

Investigation of the Relationship Between Brent Oil and Cryptocurrencies During the COVID-19 Pandemic Period

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ABSTRACT

The function of money plays an essential and indisputable role in developing trade. Typically, banknotes and coins are usually introduced by central authorities. However, Bitcoin, which emerged after the 2008 crisis, was considered the original cryptocurrency and contributed to money in an unprecedented dimension as it is the first decentralized peer-to-peer payment network. Cryptocurrencies are in constant interaction and have a casualty relationship, among other variables, with Brent Oil. This study attempts to investigate the relationship between Bitcoin, Ethereum and Brent Oil price movements using 210 daily data extractions between 10.12.2019 and 01.10.2020, featuring the period of the start and spread of the COVID-19 pandemic. In this study, the casualty relationship among Brent Oil, Bitcoin and Ethereum was examined with the Granger Causality test. As a result of the study, a bidirectional casualty relationship was determined between Brent Oil and Ethereum. However, a one-way causality relationship was also found between Brent Oil and Bitcoin. On the other hand, there is no causality relationship between Ethereum and Bitcoin.

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1. INTRODUCTION

With the emergence of humanity, the need for consumption, production and trade (shopping) has also emerged. People's consumption and production predate trade, with the need for shopping arising over time. Although people first realized exchange transactions with barter, complexities led people to use a standard exchange variable. In history, animals, wheat and barley were used as a means of exchange for the first time, and then these products were replaced by precious metals such as silver, copper and iron. With the introduction of gold money, gold and coins became widespread in trade. Due to the security problems of its storage, gold and coins were abandoned, and leather money, the first documented type of banknote, was invented. With the development and globalization of the world, this type of money has left its place to paper money, which is lighter and more practical. However, with the acceleration of technology and trade, this development was also insufficient. As needs and habits changed over time, cash has started being replaced by digital currencies. Today, the last conception of money is crypto money. As Karadağ and Aymelek (2019) put forward, one of the most crucial turning points in the history of money was experienced during the 2008 financial crisis. With this crisis,

global companies came to the point of bankruptcy. The cost incurred for rescuing these companies with the help of states has now been placed on people's shoulders. During this process, cryptocurrencies have emerged as traditional coins have somehow started losing their reputation.

On the other hand, petroleum is today amongst the most essential raw materials and has become of indispensable importance in commercial life. Apart from commercial uses, it is among the most valuable energy sources. In addition to being used as raw material, it is also used in production and logistics. Since it can affect other markets, movements in oil prices draw considerable attention. As indicated by Kılıç (2017: 67), the most crucial feature that distinguishes Brent Petrol from other oils is its low production and logistics costs. However, oil moving westward from Europe, Africa and the Middle East is priced according to the Brent Oil price. Thanks to this feature, Brent Petrol is regarded as an international indicator.

In this study, the relationship between cryptocurrencies expressed as the money of the future, and Brent oil, which has experienced the worst price level in the last 30 years, will be examined. The selected period between 10.12.2019 and 01.10.2020 chosen for analysis enables us to reveal the price relationship for the period marked by the COVID-19 pandemic.

2. LITERATURE REVIEW

Explaining the relationship between oil prices and macroeconomic indicators has gained importance, especially since the 1972 and 1979 oil crises. In that regard, researches by Hamilton (1983) and Trehan (1986) appear to be among the first renowned studies, with the research by Papapetrou (2001) also being a frequently cited study in the literature. Hamilton (1983) and Papapetrou (2001) focused on the relationship between oil, unemployment and gross national product. On the other hand, Trehan (1986), followed by other researchers such as Fratzscher et al. (2014), Babatunde (2015), Arfaoui and Rejeb (2017), Delgado (2018), and Liu et al. (2020), focused on the interaction between exchange rates and oil.

Another section of research on oil (for example, Arfaoui and Rejeb, 2017; Yun and Yoon, 2019; Corbet et al., 2020b) focused on examining its relationship with stocks. Another set of studies on oil is about the effect of COVID-19 on the price of oil. For instance, Sansa (2020) found that oil prices were negatively affected by the number of COVID-19 cases and the COVID-19 outbreak.

There are frequently cited studies in the literature on oil within the context of Turkey. Some of these studies (Abdioğlu & Değirmenci, 2014; Eyüboğlu & Eyüboğlu, 2016; İşcan, 2010; Kapusuzoğlu, 2011) focused on measuring the relationship of oil prices with stock prices. Furthermore, another part of the researches probed the relationship between oil and BIST indices (Timur and Günay, 2019; Kiracı, 2020). Finally, another group of studies examined the relationship among COVID-19, gold and oil (Sarı and Kartal, 2020; Gülhan, 2020; Çevik et al., 2020).

On the other hand, studies on cryptocurrencies have started to appear in the literature following the article by Satoshi Nakamoto titled "Bitcoin: A Peer-To-Peer Electronic Cash System" in 2008. Since then, cryptocurrencies have taken up their share in econometric studies alongside domestic and foreign currencies. Similar studies using exchange rates have been performed this time by using cryptocurrencies.

In general, a significant part of the studies regarding cryptocurrencies (Eswara, 2017; Miglietti et al., 2019; Yarovaya et al., 2020) focused on exchange rates. Another vital part of the studies on cryptocurrencies (Kostika and Laopodis, 2019; Maghyereh and Abdoh, 2021; Conlon et al., 2020; Lahmiri and Bekiros, 2020; Caferra and Vidal-Tomas, 2021; Kjaerland et al., 2018) examined the relationship between cryptocurrencies, stocks and stock market performance. Another brand of studies (for example, Burggraf et al., 2020; Ghorbel and Jeribi, 2020) probed the interaction between cryptocurrencies and fear indices. Some other studies, such as Corbet et al. (2020a), James et al. (2020) and Mnif et al. (2020), investigate the effect of COVID-19 on cryptocurrencies. Finally, there are researches on cryptocurrencies (for example, Derbali et al., 2020; Yin et al., 2021; Ghazani and Khosravi, 2020; Nunes, 2017; Ji et al., 2019) that have focused on oil and gold.

When it comes to the research in Turkey, an essential part of the studies on cryptocurrencies in Turkey (Yıldırım, 2018; Kamisli, 2019; Pirgaip et al., 2019; Aghalibaylı, 2019; Gürsoy, Tunçel and Sayar, 2020; Gül, 2020; Deniz and Teker, 2019; Deniz and Teker, 2020; Deniz, 2020) focused on the interaction between cryptocurrencies and gold. Another group of studies (Dirican and Canoz, 2017; Hamid and Talib, 2019; Erdas and Çağlar, 2018; Gürsoy, Tunçel and Sayar, 2020) examined the relationship between cryptocurrencies and indices. There are studies (for example, Ağan and Aydın, 2018; Özyeşil, 2019; Çakın, 2019; Dere, 2019; Aghalibaylı, 2019 and Gül, 2020) focusing on cryptocurrencies and exchange rates. The relationship between cryptocurrencies and Brent oil has been the subject of a limited number of studies by Gül (2020), Deniz and Teker (2019), Deniz and Teker (2020), and Deniz (2020).

Using daily data between 7 August 2015 and 23 January 2020, Gül (2020) evaluated the effect of adding selected cryptocurrencies (Bitcoin, Ethereum, Ripple) into portfolios with several assets, including Brent oil. The study results revealed that with the addition of cryptocurrencies to portfolios, overall higher returns were obtained, and lower risk levels were achieved.

Deniz and Teker (2019), by using daily data between the period of 28.04.2013 and 23.07.2019, aimed at identifying the interaction between Bitcoin, Brent oil and gold. According to their results, gold and Brent oil prices do not substantially affect daily Bitcoin prices. In their later study and using a daily database between 3 April 2018 to 31 December 2019, Deniz and Teker (2020) included two more cryptocurrencies, namely Ethereum and Ripple, together with Bitcoin in their analysis. The analysis revealed that only Bitcoin has a short term impact on gold prices. Furthermore, no causality was found between Ethereum, Ripple, gold and Brent oil.

In her Masters Dissertation, Deniz (2020), using the same period as Deniz and Teker (2020), but widening the scope of cryptocurrencies by employing seven types (Bitcoin, Ethereum, Ripple, Tether, Bitcoin Cash, Bitcoin S.V. and Litecoin), searched for the price relationship

between gold, Brent oil and the selected seven cryptocurrencies with high market values. The same results were confirmed here, with only Bitcoin having a short term impact on gold prices.

As the novel virus in Wuhan, China, was discovered in December 2019, studies mentioned above by Deniz and Teker (2019), Deniz and Teker (2020) and Deniz (2020) do not cover the COVID-19 epidemic period in analyzing the interaction between cryptocurrencies and Brent oil. Therefore, in the current study, daily data between 10 December 2019 and 1 October 2020 were examined to explore the relationship between cryptocurrencies and Brent oil during the spreading stage of the pandemic. Furthermore, since both Bitcoin and Ethereum single themselves out in terms of market capitalization, they are the cryptocurrencies selected to be included in the analysis of the current study.

3. DATA SOURCES AND RESEARCH METHODS

While selecting the data for the analysis, the period between 10.12.2019 and 01.10.2020 was taken as a basis, imminently covering the date of 31.12.2019, when pneumonia cases of unknown cause were first reported by China (Budak and Korkmaz, 2020). Hence, the selected period features well the time when Covid-19 disease started to spread globally. Analysis was carried out using a total of 210 daily data extractions. The data for the three variables, Bitcoin, Ethereum, and Brent petroleum, used in the analysis were taken from the website www.tr.investing.com.

In the current study, as the first step, the Phillips-Perron and Augmented Dickey-Fuller unit root tests were conducted to see whether the series are stationary. As the series turned out to be nonstationary at the level, the same tests were then used on the logarithmically first differenced variables. Finally, as the series became stationary at the integrated level of 1, the Johansen cointegration test was used to decide whether there was a long-run relationship between the series. As for identifying the casualty relationship, the Granger causality test was chosen as it is amongst the widely used causality tests in the literature.

4. RESULTS AND INTERPRETATION

Prior to analyzing time series, the Phillips-Perron (P.P.) and Augmented Dickey-Fuller (ADF) unit root tests were conducted to see whether the series were stationary. As reported in the top part of Table.1, the levels of the series are nonstationary.

Table 1: Unit Root Test Results

-----	Variables	ADF		PP	
		<i>t</i> -statistics	Probability	<i>t</i> -statistics	Probability
<i>Level</i>	Brent	-1.120071	0.9223	-1.294625	0.8864
	Bitcoin	-2.444997	0.3553	-2.396530	0.3803
	Ethereum	-2.144194	0.5177	-2.144194	0.5177
<i>Logarithmic difference</i>	Brent	-12.42934	0.0000*	-12.45607	0.0000*
	Bitcoin	-17.85550	0.0000*	-17.58353	0.0000*
	Ethereum	-17.58892	0.0000*	-17.28879	0.0000*

Then, the logarithmically first differenced series was created, and the analysis was repeated. As reported in the bottom part of Table.1, after taking their first differences, all series now became stationary, as they are integrated of order 1.

Consequently, the cointegration relationship is explored to see whether there is a long-run or equilibrium relationship between Brent oil and Cryptocurrencies. The Johansen Cointegration Test is run in this study, and the results are reported in Table.2.

Table 2: Johansen Cointegration Test

	Eigenvalue	Trace statistic	0.05 Critical Value	Probability
Zero*	0.240308	131.2328	24.27596	0.0001
At most 1*	0.203082	74.88998	12.32090	0.0000
At most 2*	0.12174	28.35423	4.129906	0.0000

As appears in Table.2, both Trace statistics and Max-Eigen statistics were less than the critical value at the 5% significance level in three models, leading to the rejection of the null hypothesis of no causality between Brent oil and cryptocurrencies. The test, therefore, reveals the existence of three cointegration relationships between Brent oil and Cryptocurrencies. In other words, the variables move together in the long run. Therefore, the Granger Causality test was used as the next step to explore the (Granger) causality relationships between the variables. For this

purpose, the appropriate Vector Autoregression (VAR) model was established, and the maximum number of lags was determined as 3. The test results are provided in Tables 3, 4, and 5.

Table 3: Dependent Variable: Brent oil

Independent variables	Chi-sq	df	Probability	relation
Bitcoin	4.265841	3	0.2342	none
Ethereum	8.011019	3	0.0458	available
ALL	17.73848	6	0.0069	significant

Before reporting the results of the Granger Causality tests, it should be noted that, as Brooks (2008) indicates, the word 'causality' is somewhat of a misnomer, for Granger-causality really means only a correlation between the current value of one variable and the past values of others; it does not mean that movements of one variable cause movements of another. Table 3 reports the model where Brent Petrol is picked as the dependent variable; A (Granger) causality relationship was found between Brent Petrol and Ethereum at the 5% significance level. On the other hand, it appears that Bitcoin does not affect Brent Petrol. The model where Bitcoin is taken as the dependent variable is reported in Table 4.

Table 4: Dependent Variable: Bitcoin

Independent variables	Chi-sq	df	Probability	Relation
Brent	19.23048	3	0.0002	available
Ethereum	0.734533	3	0.8651	none
ALL	19.52948	6	0.0034	significant

As shown in Table.2, Brent Petrol (Granger) causes Bitcoin prices at the 5% significance level. On the other hand, Ethereum does not (Granger) cause Bitcoin prices. Finally, in the last model reported in Table 5, Ethereum is used as the dependent variable.

Table 5: Dependent Variable: Ethereum

Independent variables	Chi-sq	df	Probability	Relation
Brent	14.34224	3	0.0025	available
Bitcoin	5.685076	3	0.1280	none
ALL	21.14453	6	0.0017	significant

According to the results reported in the Table, Brent Petrol (Granger) causes Ethereum prices, whereas Bitcoin does (Granger) cause Ethereum.

The study's overall findings could be succinctly summarized as in Figure.1.

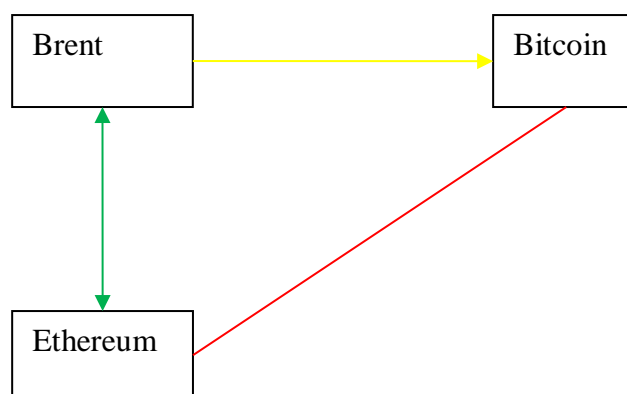


Figure 1: (Granger) Causality Flows

As seen from Figure 1, there is a bi-directional (Granger) causality between Brent Petrol and Ethereum during the Pandemic period. Moreover, (Granger) causality relationship between Brent Petrol and Bitcoin is one way, from Brent petrol to Bitcoin. Finally, Bitcoin and Ethereum are independent of each other, with no (Granger) causality.

5. CONCLUSIONS

The current research attempts to determine the relationship between Bitcoin, Ethereum and Brent Oil price movements during the pandemic. First, the VAR model was used to investigate the relationship between Brent oil, Bitcoin and Ethereum using 210 daily data from 20.12.2019 to 01.10.2020. Then, the direction of the relationship between the variables was determined by the Granger causality test.

As discussed in the literature review, a limited number of studies are available exploring the causality between cryptocurrencies and Brent oil. The results of those studies indicated that Brent oil has no causality relationship with Bitcoin (Deniz, 2020; Deniz and Teker, 2019; and Deniz and Teker, 2020) and Ethereum (Deniz, 2020; and Deniz and Teker, 2020). However, the findings of this analysis reveal that Brent Petrol has the power to (Granger) cause Bitcoin prices. Another finding of the current study is that Ethereum and Bitcoin prices move independently of each other as there is no (Granger) causality relationship between Ethereum and Bitcoin.

Finally, bidirectional (Granger) causality was found between Brent Petrol and Ethereum. Overall, those causality relationships sound relatively plausible. The global oil market is the most important world energy market because of oil's dominant role as an energy source (Ural, 2006). Therefore, movements in the Brent oil prices appearing to lead those of Bitcoin and Ethereum seem worthy of acceptance. On the other hand, of the two cryptocurrencies covered in the analysis, changes in Ethereum prices, not Bitcoin prices, precede changes in Brent oil prices. This finding seems surprising as Bitcoin has the most name recognition in the markets and has more than twice the market capitalization value of Ethereum. The fact that Ethereum has the potential to revolutionize finance and technology and the bullish sentiment among experts in the field appears to have only grown in 2020 for Ethereum (Divine, 2021) might explain the pioneering role Ethereum takes over in preceding the Brent oil price movements.

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