The Effects of FED's and ECB's QE Announcements on Exchange Rates of Bitcoin, Euro, and Dollar in the Period of COVID-19: An Event Study Approach

Sofia Karagiannopoulou
University of Western Macedonia, Kozani, Greece

Paris Patsis
University of Western Macedonia, Grevena, Greece

Nikolaos Sariannidis
University of Western Macedonia, Kozani, Greece

Corresponding to the pandemic COVID-19, both FED and ECB were committed to using their full range of tools, such as the helicopter money policy and a new quantitative easing programme to support the economy in this challenging time. The goal of this study is to explore the impact of ECB's and FED's COVID-19 Quantitative Easing (QE) announcements on exchange rates. Using an event study with daily data from 01/10/2019 to 02/05/2020, it investigates the impact of these "Odyssean shocks" on EUR/USD, BTC/EUR, and BTC/USD. The empirical results show an unexpected behavior of exchange rates in response to monetary policy actions. More specifically, the ECB's announcement led to appreciation of the Euro against the Dollar. On the other hand, the FED's announcement leads to depreciation of the Euro. The virtual exchange rates of Bitcoin do not seem to be affected by the announcements of the ECB and the FED, confirming the role of Bitcoin as a decentralised currency and independent of Central Banks and governments. The conclusions of the study are useful for investors and policy makers, as the unforeseen COVID-19 crisis has disturbed and modified investor behavior.

Keywords: monetary policy, Central Bank, financial market

Introduction

The main tool that the Central Banks use for their monetary policy is the control of interest rates. These are set primarily by taking into account the Taylor rule, according to which there is an increase in interest rates, in order to keep inflation at acceptable levels. In the period of crisis and deep recession, the Central Banks decided to continuously reduce interest rates, until they reached the zero threshold. At this point, conventional monetary policies were deemed inadequate (Adam & Billi, 2006; Schmitt-Grohe & Uribe, 2007), making it clear that there was need for non-conventional monetary policy measures, such as liquidity, asset purchasing,

Sofia Karagiannopoulou, Ph.D. candidate, Department of Accounting and Finance, University of Western Macedonia, Kozani, Greece.
Paris Patsis, adjunct lecturer, Department of Business Administration, University of Western Macedonia, Grevena, Greece.
Nikolaos Sariannidis, professor, Department of Accounting and Finance, University of Western Macedonia, Kozani, Greece.

and management of expectations. The most effective of the above-mentioned measures is considered to be the purchase of assets also known as Quantitative Easing (QE).

The first Central Bank to pursue unconventional monetary policy was the Bank of Japan in the 1990s, followed by the Federal Reserve in 2008 and the Bank of England (BOE) in 2009. The European Central Bank (ECB) announced its first Quantitative Easing program in January 2015.

Quantitative Easing influences economic activity through various transmission channels (Bubeck, Habib, & Manganelli, 2018). The main channels are: (i) the "Portfolio Balance Sheet" channel, (ii) the liquidity channel, (iii) the inflation channel, (iv) the default risk channel, (v) signaling channel, and (vi) exchange rate channel. The present research makes use of the signaling and exchange rate channels. The signaling channel refers to the cultivation of expectations (Theory of Expectations) regarding the future course of the monetary policy. Central Banks achieve this through the techniques of "forward guidance" and the "announcement effect". Empirical evaluation is carried out through the case study (event study). As far as the exchange rate channel is concerned, declining interest rate yields are pushing investors to look for more attractive returns in other economies, resulting in lower domestic currency demand and devaluation. The devaluation of the domestic currency has an increasing effect on inflation, and at the same time, improves the competitiveness of the economy.

The present study examines the announcements related to the Quantitative Easing programs of the ECB and the FED respectively. The ECB has implemented three Quantitative Easing programs. The first one, the Covered Bond Purchase Program (QE1), was launched in September 2014 and covered the issues of Asset-Backed Securities Purchase Program (ABSPP) and Covered Bonds (CBPP3). On January 22nd, 2015, the Governing Council of the ECB decided to expand the existing program, by adding the Public Sector Program (PSPP) QE2 of 60 billion on a monthly basis. On March 18th, 2020, the 3rd QE3 Pandemic Emergency Purchase Program (PEPP) was launched to address the effects of the COVID-19 pandemic.

Regarding the Quantitative Easing programs implemented by the FED, the first program was implemented from December 2008 to August 2010. In order to increase the availability of credit in the housing market and reduce the interest rates on mortgages, the FED proceeded to the purchase of $175 million in direct liabilities from Fannie Mae, Freddie Mac, and the Federal Home Loan Banks. In addition, from January 2009 to August 2010 it bought $1.25 trillion in Mortgage-Backed Securities (MBS) secured by Fannie Mae, Freddie Mac, and Ginnie Mae, and from March 2009 through October 2009, it bought $ 300 million worth of US Treasury bonds. From November 2010 to June 2011, the US Federal Reserve launched the second Quantitative Easing program, further increasing its $600 billion long-term government bond purchases. During the third program, which began in September 2012, it made monthly purchases of $40 billion in Mortgage-Backed Securities (MBS), while in January 2013 it purchased $45 billion in long-term government-issued debt instruments, after the completion of the Maturity Extension Program (MEP) 7, in December 2012. To address the financial shock caused by COVID-19, the FED began buying assets at an average of $120 billion a month. Since the beginning of 2020, these markets have increased their balance sheet by more than 80%.

In the present study, the ECB and FED announcements that were used were those corresponding to the latest Quantitative Easing programs implemented to address COVID-19. The specific programs were selected, as they present particular differences in relation to the previous ones. Helicopter money is applied for the first time. This measure was first mentioned by Milton Friedman (1968). The idea behind helicopter money is to print money and market it without restrictions (Yashiv, 2020).

The purpose of the paper is to study the effect of QE announcements on exchange rates. Exchange rates have been the focus of interest in both academic and policy debates about the effectiveness, transmission channels, and spillovers of QE (Bernanke, 2015; Powell, 2018; Rajan, 2013). Several factors such as supply and demand, international trade balance, economic growth, interest rates, and public debt play a decisive role in exchange rates (Aloui, 2021). Exchange rates are sensitive to both new economic or financial information (Frankel, 1992; Bacchetta & Wincoop, 2006) and monetary policy news (Ferrari, Kearns, & Schrimpf, 2021). The effects of monetary policy on exchange rates differ depending on how monetary policy affects agents' expectations as well as its perceived effects on the riskiness/uncertainty in the economy in specific episodes (Inoue & Rossi, 2019; Nilavongse, Michał, & Uddin, 2020; Rosa, 2011). Exchange rate behavior is closely related to political trust. Under increased political uncertainty, investors demand a higher risk premium, which can lead to depreciation of the currency (Tamgac, 2021; Beckmann & Czudaj, 2017; Kido, 2016; X. L. Li, X. Li, & Si, 2020). In the present study, in addition to the EUR/USD exchange rate, the BTC/EUR and BTC/USD exchange rates will also be studied. One of the topics that are of increasing concern to the international finance literature is the analysis of cryptocurrencies and their interaction with economic and macroeconomic variables (Isah & Raheem, 2019). The ever-increasing interest in virtual currencies is largely due to their increasing influence and usage. For instance, between 2016 and 2017, the price of Bitcoin rose by more than 1,300%, reaching a market capitalization of US $215 billion (Bouri, Das, Gupta, & Roubaud, 2018). Bitcoin is proposed as a decentralized currency requiring no third-party involvement, and independent of Central Banks and governments (Corbet et al., 2020).

The research is structured as follows: In Chapter 1, there is an introduction on Quantitative Easing programs and exchange rates; Chapter 2 covers the literature review; in Chapter 3, the methodology and variables are described; Chapter 4 presents the results of the study, while the last chapter presents the conclusions.

Literature Review

In times of uncertainty, the announcements of the Central Bank greatly influence the financial market, as investors reconsider their views not only on monetary policy, but on the economy as a whole (Melosi, 2017; Nakamura & Steinsson, 2018). Much research has been conducted on the central bank announcement effect, both by the ECB (Andrade & Ferroni, 2020; Kerssenfischer, 2019; Enders, Hünnekes, & Müller, 2019) and the FED (Kutner, 2001; Miranda-Agrippino & Rey, 2020; Campbell, Evans, Fisher, & Justiniano, 2012; Anderson & Cesa-Bianchi, 2020).

The event study, which is also used in the present paper, is one of the most common methods used in the study of the impact of QE and is found in several working papers of Central Banks such as the FED (Rudebusch & Christensen, 2012), the ECB (Altavilla et al., 2019; Jarocinski, 2020), and the BOE (Joyce, Lasaosa, Stevens, & Tong, 2011). Event studies on the effect of QE announcements refer mainly to a short-term basis (Kapetanios, Mumtaz, Stevens, & Theodoridis, 2012; Reich, 2014). Falagiarda and Reitz (2015) studied the effect of ECB's policy announcements on the sovereign spreads of five European countries, and Szczeerbowicz (2015) studied the correlation between ECB's announcements and bank's financing costs, while Altavilla, Carboni, and Motto (2015) studied the effect of QE2 APP on bond yields of European countries.

Numerous studies have been conducted to study the effect of unconventional monetary policy on exchange rates (Inoue & Rossi, 2019; Gurkaynak, Kara, Kısacıkoğlu, & Lee, 2021; Ferrari et al., 2021; Paries &

Papadopouloub, 2020). Most studies have concluded that the conduct of unconventional monetary policy by Central Banks leads to a devaluation of the domestic currency (Eichenbaum & Evans, 1995; Faust & Rogers, 2003; Bouakez & Normandin, 2010). The exchange rate channel of QE has been the subject of several studies (Haldane, Roberts-Sklar, Wieladek, & Young, 2016; Ueda, 2012). Specifically, Glick and Leduk (2012) concluded that QE announcements led to a devaluation of the dollar; similarly, Wright (2012) concluded that the US QE led the dollar to depreciate against the Canadian Dollar, the Euro, and the British Pound. Bhattarai, Chatterjee, and Park (2018) and Anaya Hachula, and Offermanns (2017) found that US QE shocks significantly appreciate the currencies of emerging market economies. Wieladek and Garcia Pascual (2016) focused on ECB asset purchases, finding that the Euro broadly depreciated against European currencies in response to QE shocks. The present study will examine the impact of ECB's and FED's QE announcements on exchange rates. Similarly, Detola, Georgiadis, Gräb, and Mehl (2021) studied the effects of the ECB and FED QE programs on the US Dollar-Euro exchange rate, concluding that the exchange rate is depreciating. Contrary to the prevailing belief that the tightening policy leads to a devaluation of the domestic currency and, respectively, the expansionary monetary policy leads to a devaluation of the domestic currency, several studies have concluded the opposite.

Gurkaynak et al. (2021) showed that unexpected behavior is prevalent in exchange rate reactions to monetary policy. Engel and Frankel (1984) observed the unexpected behavior of exchange rates in response to monetary policy actions, with the local currency depreciating when policy is tightened. Their explanation rested on policy reversals. Relevant are works that focus on non-monetary policy data releases and exchange rate reactions, relating these to monetary policy rules. Clarida and Waldman (2008) argued that inflation surprises (inflation higher than expected) may lead to local currency appreciations if inflation is a persistent process and monetary policy is sufficiently attuned to inflation stabilization. On a more recent study, Stavrakeva and Tang (2018) noted the appreciation of the Dollar in response to easings in FED policy during the Great Recession. They propose a combination of information (Delphic forward guidance) and exorbitant duty—Gourinchas, Rey, and Govillot (2018)—as an explanation. Another factor that should not be overlooked is the transatlantic spillover. According to Jarocinski (2020), Central Bank information effects are an important channel of the transatlantic spillover of monetary policy. They account for a part of the co-movement of German and US government bond yields around FED policy announcements, for most of this co-movement around ECB policy announcements, and significantly affect a range of financial and macroeconomic quantities on both sides of the Atlantic. Announcements of the US FED and the European Central Bank (ECB) are closely followed also outside their respective jurisdictions and arguably affect financial conditions there. These international spillovers are not necessarily desirable and hence highly controversial (Bernanke, 2015; Miranda-Agrippino & Rey, 2020; Powell, 2018; Rajan, 2016).

The announcements that will be studied in this research concern the latest QE programs designed to deal with the COVID-19 pandemic. Several scholars have turned their attention to the study of the effects of COVID-19 and the policy measures that accompanied it in exchange rates. Many studies have suggested that the pandemic affected, among others, oil markets (Depvupa & Narayan, 2020; Iyke, 2020; Prabheesh, Padhan, & Garg, 2020), stock markets (Mazur, Dang, & Vega, 2020; Topcu & Gulal, 2020; Narayan, 2020), foreign exchange markets (Lyke, 2020; Narayan, 2020), and insurance markets (Y. T. Wang, Zhang, X. Q. Wang, & Fu, 2020). Feng, Yang, Gong, and Chang (2021) explored the impact of COVID-19 and the relevant government response policies on exchange rate volatility. The results show that the three major currencies (EUR, GBR,

YEN) did experience greater fluctuations during the pandemic (Chang, Feng, & Zheng, 2021). Aloui (2021) investigated the transmission of the Quantitative Easing (QE) to the exchange rate and found that the responses of the exchange rate EYR/USD to monetary policy shocks vary over time, implying that the unforeseen COVID-19 crisis has disturbed and modified investors' behavior. Kinateder, Campbell, and Choudhury (2021) and Wei, Luo, Huang, and Guo (2020) came to similar conclusions. According to Narayan (2021), exchange rates have been impacted by the pandemic for over six months giving them a level of resilience to the pandemic. In other words, exchange rates have absorbed the pandemic shock. Regarding virtual currency and the effect that QE programs have on these exchange rates, there is no extensive literature, so the present research is called to fill this gap. For example, Corbet et al. (2020) examined the response of a broad set of digital assets (considering the Bitcoin as the leader) to US Federal Fund Quantitative Easing announcements, and found significant evidence of volatility spillover transfers from US monetary policy announcements, to the digital asset market. Isah and Raheem (2019) concluded that the unconventional monetary policy, such as Quantitative Easing (QE), is the underlying factor that has sustained the evolution of cryptocurrencies due to resilience of cryptocurrencies during the periods of stress (Bouri et al., 2018; Bouri, Gupta, Tiwari, & Roubaud, 2017; Luther & Salter, 2017; Weber, 2014). For instance, the attendant inflationary effects of QE could be avoided by investors' diversification of their portfolio towards cryptocurrency (Moore, Nam, Suh, & Tepper, 2013).

Data and Methodology

Data

In contrast to other surveys, the present case study (event study) takes only two announcements of the Central Banks ECB and FED into account. The reasons that make these two announcements so similar to each other and yet so different from all the others—so it makes sense to study them in tandem—will be mentioned below.

The first announcement concerns the ECB press release on March 18, 2020, when the new Quantitative Easing program for dealing with the pandemic—Pandemic Emergency Purchase Program (PEPP)—amounting to 750 billion Euros, was announced. In the context of the announcement of the program, the President of the Governing Council of the ECB, Mrs. Christine Lagarde, characteristically stated, "The Governing Council will do everything necessary within its mandate. The Governing Council is fully prepared to increase the size of its asset purchase programs and adjust their composition, by as much as necessary and for as long as needed".

Several economists believed that a public-health alert that initially threatened a temporary hit to growth turned into a full-blown economic crisis. With governments dragging their feet over a joint fiscal response, she ultimately took a "no limits" approach echoing the turmoil-fighting predecessor, Mario Draghi (Bloomberg). According to Peter Praet, the ECB's former chief economist, "She made a U-turn and delivered something so bold I never thought we could have done so quickly at the ECB".

The 2nd announcement concerns the FED press conference on April 29, 2020, when the Chairman of the Fed Board of Directors, Mr. Jerome Powell, describing the measures taken by the FED to deal with the COVID-19 pandemic, stated characteristically, "We are also committed to using our full range of tools to support the economy in this challenging time… We will continue to use these powers forcefully, proactively, and aggressively until we are confident that we are solidly on the road to recovery".

What makes these two announcements special is, on one hand, the fact that they use helicopter money and on the other hand, the fact that they could be described as Odyssean monetary policy shock. As far as helicopter

money is concerned, it is the first time that it has been used by the Central Banks. The first to mention this was Milton Friedman (1968). The idea behind helicopter money is to print money and market it without restrictions (Yashiv, 2020). Regarding the definition of the announcements as "Odyssean shocks", the term "Odyssean" terminology was introduced by Campbell, Evans, Fisher, and Justiniano (2012). Odyssean shocks correspond to the Central Bank tying its hands to the mast to commit to future deviations from its usual reaction function. According to Philippe Andrade (senior economist in the research department at the Federal Reserve Bank of Boston) and Filippo Ferroni (policy economist in the research department at the Federal Reserve Bank of Chicago) (2019), they do not identify a clear driver of Odyssean shocks, but conclude that news related to future expansionary monetary policy are considered as Odyssean shocks. They find evidence that the ECB announcements became predominantly understood as Odyssean when explicit forward guidance policy was implemented relative to the period without forward guidance policies.

The exchange rate data are on a daily basis, covering the period from 18/10/2019 to 01/05/2020 and have been taken from the Thomson Reuters Database.

Methodology

The present paper will study the effect of QE programs on exchange rates through an event study using daily data (Inoue & Rossi, 2019; Feng et al., 2021; Iyke & Ho, 2021) and the method "classified event-abnormal return rate method" similar with Guo, Chen, and Sevic (2021) and Kocenda and Moravcova (2018). The ''classified event study" method is pioneered by Liu and Pauwels (2012) to study multiple impacts of political events on the exchange rate.

First, the event period and the estimation window should be defined. Considering the anticipation of the event and the adjustment after the event, the event period should include the occurrence date and the pre- and post-event window thereof. The event period is intended for estimating the actual exchange rate under the influence of the event, while the estimation period is a time in which normal exchange rate fluctuations unaffected by the event happened, and it is used to estimate the normal rate of return on exchange rates unaffected by the event.

With respect to the setting of event windows, to obviate losses of the number of event samples due to event overlap caused by lengthy windows, and to evaluate the impact of different events on abnormal returns of the RMB exchange rate more accurately, we determine a period of five days based on the mainstream literature (including the event day and the trading day before and after it) as the event period, and the event windows will be two days before and after the event period (Fatum & Hutchison, 2006).

As for the setting of estimation periods, the estimation period should have an appropriate length for the validity and structural stability of model estimation results. According to Peterson (1989),

> Selection of the length of the estimation period also is left to the researcher; the researcher must weigh the benefits of a longer period (an improved prediction model) and the cost of a longer period (model parameter instability). Typical lengths of the estimation period range from 100 to 300 days for daily studies and from 24 to 60 months for monthly studies. (p. 51)

In this manuscript, we choose the time interval of 138 trading days.

An appropriate estimation model should be decided among four classic models that estimate the expected normal rate of return: market model, mean adjusted return model, constant return model.

Raw data (R_t) are transformed into a stationary series of percentage exchange rate returns (r_t):

$$r_t = \ln\left(\frac{R_{t+1}}{R_t}\right) * 100$$

A negative change in an exchange rate means an appreciation of the quoting currency (EUR) with respect to the reference currency (USD); from the perspective of a forex trader, appreciation means a positive return because less units of the quoting currency are needed to buy one unit of the reference currency. Conversely, a positive change represents a depreciation of the quoting currency; depreciation means a negative return.

Abnormal returns are defined as the difference between actual returns and their expected values. Hence, for the *i* event and time *t* the abnormal return (ARit) is defined formally as:

$$AR_{it} = r_{it} - E[r_{it}]$$

where r_{it} denotes the actual return and $E[r_{it}]$ denotes the expected return.

We follow the practice in the literature (MacKinlay, 1997; Kothari & Warner, 2006) and calculate expected returns from a model estimated on the basis of the returns materializing before the event window. When estimating the expected returns $E[r_{it}]$, we test the currencies' returns for autocorrelation and heteroscedasticity over all periods (pre-event plus event windows). As either autocorrelation or heteroscedasticity are largely absent in the returns, we employ a Constant Mean Return Model (CMRM).

Results

Table 1 shows the results of the exchange rates on hearing the ECB QE announcement.

Table 1

ECB's QE Announcement

		Event	Anticipation	Adjustment
EUR/USD	Return (CAR)	-0.01687*	-0.00037	-0.02841*
	t-statistic	-3.66585	-0.11385	-13.8068
	p-value	0.000389	0.909578	2.41E-25
BTC/EUR	Return (CAR)	0.021522	-0.01453	0.151452
	t-statistic	0.400009	-0.3818	6.294414
	p-value	0.689727	0.703154	3.31E-09
BTC/USD	Return (CAR)	0.02059	-0.01367	0.159638
	t-statistic	0.395028	-0.37102	6.84856
	p-value	0.693631	0.711379	5.38E-10

Notes. * significance level of 10%. Source: Author's calculations.

Following the ECB announcement, the Euro appreciated in relation to the Dollar by 1.7% to a significance level of 1%. In the previous two days there was no anticipation in the foreign exchange market for the news, in contrast to the adjustment in the next two days which recorded an even higher percentage and reached 2.8% the appreciation of the Euro against the Dollar at a significance level of 1%. Figure 1, which depicts the returns of the Euro/Dollar exchange rate, shows very strong fluctuations of the returns around the date of the announcement of the ECB (March 18). According to Table 1, the Bitcoin exchange rate appears not to be affected by the ECB QE announcement, neither with relation to the Euro (BTC/EUR) nor to the Dollar (BTC/USD).
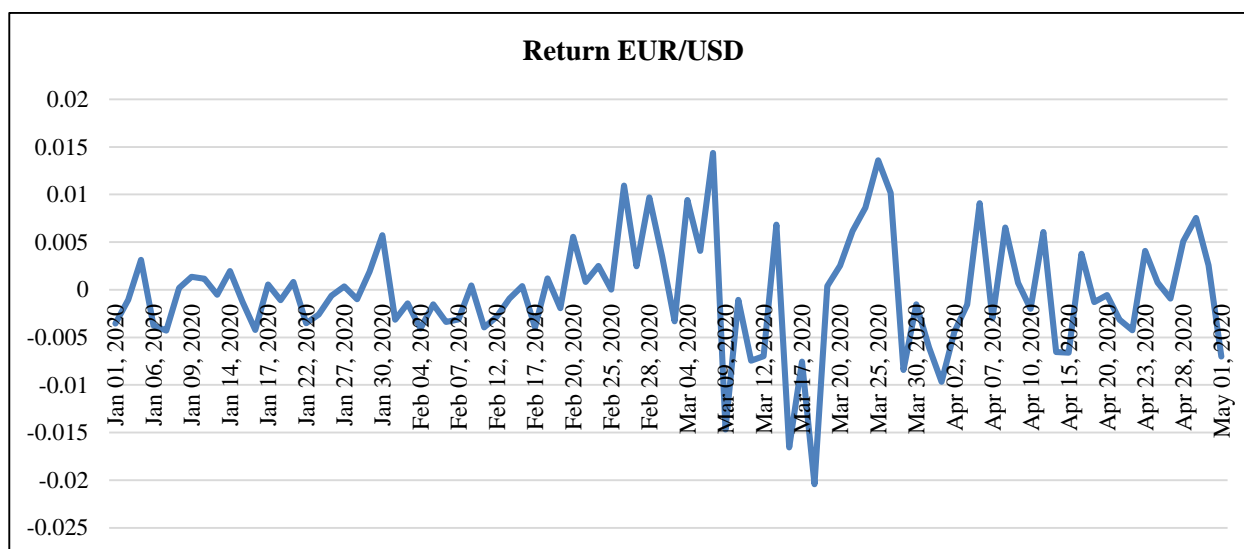
Figure 1. Return exchange rate EUR/USD. Source: Author's calculations.

Table 2 shows the results of the exchange rates upon hearing the FED QE announcement.

Table 2

FED's QE Announcement

		Event	Anticipation	Adjustment
EUR/USD	Return (CAR)	0.007599***	0.004275	-0.00434**
	t-statistic	1.865738	1.245762	-1.99976
	p-value	0.091717	0.214978	0.047503
BTC/EUR	Return (CAR)	-0.03694	0.042686	00.0259
	t-statistic	-0.47064	0.769198	0.737946
	p-value	0.63878	0.443339	0.462038
BTC/USD	Return (CAR)	-0.3425	0.125121*	0.034122
	t-statistic	-0.3279576	3.279576	1.414123
	p-value	0.732598	0.001373	0.160004

Notes. ***, **, * significance level of 1%, 5%, and 10%, respectively. Source: Author's calculations.

Following the announcement of the FED, the Euro depreciated in relation to the Dollar by 0.76% at a significance level of 10%. In the previous two days, there was no anticipation in the foreign exchange market for the news, in contrast to the adjustment in the next two days that followed the appreciation of the Euro by 0.43% to a significance level of 5%. Figure 1 shows that the yield variance around the FED announcement date (29 April 2020) is small, and clearly much smaller than the exchange rate fluctuation shown in the ECB announcement (18 March 2020). According to Table 2, the Bitcoin exchange rate appears not to be affected by the FED QE announcement in relation to both major currencies (EYR, USD). Figures 2 and 3 show the BTC/EUR and BTC/USD exchange rate returns. The yields in both graphs follow a similar course, with the BTC/EUR exchange rate showing a slightly stronger fluctuation compared to the BTC/USD. The fluctuations in both exchange rates on the days of the announcements (March 18, 2020 and April 29, 2020) do not show strong fluctuation, but a relatively stable course, a fact that is confirmed by the research findings.
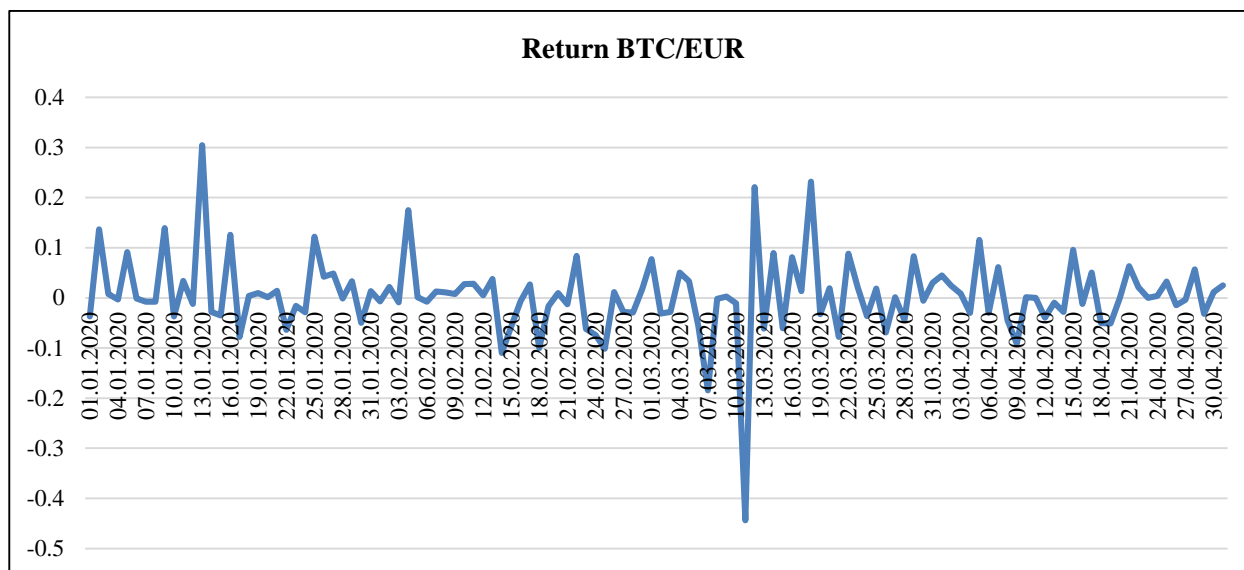
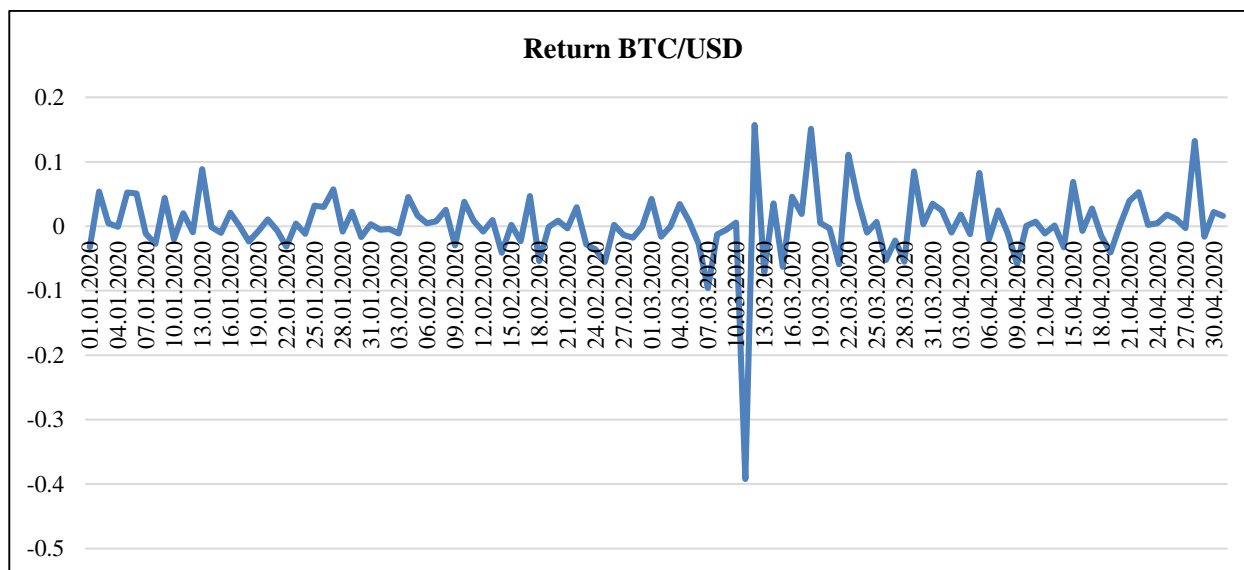*Figure 2.* Return exchange rate BTC/EUR. Source: Author's calculations.

Figure 3. Return exchange rate BTC/USD. Source: Author's calculations.

Conclusion

The aim of the present paper was to investigate the effect of two announcements of the two Central Banks, ECB and FED, on exchange rates through an event study. The announcements chosen are significant, because they implement "helicopter money"—an instrument considered taboo for Central Banks—and, also, because they apply the forward guidance policy. This is important that because for many academics and central bankers, the potency of monetary policy decisions does not stem from their direct impact on current short-term rates but from their influence on expectations about future interest rates and, hence, on the whole yield curve. Regarding the exchange rates, in addition to the EUR/USD exchange rate, it was deemed necessary to examine the virtual currencies, namely the BTC/EUR and BTC/USD exchange rates. The results of the survey showed that there was a large appreciation of the Euro in relation to the Dollar upon hearing the ECB's QE announcement. While

the ECB's announcement was about expansionary policy measures; however, instead of leading to a devaluation of the Euro as expected in theory, the results of the survey showed an appreciation of the Euro. This unexpected reaction of the EUR/USD exchange rate to monetary policy appears in the literature of other studies as well (Gurkaynak et al., 2021; Clarida & Waldman, 2008; Engel & Frankel, 1984). One possible explanation is that the ECB's announcement was not limited to describing Quantitative Easing measures, but used strong expressions such as "will do everything necessary" for as long as needed, thus giving a political tone, leading to the stimulation and strengthening of the Euro. This is consistent with Rogers, Scotti, and Wright's (2014) "saving the euro" effect, in which it is stated that easier than expected monetary policy announcements during the European debt crisis sometimes led to appreciations of the Euro, as these were seen as signs that the ECB was determined to hold the Eurozone together. The transatlantic spillover of monetary policy should also be considered (Jarocinski, 2020; Powell, 2018; Bernanke, 2015). For example, a devaluation of the Euro due to the ECB QE could be prevented by the FED's decision to increase the lending rate. Regarding the FED, the investigation showed that the Euro depreciated after the release of the announcement. The result is consistent with other studies, such as that of Stavrakeva and Tang (2018), who noted the appreciation of the Dollar in response to easings in FED policy during the Great Recession. They propose a combination of information (Delphic forward guidance) and exorbitant duty —Gourinchas, Rey, and Govillot (2018)—as an explanation. According to the results of the research, the exchange rates related to Bitcoin appear not to be affected by the announcements of the Central Banks, a fact that is in accordance with other surveys, where the independent role of the Bitcoin is emphasized, in relation to political decisions, either those of governments or of Central Banks (Corbet, 2020).

References

Adam, K., & Billi, R. M. (2006). Optimal monetary policy under commitment with a zero bound on nominal interest rates. *Journal of Money, Credit and Banking, 38*, 1877-1905.

Aloui, D. (2021). The COVID-19 pandemic haunting the transmission of the quantitative easing to the exchange rate. *Finance Research Letters, 43*, 102025.

Altavilla, C., Brugnolini, L., Gürkaynak, R. S., Motto, R., & Ragusa, G. (May 2019). Measuring euro area monetary policy. *Working Paper Series, No. 2281*.

Altavilla, C., Carboni, G., & Motto, R. (2015). Asset purchase programmes and financial markets: Lessons from Euro Area. *Working Paper Series No. 1864*. Frankfurt, Germany: European Central Bank.

Anaya, P., Hachula, M., & Offermanns, C. J. (2017). Spillovers of US unconventional monetary policy to emerging markets: The role of capital flows. *J. Int. Money Finance, 73*, 275-295.

Anderson, G., & Cesa-Bianchi, A. (2020). Crossing the credit channel: Credit spreads and firm heterogeneity. *Bank of England Working Papers 854*. Bank of England.

Andrade, P., & Ferroni, F. (2020). Delphic and Odyssean monetary policy shocks: Evidence from the Euro Area. *Journal of Monetary Economics*, forthcoming.

Andrade, P., & Ferroni, F. (July 2019). Delphic and Odyssean monetary policy shocks: Evidence from the Euro Area. *Working Papers, Federal Reserve Bank of Boston No. 19-17*.

Bacchetta, P., & Wincoop, E. (2006). Can information heterogeneity explain the exchange rate determination puzzle? *Am. Econ. Rev., 96*(3), 552-576.

Beckmann, J., & Czudaj, R. (2017). Exchange rate expectations and economic policy uncertainty. *European Journal of Political Economy, 47*, 148-162.

Bernanke, B. (5 November 2015). Federal Reserve policy in an international context. *Speech at the 16th Jacques Polak Annual Research Conference*. Washington.

Bhattarai, S., Chatterjee, A., & Park, W. (2018). Effects of US quantitative easing on emerging market economies. *ADBI Working Paper, 803*.

Bouakez, H., & Normandin, M. (2010). Fluctuations in the foreign exchange market: How important are monetary policy shocks? *J. Iint. Econ., 81*(1), 139-153.

Bouri, E., Das, M., Gupta, R., & Roubaud, D. (2018). Spillovers between Bitcoin and other assets during bear and bull markets. *Working Papers 201812.* University of Pretoria, Department of Economics.

Bouri, E., Gupta, R., Tiwari, A., & Roubaud, D. (2017). Does Bitcoin hedge global uncertainty? Evidence from wavelet-based quantile-in-quantile regressions. *Finance Res. Lett., 23*, 87-95.

Bubeck, J., Habib, M., & Manganelli, S. (2018). The portfolio of Euro Area fund investors and ECB monetary policy announcements. *Journal of International Money and Finance, 89*, 103-126.

Cambell, J. R., Evans, C. L., Fisher, J. D., & Justiniano, A. (2012). Macroeconomic effects of Federal Reserve forward guidance. *Brookings Papers on Economic Activity (Spring)*.

Chang, C., Feng, G., & Zheng, M. (2021). Government fighting pandemic, stock market return and COVID-19 virus outbreak. *Emerg. Mrk. Finance Trade, 57*, 2389-2406.

Clarida, R., & Waldman, D. (2008). Is bad news about inflation good news for the exchange rate? And, if so, can that tell us anything about the conduct of monetary policy? *NBER Working Paper Series.*

Corbet, S., Larkin, C. J., Lucey, B. M., Meegan, A., & Yarovaya, L. (2020). Cryptocurrency reaction to FOMC announcements: Evidence of heterogeneity based on blockchain stack position. *Journal of Financial Stability, 46*, 100706.

Depvupa, N., & Narayan, P. (2020). Hourly oil price volatility: The role of COVID-19. *Energy Research Letters, 1*(2), 13683.

Detola, L., Georgiadis, G., Gräb, J., & Mehl, A. (2021). Does a big bazooka matter? Quantitative easing policies and exchange rates. *Journal of Monetary Economics, 117*, 489-506.

Eichenbaum, M., & Evans, C. (1995). Some empirical evidence on the effects of monetary policy shocks on exchange rates. *Q. J. Econ., 110*, 975-1009.

Enders, Z., Hünnekes, F., & Müller, G. J. (2019). Monetary policy announcements and expectations: Evidence from German firms. *Journal of Monetary Economics, 108*, 45-63.

Engel, C., & Frankel, J. (1984). Why interest rates react to money announcements: An explanation from the foreign exchange market. *J. Monet. Econ., 13*(1), 31-39.

Falagiarda, M., & Reitz, S. (2015). Announcements of ECB unconventional programs: Implications for the sovereign spreads of stressed euro area countries. *Journal of International Money and Finance, 53*, 276-295.

Fatum, R., & Hutchison, M. (2006). Effectiveness of official daily foreign exchange market intervention operations in Japan. *J. Int. Money Finance, 25*(2), 199-219.

Faust, J., & Rogers, J. (2003). Monetary policy's role in exchange rate behavior. *J. Monet. Econ, 50*(7), 1403-1424.

Feng, G. F., Yang, H. C., Gong, Q., & Chang, C. P. (2021). What is the exchange rate volatility response to COVID-19 and government interventions?. *Economic Analysis and Policy, 69*, 705-719.

Ferrari, M., Kearns, J., & Schrimpf, A. (2021). Monetary policy's rising FX impact in the era of ultra-low rates. *Journal of Banking and Finance, 129*, 106142.

Frankel, J. (1992). Monetary and portfolio-balance models of exchange rate determination. In *International economic policies and their theoretical foundations* (pp. 793-832). New York: Academic Press.

Friedman, M. (1968, March). The role of monetary policy. *The American Economic Review, 58*(1), 1-17.

Glick, R., & Leduc, S. (2012). Central bank announcements of asset purchases and the impact on global financial and commodity markets. *J. Int. Money Finance, 31*, 2078-2101.

Gourinchas, P.-O., Rey, H., & Govillot, N. (2018). Exorbitant privilege and exorbitant duty. *Working Paper*.

Guo, W., Chen, Z. F., & Sevic, A. (2021). The political pressure from the US upon RMB exchange rate. *Journal of International Financial Markets, Institutions & Money, 73*, 101293.

Gurkaynak, R., Kara, H., Kısacıkoğlu, B., & Lee, S. (2021). Monetary policy surprises and exchange rate behaviour. *Journal of International Economics, 130*, 103443.

Haldane, A., Roberts-Sklar, M., Wieladek, T., & Young, C. (October 2016). QE: The story so far. *Staff Working Paper Series 624*. Bank of England.

Inoue, A., & Rossi, B. (2019). The effects of conventional and unconventional monetary policy on exchange rates. *Journal of International Economics, 118*, 419-447.

Isah, K., & Raheem, D. (2019). The hidden predictive power of cryptocurrencies and QE: Evidence from US stock market. *Physica A, 536*, 121032.

Iyke, B. (2020). COVID-19: The reaction of US oil and gas producers to the pandemic. *Energy Research Letters, 1*(2), 13912.

Iyke, B., & Ho, S.-Y. (2021). Exchange rate exposure in the South African stock market before and during the COVID-19 pandemic. *Finance Research Letters, 43*, 102000.

Jarocinski, M. (October 2020). Central bank information effects and transatlantic spillovers. *Working Paper Series No. 2482.* European Central Bank.

Joyce, M., Lasaosa, A., Stevens, I., & Tong, M. (2011). The financial market impact of quantitive easing in the United Kingdom. *Bank of England, Working Paper No. 393.*

Kapetanios, G., Mumtaz, H., Stevens, I., & Theodoridis, K. (2012). Assesing the economy—Wide effects of quantitive easing. *Bank of England Working Pape No. 443*.

Kerssenfischer, M. (2019). Information effects of Euro Area monetary policy: New evidence from high-frequency futures data. *Discussion Paper 07/2019.* Deutsche Bundesbank.

Kido, Y. (2016). On the link between the US economic policy uncertainty and exchange rates. *Economics Letters, 144*, 49-52.

Kinateder, H., Campbell, R., & Choudhury, T. (2021). Safe haven in GFC versus COVID-19: 100 turbulent days in the financial markets. *Finance Res. Lett., 43*, 101951.

Kocenda, E., & Moravcová M. (2018). Intraday effect of news on emerging European forex markets: An event study analysis. *Economic Systems, 42*, 597-615.

Kothari, S., & Warner, J. (2006). Econometrics of event studies. In *Handbook of corporate finance: Empirical corporate finance, Vol. 1* (Ch. 1). North-Holland: Elsevier.

Kutner, K. N. (2001). Monetary policy surprises and interest rates: Evidence from the fed funds futures market. *Journal of Monetary Economics, 47*(3), 523-544.

Liu, L. G., & Pauwels, L. (2012). Do external political pressures affect the Renminbi exchange rate? *J. Int. Money Financ., 31*(6), 1800-1808.

Li, X. L., Li, X., & Si, D. K. (2020). Investigating asymmetric determinants of the CNY-CNH exchange rate spreads: The role of economic policy uncertainty. *Economics Letters, 186*, 108827.

Luther, W., & Salter, A. (2017). Bitcoin and the bailout. *Q. Rev. Econ. Finance, 66*, 50-56.

Lyke, B. (2020). The disease outbreak channel of exchange rate return predictability: Evidence from COVID-19. *Emerging Markets Finance and Trade, 56*(10), 2277-2297.

MacKinlay, A. (1997). Event studies in economics and finance. *J. Econ. Lit., 35*(1), 13-39.

Mazur, M., Dang, M., & Vega, M. (2020). COVID-19 and the March 2020 stock market crash. Evidence from S&P1500. *Finance Research Letters, 38*(1), 101690.

Melosi, L. (2017). Signalling effects of monetary policy. *The Review of Economic Studies, 84*(2), 853-884.

Miranda-Agrippino, S., & Rey, H. (2020). U.S. monetary policy and the global financial cycle. *The Review of Economic Studies, 87*(6), 2754-2776.

Moore, J., Nam, S., Suh, M., & Tepper, A. (2013). Estimating the impacts of US LSAPs on emerging market economies local currency bond mrkets. *Federal Reserve Bank of New York Staff Reports No. 595.*

Nakamura, E., & Steinsson, J. (2018). High-frequency identification of monetary non-neutrality: The information effect. *The Quaterly Journal of Economics, 133*(3), 1283-1330.

Narayan, P. (2020). Has COVID-19 changed exchange rate resistance to shocks? *Asian Economics Letters, 1*(1), 1-4.

Narayan, P. (2021). Understanding exchange rate shocks during COVID-19. *Finance Research Letters, 45*, 102181.

Narayan, P., Phan, D., & Liu, G. Q. (2020). COVID-19 lockdowns, stimulus packages, travel bans, and stock returns. *Finance Research Letters, 38*(1), 101732.

Nilavongse, R., Michał, R., & Uddin, G. (2020). Economic policy uncertainty shocks, economic activity, and exchange rate adjustments. *Economics Letters, 186*, 108765.

Paries, M. D., & Papadopouloub, N. X. (2020). On the credit and exchange rate channels of central bank asset purchases in a monetary union. *Economic Modelling, 91*, 502-533.

Peterson, P. (1989). Event studies: A review of issues and methodology. *Quart. J. Business Econ., 28*(3), 33-66.

Powell, J. (8 May 2018). Monetary policy influences on global financial conditions and international capital flows. *Speech at Eight High-Level Conference on the International Monetary System.* Zurich.

Prabheesh, K., Padhan, R., & Garg, B. (2020). COVID-19 and the oil price-stock market nexus: Evidence from net oil-importing countries. *Energy Research Letters, 1*(2), 13745.

Rajan, R. (2013). *A step in the dark: Unconventional monetary policy after the crisis.* BIS Basel.

Rajan, R. (12 March 2016). Towards rules of the monetary game. *Speech at the IMF/Government of India Conference on*

"Advancing Asia: Investing for the Future". New Delhi.

Reich, C. (2014). Effects of unconventional monetary policy on financial institutions. *Brookings Papers on Economic Activity.*

Rogers, J., Scotti, C., & Wright, J. (2014). Evaluating asset-market effects of unconventional monetary policy: A multi-country review. *Econ. Policy, 29*(80), 749-799.

Rosa, C. (2011). The high-frequency response of exchange tares to monetary policy actions and statements. *Journal of Banking & Finance, 35*(2), 478-489.

Rudebusch, G., & Christensen, J. (2012). The response of interest rates to U.S and U.K. quantitive easing. *Federal Reserve Bank of San Francisco. Working Paper Series, No. 2012-06.*

Schmitt-Grohe, S., & Uribe, M. (2007). Optimal inflation stabilization in a medium-scale macroeconomic model. In *Monetary policy under inflation targeting* (pp. 125-186). Central Bank of Chile, Santiago.

Stavrakeva, V., & Tang, J. (2018). The dollar during the global recession: US monetary policy and the exorbitant duty. *Working Papers 18-10 Federal Reserve Bank of Boston*.

Szcerbowicz, U. (2015). The ECB unconventional monetary policies: Have they lowered market borrowing costs for banks and governments? *International Journal of Central Banking, 11*, 91-127.

Tamgac, U. (2021). Emerging market exchange rates during quantitative tapering: The effect of US and domestic news. *Research in International Business and Finance, 57*, 101393.

Topcu, M., & Gulal, O. (2020). The impact of COVID-19 on emerging stock markets. *Finance Research Letters, 36*, 101691.

Ueda, K. (2012). The effectiveness of non-traditional monetary policy measures: The case of the Bank of Japan. *Jpn. Econ. Rev., 63*(1), 1-22.

Wang, Y. T., Zhang, D. H., Wang, X. Q., & Fu, Q. Y. (2020). How does COVID-19 affect China's insurance market? *Emerging Markets Finance and Trade, 56*(10), 2350-2362.

Weber, B. (2014). Bitcoin and the legitimacy crisis of money. *Camb. J. Econ., 40*, 50-56.

Wei, Z. X., Luo, Y., Huang, Z. L., & Guo, K. (2020). Spillover effects of RMB exchange rate among B&R countries: Before and during COVIDE-19 event. *Finance Res. Lett., 37*, 101782.

Wieladek., T., & Garcia Pascual, A. (2016). The European Central Banks's QE: A new hope. *CEPR Discussion Paper, No. 10495*.

Wright, J. (2012). What does monetary policy do to long-term interest rates at the zero lower bound? *The Economic Journal, 122*(564), F447-F466.

Yashiv, E. (26 March 2020). Breaking the taboo: The political economy of COVID-motivated helicopter drops. In *Europe in the time of COVID-19* (pp. 240-244). Centre for Economic Policy Research.