of the Covid-19 pandemic.

The remainder of the paper is organized as follows. Section 2 presents the data and methodology. Section 3 describes the empirical results. Finally, section 4 concludes.

2. Data and methodology

2.1. Sample

As presented in Table 1, our work focuses on a sample collected daily, with 246 observations per variable for the period between January 2, 2020, and December 15, 2020.

Empirically, Yang et al. (2020) detected that WTI spot price leads Brent spot price slightly, which provides support to the price leadership of WTI over Brent. However, the lead-lag relationship is volatile and sensitive to extreme events like geopolitical conflict and policy shift. Further, this is the case of the current health crisis affecting the whole world.

Fig. 1 demonstrates that we did not assist on a parity relationship between Brent returns and WTI returns. The spread is in favor of Brent.

There was a higher supply of WTI crude as the production in Europe, in the Brent, was relatively low. This may be explained by the length of national-containment periods affecting European countries against a policy with less access to lockdown decisions adopted in the United States. This fact is validated by Okorie and Lin (2021) which detected,

| Data presentation and stationarity results. |
|--------------------------------------------|
| **COVID-19 Cases** | **COVID-19 deaths** | **WTI** | **Brent** |
| Number of cases | Number of deaths | (Dollars per Barrel) | (Dollars per Barrel) |
| www.ourworldindata.org | www.ourworldindata.org | www.eia.gov | www.eia.gov |
| Mean | 216983.7 | 4911.524 | 39.047 | 41.518 |
| Median | 168584 | 5400.5 | 40.49 | 42.12 |
| Skewness | 1.498 | 1.061 | –1.375 | –0.149 |
| Kurtosis | 7.205 | 2.75 | 9.538 | 3.101 |
| ADF results | Not stationary | Not stationary | Not stationary | Not stationary |
| Result in first difference | Stationary | Stationary | Stationary | Stationary |

**Source:** Author calculation.
due to Covid-19 framework, fractal contagion on the market return and volatility. We note, moreover, strong volatility during the period between March and June. It presents the lockdown period of a large number of European countries and the drop in the oil supply.

2.2. Applied methodology

First, we begin this empirical investigation by applying a DCC-Egarch model presented as follow:

\[ D(X)_t = C^D(X)_{t-1} + \epsilon_X \]
\[ D(y)_t = C^D(y)_{t-1} + \epsilon_Y \]

Where X presents Brent returns, Y presents the WTI returns. \( \epsilon_X \) and \( \epsilon_Y \) present the innovations normally distributed.

The average equations:

\[ \ln(\sigma^2_X) = \omega + \alpha (|\epsilon_X| - E|\epsilon_X|) + \beta \ln(\sigma^2_X - 1) \]  
\[ \ln(\sigma^2_Y) = \omega + \alpha (|\epsilon_Y| - E|\epsilon_Y|) + \beta \ln(\sigma^2_Y - 1) \]

This step allows us to detect the dynamic conditional correlation between Brent and WTI. In the second step, we applicate the Bai Perron test to estimate the existence of structural breaks. This step allows us to detect 5 breakout periods as presented in Table 2. Finally, we estimate the dynamic conditional correlations (Brent-WTI) pair by the OLS model. We introduce in this step the variables covid-19 cases and deaths and we apply the model for each outbreak period.

At this level, we consider estimating the following regression model:

\[ \rho(\omega)_t = C_1 + C_1 \text{Covid} - 19 \text{ cases}_t + C_1 \text{Covid} - 19 \text{ deaths}_t + C_1 \text{K}_t^i + \epsilon_t \]

where X presents Brent returns. Y presents the WTI returns. Covid - 19 cases \( t \) and Covid - 19 deaths \( t \) present the number of cases and deaths reported worldwide. \( K_t^i \) is a dummy variable that takes the value 1 in the outbreak period and 0 otherwise.

3. Empirical results

Fig. 2 exhibits the DCC conditional correlations for the Brent-WTI pair. It reveals a positive connection globally throughout stress periods. Yet, we assist on high volatility and oscillation towards the negative zone during the covid-19 bearish period.

The analysis of the periodic framework is very promising for our research. Graphically, we remark two periods that can be due to the world declaration of two outbreak waves. Thus, a change in behavior according to the analysis’s period is quite probable and requires a thorough investigation.

Looking at Table 3, we observe that the introduction of the periodic effect has an impact that oscillates between positive and negative on the correlation of the (Brent-WTI) pair.

The first outbreak period showed a positive effect. It, therefore, contributed to improving and increasing the correlation between the two types of crude oil. This period is characterized by the announcement of the coronavirus as a global pandemic and the start of its spread across the world. Industrial activity during this period was not suspended. The demand thus oscillated between the two dominant crude oil markets.

The second outbreak period nevertheless harms the pair (Brent-WTI). Moreover, this period is marked by a worldwide trend towards the use of total containment. Other crisis measures emerged during this period, especially the reduction of industrial activity to the vital sector, remote working, and the adoption of sanitary protocol reducing private and public transport.

Investors thus attempted to seek haven markets to cover their crude oil portfolio. Besides, they addressed the gold and cryptocurrency markets. The latter behaved as a haven market allowing either the hedging neither the diversification of risky portfolios.

The gradual return to activity during the third outbreak period of our analysis favored the return to industrial activity, the increase in demand for crude oil, and a positive effect on the correlation pair (Brent-WTI).
The fourth outbreak period has seen a return to restrictive health measures and the announcement of a second more aggressive wave of the pandemic. Thus, market investors behave in search of cover and direct their investments to other safer markets.

Finally, the last period presents a positive effect. We can, therefore, conclude that the outbreak’s public measures and new restrictions are associated with a search for refuge by oil market investors. This behavior subsequently recovered due to an investor confidence level recovery in the oil market.

We can, therefore, conclude that the demand on this market and the search for hedging opportunities through its products has changed between the pandemic’s onset and the most recent period. Investors have therefore adjusted their behavior about investment in the oil market by the study outbreak period.

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Theoretically, the results of previous studies diverged between the significant impact of the Covid-19 reported cases number (Al-Awadi et al. (2020), Ashraf (2020)) and non-significant (Bahrini and Filfilan (2020)) on the different financial markets.

In this context, our research confirms the importance of the reported cases number as an indicator of Covid-19 pandemic. Nevertheless, we emphasize it has lost its explanatory power since the emergence of the second wave of the pandemic. On the contrary, mortality following this virus has become a significant explanatory factor that can guide investors and explain their recourse or not to the Oil market. This result can be explained by the public awareness of the obligation to survive with this virus. Likewise, market participants believe the unreliability of the reported cases’ number.

Thus, they estimate that they cannot be retained as exact values since the rapid and spectacular emergence of this pandemic exceeds the public authorities in screening for the virus. Their confidence is addressed to the mortality values that they consider more representative of reality.

4. Conclusion

Addressing the sensitivity of the energy market and essentially the oil market to a global health crisis is a first. This research thus attempted to question the robustness of the energy market in the face of shocks originating from the market and to disclose the sensitivity of their responses to changes in crisis indicators.

Table 3
The results of the regression model.

| Period | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|--------|---------|---------|---------|---------|---------|
| CI     | 0.755802*** | 0.761079*** | 0.755693*** | 0.766668*** | 0.768752*** |
| Cases  | 2.26E-07*** | 1.96E-07*** | 2.39E-07*** | 2.57E-07*** | 1.25E-07     |
| Deaths | -1.21E-05   | -1.10E-05*** | -1.37E-05*** | -1.34E-05*** | -1.23E-05*** |
| Per 1  | 0.004963    | -0.013547   | 0.042692   | -0.048285** | 0.073749*    |
| Per 2  |          |           |          |         |         |
| Per 3  |          |           |          |         |         |
| Per 4  |          |           |          |         |         |
| Per 5  |          |           |          |         |         |

Source: Author calculation.

Fig. 2. Dynamic conditional correlations between Brent and WTI returns.
Investigating Oil market in the Covid-19 framework permits us to conclude that the announcement of a new pandemic wave declines the recourse to the Oil market whose loses its characteristics of a safe-haven market in favor of other markets such as gold or cryptocurrencies. This result fits that of Dutta et al. (2020) whose detect that all the major oil markets have become extremely volatile, and investments in these markets could lead to substantial losses.

Nevertheless, we find that this market joins its safe-haven character during the least severe Covid-19 crisis outbreaks. Thus, the Oil market refuge and hedging propriety evolve with the evolution of the studied crisis period severity degree.

Thus, this market loses its reassuring power to investors during the darkest periods of the pandemic giving chances to more innovative and normally more precarious investment markets such as the cryptocurrency market to have a more secure and attractive facet.

By resorting to an empirical investigation of the different outbreaks of the pandemic, we find that the explanatory power of the number of the reported cases changes according to the study phase. It even loses its lead about mortality towards the end of 2020.

This result presents aid to investment decision-making. It explores the change in the informational and explanatory power of the two indicators by emphasizing the accentuation of the market’s sensitivity to more negative information in the context of a health crisis. Thus, in their analysis of the pandemic severity evolution, market participants abandon the number of cases declared in favor of mortality especially, in the darkest periods of this crisis.

Author statement

S.A.B. and S.A.A. conceived of the presented idea. S.A.B. developed the theory and S.A.A. performed the computations. S.A.B. and S.A.A. verified the analytical methods. S.A.A. discussed the results. S.A.B. contributed to the final manuscript.

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