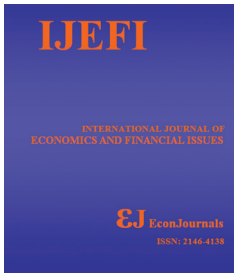

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The Impact of Quantitative Easing on Cryptocurrency

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ABSTRACT

On March 23, 2020, the Federal Reserve Board started the "unlimited quantitative easing" to boost economy. After the announcement, an obvious boom in the cryptocurrency markets is observed. This research adopted an event analysis method, by analyzing the cumulative abnormal returns before and after the statement, the study confirmed that the QE announcement has a significant impact on the two most popular cryptocurrencies, Bitcoin and Ethereum. There could be several possible explanations: cryptocurrencies can be used as an inflation hedge, a "safe haven" for other financial asset classes, and a substitute way of transaction. While gold is also known as an inflation hedge and a safe haven, the abnormal returns of the two biggest cryptocurrencies over gold indicate that the third reason, cryptocurrencies are being favored as an alternative option for transactions, played an important role in the boom of Bitcoin and Ethereum, and the boom of them might lead to the frenzied market of other cryptocurrencies.

Keywords: Bitcoin, Cryptocurrency, Quantitative Easing, Event Analysis
JEL Classifications: G15, C10, E52

1. INTRODUCTION

Since 2020, the US government and Federal Reserve Board (FRB) issued a series of policies to stimulate the economy, including a policy called "unlimited quantitative easing"; on March 23, 2020, FRB announced that they would "buy assets in the amounts needed to support smooth market functioning and effective transmission of monetary policy." In the same year, a remarkable bull market came for cryptocurrencies, the most popular one, Bitcoin (BTC) increased from $5000 in March 2020 to over $60000 in March 2021. Smaller cryptocurrencies, like Dogecoin (DOGE), also experienced huge increases and attracted much attention from the public. The purpose of this research is to study the impact of quantitative easing (QE), especially this unlimited QE announcement, on the cryptocurrency market.

During the process of quantitative easing, FRB would buy back securities like Mortgage-backed securities (MBS) and U.S Treasury securities (UST), the corresponding amount of currency will flow to the market. As shown in Figure 1, after the announcement of the unlimited QE (the red line) in March 2020, FRB bought a considerable amount of MBS and UST from the market, the money supply also surged.

Quantitative easing has been proved to have a significant impact on economic variables (Bhattarai et al., 2021; Kapetanios et al., 2012), financial markets (Todorov, 2020) and gold price (Zhu et al., 2018). Time series of the SP500 index and gold price are shown in Figure 2. After the outbreak of Covid19, the SP500 index experienced a crash in March, the announcement of QE stopped the crash immediately and started a new round of bull market. The gold price also surged after the announcement. At the same time, a boom in the Cryptocurrency markets also came. As shown in Figure 2, although the major part of the increase in BTC and ETH prices happened a few months later, obviously the red line marked the start of the bull market.

The first cryptocurrency, Bitcoin, was introduced by Nakamoto (Nakamoto, 2008), as a decentralized transaction tool. Since

then, cryptocurrency is becoming more and more popular. There are many similarities between cryptocurrency and gold; most importantly, their supplies are constrained by inartificial factors. For cryptocurrencies, the supply is strictly controlled by algorism; no matter how much calculation power is contributed to the network, the number of blocks being discovered will remain stable. In 2021/01, Standard and Poor's published a blog on their official website stating that the similarity between bitcoin and gold is increasing, "both of them are scarce," and are "uncorrelated to other popular asset classes in portfolios."

The impact of QE on the gold market has been studied by formal studies (Grynberg et al., 2019; Zhu et al., 2018); Some mechanisms that QE impacting the gold market can also be used in cryptocurrency markets. When the money supply increases, inflation may occur, people will look for financial assets that can preserve value as an inflation hedge. Since ancient times, the value of gold has been recognized by the public. As we stated before, one of the most important similarities between bitcoin and gold is their scarcity, so if the value of a cryptocurrency can be trusted by the public, its scarcity will make it a good inflation hedge. At the same time, many researchers point out that cryptocurrency can also be used as a "safe haven" (Bouri et al., 2020; Shahzad et al., 2020; 2019). During the QE process, monetary policies will increase the uncertainty of ordinary financial assets, and investors might turn to gold or cryptocurrencies to hedge their financial risk.

But different from other financial assets like stocks and gold, cryptocurrency is also a currency, a well-designed digital tool for transactions. In ancient times, gold was also used as an international currency, but since the legal currency-based transaction system was established in modern society, gold is not recognized as a currency anymore. When BTC was invited in 2008, it was designed to be a digital currency that can be easily used for transactions in an international environment, as a substitute for the legal currencies. For some investors, cryptocurrency is recognized as "the currency in the future."

Researchers have pointed out that the value of legal currencies and the stability of the modern financial system are based on people's trust toward the central bank and the government (Carruthers and Babb, 1996). If the monetary policy goes too far, people will doubt the legal currencies, and look for substitutes. Some researchers have pointed out that the boom of gold and cryptocurrency markets might indicate that people have begun to question the validity of the monetary policies (Braun, 2016). While cryptocurrency is invited as a transaction tool, this property might be attracting the public's attention as a substitute for the legal currency system, and this trend might accelerate during an undesirable QE process.

QE announcement in the US has two major differences from QE announcements in other countries. Firstly, since the establishment of the Bretton-Woods system US dollar has been the most important international currency. In the beginning, the issuance of the US Dollar is backed by gold, the other currencies will maintain a stable exchange rate with US Dollar. But in 1971 the Bretton-Woods system collapsed, US dollar is no longer backed by gold. Since then, the Federal Reserve Board (FRB) is able to control the money supply without gold deposits, like buying securities from the market. The US Dollar's role as the most important international currency has not changed, but during abnormal QE processes, concerns around its dominating position will generate among international investors. Secondly, since the other countries need to keep a stable exchange rate with the US dollar, most of them need to adopt an easing monetary policy.

In this research, we adopt an event analysis method to exam the impact of the unlimited QE announcement on cryptocurrencies. We first construct a pricing model for each cryptocurrency with SP500 index and gold price, by analyzing the residuals we can calculate the abnormal return of each cryptocurrency over traditional financial assets. The result shows that for the two biggest cryptocurrencies, BTC and ETH, there are significant abnormal returns after the announcement. For other less popular cryptocurrencies, most of them also have a positive abnormal return, but not statistically significant. We interpret that the most popular cryptocurrencies which have been widely recognized by the public, their roles as currency were strengthened during the QE process, and their growth may promote the boom in other smaller cryptocurrencies.

At the same time, central banks' movements around digital currencies also accelerate this year. For example, in October 2020 the European Central Bank (ECB) published its report on the digital euro. Together with the bull market of cryptocurrency, we interpret that these phenomena might indicate that both the governments and individual investors have begun to look for new solutions for international transactions.

2. LITERATURE REVIEW

This paper is related to three streams of studies. Firstly, our research is related to the growing literature of monetary policies and quantitative easing (QE), especially the impact of QE on financial markets. Secondly, this research builds on the extensive literature on cryptocurrency pricing. Last but not the least, several previous works analyzing how monetary policy impacts the gold market are very inspirational to our study.

The impact of QE has become a hot issue since the first round of QE in 2007. Among the first group of studies, the QE has been proved to be an effective way to overcome the financial crisis and boost GDP growth (Kapetanios et al., 2012). At the same time, the mechanism of QE affect interest rates (Christensen and Rudebusch, 2012), the impact on macroeconomic factors (Kapetanios et al., 2012), the impact on liquidity, turnover and asset prices (Joyce et al., 2010) have also been studied. In some of the latest studies, the US QE programs' effect on emerging countries' financial markets was analyzed (Bhattarai et al., 2021), QE programs of the European Central Bank have been proved to have a significant impact on the prices and liquidity of bonds (Todorov, 2020) and on international investment position (Cezar and Silvestrini, 2021). The work analyzing how the QE process affects people's trust in the central bank legitimacy (Braun, 2016), is closely correlated with our study. Although QE has been a hot issue in recent years, up to the present we haven't found any study around the QE's effect on the cryptocurrency market.

Cryptocurrency is another focused topic at present; many researchers put their effort into building quantitative models to analyze factors affecting cryptocurrency price and volatility. In the early attempts, (Dyhrberg, 2016) constructed a garch model including gold prices, exchange rates and stock index to price bitcoin, and claimed that bitcoin has many similarities with US Dollar and gold. (Baur et al., 2018) made several improvements toward the previous study and pointed out that bitcoin looks more like an investment with high risk. The google search data is proved to be a good indicator of the BTC price fluctuations (Kjærland et al., 2018). The volatility spillovers of cryptocurrency are also studied (Malhotra and Gupta, 2019; Mighri and Alsaggaf, 2019). In some recent works, the impacts of factors like economic policy uncertainty (Mokni, 2021) and gold price (Jareño et al., 2020) on bitcoin were analyzed. Another trend of studies is the safe heaven test of bitcoin; previous studies pointed out that gold can be used as a "safe heaven" for stock investors; as an asset having many similarities with gold, some researchers found that bitcoin might also be used as a "safe heaven" (Bouri et al., 2020; Shahzad et al., 2020). But in some other studies, the cryptocurrency's role as a "safe heaven" is rejected (Baur et al., 2018; Kjærland et al., 2018). At the same time, the safety issues around cryptocurrency and blockchain technology also attract researchers' attention (Ghalwesh et al., 2020; Mselmi, 2020).

Bitcoin has many similarities with gold, they don't generate cash flow; their value depends heavily on people's recognition, and their supplies are constrained by inartificial factors. Many researchers have found the role of gold as an inflation hedge, in the original study, (Sjaastad and Scacciavillani, 1996) find out the relation between currency appreciation and the price of gold in that currency. Later the relation has been verified by several other studies (Pukthuanthong and Roll, 2011; Reboredo, 2013). Additionally, in recent studies, the relation between monetary policy and gold is also confirmed, (Zhu et al., 2018) find that the gold price moves significantly in response to the QE announcements of the US Federal Reserve and the European Central Bank; (Grynberg et al., 2019) also find that extensive use of quantitative easing aimed at facilitating the economic recovery post 2009 caused price bubbles in gold. On the one hand, these similarities can help explain the bull market of cryptocurrency; on the other hand, if we observe a significant abnormal return of cryptocurrency over gold, we can prove that besides being an inflation hedge or risk hedge, the role of cryptocurrency as a digital transaction tool also result in the price increase.

At the same time, to study the impact of the QE announcement as an event, we decide to adopt an event analysis method which is first introduced in (Brown and Warner, 1985).

3. DATA AND METHODOLOGY

3.1. Data

Weekly data from 2016/01-2021/04 (the last week in 2015 is also used to calculate the price return of the 1st week in 2016) is used to study the impact of the QE announcement on cryptocurrency.

We first investigate the market structure of cryptocurrency. Some information on the ten biggest cryptocurrencies is listed in Table 1, and the market cap distribution of them is shown in Figure 3. The data comes from "investing.com" and is documented in 2021/05/02. The first, biggest, and the most popular cryptocurrency is Bitcoin, which contributes 60% to the market value of these ten cryptocurrencies. The following one is Ethereum, which is first introduced by Vitalik Buterin in 2013, several drawbacks of Bitcoin were fixed. No matter in market capitalization, or popularity, these two cryptocurrencies weigh bigger than the others. Polkadot (DOT) and Uniswap(UNI) are excluded from our study since they don't have a price history that is long enough for our analysis.

The price series of the remaining eight cryptocurrencies are shown in Figure 4. As we notice, a boom in the cryptocurrency market came last year, except for USDT, all the cryptocurrencies experienced a significant increase in their prices. USDT is a special cryptocurrency that is backed by USD cash, so its price will move around 1. But the price increase didn't happen at the same time, and for some cryptocurrencies like DOGE and BNB, obviously, the significant increase didn't come until 2021, long after the QE announcement. As a result, we are not able to claim that the QE announcement has a positive impact on the cryptocurrencies with the original price series. To analysis the impact of the QE announcement, we decide to adopt an event analysis method which is first introduced in (Brown and Warner, 1985) and is frequently used in the following studies (Chang et al., 2007) that analyze the impact of an individual event on financial assets.

To make sure the stationarity of the time series, we calculate the log return of the prices. As shown in formula 1, the log return of Bitcoin in time t is the log difference of Bitcoin price in time t and t-1. The same method is also used in other price series, the log-return series of them are noted by rBTC and rSP, etc. The descriptive statistics are listed in Table 2.

$$rBTC_t = Ln(BTC_t) - Ln(BTC_{t-1}) \quad (1)$$

We use Dickey–Fuller test to verify the stationarity of the time series. The result is shown in Table 3, while the original price series are very likely to contain a unit root, the log-returns are proved to be generated by a stationary process.

3.2. The Event Analysis Method

We adopt an event analysis method using cumulative abnormal return (CAR) to test the impact of this QE announcement on the cryptocurrency market. In previous studies, researchers often

Table 1: Top ten biggest cryptocurrencies

	Code	Price	Market cap	Volume
Bitcoin	BTC	56925	$1.07T	$41.51B
Ethereum	ETH	2925.4	$339.68B	$29.19B
Binance Coin	BNB	617.13	$94.90B	$3.67B
Ripple	XRP	1.57215	$71.58B	$8.39B
Tether	USDT	1.0001	$51.78B	$95.31B
Dogecoin	DOGE	0.37972	$49.23B	$9.73B
Cardano	ADA	1.32779	$42.19B	$2.02B
Polkadot	DOT	36.625	$34.22B	$1.61B
Uniswap	UNI	40.783	$21.32B	$762.46M
Bitcoin Cash	BCH	980.78	$18.43B	$2.98B

Figure 1: The unlimited QE (the redline stands for the QE announcement; M2 after 2020/05 have been adjusted downward due to the scale change of FRB.)

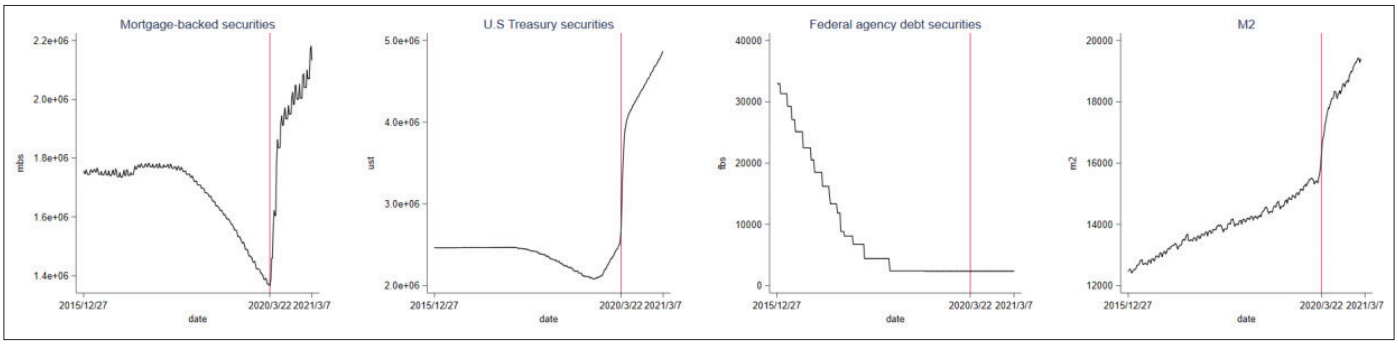


Figure 2: The impact of QE on asset prices

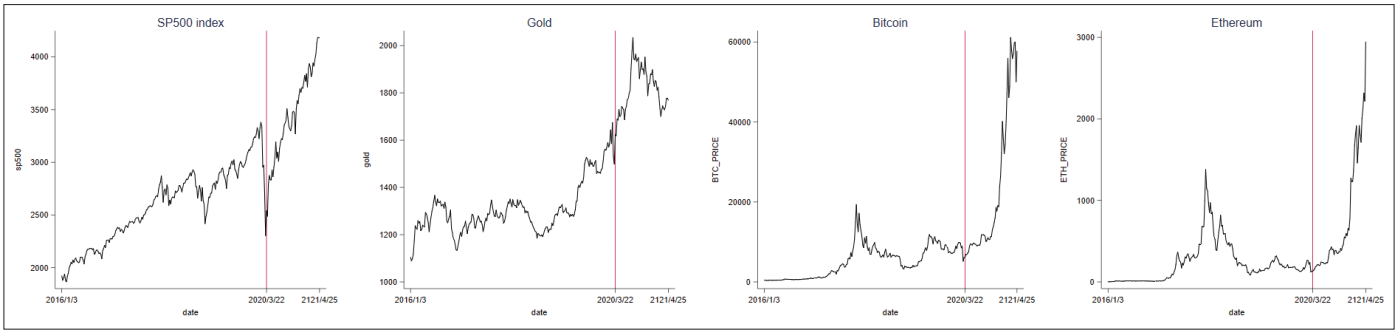
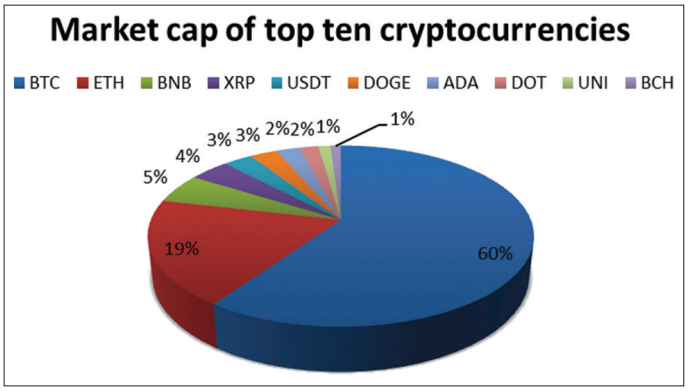


Figure 3: Market cap distribution of cryptocurrencies



use the stock market index to construct benchmark portfolios. Considering the unique property of Bitcoin, and its similarity with gold as we talked in the previous part, we decide to include the spot price of gold (XAU) in our pricing model. So the pricing model is a simple OLS regressing model, which uses the market index return and spot gold price return to predict the return of the cryptocurrency, as shown in formula 2. After we get the parameters of the pricing model, we are able to construct a portfolio with traditional financial assets to simulate the movements of the cryptocurrency, and the residuals of the pricing model can be considered as the abnormal return of the cryptocurrency over this portfolio. By analyzing the CAR calculated by formula 3 and formula 4, we can have an insight into the impact of this QE announcement.

$$rCC_t=\alpha+\beta\cdot rSP_t+\gamma\cdot rXAU_t+\varepsilon_t,\ rCC=[rBTC, rETH,\ldots,rBCH] \quad (2)$$

$$AR_t=rCC_t-\alpha-\beta\cdot rSP_t-\gamma\cdot rXAU_t=\varepsilon_t \quad (3)$$

Table 2: Descriptive statistics

Variables	n	Mean	SD	Min	Max
XAU	278	1,414	231.4	1,089	2,035
SP	278	2,765	513.8	1,865	4,185
BTC	278	8,861	11,670	376.7	61,195
ETH	278	338.6	451.6	0.999	2,945
BNB	181	39.45	88.72	1.670	619.8
XRP	278	0.312	0.340	0.00400	2.650
USDT	211	1.000	0.0103	0.915	1.030
DOGE	204	0.0106	0.0396	0.000914	0.391
ADA	174	0.199	0.305	0.0258	1.371
BCH	195	529.6	476.7	78.35	2,898
rXAU	278	0.00184	0.0193	-0.0903	0.0803
rSP	278	0.00257	0.0250	-0.162	0.114
rBTC	278	0.0176	0.113	-0.539	0.362
rETH	278	0.0288	0.163	-0.660	0.570
rBNB	180	0.0329	0.183	-0.692	1.091
rXRP	278	0.0208	0.200	-0.671	1.145
rUSDT	210	0.000424	0.00721	-0.0296	0.0543
rDOGE	203	0.0235	0.236	-0.637	1.488
rADA	173	0.00154	0.167	-0.638	0.622
rBCH	194	0.00598	0.212	-0.732	0.912

$$CAR_{[t_1,t_2]}=\sum_{t=t_1}^{t_2} AR_t \quad (4)$$

The regression parameters of formula 2 are calculated from the return series from 2016-2021 with OLS. On the one hand, the parameters measure the impact of the SP500 index and the gold price on the cryptocurrency. On the other hand, a portfolio of fixed-rate bonds, SP500 and gold with the amount of α, β, γ can be used to simulate the return of the responding cryptocurrency. If the QE announcement has no impact on the cryptocurrencies, the residuals and the cumulation of it should statistically be zero according to

the OLS principles. But if there is a significant positive CAR after the announcement, indicating that the responding cryptocurrency has a significantly higher return over the benchmark portfolio, the positive impact can be proved. Or perhaps there are other factors beyond the SP500 index and gold also affecting the cryptocurrency, and the QE announcement changed the situation, making the CAR after the announcement significantly higher than the CAR series before the announcement, the positive impact of the announcement can also be proved. So we come up with the following hypothesis, and the one-sided t-test is used to verify them.

$$\begin{cases} H_0 : \text{Mean}\left(CAR_{[t_1,t_1]},\ldots,CAR_{[t_1,t_8]}\right) = 0 \\ H_a : \text{Mean}(CAR_{[t_1,t_1]},\ldots,CAR_{[t_1,t_8]}) > 0 \end{cases} \quad (5)$$

Table 3: Results of the Dickey–Fuller tests

	Statistic	P-value		Statistic	P-value
XAU	–0.912	0.784	rXAU	–17.527	0.000
SP	–0.041	0.955	rSP	–18.194	0.000
BTC	1.906	0.999	rBTC	–17.032	0.000
ETH	3.711	1.000	rETH	–14.378	0.000
BNB	8.1	1.000	rBNB	–11.093	0.000
XRP	–2.034	0.272	rXRP	–13.666	0.000
USDT	–10.297	0.000	rUSDT	–15.568	0.000
DOGE	5.982	1.000	rDOGE	–12.637	0.000
ADA	–0.001	0.959	rADA	–10.875	0.000
BCH	–2.398	0.142	rBCH	–14.776	0.000

$$\begin{cases} H_0 : \text{Mean}(CAR_{[t_1,t_1]},\ldots,CAR_{[t_1,t_8]}) = \text{Mean}(CAR_{[t_{-8},t_{-8}]},\ldots, \\ CAR_{[t_{-8},t_{-1}]}) \\ H_a : \text{Mean}(CAR_{[t_1,t_1]},\ldots,CAR_{[t_1,t_8]}) > \text{Mean}(CAR_{[t_{-8},t_{-8}]},\ldots, \\ CAR_{[t_{-8},t_{-1}]}) \end{cases} \quad (6)$$

4. EMPIRICAL RESULTS

As the first step of our empirical analysis, we need to use the SP500 index and gold price to construct a pricing model for each cryptocurrency. A simple OLS model is used, the result of the regressions can be found in Table 4. The stock index and gold price are proved to have a significant impact on the two biggest cryptocurrencies, BTC and ETH; but when we look at the parameters for other cryptocurrencies, most of them are not significant. As we expected, BTC and ETH are more likely to act together with other traditional financial assets, and the smaller cryptocurrencies have more unexpected fluctuations. Another interesting fact is that most of the parameters are positive, which means the cryptocurrency returns have a positive relationship with these two traditional assets. As a result, use cryptocurrency to hedge financial risk might not be a good idea.

In the next step, the residuals of these pricing models will be used to analyze the abnormal return of cryptocurrency around the announcement.

Table 4: The pricing models

Var	btc	eth	bnb	xrp	usdt	doge	ada	bch
xau	0.790**	1.775***	1.348*	0.953	–0.0243	1.292	0.603	1.667**
	–0.351	–0.497	–0.736	–0.625	–0.0277	–0.913	–0.679	–0.835
sp	0.479*	0.863**	0.603	0.765	0.0134	0.697	1.002**	–0.0753
	–0.271	–0.383	–0.479	–0.482	–0.0189	–0.614	–0.437	–0.554
Constant	0.0149**	0.0233**	0.0289**	0.017	0.000424	0.0196	–0.00192	0.00347
	–0.00675	–0.00955	–0.0136	–0.012	–0.000502	–0.0165	–0.0126	–0.0152
Observations	278	278	180	278	210	203	173	194

***P<0.01, **P<0.05, *P<0.1

Figure 4: Price of the cryptocurrencies

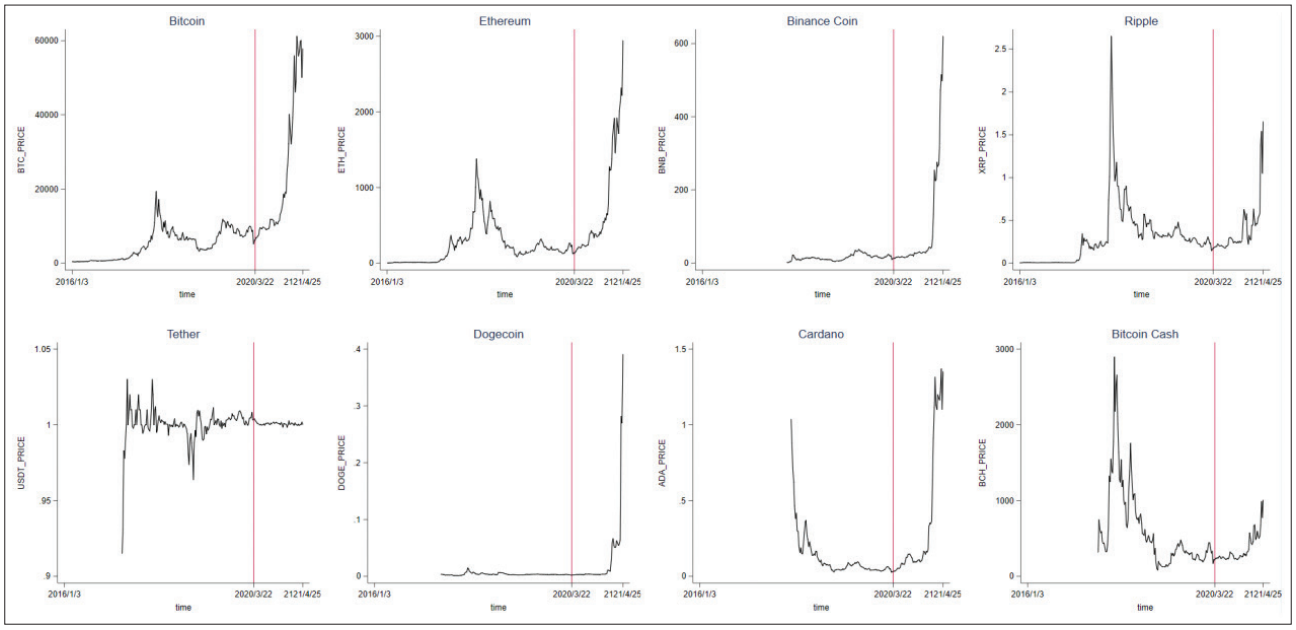


Figure 5: CAR of the cryptocurrencies

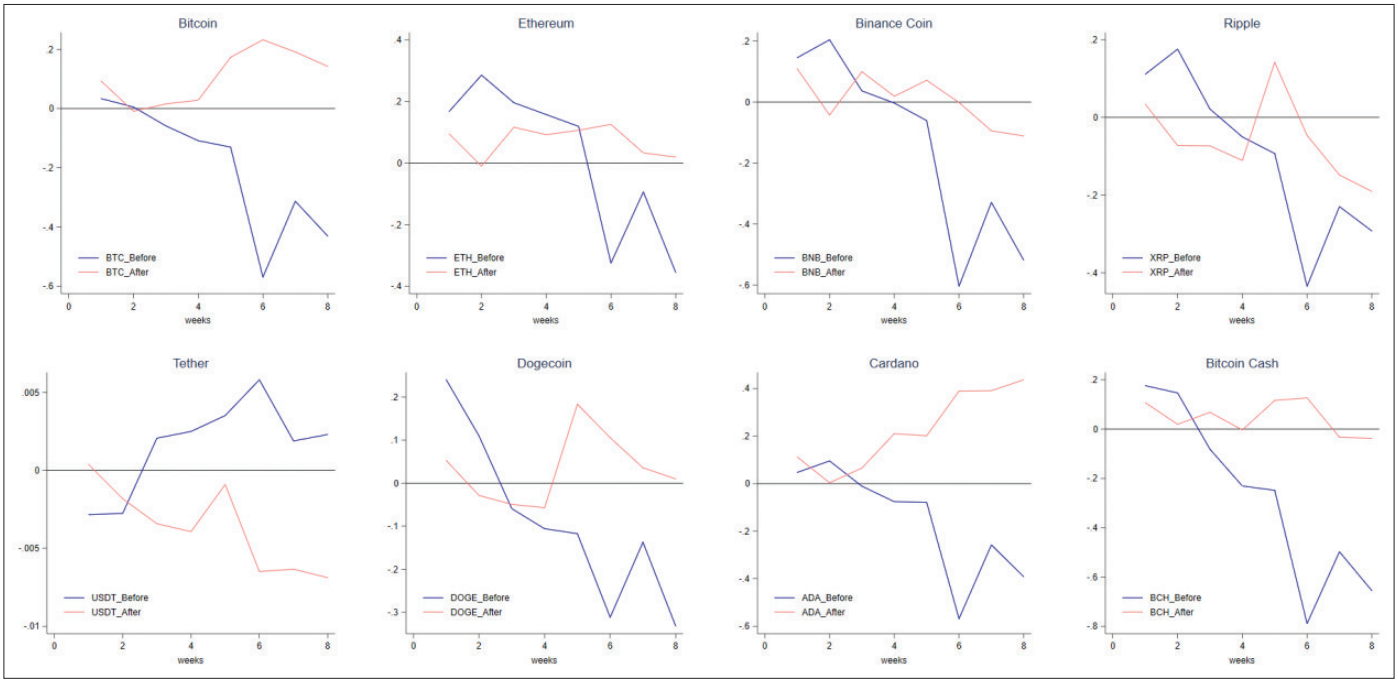


Table 5: Results of the one-sided t-tests

	$Mean_a=0$		$Mean_a=Mean_b$	
	t	P>t	t	P>t
BTC	3.4044	0.0057***	2.9393	0.0109**
ETH	4.0332	0.0025***	0.0109	0.2834
BNB	0.2171	0.4171	1.5692	0.0803*
XRP	-1.5614	0.9188	0.5674	0.2941
USDT	-3.7801	0.9966	-2.8703	0.988
DOGE	1.0864	0.1566	1.525	0.0855
ADA	3.9103	0.0029***	2.7984	0.0133**
BCH	1.8985	0.0497**	2.5726	0.0184**

***P<0.01, **P<0.05, *P<0.1

The CAR is then calculated with the parameters we listed above, we print the timeline view of the CAR in Figure 5. The CAR during 8 weeks before and after the QE announcement is separately printed with blue lines and red lines. In most cases, the red line lies above the blue line, and for BTC and ETH, there is a significant positive abnormal return after the QE announcement.

We also use one-sided t-tests to verify our findings. The result of the t-tests is shown in Table 5. As we expected, there are statistically significant positive abnormal returns after the QE announcement for BTC and ETH. At the same time, the CAR after the announcement is significantly higher than the CAR before for BTC. As for ETH, the t statistic is positive, indicating that the CAR after is higher, but not statistically significant, from the graph we notice that this is due to the positive CAR in the beginning, long before the announcement. Obviously, there is a negative performance during the last few weeks before the QE announcement, and the situation changed quickly after the announcement. But the following smaller cryptocurrencies start from BNB, although most of them still have positive t statistics, the p-values are not significant in many cases.

5. DISCUSSION

5.1. How QE Announcement Affected the Cryptocurrency Market

The main result of this article is that the QE announcement had a significant positive impact on the two biggest cryptocurrencies, BTC and ETH. In the 2 months after the QE announcement, significant abnormal return of BTC and ETH is found. For smaller cryptocurrencies, four out of six don't exhibit a significant abnormal return.

We look further into the mechanisms, there could be at least three ways QE might influence the cryptocurrency market. The QE process will cause inflation, like we discussed above the scarcity make cryptocurrency a possible inflation hedge. At the same time, cryptocurrencies can also be used as a hedge for other popular financial asset classes, while QE increases uncertainty around the financial system, some investors might turn to this "safe haven." Formal studies also proved that during undesirable QE process the public's trust toward legal currency will be affected and someone will look for substitutes. Cryptocurrency, as a well-designed transaction tool, is recognized by some investors as the currency in the future.

We need to notice that the gold price is also included in our pricing models, which means the two biggest cryptocurrencies exhibit significant abnormal returns over a portfolio including gold. As we all know, gold has been recognized as an inflation hedge for a long time (Sjaastad and Scacciavillani, 1996), and is also used as a "safe haven" by many investors when the uncertainty of the financial market increases (Baur and Lucey, 2010). In history, gold is also used as an international currency, but after the Second World War the system of legal currencies took place, gold is not recognized as a currency anymore. On the contrary, cryptocurrency is designed

to be the transaction tool that can be easily used in the digital age, so we interpret that the third reason, cryptocurrency as a substitute for legal currency, plays an important role in this bull market.

Additionally, one basic requirement of a currency is that its value needs to be recognized and accepted by the public. From this point, the top two biggest, most widely recognized cryptocurrencies are more likely to be taken as substitutes for legal currency. The empirical analysis also shows that the two biggest cryptocurrencies exhibit significant abnormal returns, while the t-values for many smaller cryptocurrencies are not significant. From Figure 4 we notice that for some cryptocurrencies like BNB and DOGE, their increase started a few months later, so it's possible that the QE announcement first stimulated the two biggest cryptocurrencies, and the boom of them gradually attracted the public's attention and caused the general prosperity in the cryptocurrency market.

5.2. Legal Currency and Cryptocurrency

Since the establishment of the Bretton-Woods system, the US dollar has always been the most important international currency. In the beginning, US Dollar kept a fixed exchange rate with gold, while the other currencies need to keep a fixed rate with US Dollar. In 1973 the system collapsed, the US dollar no longer follows the gold, and the FRB is able to issue US Dollars without deposit. Although no longer backed by gold, its role as the most important international currency has not changed. During the following decades, the international trade and world economy prospered in this environment where the value of US Dollar remains stable and "can be taken for granted" (Carruthers and Babb, 1996). However, after the four rounds of QE during the financial crisis, and the unlimited QE during the crisis of Covid19, researchers and international investors begin to be aware of the drawbacks of this financial system. When the US government needs to use monetary policy to meet domestic economic goals, the whole world is tied together, huge waves of international capital flows will generate. Under this system, developing countries that can't keep enough foreign exchange reserves are particularly vulnerable.

In 2021/03, the exchange rate, Treasury bond and stock market in Turkey collapsed together, many analysts blamed Turkey's high debt levels for the incident. As a matter of fact, the rate of government debt over GDP is 39.5% for Turkey in 2020, while the same number for the US is 108%. At the same time, the US 10 year treasury rate is around 1.6% in 2021/05, while the same number for Turkey is around 18.2%. The direct reason for the crash might be the removal of the governor of Turkey's central bank, but the real reasons behind this are the international capital flows and the developing countries' inability to keep their exchange rates from international capital flows under this international financial system. As another example, in 1997 the Asian financial crisis deeply harmed a series of Asian countries including Thailand, Indonesia and South Korea, when these countries' currencies were deliberately attacked by international capital.

At the same time, under the current transaction system, international transactions have to be made with the help of platforms and intermediates. Sizable costs will generate, and the system might be distracted by politics.

Under this circumstance, the idea that cryptocurrencies might become a substitute for legal currency gradually emerges. However, there are obvious drawbacks of cryptocurrency. The anonymity and secretiveness of cryptocurrency might be a good thing for transactions, but it also makes cryptocurrency a good tool for international crime and money laundering; the non-centricity makes cryptocurrency totally out of control from any government. Another point is that, although the supply is constrained by algorism for a certain kind of cryptocurrency, various kinds of cryptocurrencies keep emerging makes the total supply explode, accompanied by frauds and financial risks. In fact, the issuing of a new cryptocurrency can be done by everyone, and the cost is very low. Together with the decentralization property, disorder and chaos can hardly be avoided. Last but not the least, cryptocurrency mining wastes huge resources. As a result, cryptocurrencies can hardly be taken as a substitute for legal currencies for now. Many countries begin to introduce legislation banning over cryptocurrency; investigations and restrictions around cryptocurrency trading platforms also emerged.

At the same time, we notice that in many countries the central banks' movements around digital currencies also accelerate. The European Central Bank (ECB) has been working on digital euro since 2019. In October 2020, the ECB published its report on the digital euro; the digital euro is described to be a crypto-based currency, which is backed by the ECB. The central bank of China started research on a digital yuan as far back as 2014, and piloted the program in 2020/04. Other countries like Thailand, Sweden and Ukraine also piloted their digital currency programs. In 2021/02, central banks from mainland China, Thailand, United Arab Emirates and Hong Kong came together to explore the digital currency cross-border payment. It's obvious that after the Covid19 pandemic and the US unlimited QE process, the movements of central banks on digital currency also accelerate.

6. CONCLUSION

In summary, our model proved that after the QE process, the two biggest cryptocurrencies, BTC and ETH, exhibit significant abnormal returns over traditional assets. We interpret that cryptocurrency's role as a substitute for legal currency plays an important role in this bull market of cryptocurrencies. As formal studies proved, undesired monetary policy will raise the public's concern over the legal currency. After the unlimited QE announcement, a huge amount of US Dollars flowed to the international market, to make the exchange rate stable, and also to fight the financial crisis, most of the countries in the world adopted a loose monetary policy. It's possible that this QE process increased the concern over legal currencies, and the investors begin to look for other transaction options.

But there are some obvious drawbacks around cryptocurrency, and the fanatical activities in the cryptocurrency market recently make it looks more like a gambling house; huge price fluctuations will greatly weaken its role as a currency. Although can't be taken as a substitute for legal currencies, there are certainly some advantages that worth learning. With crypto technology, international online transactions can be made without intermediate companies, and

with algorism restrictions the issuance of currency can be properly controlled. We notice that the central banks' movements around crypto-technology-based digital currencies also accelerate since 2020, these properties of cryptocurrencies can be very enlightening for the design of digital currencies in the future.

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