JOEEP

Journal Homepage: http://dergipark.org.tr/joeep

Araştırma Makalesi ● Research Article

Volatility and the Day of the Week Effect on Bitcoin Returns

Bitcoin Getirileri Üzerinde Haftanın Günü ve Oynaklık Etkisi

Ayhan Orhan[a], Murat Emikönel[b,*] & Melek Emikönel[c]

[a] Prof. Dr., Kocaeli Üniversitesi, İİBF, İktisat Bölümü, 41350, Kocaeli/Türkiye
ORCID: 0000-0002-8109-4306
[b] Arş. Gör., Kocaeli Üniversitesi, İİBF, İktisat Bölümü, 41350, Kocaeli/Türkiye
ORCID: 0000-0002-8415-0510
[c] Yüksek Lisans Öğrencisi, Kocaeli Üniversitesi, İİBF, İktisat Bölümü, 41350, Kocaeli/Türkiye
ORCID: 0000-0002-9632-4629

MAKALE BİLGİSİ

Makale Geçmişi:
Başvuru tarihi: 30 Mart 2021
Düzeltme tarihi: 11 Mayıs 2021
Kabul tarihi: 23 Mayıs 2021

Anahtar Kelimeler:
Kripto para -Bitcoin
Haftanın günü etkisi
Oynaklık
Tahmin modeli
ARCH-GARCH

ÖZ

Bitcoin, sahibi ve merkezi otoritesi bulunmayan eşler arası elektronik nakit sistemi olarak ortaya çıkmıştır. Herhangi bir aracıya ihtiyaç duymadan değişim aracı olarak kullanılması, işlemlerin hızlı ve maliyetinin düşüklüğü gibi sebeplerle de yıllar içerisinde popülaritesini artırmıştır. Bu süreçte dolaşımdaki miktarının ve talebindeki artışlar ile fiyatındaki ani yükselişler ve düşüşler yüksek oynaklığa neden olmuştur. Bu sebeple çalışmada, Bitcoin getirilerinde haftanın günü etkisi ile getirilerdeki oynaklığın belirlenmesi amaçlanmıştır. Bu doğrultuda çalışmada 2877 günlük kapanış fiyatlarından oluşan veri seti kullanılarak analiz sonucu göreli olarak sağlamlaştırılmıştır. Analiz sonucunda getirinin en yüksek olduğu gün pazartesi, getirideki oynaklığın en yüksek olduğu gün cumartesi olarak belirlenmiştir.

ARTICLE INFO

Article history:
Received: March 30, 2021
Received in revised form: May 11, 2021
Accepted: May 23, 2020

Keywords:
Cryptocurrency-Bitcoin
Day of the week effect
Volatility
Predictive model
ARCH-GARCH

ABSTRACT

Bitcoin emerged as a peer-to-peer electronic cash system with no owner and no central authority. It has increased in popularity over the years due to reasons such as being used as a means of exchange without the need for any intermediary, fast and low cost of transactions. In this process, the increases in its circulation amount and its demand and the sudden increases and decreases in its price caused high volatility. For this reason, in this study, it is aimed to determine the volatility in Bitcoin returns with the effect of the day of the week. In this direction, the result of the analysis has been relatively strengthened by using the data set consisting of 2877-day closing prices in the study. As a result of the analysis, it was determined that the day with the highest return was Monday and the day with the highest volatility in return was Saturday.

1. Introduction

Looking at the historical development of cryptocurrencies, its theoretical infrastructure was laid out in 1998 by Wei Dai. Bitcoin first appeared with the decentralized peer-to-peer crypto protocol, outlined in an article by Nakamoto (2008). The insecurity of financial institutions after the crisis in 2008 and the effects of crises on people are seen as the main

* *Sorumlu yazar/Corresponding author*.
e-posta: *murat.emikonel@kocaeli.edu.tr*

Atıf/Cite as: Orhan, A., Emikönel M., & Emikönel, M. (2021). Volatility and the Day of the Week Effect on Bitcoin Returns. *Journal of Emerging Economies and Policy*, 6(2), 51-58.
e-ISSN: 2651-5318.

factors in the emergence of cryptocurrencies. During this period, its popularity grew in response to the failed management of money and financial authority and the 2010-2013 European sovereign debt crisis (ESDC). With the use of cryptocurrencies, controversy arose, especially due to the missing distinction between Bitcoin and electronic money, and Rotman compared Bitcoin with electronic money in 2014 (Rotman, 2014: 1-4). Considering the share distribution of the crypto money market as of the date of writing of the article, Bitcoin has the dominant position as the most preferred cryptocurrency with a share of about 66%.

Bitcoin is very different from traditional currencies. Grinberg (2011) stated that Bitcoin is an alternative currency and stated that Bitcoin has the potential to be an important player in virtual world trade markets. Rogojanu and Badea (2014) and Shubik (2014) discussed Bitcoin as an alternative currency in their study. As a result of the more use of Bitcoin in countries, they are in a softer attitude than before. For example, a new legislation has made Bitcoin a legal payment instrument in Japan (Keirns, 2017). However, as of today, many countries do not see Bitcoin as a legal payment instrument. However, the existence of such positive developments also contributes to the increase in the price of bitcoin. The introduction of a nationwide ban on a large Bitcoin exchange is a factor that will lower the price. In this direction, a comparison of Bitcoin, gold and fiat coins is given in table-1.

Table 1: Comparison of bitcoin, gold and fiat currency

Traits of Money	Bitcoin	Gold	Fiat
Verifiable	High	Moderate	Moderate
Fungible	High	High	High
Portable	High	Low	High
Durable	Moderate	High	Low
Divisible	High	Low	Moderate
Scarce	High	Moderate	Low
Established History	Low	High	Low
Censorship Resistant	High	Moderate	Low
Unforgeable Costliness	High	High	Low
Openly Programmable	High	Low	Low
Decentralized	High	Moderate	Low

Source: Hedl, D. (2019). "Planting Bitcoin"

When the comparison of Bitcoin, gold and fiat money given in Table-1 is examined, it is seen that Bitcoin is disadvantageous against gold and fiat money due to its lack of history, and superior with gold and fiat money with other features. In addition, it is remarkable that Bitcoin has high volatility compared to dollar, euro, sterling, yen or gold. Baur and Dimpfl (2017) compared Bitcoin's volatility with foreign currencies. They concluded that Bitcoin's volatility was higher than the Dollar, Euro and Yen. Dwyer (2015) found that the monthly average volatility of Bitcoin returns is higher than other currencies in gold or dollars. While Hanley (2013) says that Bitcoin has no fundamental value for its traditional currency, Woo et al. (2013) argues that Bitcoin has a reasonable value due to its money-like properties. While open-source code, decentralized structure, cross-border value transfer, fixed supply, low transaction cost, privacy, transparency, and non-blocking are the advantages of Bitcoin; It stands out as money laundering, legal uncertainty, irreversibility of transactions and high volatility disadvantages.

Looking at the literature, there are many studies supported by verbal and econometric methods for Bitcoin. Bouoiyour and Selmi (2015) stated that speculation is an important factor affecting the price of Bitcoin. Likewise, Baek and Elbeck (2015), Cheah and Fry (2015), Baur et al. (2018) stated in their studies that bitcoin is a speculative bubble. These researchers have stated that gains are obtained from bitcoin price movements with speculative movements. Although Luther and White (2014) concluded that Bitcoin is used as a speculative tool, they concluded that cryptocurrencies will offer an alternative payment system to consumers in the future. Kristoufek (2014) argues that Bitcoin represents both a standard financial asset and a speculative asset. Therefore, in a speculative market, understanding the volume-return paradigm is crucial to achieve possible outcomes for winning strategies. Practically, if predictable for returns on the trading volume in the Bitcoin market, this means that practitioners can create volume-based strategies to increase profit (Chen et al., 2001). However, since there is no method that can measure the real value of Bitcoin, technical analysis has come to the fore as an alternative method. Therefore, the models based on the relationship between return and volume and the use of trading rules underline the need to better understand the Bitcoin volume-return relationship. However, there are also studies indicating that Bitcoin's high volatility does not stem from speculative trade (Blau, 2017). Although there are studies that found that the Bitcoin market is not efficient (Urquhart, 2016), there are studies (Jiang et al.2018) that conclude that the market has become more efficient as a result of the regulations made with the increase in demand for Bitcoin. However, Bitcoin has also been examined in terms of price clustering (Urquhart, 2017), structural breaks (Thies & Molnár, 2018), investor interest (Urquhart, 2018) and its relationship with other currencies (Baumohl, 2018). Carrick (2016) explored Bitcoin's value, volatility and ways to complement emerging market currencies . As a result of the analysis, he stated that Bitcoin has features that make it complementary especially with developing market currencies. In addition, the study concluded that Bitcoin is highly effective for transactions

and can be used with fiat currencies to make transactions by researching Bitcoin from a transaction perspective. Halaburda and Gandal (2014) conclude that if Bitcoin is included in a diversified portfolio, its risk-adjusted returns will increase significantly due to its high average return and also its low correlation with other assets. Briere et al. (2013) examined the relationship between Bitcoin and other cryptocurrencies in terms of its value against the dollar. As a result of the analysis, they found that if Bitcoin gains value against USD, it also gains value against other crypto currencies.

It is important to understand the variation of Bitcoin's average return and volatility over time for predicted average return and volatility from historical data. High volatility prevents Bitcoin from being a successful currency. Therefore, Yermack (2013) investigated Bitcoin volatility. After all, he concludes that the height in bitcoin volatility negatively affects its usefulness as a currency. He also argues that bitcoin acts as a speculative investment rather than a currency. In this context, there is a lot of work in the academic literature to find the determinants and return of Bitcoin's volatility. Therefore, Bitcoin has a place in financial markets and portfolio management (Dyhrberg, 2016a). That is why it is so important to study the volatility. Also, the presence of long memory and permanent variability (Bariviera et al., 2017) justifies the application of GARCH-type models. Charles and Darne (2018) investigated Bitcoin's volatility prediction with GARCH models. They concluded that the AR-GARCH model is suitable. Aharon and Qatar (2019) researched Bitcoin's daily return and volatility using OLS and GARCH models. They concluded that Bitcoin's return and volatility were higher on Monday. Caporale and Plast (2019) concluded that Monday, positive abnormal returns were obtained for Bitcoin Decourt, Chohan and Perugini (2019) investigated the return of Bitcoin for the week with a student t-test. At the end of the study, they found that the returns on Tuesdays and Wednesdays were higher. Ma and Tanizaki (2019) investigated the return of the week in the Bitcoin market by linear regression analysis and rounding window analysis. According to the analysis result, they came to the conclusion that the Bitcoin market's return on Monday was positive. Bouri, Roubaud and Shahzad (2020) investigated for 12 cryptocurrencies using the method of splash analysis. According to the results of the analysis, they concluded that a leap in one currency increases the probability of a leap in another currency. Gonzalez, Jareno, and Skinner (2020) investigated the relationship between the returns of Bitcoin and Ethereum, XRP, Bitcoin Cash, Tether, Bitcoin SV, Litecoin, EOS, Binance coin, and Tezos using a nonlinear autoregressive distributed delay (NARDL) approach. According to the results of the analysis, the researchers determined that both positive and negative changes in Bitcoin returns have an impact on other cryptocurrency returns. Moussa, Basty, Ghazouani (2020) investigated the asymmetric effect and dynamic relationships between Bitcoin and the returns of other cryptocurrencies with VAR, GJR-GARCH and DCC-GJR-GARCH models. According to the analysis result, they concluded that there is a dynamic relationship between Bitcoin and the returns of other cryptocurrencies. They also stated that positive shocks increased volatility more. Therefore, the aim of the study is to contribute to the literature by examining Bitcoin's income effect and volatility up to date and together. While investigating the existence of day of the week anomalies, GARCH type models are used, which take into account time series features such as non-normal distribution of returns and thick tail. For this reason, the GARCH model was used in the study to determine the effect of day of the week and volatility. In addition, the study covers the dates between 30.04.2013-15.03.2021. In order to measure the Bitcoin returns, on the date of 15.03.2021, 2877 daily close data was taken. Therefore, the results are more robust as the day of the week effect and volatility are examined in more detail in the crypto money market. The study conducted in this direction consists of four chapters. In the first part, the history of Bitcoin and its related studies are explained under the title of introduction. The second section describes the data set and method used. In the third section, the findings from the analysis and study are discussed. In the fourth title, the study was concluded with the conclusion and suggestions section.

2. Data and Methodology

The study covers the dates between 30.04.2013-15.03.2021. In order to measure the Bitcoin returns, on the date of 15.03.2021, 2877 daily dollar closing data was taken from coinmarketcap.com and Eviews 10 package program was used in the application. In the analysis, by taking the logarithms of Bitcoin data are included in the model and descriptive statistics of the Bitcoin cryptocurrency return are given in Table-2.

Table 2: Descriptive statistics of bitcoin currency unit

	BITCOIN
Mean	0.002096
Median	0.001920
Maximum	0.357451
Minimum	-0.464730
Standart Dev.	0.042619
Skewness	-0.552272
Kurtosis	14.63461
Jarque-Bera	16378.72
Probability	0.000000

Source: authors' research

Considering the results given in Table-2, the negative value of the skewness indicates that the distribution tails of the series are skewed to the left, the kurtosis value is greater

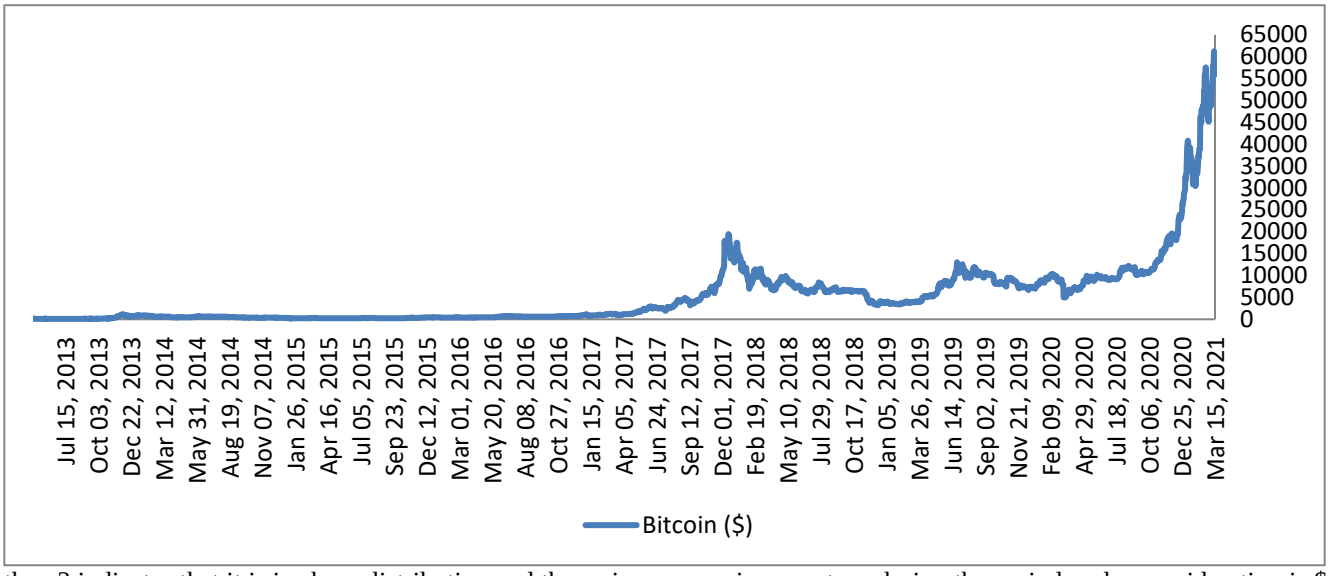


Figure 1: Bitcoin closing prices (30.04.2013 - 15.03.2021)
Source: www.coinmarketcap.com

When Figure 1 is analyzed, Bitcoin, which fluctuated slightly and was stable when it was first released, was around $ 900 at the beginning of 2017, but started to rise rapidly since April and reached the level of ($ 20,000) on December 27, 2017. It fluctuated as of January 2018 after its historical first peak, but remained below the starting level at the end of the year. After a four-month horizontal movement in 2019, it started to rise again from April 2019 to June 2019, and then fell again, closing the year with $ 7139.6. It continued to rise rapidly as of 2020 and reached its highest level ($ 61,243) on March 13, 2021. These sudden spikes in Bitcoin have increased investors' orientation towards Bitcoin, and not only individuals but also institutional investment companies such as Pantere Capital, Falcon Global Capital and Global Advisors Bitcoin Investment Fund have started to use Bitcoin as an investment tool.

This paper aims to fill the gap in the literature by providing much more extensive evidence on the day of the week effect in this market. The return effect was calculated by the formula shown in equation (1).

$$P_t = \text{In}\left(\frac{E_t}{E_{t-1}}\right) \quad (1)$$

P_t = The logarithmic return of the index on the day "t"

E_t = The closing value of the index on the day "t"

E_{t-1} = It is the closing value of the index on the day "t-1".

3. Analysis and Findings

To determine the stationarity of the series, generally either ADF unit root test developed by Dickey and Fuller (1981) or PP unit root tests developed by Phillips and Perron (1988) are applied. The purpose of unit root tests is to find the stationarity of the series by looking at whether the series contains a unit root. According to the test result, if the serials do not contain a unit root, it is stationary. In this study, ADF unit root test developed by Dickey and Fuller (1981) was applied to control the stationary of the series. In order to perform ADF unit root test, 3 different regression equations were established, which included the first difference of the series as the dependent variable and the original values of the series as the independent variable.

None;

$$\Delta Lbitcoin_t = \alpha_1 Lbitcoin_{t-1} + \sum_{i=1}^{z} \beta_i \Delta Lbitcoin_{t-i} + \varepsilon_t \quad (2)$$

Intercept;

$$\Delta Lbitcoin_t = \alpha_0 + \alpha_1 Lbitcoin_{t-1} + \sum_{i=1}^{z} \beta_i \Delta Lbitcoin_{t-i} + \varepsilon_t \quad (3)$$

Trend and Intercept;

$$\Delta Lbitcoin_t = \alpha_0 + \alpha_1 \text{trend} + \alpha_2 Lbitcoin_{Yt-1} + \sum_{i=1}^{z} \beta_i \Delta Lbitcoin_{t-i} + \varepsilon_t \quad (4)$$

According to the unit root test results, it is concluded that the return series is stationary at the level. Analysis test results are given in table 3.

than 3 indicates that it is in sharp distribution and the series has a thick tail. According to the J-Bera statistic result, it was determined that the series did not show normal distribution since the value was greater than 5.99 and the probability value was less than 5% significance level. It is seen that the maximum return during the period under consideration is $ 0.357451 and the minimum return is $ -0.464730.

Table 3: Bitcoin unit root test results I (0)

ADF Test		
Intercept	Trend and Intercept	None
-54.3596*	-54.3614*	-54.2392*

Note: * sign indicates significance at 1% significance level.

According to the Bitcoin unit root test result, after determining that the series is stationary, it should be checked whether it contains autocorrelation. While it is considered sufficient to look for 1, 5 or 10 days for delayed interaction in return series, in this study autocorrelation problems were investigated up to 36 delays and it was concluded that autocorrelation was 1 delayed. First degree AR, MA and ARMA models were tried to determine the appropriate model according to the result obtained. In this context, the AR (1) model was preferred because Schwarz Bilgi Kriteri (SIC) information criterion is the smallest. The equation and test results for the model are given in table 4 with equation (5).

$$BITCOIN_t = \delta BITCOIN_{t-1} + c + \varepsilon_t \quad (5)$$

Table 4: AR(1) model for bitcoin

	Coefficient	T-Statistics	Probability
c	0.002	1.860	0.063
BITCOIN(-1)	0.880	7.827	0.000

After determining the suitable model for the return series, ARCH-LM test was applied to determine whether the ARCH effect exists in the selected model AR(1). In the ARCH-LM test, the H_0 hypothesis shows the covariance state. If the H_0 hypothesis is rejected, the ARCH effect is mentioned.

Table 5: ARCH-LM test results

F-statistic	119.436	Prob. F(1,2875)	0.000
Obs*R-sq.	114.752	Prob. Chi-Square(1)	0.000

According to the test result given in Table-5, the chi-square test statistic result for Bitcoin was found 114.7523 and was found significant at 1% significance level. According to these results, H_0 hypothesis was rejected. So it was concluded that is ARCH effect in the test and this effect should be eliminated. After determining that the ARCH effect exists in the series used in the study, Akaike Information Criterion (AIC) was used to determine the appropriate ARCH-GARCH model. In case the AIC and SIC criteria get the smallest possible values, the appropriate model will be determined. The EGARCH (1,1,1) model with the lowest (-3.735032) Akaike Information Criterion value was chosen among the various ARCH-GARCH models made to determine the model. The results of the model are given in Table-6 below.

Table 6: Bitcoin's EGARCH (1,1,1) model estimation results

	BITCOIN
	EGARCH (1,1,1)
C	0.001762
C(2)	-0.600184
C(3)	0.275933
C(4)	-0.030473
C(5)	0.936242
R^2	-0.000061
Akaike Information Criteria	-3.735032
Schwarz Information Criteria	-3.724670
Log likelihood	5379.712
ARCH-LM(1)	N^*R^2 (0.070684) X^2 Olasılık (0.7903)

According to the ARCH-LM(1) test results given in Table 6, the heteroskedasticity problem has disappeared. Then, using dummy variables, the regression equation shown in equation (6) is applied to calculate the days of the week effect in bitcoin:

$$P_t = \beta_0 + \beta_1 D_{monday} + \beta_2 D_{tuesday} + \beta_3 D_{wednesday} + \beta_4 D_{thursday} + \beta_5 D_{friday} + \beta_6 D_{saturday} + \beta_7 D_{sunday} + \beta_8 P_{t-1} + \varepsilon_t \quad (6)$$

According to the regression equation;

P_t= the logarithmic return of the index on the day "t",

regression coefficients for β_1, β_2, β_3, β_4, β_5, β_6 and β_7,

D_{monday} , $D_{tuesday}$, $D_{wednesday}$, $D_{thursday}$, D_{friday} , $D_{saturday}$, and D_{sunday} represent dummy variables. With the help of dummy variables, the effect of returns for each day will be examined.

D_{monday}: if Monday is 1, otherwise 0,

$D_{tuesday}$: if Tuesday is 1, otherwise 0,

$D_{wednesday}$: if Wednesday is 1, otherwise 0,

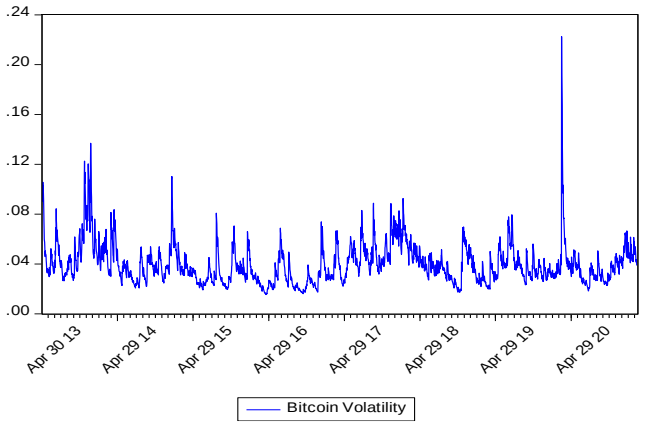
$D_{thursday}$: if Thursday is 1, otherwise 0,

D_{friday}: if Friday is 1, otherwise 0,

$D_{saturday}$: if Saturday is 1, otherwise 0,

D_{sunday}: if Sunday is 1, otherwise 0. Dummy variables have been created in such a way.

Figure 2: Bitcoin Volatility



Until 2020, as Bukovina and Martiček said, in 2013 Bitcoin peaked with exponential growth. However, with the pandemic in 2020, although Bitcoin fell sharply, it recovered in a short time and reached its highest level by seeing $ 61,243 on March 13, 2021. Therefore, 2020 has been the year when Bitcoin reached its highest level. As can be seen in Figure 2, 2013 and 2020 were the periods of the highest volatility. After 2013, until 2020, the volatility in returns tended to decrease over the years, while 2020 is the period when the volatility in return is the highest. EGARCH (1,1,1) model, which is the most suitable GARCH model, was created to test the return effect on the day of the week for Bitcoin. Analysis results are given in table 7.

Table 7: Analysis results related to the day of the week effect for bitcoin EGARCH (1,1,1)

	Coefficient	Probability	Standart
Monday	0.004336	0.001	%0.131
Tuesday	0.003575	0.004	%0.125
Wednesday	-0.001014	0.392	%0.118
Thursday	-0.000434	0.744	%0.133
Friday	0.001652	0.265	%0.148
Saturday	0.003715	0.028	%0.168
Sunday	0.002412	0.085	%0.148

According to the analysis result given in Table-7, it is statistically significant at the level of 1% on Monday and Tuesday, 5% on Saturday, and 10% on Sunday. It is seen that in these four days, the bitcoin return is positive and the most returns are provided on Mondays. As the other days were statistically insignificant, the day of the week effect was not observed. In the study where volatility is analyzed according to standard deviation, Saturday is the day has the most volatility, and Tuesday is the day has the least volatility.

4. Conclusions and Recommendations

The Bitcoin project, which was implemented based on open-source software with the article published in late 2008, has become controversial in the society only when it reached the historical maximum value predicted by the exponential growth in 2013 (Bukovina, J., Martiček, M., 2016: 1). Bitcoin, which fell with the pandemic in 2020, then rose rapidly and reached its highest level on March 13, 2021. This rapid rise also led to the year with the most volatility. For Bitcoin, which has been on the market for nearly 13 years, there has been a growing debate among politicians and economists as to whether it is a currency or a commodity. In recent years, there has been an increase in the work on Bitcoin. In studies conducted with Bitcoin, market efficiency, day of the week and liquidity effects were investigated. While some of these studies in which market effectiveness is played out give results that support the effective market hypothesis, some studies have seen results that contradict the effective market hypothesis. In the studies in which the effect of the day of the week was examined, different results were obtained according to the period that was handled similarly. In the studies examining the liquidity effect, it was concluded that crypto investors traded in yuan in the region where they are located and trades in dollars in the reserve currency position. In many studies conducted in this direction, the authors found that the majority of users saw bitcoin and its derivatives as speculative assets, not as a means of payment. For this reason, it has become widespread that it is more correct to think of bitcoin as an asset rather than a currency. (Glaser et al., 2014; Baek and Elbeck, 2015). As the crypto money market is open to speculative discourses, volatility is higher than other currencies. Due to the high volatility, much work has been done on the determinants of volatility in Bitcoin. As a result of the analysis of this study, in which the volatility of Bitcoin and the effect of the day of the week were analyzed, as the optimal model was determined EGARCH (1,1,1). In this study, in which 2877 days were evaluated, Monday was determined as both statistically significant and highest return day. It was found as the most volatile day on Saturday and the least volatile on Wednesday. According to the 1% significance level, the day with the highest return is Tuesday. The days with the highest returns at the 5% and 10% significance level are Saturday and Sunday, respectively. Since the results were insignificant at 5% significance level for other days, they were not statistically interpreted. Although there is a discussion of currency or investment vehicle or speculative discourses in the studies for cryptocurrencies in the literature, the fact that there is volatility according to our observations makes us think that it is more sensitive to speculative movements. The fact that hot money entry into the crypto money market in the future is the factor that will increase the volatility, especially bitcoin.

References

Aharon, D.Y., Qadan, M. (2019), "Bitcoin and the Day-of-the-Week Effect". *Finance Research Letters, 31*, 415-424

Baek, C., Elbeck, M. (2015), "Bitcoins As An Investment or Speculative Vehicle? A first look", *Applied Economic Letters, 22*(1), 30–34.

Bariviera, A.F. (2017), "The Ineficiency of Bitcoin Revisited: a Dynamic Approach", *Economics Letters, 161*,1-4

Baumohl, E., (2018), "Are Cryptocurrencies Connected to Forex? A Quantile Cross-Spectral Approach". W*orking papers*.

Baur, D.G., DİMPF, T. (2017), "Realized Bitcoin Volatility", Available at https://www.researchgate.net/profile/Thomas_Dimpfl/publication/317994265_Realized_Bitcoin_Volatility/links/5bf56f3892851c6b27d14f3c/Realized-Bitcoin Volatility.pdf 09.02.2020 , 1-25.

Baur, D. G.,Hong, K., Lee, A. D.(2018) "Bitcoin: Medium of exchange or speculative assets?", *Journal of International Financial Markets, Institutions and Money, (54),*177–189.

Blau, B. M. (2017), "Price Dynamics and Speculative Trading in Bitcoin", *Research in International Business and Finance. (41*), 493-499

Bouoıyour, J., Selmi, R. (2015)," What does Bitcoin look like?", *Ann. Econ. Finance 16* (2), 449-492

Bouri, B., D. Roubaud, and S. J. H. Shahzad. 2020. "Do Bitcoin and Other Cryptocurrencies Jump Together?" *The Quarterly Review of Economics and Finance (76),* 396–409

Briere, M.,Oosterlinck, K.,Szafarz, A.(2013),"September. Virtual Currency, Tangible Return: Portfolio Diversification with Bitcoins."

Bukovina, J., Martıček, M. (2016), "Sentiment and Bitcoin volatility", *Mendelu Working Papers in Business and Economics, (58),* 1-5.

Caporale, G.M.,Plastun, A. (2019), "The Day of the Week Effect in the Crypto Currency Market", *Finance Research Letters, (31),* 258–269.

Carrick, J. (2016), "Bitcoin As a Complement to Emerging Market Currencies", *Emerging Markets Finance and Trade, 52*(10), 2321–2334.

Charles, A.,Darne, O.(2018), "Volatility Estimation for Bitcoin: Replication and Extension", Available at https://www.researchgate.net/profile/Olivier_Darne/publication/322861075_Volatility_estimation_for_Bitcoin_Replication_and_extension/links/5a731971a6fdcc53fe137297/Volatility-estimation-for-Bitcoin Replication-and-extension.pdf , 1-18.

Cheah, E.,Fry, J. (2015), "Speculative Bubbles in Bitcoin Markets? An Empirical Investigation into the Fundamental Value of Bitcoin", *Economics Letters, (130*), 32-36. ISSN 1873-7374.

Chen, G.M.,Firth, M. - Rui, O.(2001), "The dynamic relation between stock returns, trading volume and volatility", *Financ. Rev. 36* (3), 153–174.

Corbet, S., Lucey, B., Yarovya, L. (2018a), " Datestamping the Bitcoin and Ethereum bubbles", *Finance Res. Lett* (In Press).

Dai, W. B-Money, (1998), Available at http://www.weidai.com/bmoney.txt, (Erişim: 12.01.2020)

Decourt, R. F., Chohan, U. W. & Perugini, M. L. (2019). "Bitcoin Returns and the Weekday Effect." https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3435176

Dickey, D.A., Fuller, W.A., (1981), "Likelihood ratio statistics for autoregressive time series with a unit root", *Econometrica, 49*(4), pp.1057-1072. http://dx.doi.org/10.2307/1912517

Dyhrberg,(2016). A.H. Hedging Capabilities of Bitcoin. Is It the Virtual Gold?. *Finance Research Letters. 16*, 139-144

Dwyer, G.P. (2014), "The Economics of Bitcoin and Similar Private Digital Currencies", *Journal of Financial Stability, 17*, 81-91.

Glaser, F., Haferhorn, M., Weber, M.C., Zimmarmann, K., ve Siering, M.B. (2014), "Bitcoin –Asset or Currency? Revealing Users' Hidden Intentions", European Conference on Information Systems ECIS, 2-12.

Gonzalez, M. O., F. Jareno, and F. S. Skinner. (2020). "Nonlinear Autoregressive Distributed Lag Approach: An Application on the Connectedness Between Bitcoin Returns and the Other Ten Most Relevant Cryptocurrency Returns." *Mathematics 8* (5), 810. doi:10.3390/math8050810.

Grinberg, J. (2011), "Bitcoin: An Innovative Alternative Digital Currency", *Hastings Science and Technology Law Journal, 41*, 159-208.

Halaburda, H., Gandal, N. (2014), "Competition in the Cryptocurrency Market", Available at: SSRN 2506463.

Hanley, B.P. (2013), "The False Premises and Promises of Bitcoin", arXivpreprintarXiv:1312.2048.

Hedl, D. (2019), "Planting Bitcoin", Available at https://medium.com/@danhedl/planting-bitcoin-56bd1459cb23 website on 12.01.2020

Jiang, Y., Nie, H., Ruan, W., (2018), " Time-varying long-term memory in Bitcoin market", *Finance Res. Lett* (In Press).

Keirns, G. (2017), "Japan's Bitcoin Law Goes into Effect Tomorrow", Available at: http://www.coindesk.com/japan-bitcoin-law-effect-tomorrow/

Kristoufek, L.(2014), " What are the main drivers of the Bitcoin price? Evidence from wavelet coherence analysis", *PLoS One 10* (4), e0123923. http://dx.doi.org/10.1371/ journal.pone.0123923.

Luther, W.J. - White, L.H (2014), "Can Bitcoin Become a Major Currency?", *GMU Working Paper in Economics 14*(17), 1-7.

Phillips, P.C.B., Perron, P. (1988), "Testing for a Unit Root in Time Series Regression", *Biometrika, 75*(2), 335–346. doi:10.1093/biomet/75.2.335

Ma, D. & Tanizaki, H. (2019). "On the day-of-the-week effects of Bitcoin markets" international evidence. international evidence. *China Finance Review International, 9*(4), 455-478.

Moussa, W., Basty, N., & Ghazouani, I. (2020). Asymmetric Effect And Dynamic Relationships Over The Cryptocurrencies Market." *Computers & Security, 96* https://doi.org/10.1016/j.cose.2020.101860

Rogojanu, A., Badea, L. (2014), "The issue of competing currencies: case study – Bitcoin", *Theor. Appl. Econ. 21* (1), 103–114.

Rotman, S. (2014), "Bitcoin Versus Electronic Money, The Consultative Group To Assist The Poor (CGAP)", Publications, 1-4.

Shubik, M. (2014), "Simecs, Ithaca Hours, Berkshares, Bitcoins and Walmarts*", Cowles Foundation Discussion Paper* No. 1947

Szetela, B., Mentel, G & Gedek, S. (2016) "Dependency Analysis between Bitcoin and Selected Global Currencies", *Dynamic Econometric Models, 16*, 133-144.

Thies, S., Molnár, P. (2018), " Bayesian change point analysis of Bitcoin returns", *Finance Res. Lett* (In Press).

Urquhart, A. (2016), " The inefficiency of Bitcoin", *Economics Letters, (148*), 80–82.

Urquhart, A. (2017), " Price clustering in Bitcoin", *Economics Letters, (159*), 145–148.

Urquhart, A. (2018), " What causes the attention of Bitcoin", *Economics Letters, (166*), 40–44.

Woo, D.,Gordon, I., Iarolov, V. (2013), " Bitcoin: a first assessment", FX and Rates, Global. Bank of America, Merrill Lynch.

Yermack, D.(2013), "Is Bitcoin A Real Currency? An Economic Appraisal", (No. w19747). *National Bureau of Economic Research*. URL: http://www.nber.org/papers/w19747
www.coinmarketcap.com