ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics

Bachelor Thesis [IBEB Financial Economics]

The Covid-19 Effects on Oil Prices

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Date final version: 10/08/2021

Abstract

In this paper we investigate the effects of the Covid-19 on the Brent Crude oil prices. We do so by building a VAR-X model with the Brent Crude oil, the Baltic Dry Index, and the Global Economic Policy Uncertainty as endogenous variable and the daily new corona virus infection cases as exogenous variable. We analyse a sample starting December 1st 2019 and ending June 7th 2021. We also test the sample for structural breaks and apply separate VAR models for before and after the break. These two VAR models contain the same variables as the original model but without the exogenous factor (i.e., the Covid-19). We found that the coronavirus does not affect significantly and negatively the Brent Crude oil prices, nevertheless it does cause a break and leaves a permanent impact in the relationship between the Brent Crude oil and the global economic activity and the global policy uncertainty.

Introduction

More than a year after the beginning of the corona pandemic, the end of it is clearing out, yet the consequences of this crisis are here to remain for longer. Indeed, habits changed, people were forced, or voluntarily stayed inside. Many shops and businesses saw their profits fall and some even definitely closed (Forbes, 2020). One of the industries which most suffered from the global epidemic is the airlines industry which had to almost cease operations or keep them to an extreme minimum level. As a matter of fact, during March 2020, the daily number of commercial flights in the world decreased from a hundred thousand to approximately thirty thousand (OECD, 2020). This naturally led to a lower consumption of fuel, thus ultimately in a huge decrease in crude oil demand (Rajput & al., 2020).

The goal of this research paper is to analyse the oil price reaction to the apparition and development of the corona virus and to determine whether this pandemic impacted the behaviour of these same oil prices. Hence the following research question:

How did the corona virus pandemic affect the North Sea Brent Crude oil price between January 2020 and May 2021?

With this research question we explore the effects of the Covid-19 crisis over time on the price of the North Sea Brent Crude oil. Over this research we also analyse the potential change in relationships between the Economic Policy Uncertainty (EPU) as developed by Baker, Bloom and Davis (2016) and the Baltic Dry Index (BDI) used as a proxy for the global economic activity (Bakshi & al., 2010).

This paper is believed to be socially relevant as it would help answer the society's question of what are the consequences of the virus that can be expected in the daily life, in this case different petrol prices for their cars. It is also practically relevant as the outcome of this study can be useful for oil producing companies as, for the next pandemic, those could immediately adapt their supply to reduce massive profits losses.

Although this study is not unique and others have already started to investigate the topic (Albulescu, 2020), the pandemic is a recent event for which data is still few and growing every day. This paper adds to the scientific community as a confirmation or additional proof of what has so far been found, yet with more data available, with a broader time scope and with a different method.

Next in this paper we review the existing literature from which we draw four hypothesis which we will test later. After that, a presentation and description of the data used for the research is to be found, followed by the same process for the methodology. Subsequently, the methods presented are applied and the empirical results are discussed. Lastly, we conclude.

Theoretical framework

The coronavirus, or COVID-19, is an infectious disease which became public on the 31st of December 2019 and was declared as a pandemic by the World Health Organization on the 11th of March 2020 (WHO, 2020). Another important concept to define for this research is the North Sea Brent Crude. The North Sea Brent Crude is a futures contract on oil and is one of the two most popular benchmark worldwide (first in Europe) for anyone in the oil market (Investopedia, 2021). It is traded on the Intercontinental Exchange (ICE) and is most called Brent Crude Oil (BCO). A futures contract is a right to buy or sell "a specified quantity of some asset at a fixed price on a fixed future date" (Jarrow & Oldfield, 1981, p. 373). Next, we shall define the global Economic Policy Uncertainty index or EPU mentioned earlier. The EPU created by Baker, Bloom and Davis (2016) is a proxy for national uncertainty based on newspaper coverage frequency and is used to predict changes in investment, GDP, and unemployment. The global EPU is a weighted average of the EPU's of 21 countries with the most influent economies. Finally, the Baltic Dry Index (BDI) is an index compiled daily which measures the costs of shipping raw materials (Investopedia, 2021). It is composed of three indices (Capesize, Panamax and Supramax) assessing the freight costs on routes around the globe (Corporate Finance Institute, 2021).

Even though the crisis is still recent, a certain number of papers studying the topic can be found on the internet. However, these papers are mostly preprints and not peer reviewed.

The literature already suggests, with an ARDL approach, a significant negative impact of the coronavirus on the oil prices, yet not as significant as the effects of economic policy uncertainty and that the impact of the virus crisis translates mostly indirectly through the financial volatility (Albulescu, 2020). Other papers using a fractional integration approach do not conclude on a negative effect of the COVID-19 on the crude oil prices but confirm that this shock to the oil price is just temporary (Gil-Alana & Monge, 2020). Nonetheless, while approving the significant plunge of oil prices due to the coronavirus, some argue that the shock in demand and on prices might be permanent because of a change in behaviour from the end user (Rajput & al., 2020). Moreover, the available literature also indicates significant spikes in volatility during the crisis with the generalized autoregressive conditional heteroskedasticity (GARCH) model approach, but that the Monte Carlo Simulation shows that there is an overall decrease in oil price volatility post coronavirus and that it is due to the COVID-19 (Bouazizi, Lassoued & Hadhek, 2020). This last result opposes to the findings of Albulescu (2020) where the corona virus significantly increased the overall price volatility of oil. Furthermore, the COVID-19 is held responsible for increasing the global economic policy uncertainty as an increase in the corona infected cases have shown to significantly decrease the global economic activity proxied by the Baltic Exchange Dry Index (BDI) (Yilmazkuday, 2020). This hypothesis is backed by the most recent study on the topic which proved a significant co-movement between oil and stock prices such that it could not be determined which one drove the other and that the corona crisis amplified this co-movement (Albulescu, Mina & Oros, 2021). This leads us to the following first hypothesis:

H1: The coronavirus' new infection per day significantly and negatively affects the Brent Crude Oil prices.

With this hypothesis we will observe the effect in time of the COVID-19 on the Brent Crude Oil prices and try to determine whether there is a significant negative relationship, at least temporarily.

On the other hand, the literature several times suggests a break in the oil prices referring to it as a crash (Gil-Alana & Monge, 2020) without explicitly analysing it. Indeed, some significant differences were observed post and pre covid in the volatility of the oil prices (Bouazizi,

Lassoued & Hadhek, 2020). This seemingly unexplored angle of research leads to the following hypotheses:

H2: There is a structural break in the Brent Crude oil prices at the time of the first surge in Covid-19 cases (March 2020).

In this paper we will verify the hypothesis by testing for structural breaks and the results should give us an insight of the potential permanent impact that the coronavirus had on the Brent Crude oil prices and other key economic variables such as the policy uncertainty and the global activity.

Data

The data used for this research are the daily Brent Crude Oil prices between the 1st of December 2019 and the 7th of June 2021 leading to 390 observations (Investing.com, 2021). This data was collected and archived by Investing.com directly from the market. Investing.com is a renowned financial institution which systematically, regularly, and automatically collects market data, hence the reliable label of this data. As data we also use the number of new corona infection per day worldwide provided by the John Hopkins University (2021), which is the best source available, and arranged for easier use by the Our World in Data organization (2021), known as reliable in the scientific community. The data starts the 22nd of January offering thus 502 observations. Next, the daily Global Economic Policy Uncertainty Index between the 1st of December 2019 and the 7th of June 2021, with therefore 555 observations, will be used in this paper. This data is provided on the website Economic Policy Uncertainty (2021) as developed by Baker, Bloom and Davis (2016), and is one of the most popular and most used indexes in the academic society. This index is used to proxy for uncertainty with the EPU being the index of uncertainty in a country based on newspaper coverage, the global EPU, used in this research, is a weighted average of 21 EPU of the world's strongest economies. We will use the version based on current price GDP measures. Lastly, we require the daily data for the Baltic Dry Index (BDI) between the 1st of December 2019 and the 7th of June 2021. However, this data is not freely accessible, and, in this case, we obtained it via a Bloomberg terminal. The data is compiled daily by the Baltic

Exchange which is a global independent source of maritime market information (Baltic Exchange 2021). This data is, as for the oil prices, systematically and consistently collected and processed by Bloomberg, a worldwide esteemed financial institution letting us expect reliable data. The BDI is used in this research as a proxy for the global economic activity as approved by numerous research such as Isserlis (1938), Tinbergen (1959), Bakshi & al. (2010) or Bildirici & al. (2015). Indeed, this data is used by investors to predict changes in global supply in demand. An increase in the BDI value signals an increase in demand for raw materials and since these are the first part of a production chain leading to end products, it implies an increase in industrial production and economic activity thus a growth in stock prices, companies, and global economy (Learning Markets, 2021), (Wärtsilä, 2019).

The data previously mentioned is enough to test the hypotheses and answer the research question. The daily frequency of the data is necessary as prices move quickly and some peaks and crashes would not be captured on a weekly basis, this is however at the cost of some extra noise in the analyses. This data is suitable for the research and for insightful conclusions from the analysis.

All data described earlier are already treated and stocked in ".csv" files on the websites or terminals cited previously. Those files must only be downloaded, imported, and converted in the chosen data treatment software (in this case STATA). As there are no prices during the weekends, we will have issues with missing values for later analyses of the time series. To solve this issue, we simply fill the gaps in the sample by extrapolating the values. For the Covid-19, every missing value that is earlier than the 22nd of January is replaced by a 0. By doing so we obtain a total of 555 observations for all the variables. This manipulation did not affect the graphs of the plotted values, but more importantly did not affect (not to say insignificantly) the mean and standard deviation of the data.

From the graph of the Brent Crude Oil Prices (BCOP), shown in Figure 1a in Appendix A, we instantly observe two major crashes in the period of March 2020. This is accompanied at the same periods by seemingly important increases in volatility (Figure 1b) as well as increases in volumes traded (Figure 1c). Additionally, while observing the graph of the daily new Covid-19 cases worldwide (Figure 2, Appendix A), we distinguish two waves around December 2020 and April 2021, but more importantly we note the apparent sudden first increase in daily

cases in March 2020, which corresponds to the period earlier mentioned for the Brent Crude Oil Price Crash. Furthermore, on the graph of the daily global economic policy uncertainty index (DGEPUI) (Figure 3, Appendix A), we observe an apparent break in March 2020 with the index surging, followed by a steady decline with only one outstanding spike at the beginning of January 2021. This spike corresponds in time with the peak of the first wave in the daily new Covid-19 cases. Lastly, we observe on the plotted value of the Baltic Dry Index (Figure 4, Appendix A) that the prices drop earlier than the crash in oil prices and remained at that same low level until the end of the crash. We notice another low at the peak of the first wave in Covid-19 cases and at the same time as the peak in policy uncertainty. The BDI value then reaches a peak at the same time as the peak in the second wave of Covid-19 cases. The Table 1 in Appendix B summarizes the descriptive statistics of the four previously presented datasets. We notice a high volatility for the daily GEPU index and the daily new Covid-19 cases.

Methods

We first aim to determine the effect of the Covid-19 new cases per day on the Brent Crude oil prices (BCOP). For that we set up a vector autoregressive model with exogenous variable (VAR-X) with the BCOP, the economic policy uncertainty (DGEPUI) and the Baltic Dry Index (BDI) as endogenous variables and the Covid-19 daily new cases (DNC) as the exogenous variable. We take the DNC as an exogenous variable since it is a virus which spreads accordingly and is not influenced by uncertainty, prices, or economic activity.

Before applying the model, we first test whether it is valid, and we do so by testing it in a calm period (i.e., between the 1st of October 2016 until the 1st of October 2019). We therefore build the model by first testing the time series for stationarity with the Augmented Dickey Fuller test and we see that the DGEPUI is stationary while the BCOP and BDI are integrated of order one (Table 2, Appendix B). We then select eight lags based on the Akaike Information Criteria (Figure 5 Appendix A). Next, we perform a Johansen test for cointegration between the two variables with the same order of integration (i.e., BCOP and BDI) and we reject the hypothesis of cointegration meaning that we can perform a vector autoregressive model. For now, we are only interested in the impulse response functions to see whether the model gives the expected results, hence whether it is valid. Indeed, we observe comforting results such as that an impulse in the global economic activity leads to a decrease in economic policy

uncertainty (Figure 6a, Appendix A), that an impulse in prices lead to increased policy uncertainty (Figure 6b, Appendix A) in the short term and long-term decrease in economic activity (Figure 6c, Appendix A). Now that this model seems to give coherent results, we apply it to the targeted period with the additional exogenous variable being the Covid-19 daily new cases (DNC).

We start by dividing the DNC time series by a hundred thousand (calling it now DNCDX) for a better match of scales between the variables. In the same way as previously, we test the time series for stationarity and only the DGEPUI is stationary and the BDI, BCOP and DNCDX are integrated of order one (Table 3, Appendix B). Next, we select seven lags based on the Akaike Information Criteria (Figure 6, Appendix A). The last step to take before performing the vector autoregression is the Johansen test for cointegration between the BCOP and the BDI and we reject the hypothesis of cointegration between these variables. We do not test for cointegration with the DNCDX variable as we assume it should be equal to zero in the long term. Finally, we estimate the vector autoregressive model, interpret the coefficients found and most importantly the impulse response functions.

For the second hypothesis, we build several simple linear regressions with the BCOP as dependent variable and the BDI, DGEPUI and DNCDX variables as independent, and we test each regression for a single break without known date with the Wald test. We then build two VAR models with only the endogenous variables (BDI, BCOP and DGEPUI), one for the period before the found break and the other for the period after this same break. We compare the results of those two models to see if there is a significant difference.

Empirical Results

From the first VAR model with the BCOP, BDI and DGEPUI as endogenous variable and the DNCDX as exogenous variable, we are only interested in the DNCDX coefficients for each of the endogenous variables. As we can see on Table 4 (Appendix B), the coronavirus coefficient is significant for all the endogenous variables: at 10% for the Brent Crude oil prices; 5% for the Baltic Dry Index; 1% for the policy uncertainty. However, we find the opposite results as expected. Indeed, we see that an increase by hundred thousand in the daily new corona

infections leads to an increase in Brent Crude oil prices by 0.047€, an increase in the Baltic Dry Index 1.908€, and a decrease in policy uncertainty by 5.937 points (Table 4, Appendix B). These results are best observed via the impulse response functions. On Figure 8a (Appendix A), we not that an impulse in the DNCDX exogenous variable leads to an increase in the prices. Moreover, we observe the same phenomenon when we take the Baltic Dry Index as response variable. And lastly, we see that an impulse in the daily new Covid-19 cases leads to a plunge in the economic policy uncertainty. This would mean that the coronavirus does not have a negative impact on the Brent Crude oil prices and the more people are infected, the more activity there is in the economy and the lower the policy uncertainty. These counter intuitive results could be explained by the fact that the corona virus pandemic apparition was a worldwide shock which fits the observations of a crash in oil prices, a surge in policy uncertainty and a lowest in global activity all in the same period in March 2020 when the Covid-19 cases first suddenly increase exponentially. The reason why we do not observe a negative impact of the coronavirus on the Brent Crude oil prices on this longer period (1st of December 2019 to 7th of June 2021) can be the fast and efficient reactions of governments worldwide, with sometimes strict measures such as curfews and lockdowns. These fast responses by governments as well as massive investments made in the development of vaccines with historical records beaten in the time of establishment of these cures can explain the steady decrease in economic policy uncertainty after its surge in March 2020. This decrease in uncertainty as well as a shift of consumption towards online alternatives can be the reason for a sustained increase in global economic activity and whence our assumption that the demand for oil was not affected permanently and ipso facto returning to pre Covid-19 price levels if not higher.

Now if we could state that the coronavirus does not negatively influence the Brent Crude oil prices it does not mean that it did not have an effect. This is what we test with the second hypothesis by testing for structural breaks. The results from the Wald test for structural break with unknown date for several linear regressions can be found summarized in Table 5 (Appendix B). We notice that the Wald test strongly rejects (at 1%) the null hypothesis of no break for all regression and this break is estimated at approximately the same time for all equations (i.e., between the 5th of March 2020 and the 7th of March 2020). We explain this break by the fact that at that time was the first sudden increase in Covid-19 cases and not

only in China anymore. This sudden increase probably (Figure 9, Appendix A) scared the global population and the businesses as the crisis suddenly became real, pandemic and out of control, hence the surge in uncertainty and the crash in oil prices.

With these results we lastly compare two VAR models, one starting the 1st of December 2019 and ending the 4th of March 2020 and the second starting the 8th of March 2020 and ending the 7th of June 2021.

For the first VAR the augmented Dickey Fuller test for stationarity (Table 6, Appendix B) shows that only the BCOP time series is non-stationary but that it is integrated of order one. Therefore, we do not have to test for cointegration and instantly select the number of lags, two in this case (Figure 10, Appendix A). The coefficients resulting from the VAR can be found in Table 7 (Appendix B) and the impulse response function are displayed on Figure 11a-c (Appendix A), we come back to it after obtaining the results of the second VAR.

Concerning the second VAR, the augmented Dickey Fuller test for stationarity (Table 8, Appendix B) shows that only the DGEPUI is stationary. Additionally, the Johansen test for cointegration shows no cointegration between the BDI and the BCOP variables. Lastly, we select two lags based on the Akaike Information Criteria (Figure 12, Appendix A). The coefficients resulting from the VAR can be found in Table 9 (Appendix B) and the impulse response function are displayed on Figure 13a-c (Appendix A).

Proceeding with the comparison of the results of the two VAR models, we firstly notice from Table 7 and Table 9 that the coefficients which are significant are approximately the same across the two models but also have a relatively similar value. However, when looking at the impulse response function, we notice that an impulse in the global economic activity causes an increase in uncertainty (Figure 13a, Appendix A) as opposed to a slight decrease prior to the Covid-19 break (Figure 11a, Appendix A). Moreover, an impulse in the brent crude oil prices is followed by a long-term decrease in uncertainty (Figure 13b, Appendix A) in contrast to the short-term decrease pre Covid-19 break (Figure 11b, Appendix A). Lastly, an impulse in the brent crude oil prices leads to a long-term increase in global economic activity (Figure 13c, Appendix A), contrary to the long-term decrease in global economic activity before the Covid-

19 break (Figure 11c, Appendix A). These findings lead us to confirm that a break occurred and that the relationship between the oil prices and core economic variables has changed.

To recapitulate the results of the research, we reject the first hypothesis that the Covid-19 significantly and negatively impacted the Brent Crude oil prices as we found the opposite. Furthermore, we do not reject the second hypothesis that there is a structural break in the Brent Crude oil prices at the time of the first surge in Covid-19 cases (March 2020), as the data shows a break at that time and this is confirmed by the statistical tool which is the Wald test. Additionally, we noticed that the relationship between the Brent Crude oil, the Baltic Dry Index and the global policy uncertainty has changed after the break and that strengthens our position of not rejecting the second hypothesis.

Discussion and Conclusion

Throughout this research we have studied the impact of the corona virus on the Brent Crude oil prices between January 2020 and May 2021. We have found that there is no significant negative effect of the coronavirus on the Brent Crude oil, but rather that the coronavirus was increasing the price of oil, decreasing policy uncertainty levels and increasing the global economic activity. We explained this by the fast response of the authorities reassuring the populations and companies thereby steadily decreasing the uncertainty, relaunching the global economic activity with massive investments and as a consequence pushing the prices of oil back up. We however still observed a significant effect of the Covid-19 which caused a break in the Brent Crude oil prices and we additionally verified that the relationship between the Brent Crude oil and the global economic activity and policy uncertainty has changed after the break. This break, as we reminded, happened at the time of the first surge in Covid-19 cases causing a global panic (see Figure 9, Appendix A). Hence we conclude by answering the research question that the corona virus does not affect the Brent Crude oil prices on the long term, but it did have an effect in March causing a break and permanently impacting the Brent Crude oil and its relationship to other key economic factors (i.e., global activity and global uncertainty).

Our results oppose to the findings of Albulescu (2020) which observed a significant negative effect of the Covid-19 on the oil prices. Additionally, the findings of this paper also contradict the results of Yilmazkuday (2020) which determined that the corona virus positively impacted the policy uncertainty and negatively affected the global economic activity. Both of these two differences between this research and those mentioned right above are probably explained by the time difference between these respective studies. Indeed, both Yilmazkuday (2020) and Albulescu (2020) made their research on a time period which starts the 1st of January and ends the 27th of April and the 9th of March 2020 respectively. The end of their samples corresponds to the period of the break found in our research (whereas our sample ends more than a year later) and this should be the reason for the negative relationships of corona virus on oil prices found in their research. The findings of this paper join however those of Gil-Alana and Monge (2020) and those of Rajput & al. (2020). Indeed, their research conclude on the impact of the corona virus being a shock which might be permanent and this is in accordance with our findings of a break due to the Covid-19 with permanent effects.

This research nonetheless has limits. Indeed, the same study applied with a sample ending at a later date could have different findings as the corona virus is evolving, notably with its delta variant which might have caused and might still cause considerable damage to the economy. These effects can however be limited with the expected new vaccines which are efficient whatever the mutations of the virus (Bloomberg 2021). Another limit to the research is the model used. Indeed, the VAR-X model used for this study only includes three endogenous variable and one exogenous variable. A more developed model might bring more accurate results. Therefore suggestions for further research would be to use a more specified model if not a different one and try to determine whether the delta variant has more effect than earlier versions of the corona virus or if this variant causes just a shock similar to the initial shock of the corona virus in March 2020.

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Appendix A

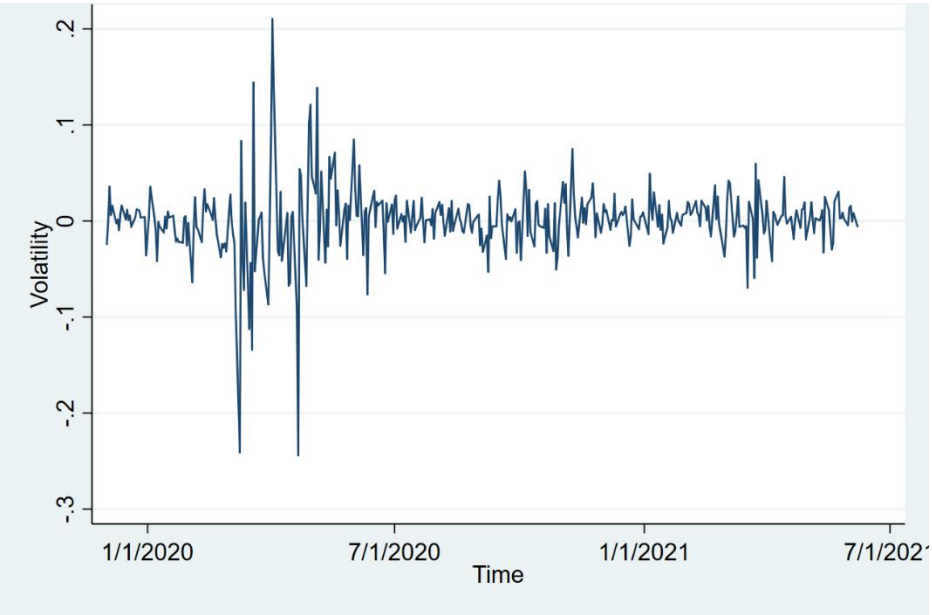
Figure 1a

Brent Crude Oil Prices Over Time

Note: This figure shows the evolution of the Brent Crude Oil Prices per day in the period between the 2nd of December 2019 and the 7th of June 2021.

Figure 1b

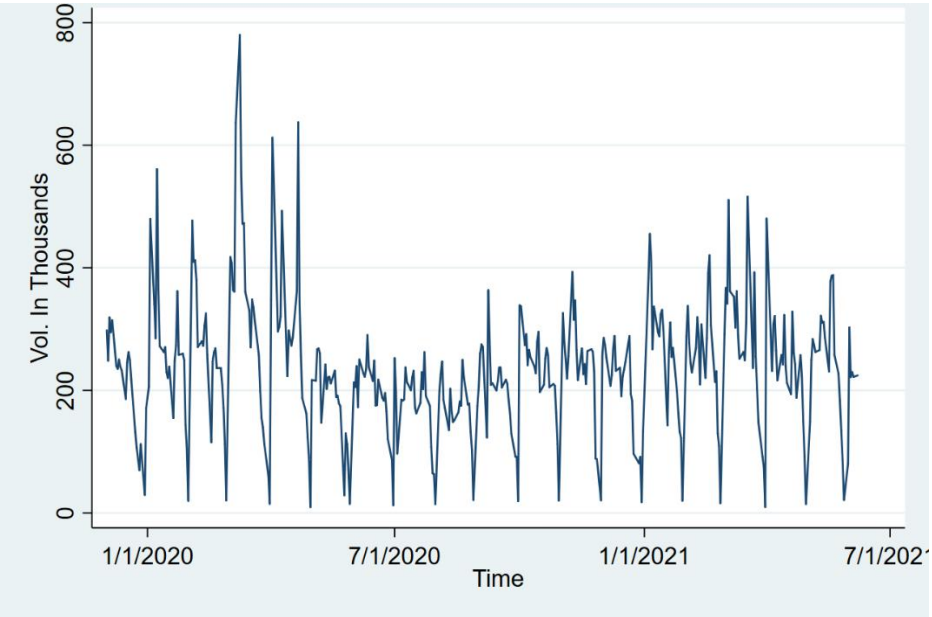
Volatility Of Brent Crude Oil Over Time



Note: This figure shows the evolution of the Brent Crude Oil Price Volatility per day in the period between the 2nd of December 2019 and the 7th of June 2021.

Figure 1c

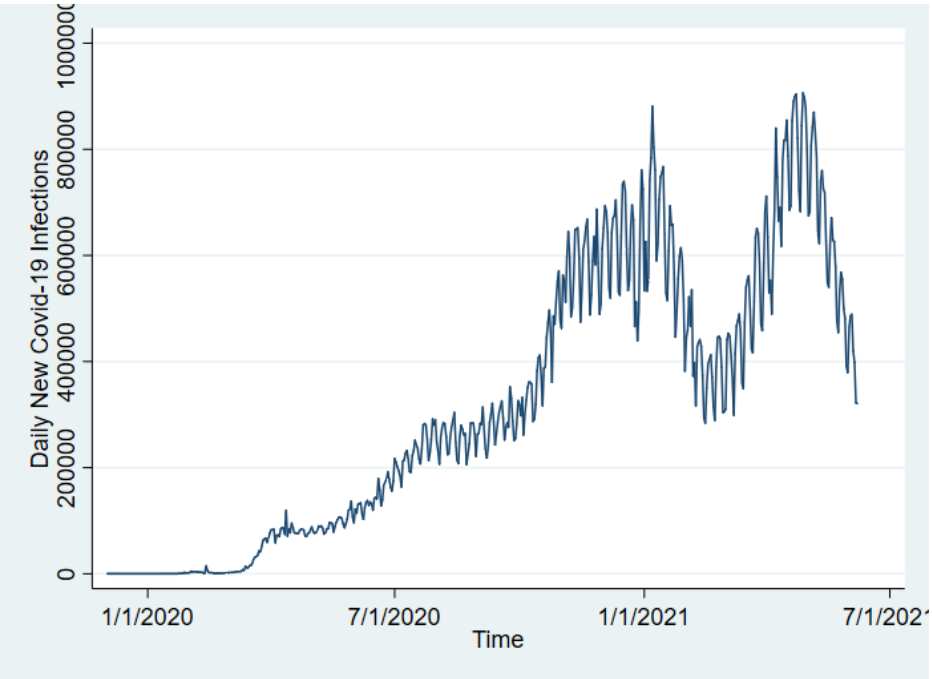
Volume In thousands Over Time



Note: This figure shows the evolution of the Brent Crude Oil Futures traded in thousands and per day in the period between the 2nd of December 2019 and the 7th of June 2021.

Figure 2

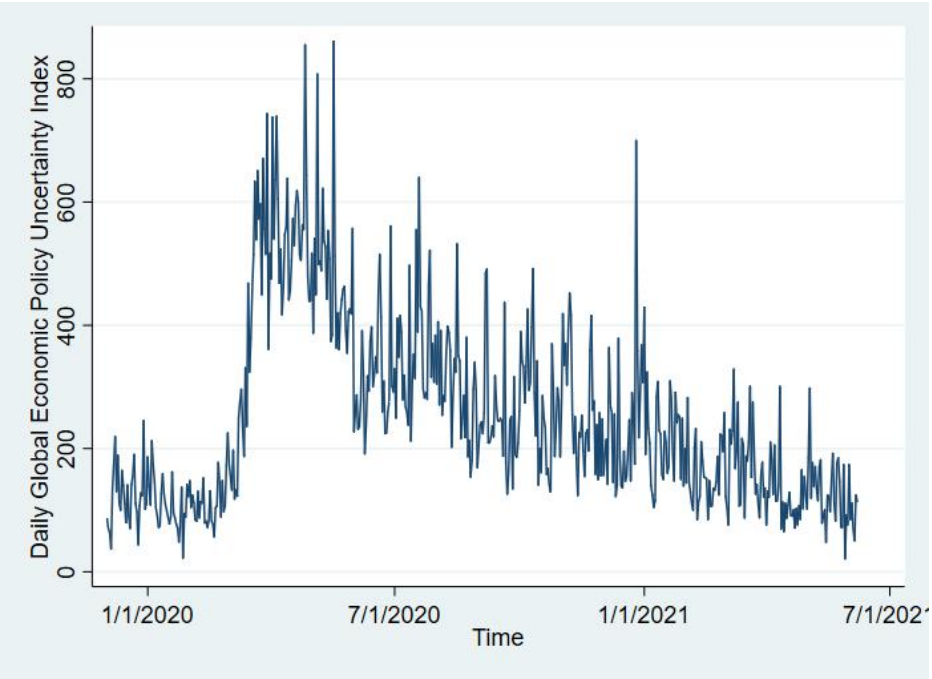
Daily New Covid-19 Cases Worldwide



Note: This figure shows the evolution of the Covid-19 daily new cases in the world in the period between the 2nd of December 2019 and the 7th of June 2021.

Figure 3

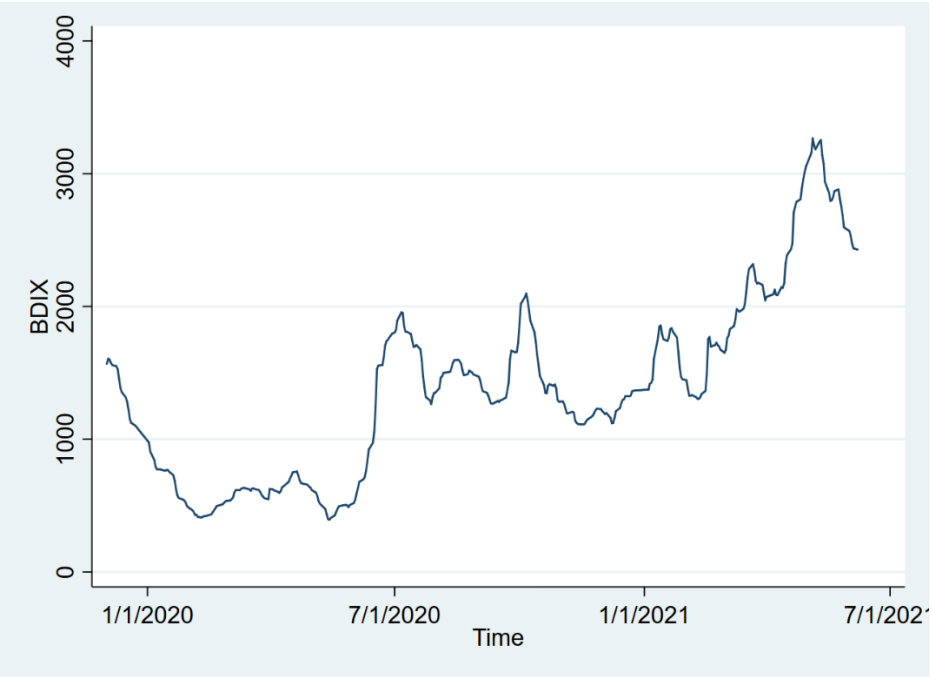
Daily Global Economic Policy Uncertainty Index



Note: This figure shows the evolution of the daily global economic policy uncertainty index as developed by Baker & al. (2016) in the period between the 2nd of December 2019 and the 7th of June 2021.

Figure 4

Daily Baltic Dry Index



Note: This figure shows the evolution of the daily Baltic Dry Index) in the period between the 2nd of December 2019 and the 7th of June 2021.

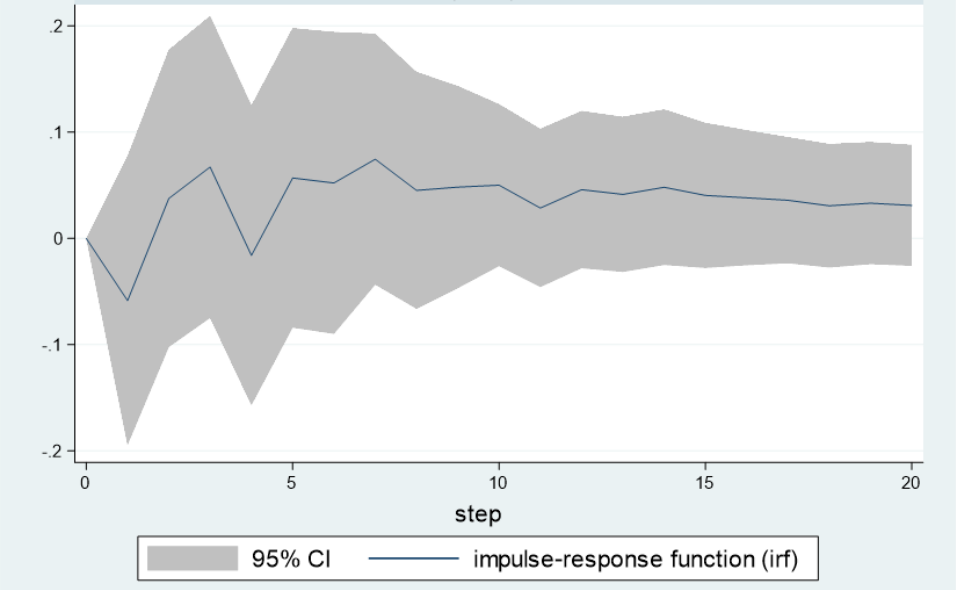
Figure 5

Lag selection based on AIC

Note: This figure shows a selection of eight lags based on the Akaike Information Criteria.

Figure 6a

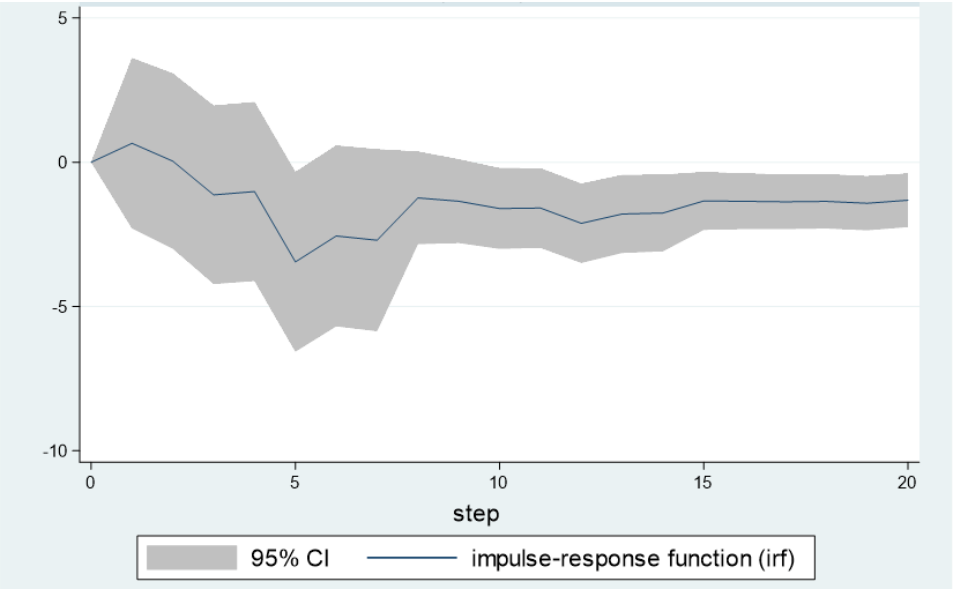
Response of the policy uncertainty to an impulse in the global economic activity



Note: This figure shows that an impulse in the global economic activity leads to a decrease in economic policy uncertainty.

Figure 6b

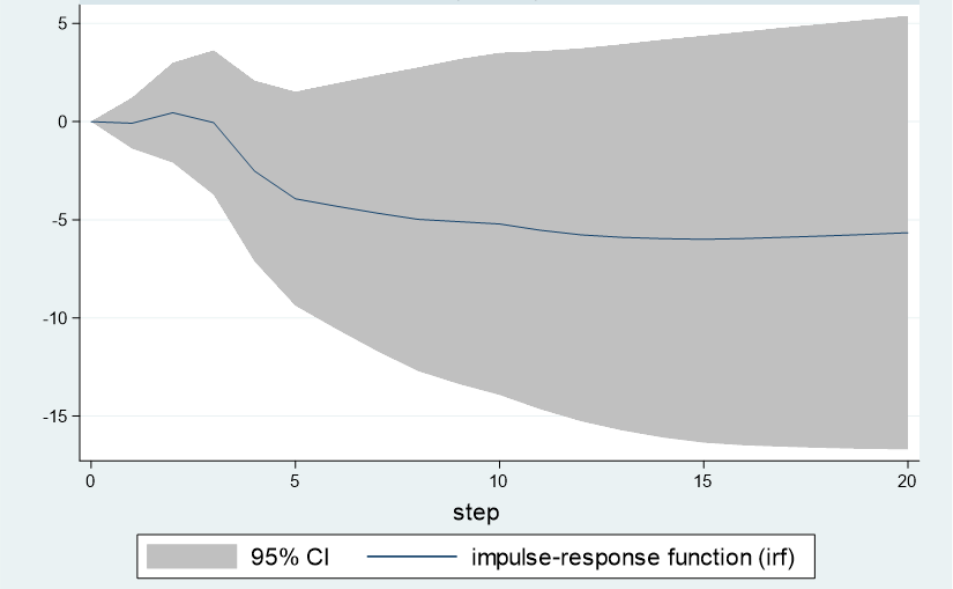
Response of the policy uncertainty to an impulse in the brent crude oil prices



Note: This figure shows that an impulse in the brent crude oil prices leads to an immediate increase in economic policy uncertainty.

Figure 6c

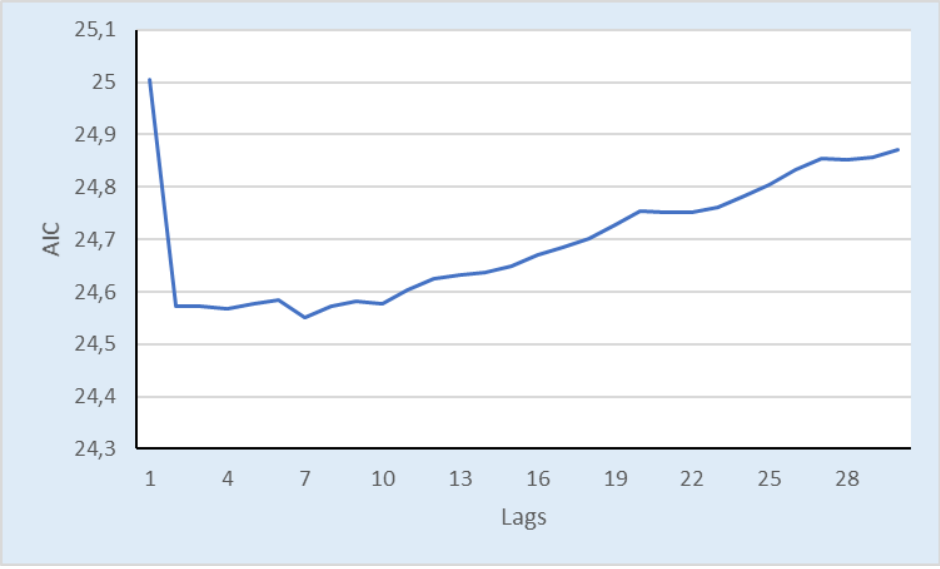
Response of the global economic activity to an impulse in the brent crude oil prices



Note: This figure shows that an impulse in the brent crude oil prices leads to a long-term decrease in global economic activity.

Figure 7

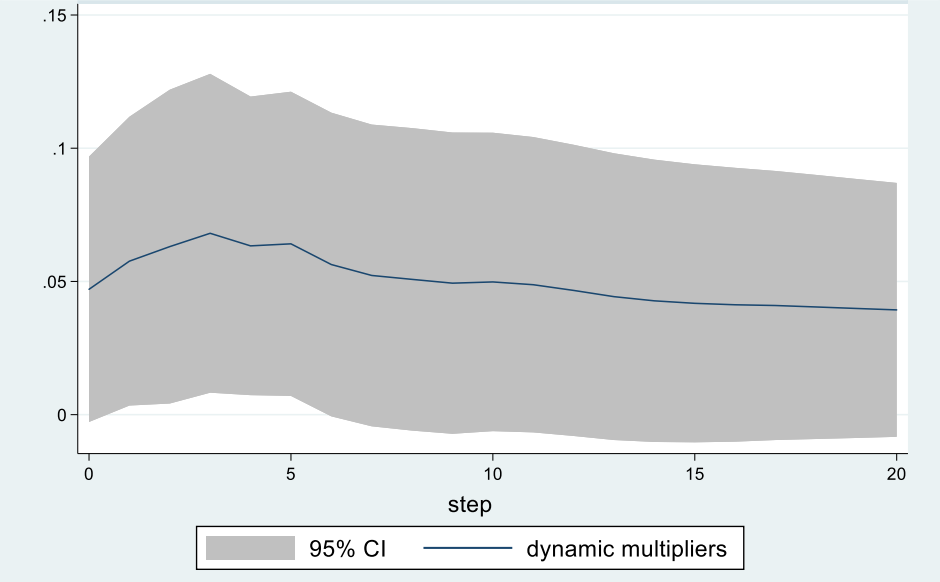
Lag selection based on AIC



Note: This figure shows a selection of seven lags based on the Akaike Information Criteria.

Figure 8a

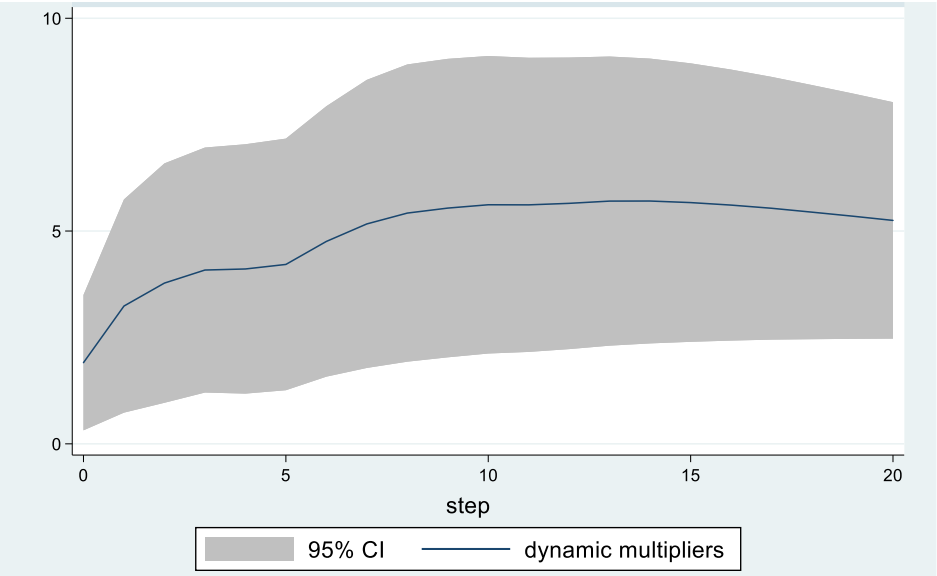
Response of the Brent Crude Oil prices to an impulse in the daily new Covid-19 cases



Note: This figure shows that an impulse in the daily new Covid-19 cases leads to an increase in the Brent Crude Oil prices.

Figure 8b

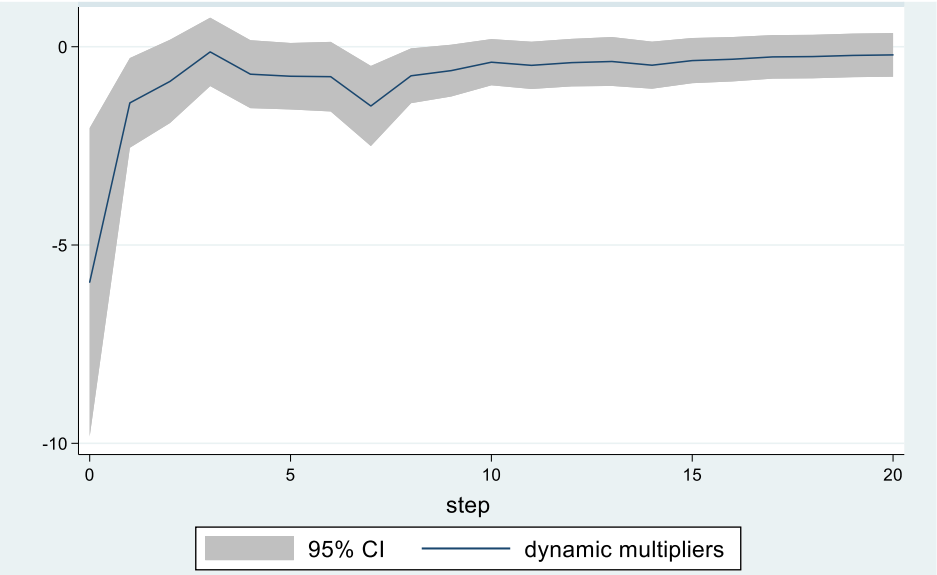
Response of the Baltic Dry Index to an impulse in the daily new Covid-19 cases



Note: This figure shows that an impulse in the daily new Covid-19 cases leads to an increase in global economic activity.

Figure 8c

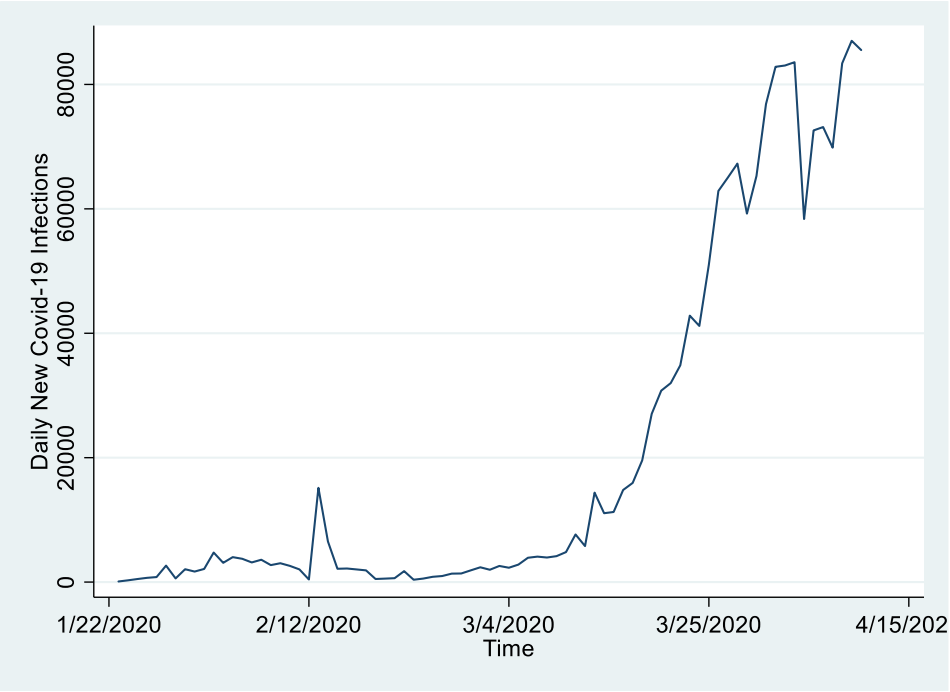
Response of the policy uncertainty to an impulse in the daily new Covid-19 cases



Note: This figure shows that an impulse in the daily new Covid-19 cases leads to a sharp decrease in global economic policy uncertainty.

Figure 9

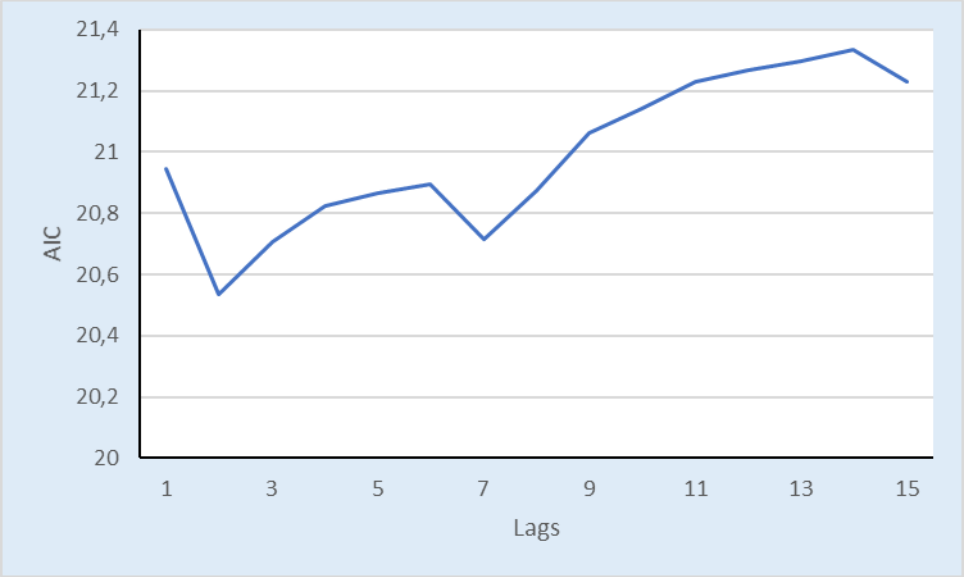
Daily new Covid-19 cases



Note: This figure shows the surge in the daily new Covid-19 cases in the period of March 2020.

Figure 10

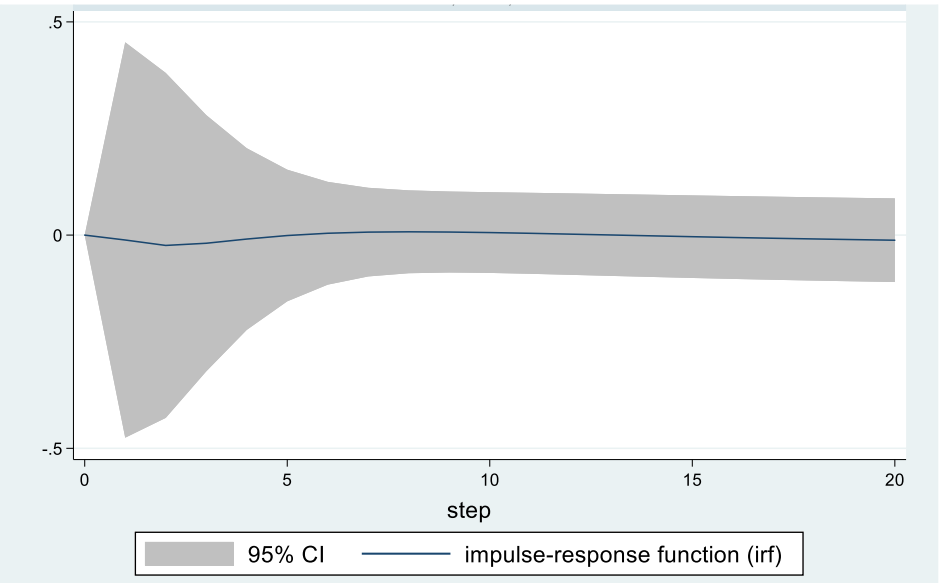
Lag selection based on AIC



Note: This figure shows a selection of two lags based on the Akaike Information Criteria.

Figure 11a

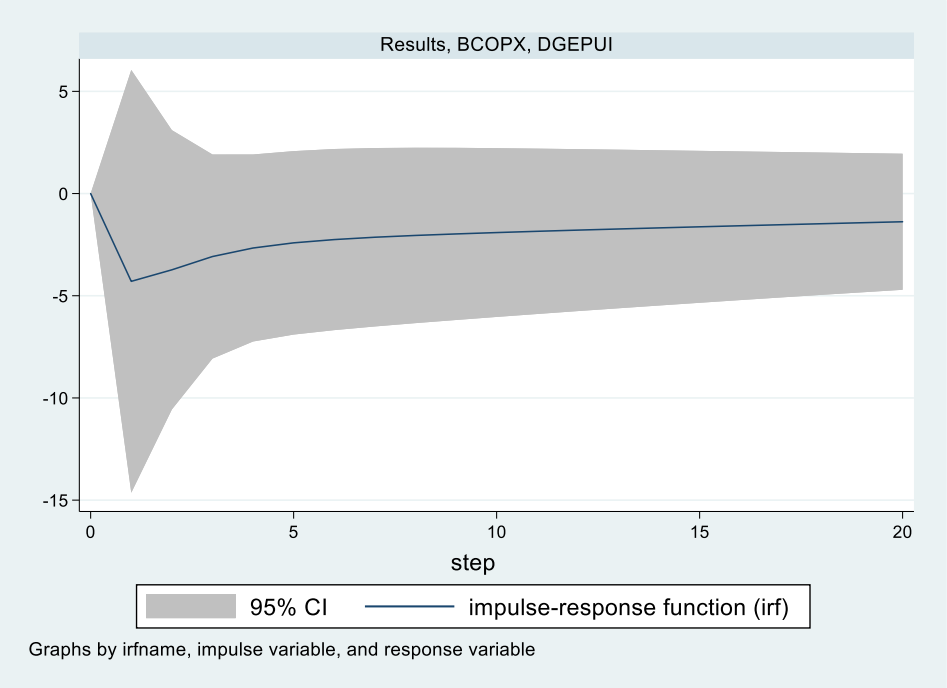
Response of the policy uncertainty to an impulse in the global economic activity



Note: This figure shows that an impulse in the global economic activity leads to a slight decrease in economic policy uncertainty.

Figure 11b

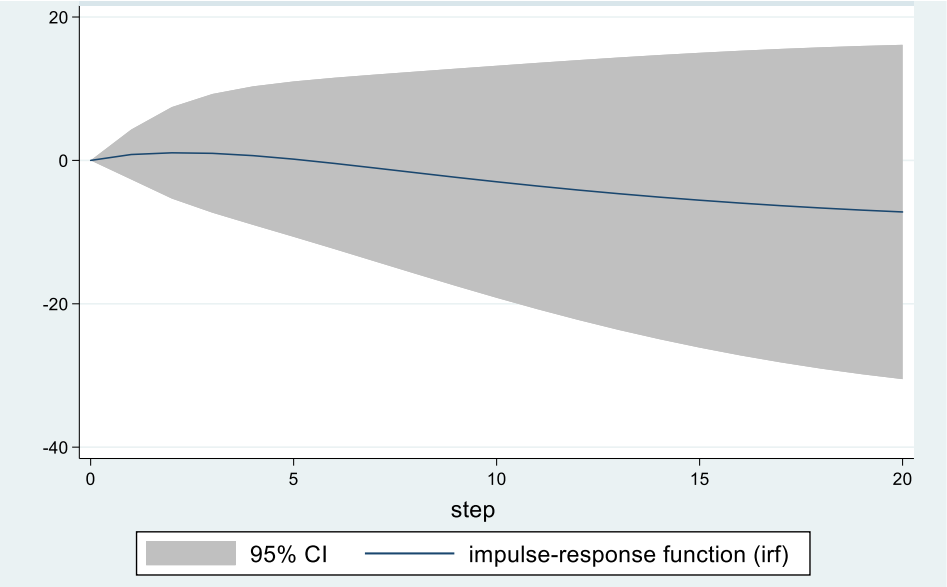
Response of the policy uncertainty to an impulse in the brent crude oil prices



Note: This figure shows that an impulse in the brent crude oil prices leads to a sharp decrease in economic policy uncertainty.

Figure 11c

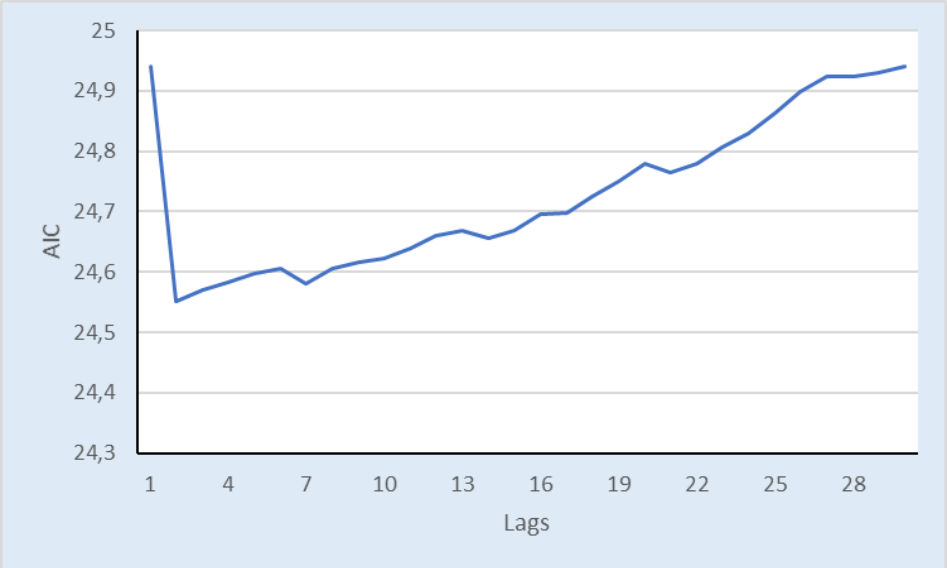
Response of the global economic activity to an impulse in the brent crude oil prices



Note: This figure shows that an impulse in the brent crude oil prices leads to a long-term decrease in global economic activity.

Figure 12

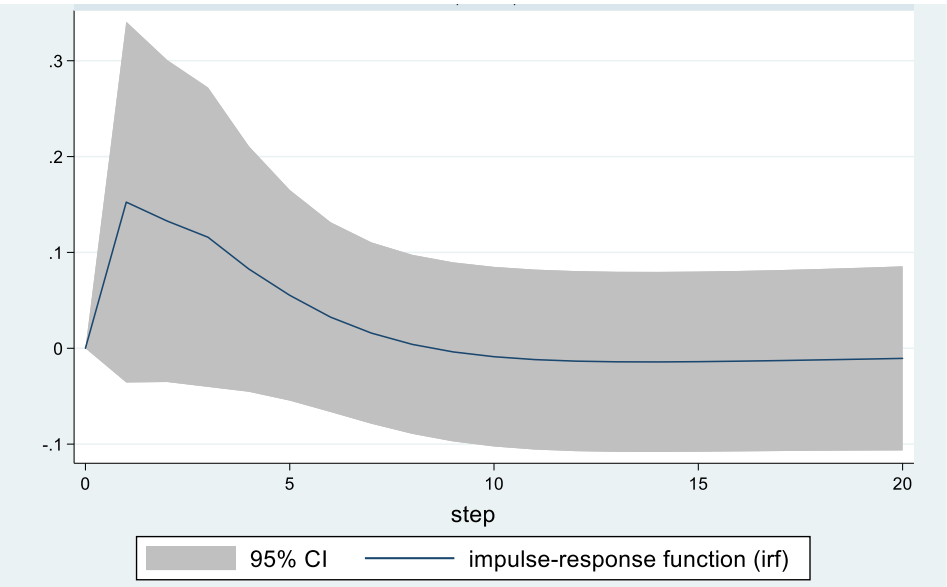
Lag selection based on AIC



Note: This figure shows a selection of two lags based on the Akaike Information Criteria.

Figure 13a

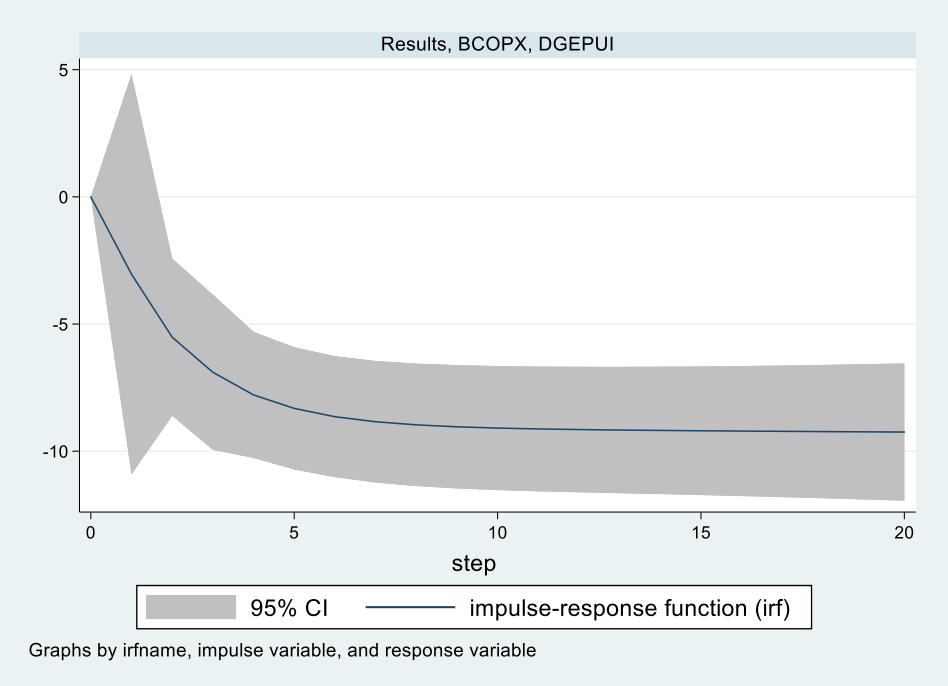
Response of the policy uncertainty to an impulse in the global economic activity



Note: This figure shows that an impulse in the global economic activity leads to a sharp increase in economic policy uncertainty.

Figure 13b

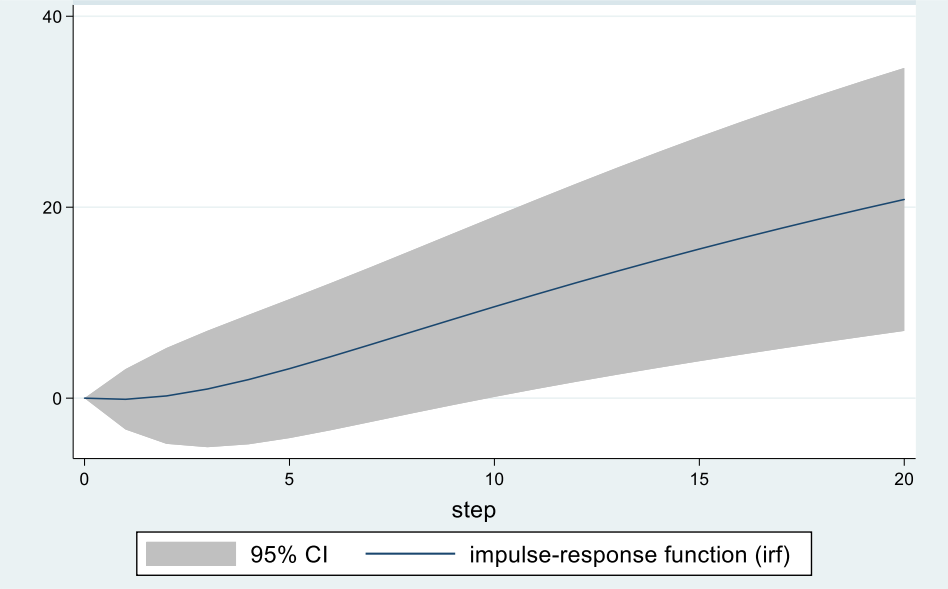
Response of the policy uncertainty to an impulse in the brent crude oil prices



Note: This figure shows that an impulse in the brent crude oil prices leads to a long-term decrease in economic policy uncertainty.

Figure 13c

Response of the global economic activity to an impulse in the brent crude oil prices



Note: This figure shows that an impulse in the brent crude oil prices leads to a long-term increase in global economic activity.

Appendix B

Table 1

Descriptive statistics

	BCOP	Covid-19	BDI	DGEPUI
Observations	554	554	554	554
Mean	50.3	312556.2	1382.169	252.226
Standard Deviation	13.232	256936.2	50.3	153.932

Notes: (i) BCOP stands for Brent Crude Oil Prices, (ii) Covid-19 represents the daily new cases of coronavirus infections worldwide, (iii) DGEPUI refers to the daily global economic policy uncertainty index, (iv) BDI represents the daily Baltic Dry Index, (v) all numbers are rounded to three decimals.

Table 2

Augmented Dickey-Fuller test for stationarity

	Test Statistic	Interpolated Dickey-Fuller		
		1% Critical Value	5% Critical Value	10% Critical Value
BCOP	-1.757	-3.430	-2.860	-2.570
BDI	-0.797	-3.430	-2.860	-2.570
DGEPUI	-22.221***	-3.430	-2.860	-2.570
BCOP_d1	-31.670***	-3.430	-2.860	-2.570
BDI_d1	-15.752***	-3.430	-2.860	-2.570

Notes: (i) ***, ** and * means significance at 1%, 5% and 10%, (ii) BCOP stands for Brent Crude Oil Prices, (iii) DGEPUI refers to the daily global economic policy uncertainty index, (iv) BDI represents the daily Baltic Dry Index, (v) BCOP_d1 represents the one time differentiated BCOP time series, (vi) BDI_d1 represents the one time differentiated BDI time series, (vii) all numbers are rounded to three decimals.

Table 3

Augmented Dickey-Fuller test for stationarity

	Test Statistic	Interpolated Dickey-Fuller		
		1% Critical Value	5% Critical Value	10% Critical Value
BCOP	-0.415	-3.430	-2.860	-2.570
BDI	0.095	-3.430	-2.860	-2.570
DGEPUI	-8.134***	-3.430	-2.860	-2.570
DNCDX	-2.450	-3.430	-2.860	-2.570
BCOP_d1	-20.324***	-3.430	-2.860	-2.570
BDI_d1	-12.153***	-3.430	-2.860	-2.570
DNCDX_d1	-19.969***	-3.430	-2.860	-2.570

Notes: (i) ***, ** and * means significance at 1%, 5% and 10%, (ii) BCOP stands for Brent Crude Oil Prices, (iii) DGEPUI refers to the daily global economic policy uncertainty index, (iv) BDI represents the daily Baltic Dry Index, (v) BCOP_d1 represents the one time differentiated BCOP time series, (vi) BDI_d1 represents the one time differentiated BDI time series, (vii) DNCDX represents the daily new Covid-19 cases divided by hundred thousand, (viii) DNCDX_d1 represents the one time differentiated DNCDX time series, (ix) all numbers are rounded to three decimals.

Table 4

Results from the VAR-X model between the 1st of December 2019 and the 7th of June 2021

		BCOP	BDI	DGEPUI
DNCDX		0.047*	1.908**	-5.937***
		[0.025]	[0.811]	[1.983]
BCOP	L1	1.106***	0.617	-4.409
		[0.043]	[1.360]	[3.323]
	L2	-0.006	-1.568	0.288
		[0.064]	[2.031]	[4.964]

	L3	-0.091	0.413	7.528
		[0.063]	[2.024]	[4.946]
	L4	-0.097	-0.418	-8.009
		[0.064]	[2.027]	[4.954]
	L5	0.124*	2.280	-1.071
		[0.064]	[2.028]	[4.957]
	L6	-0.007	-0.636	-1.170
		[0.064]	[2.031]	[4.964]
	L7	-0.028	-0.850	3.798
		[0.043]	[1.367]	[3.342]
BDI	L1	0.001	1.597***	0.144
		[0.001]	[0.042]	[0.103]
	L2	-0.001	-0.729***	0.017
		[0.003]	[0.080]	[0.195]
	L3	0.000	0.146*	-0.105
		[0.003]	[0.085]	[0.209]
	L4	0.000	0.033	-0.088
		[0.003]	[0.086]	[0.209]
	L5	-0.001	-0.066	0.020
		[0.003]	[0.085]	[0.208]
	L6	-0.002	0.171**	0.068
		[0.003]	[0.079]	[0.194]
	L7	0.003*	-0.160***	-0.032
		[0.001]	[0.042]	[0.103]
DGEPUI	L1	-0.000	-0.027	0.250***
		[0.001]	[0.017]	[0.042]

L2	0.000	0.000	0.131***
	[0.001]	[0.018]	[0.043]
L3	-0.000	-0.024	0.037
	[0.001]	[0.018]	[0.044]
L4	0.001	0.030*	0.069
	[0.001]	[0.018]	[0.043]
L5	0.000	-0.010	0.024
	[0.001]	[0.018]	[0.043]
L6	0.001	-0.023	0.019
	[0.001]	[0.018]	[0.043]
L7	0.000	0.027	0.181***
	[0.001]	[0.017]	[0.041]

Notes: (i) ***, ** and * means significance at 1%, 5% and 10%, (ii) BCOP stands for Brent Crude Oil Prices, (iii) DGEPUI refers to the daily global economic policy uncertainty index, (iv) BDI represents the daily Baltic Dry Index, (v) DNCDX represents the daily new Covid-19 cases divided by hundred thousand, (vi) L1 to L7 represent the seven lags of the endogenous variables, (vii) all numbers are rounded to three decimals.

Table 5

Wald test for single structural break with unknown date

	Model 1 BCOP regressed on BDI	Model 2 BCOP regressed on DNCDX	Model 3 BCOP regressed on BDI and DGEPUI	Model 4 BCOP regressed on BDI and DNCDX
Estimated break date	6th March 2020	7th March 2020	5th March 2020	7th March 2020
Supremum Wald test statistic	806.961***	652.330***	289.758***	1102.992***

Notes: (i) ***, ** and * means significance at 1%, 5% and 10%, (ii) BCOP stands for Brent Crude Oil Prices, (iii) DGEPUI refers to the daily global economic policy uncertainty index, (iv) BDI represents the daily Baltic Dry

Index, (v) DNCDX represents the daily new Covid-19 cases divided by hundred thousand, (vi) all numbers are rounded to three decimals.

Table 6

Augmented Dickey-Fuller test for stationarity

	Test Statistic	Interpolated Dickey-Fuller		
		1% Critical Value	5% Critical Value	10% Critical Value
BCOP	0.480	-3.520	-2.896	-2.583
BDI	-4.045***	-3.520	-2.896	-2.583
DGEPUI	-6.434***	-3.520	-2.896	-2.583
BCOP_d1	-6.600***	-3.520	-2.896	-2.583

Notes: (i) ***, ** and * means significance at 1%, 5% and 10%, (ii) BCOP stands for Brent Crude Oil Prices, (iii) DGEPUI refers to the daily global economic policy uncertainty index, (iv) BDI represents the daily Baltic Dry Index, (v) BCOP_d1 represents the one-time differentiated BCOP time series, (vi) all numbers are rounded to three decimals.

Table 7

Results from the VAR model between the 1st of December 2019 and the 4th of March 2020

		BCOP	BDI	DGEPUI
BCOP	L1	1.259***	0.824	-4.295
		[0.097]	[1.776]	[5.276]
	L2	-0.286***	-1.148	3.031
		[0.096]	[1.748]	[5.193]
BDI	L1	0.009**	1.519***	-0.012
		[0.004]	[0.080]	[0.237]
	L2	-0.008*	-0.531***	0.037
		[0.004]	[0.079]	[0.235]

DGEPUI	L1	-0.000	0.019	0.313***
		[0.002]	[0.036]	[0.106]
	L2	-0.002	-0.060*	0.031
		[0.002]	[0.035]	[0.104]

Notes: (i) ***, ** and * means significance at 1%, 5% and 10%, (ii) BCOP stands for Brent Crude Oil Prices, (iii) DGEPUI refers to the daily global economic policy uncertainty index, (iv) BDI represents the daily Baltic Dry Index, (v) L1 and L2 represent the two lags of the endogenous variables, (vi) all numbers are rounded to three decimals.

Table 8

Augmented Dickey-Fuller test for stationarity

	Test Statistic	Interpolated Dickey-Fuller		
		1% Critical Value	5% Critical Value	10% Critical Value
BCOP	-0.070	-3.444	-2.872	-2.570
BDI	-0.645	-3.444	-2.872	-2.570
DGEPUI	-7.979***	-3.444	-2.872	-2.570
BCOP_d1	-20.567***	-3.444	-2.872	-2.570
BDI_d1	-11.224***	-3.444	-2.872	-2.570

Notes: (i) ***, ** and * means significance at 1%, 5% and 10%, (ii) BCOP stands for Brent Crude Oil Prices, (iii) DGEPUI refers to the daily global economic policy uncertainty index, (iv) BDI represents the daily Baltic Dry Index, (v) BCOP_d1 represents the one-time differentiated BCOP time series, (vi) BDI_d1 represents the one time differentiated BDI time series, (vii) all numbers are rounded to three decimals.

Table 9

Results from the VAR model between the 1st of December 2019 and the 4th of March 2020

	BCOP	BDI	DGEPUI

BCOP	L1	1.023***	-0.120	-3.040
		[0.046]	[1.614]	[4.013]
	L2	-0.026	0.420	-1.412
		[0.047]	[1.634]	[4.063]
BDI	L1	0.001	1.546***	0.153
		[0.001]	[0.039]	[0.096]
	L2	-0.001	-0.560***	-0.149
		[0.001]	[0.038]	[0.095]
DGEPUI	L1	-0.001	-0.040**	0.321***
		[0.001]	[0.018]	[0.046]
	L2	0.001	-0.001	0.205***
		[0.001]	[0.018]	[0.046]

Notes: (i) ***, ** and * means significance at 1%, 5% and 10%, (ii) BCOP stands for Brent Crude Oil Prices, (iii) DGEPUI refers to the daily global economic policy uncertainty index, (iv) BDI represents the daily Baltic Dry Index, (v) L1 and L2 represent the two lags of the endogenous variables, (vi) all numbers are rounded to three decimals.