

ENERGY PRICES AND COVID-IMMUNITY: THE CASE OF CRUDE OIL AND NATURAL GAS PRICES IN THE US AND JAPAN

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Overview

The COVID-19 pandemic storm has struck the world economies and energy markets with extreme strength. The goal of our study is to assess how the pandemic has influenced oil and gas prices, using energy market reactions in the United States and Japan. To investigate the impact of the COVID-19 cases on the crude oil and natural gas markets, we applied the Auto-Regressive Distributive Lag (ARDL) approach to the number of the US and Japanese COVID-19 cases and energy prices. Our study period is from 21 January 2020 to 2 June 2020, and uses the latest data available at the time of model calibration and captures the so-called “first pandemic wave”. In the US, the COVID-19 pandemic had a statistically negative impact on the crude oil price while it positively affected the gas price. In Japan, this negative impact was only apparent in the crude oil market with a two-day lag. Possible explanations of the results may include differences in pandemic development in the US and Japan, and the diverse roles both countries have in energy markets.

Methods

Our study uses a selection of research methods. On one hand in the literature review, we employed critical literature analysis referring mainly to oil shocks and pandemic effects on behaviour of energy markets. On the other hand in our quantitative part, when we investigated the impact of the COVID-19 cases on crude oil and natural gas markets, we applied the Auto-Regressive Distributive Lag (ARDL) approach proposed by Pesaran et al. (2001) on the number of US and Japanese COVID-19 cases and energy prices. The period investigated in this study is from 21 January 2020 to 2 June 2020. The date of 21 January 2020 was used as the initial data period since this was the date when the COVID-19 pandemic had become apparent in the US. In this way, we aim to capture the so-called “first pandemic wave”.

Results

As our cointegration tests revealed that the US crude oil and natural gas prices are cointegrated with the COVID-19 cases, we estimated the conditional error correction ARDL estimations for the US model. It is observable that there was a negative impact from the COVID-19 cases on crude oil prices, while the natural gas market had a positive impact from the COVID-19 cases. The test results indicated that both serial correlation and heteroskedasticity of the residuals were not a problem in our model based on the 5% significance level. The CUSUM (cumulative sum) diagnostic test for parameter stability also confirmed that all our estimated coefficients satisfy the stability condition at the 5% significance level.

Our results show that a 1% increase in the cumulative number of COVID-19 cases in the US leads to a 0.077% decrease in the WTI crude oil price while a 1% increase in the COVID-19 cases increases the Henry Hub natural gas price by 0.023%. These contrasting results between the crude oil and natural gas markets might reflect differences in their uses. Since crude oil plays a central role in powering automobiles and jets as compared to natural gas, it could be that the decreased number of people using automobiles and airplanes after the increase in the COVID-19 cases reduced crude oil demand, negatively affecting crude oil prices. On the other hand, the IEA (2020) suggests that the use of natural gas for power generation has increased in the first quarter of 2020 in the US (due to a switch away from coal for that purpose), and it is suggested that natural gas consumption in North America remained resilient even during the lockdown periods. This could be the reason why COVID-19 cases positively affected US natural gas prices.

Conclusions

In sum, our results indicate that in the US, both crude oil and natural gas markets were affected by the COVID-19 pandemic, with both short-run and long-run relationships. In the US, the cumulative number of COVID-19 cases had a negative impact on the crude oil price while it positively affected the natural gas price. On the other hand, for Japan, only a short-run shock with a lag was apparent in the crude oil market and no evidence from that shock was visible in the natural gas market. One possible reason for the difference in diverse oil and gas markets reactions to the COVID-

pandemic might be greater stability in gas prices being the consequence of preceding warm winters. As a result, market players, especially exporters, have been less optimistic and more cautious about future investments as they had already expected lower gas sales. Another possible explanation for differences in the US and Japanese oil and gas market reactions to the pandemic maybe the severity of the spread of the virus in the US as compared to Japan. The number of US COVID-19 cases is more than a hundredfold greater than in Japan and most states in the US implemented more severe stay-at-home regulations than Japan did. For example, many US states enforced social distancing protocol with fines and penalties for violating lockdown laws. By contrast, in Japan, no such lockdown regulations were enforced by the government (only 27% of the companies answering the nationwide survey asked workers to work from home and more than half of companies forced their workers to commute to the office even during Japan's state of emergency). Finally, another potential reason is that the US has been both a supplier and consumer of oil and gas while Japan is an importer of both goods. Hence, it could be that the COVID-19 cases caused a dual shock on both the supply and demand sides for the US, while only the demand side of the Japanese oil and gas markets was affected by the pandemic.

The COVID-19 pandemic proved that the oil market is volatile and fragile. Its instability has historically resulted from crude oil economic characteristics connected with the limited price elasticity of supply. This time, in contrast with other energy shocks, the oil market was not determined by the low-price elasticity of demand (see Hamilton 2009). The fragility of the oil market might derive far-reaching consequences in the future. The pandemic and its continuing threat have changed behavioral patterns in society. Remote work, which was hesitantly introduced initially, is now widely appreciated as an effective way for employees to work without occupying expensive office spaces. Additionally, the COVID-19 threat forced many people to give up on their holiday/free-time activities. If these disruptions also contribute to the wider use of renewable energy sources, the world may emerge from the pandemic better equipped to facilitate a fast-track energy change. In that regard, natural gas, due to "before-lockdown" market conditions, may be relatively more resilient to changes than crude oil, but the COVID-19 pandemic is a challenge for both oil and gas companies. The worst situation is experienced by smaller players unable to withstand lower prices. The biggest national oil companies are either "too big to fail," or are supported by governments. For energy exporters, the pandemic might be a trigger to diversify their economies and decrease reliance on energy exports [World Bank]. For energy importers like Japan, it could be the case that little will change in that respect.

Like any study, our empirical investigation has its research limitations. It is conditioned by an analytical approach informed by a literature review and data availability. Regarding literature, we decided to present only those papers that guided us in our study and positioned our research mainly within the literature strings on energy shocks and the pandemic's effects on energy markets, here limited to hydrocarbons. Since we believe that the COVID-pandemic volatility of daily changes is crucial, we opted for relatively high-frequency data, which became one of the important factors that delimited our empirical investigation. Since our main independent variable, COVID-19 cases, was a daily time series data, we needed to obtain the same frequency data for the other variables as well and this limited the variables used in the study. Extending the period or range of the data sample when it becomes available should be an interesting research step for future research. Furthermore, we also hope to compare the results of this study with other countries in the future.

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