

# The Occurrence of Fintech: The Insight into the World of Cryptocurrency from a Chinese Investment Perspective

Irfah Najihah Basir<sup>1\*</sup>, Shaliza Alwi<sup>2</sup>, Masrina Nadia Mohd Salleh<sup>3</sup>, Siti Nor Aini Mohd Aslam<sup>4</sup> and Siti Mariam Mellisa Abdullah<sup>5</sup>

<sup>1,2,4</sup>Taylor's University, Malaysia

<sup>3</sup>Universiti Teknologi Malaysia

<sup>5</sup>INTI International College & University, Malaysia

*irfahnajihah.basir@taylors.edu.my, shaliza.alwi@taylors.edu.my,*

*mnadia4@postgraduate.utm.my, aini.aslam@taylors.edu.my, mellisa.abdullah@newinti.edu.my*

## Article Info

Volume 83

Page Number: 1089 - 1100

Publication Issue:

March - April 2020

## Abstract

The concept of cryptocurrency, as part of the digital currency phenomena has been around since 1998 but world-wide adoption only started after the birth of Bitcoin. Financial technology or Fintech is a term used to describe the technological innovation in the financial sector; has seen various major breakthroughs over the past decade, and Bitcoin was right at the center stage. Clearly, a lack of public trust on financial systems after the global financial crisis which describes to the financial crisis of 2007-2008 which started from the subprime mortgage market in the U.S has given cryptocurrency an opportunity to enter the market. Since then, the industry has been growing at a rapid pace driven by increasing acceptance, greater media coverage, sustained inflows, initial coin offering 3 (ICO) frenzy and increased transaction capacity. This study aims to fill the gap by providing insight into the world of cryptocurrency from a Chinese investment perspective. The findings will help the global audience (not limited to those with domicile in China) understand the implication of cryptocurrency as an alternative investment in China. Therefore, this study strives to contribute to the literature and open up a gateway for more future research on FinTech in China.

**Keywords:** *Fintech, cryptocurrency, Chinese Investment Perspective, Bitcoin*

## Article History

Article Received: 24 July 2019

Revised: 12 September 2019

Accepted: 15 February 2020

Publication: 14 March 2020

## 1. INTRODUCTION

Fintech is a term used to describe the technological innovation in the financial sector; has seen various major breakthroughs over the past decade, and Bitcoin was right at the center stage. Clearly, a lack of public trust on financial systems after the global financial crisis which describes to the financial crisis of 2007-2008 which started from the subprime mortgage

market in the U.S has given cryptocurrency an opportunity to enter the market. Since then, the industry has been growing at a rapid pace driven by increasing acceptance, greater media coverage, sustained inflows, initial coin offering 3 (ICO) frenzy and increased transaction capacity [1]. At the time of this writing, according to the data from the industry website [coinmarketcap.com](http://coinmarketcap.com)<sup>4</sup>, there are around

1,326 cryptocurrencies throughout 7,120 markets, and these numbers continue to increase. As argued by [2], the current low interest rate environment could drive investors to favor cash over treasury bills, and a cashless society could be the solution. In fact, countries like Denmark, Sweden, Norway, Somaliland and South Korea have already shown interest in promoting a cashless society [3]. With proper government driven initiatives, the cryptocurrency market is likely to grow and thrive.

Of all the cryptocurrencies, Bitcoin is seen as the most successful due to its wide acceptance in the industry [1]. Although seen as a disruption to banking, Bitcoin is seen by many to have the potential to revolutionize transaction and settlement systems at banks [4]. Like other disruptive innovations, Bitcoin became the center of various criticisms coming from the likes of central banks, economists and regulatory authorities. Most of the criticisms were driven by the scandals related to the fraud, theft and loss of Bitcoins, causing the price of Bitcoin to swing irregularly.

Regardless of all the issues revolving around the technology, the acceptance of Bitcoin continues to grow across the globe. Bitcoin first came to the scene in 2009 at the time when internet has long been accepted as part of everyday lifestyle for many individuals worldwide. Unlike gold and silver, Bitcoin is not linked to any commodity [5]. In [6] argue that Bitcoin is a hybrid of precious metals and conventional hard currencies. Bitcoin has no intrinsic value as it is not a legal tender [7] but its popularity continues to dominate the media. In fact, many businesses have already started accepting Bitcoin, from the biggest online traveling site Expedia, software giant Microsoft, top Japanese online

shopping site Rakuten, to the fast food giant Subway. The list looks to grow as businesses are constantly looking for ways to expand their businesses by providing more payment options. Just recently, in September 2017, CME Group and Chicago Board Options Exchange (CBOE) Global Markets, two of the largest futures exchanges under the oversight of the Commodity Futures Trading Commission (CFTC), have been given the greenlight to list Bitcoin futures, enabling investors to buy and sell the cryptocurrency [8].

The growing popularity, along with the increasing availability through exchanges and futures, the demand for Bitcoin has skyrocketed in late 2017, pushing the price to all-time high [9]. Nevertheless, Bitcoin price failed to defy the gravity and took a nosedive the subsequent year. Although Bitcoin has gone through multiple downturns between 2011 and 2015, the one in 2018 is by far the worst and experts are speculating further drop in price [9]. While FinTech is making strides by applying IT innovations into the field of finance, much is still needed to close the gap between finance and IT. The application of cryptocurrency in the field of finance remains one of the many gaps present in the existing literature. This study aims to fill the gap by providing insight into the world of cryptocurrency from a Chinese investment perspective. The findings will help the global audience (not limited to those with domicile in China) understand the implication of cryptocurrency as an alternative investment in China. Therefore, this study strives to contribute to the literature and open up a gateway for more future research on FinTech in China.

Bitcoin's potential has shaken the finance industry, attracting attention from online community, investors, to

academic scholars. Nevertheless, there is a lack of understanding with regards to the trading behavior of Bitcoin denominated in major currencies and most importantly, the potential of Bitcoin as an alternative to stocks in China. With various domestic governmental control and crackdown, and along with the scandals (domestic and international) involving Bitcoin, the volatility has been enormous since inception. The volatility in the return can be detrimental to Bitcoin and affect its risk-and-reward dynamic. As a result, a volatility analysis is needed to help understand the risk-and-reward of the CNY- denominated Bitcoin. Nevertheless, having great return-volatility may not be sufficient to qualify Bitcoin as an alternative investment to stocks in China. A study of the integration between the CNY-denominated Bitcoin and the Chinese stocks is needed to see if it can be used to diversify against Chinese equities risk. The findings of this paper could provide useful input to the scholars, regulators and the investment community. This study aims to address the main research question: Can Bitcoin act as an alternative to stocks in China and offer diversification from Chinese equities risk? Therefore, the research question is (1) Does the CNY-denominated Bitcoin exhibit similar trading characteristics as the ones denominated in EUR and USD?

## 2. LITERATURE REVIEW

### 2.1. The Performance of Bitcoin

Bitcoin has enormous ups and downs since inception, making it one of the most volatile assets ever known. The price of Bitcoin is believed to be the result of the demand and supply dynamic [10] but such dynamic fails to explain the swings seen in the historical prices. The price of Bitcoin is affected by the development in global financial and economic movements such

as the price of foreign exchange, stock exchange and oil [11]. Clearly, Bitcoin is like any other financial innovation and it is extremely difficult to value, and assets associated with it are likely to exhibit bubble-like behavior [12]. On top of that, in [13] argues that limited supply of Bitcoin makes it hard to duplicate and expand like hard currencies.

In [14] suggests that conventional economic and financial theory cannot be used to explain the price movement of Bitcoin and that a study of internet searches (through Google and Wikipedia) shows a significant correlation between the price of USD-denominated Bitcoin and investor sentiment. Investor sentiment can bring about speculative behavior, causing speculative market volatility [15]. Positive feedback loop can be observed when speculation causes asset price to increase, stemming more speculative behavior, pushing asset price to an unsustainable level, and ultimately creating an economic bubble [16].

Volatility is no stranger to Bitcoin. [17-19] find Bitcoin more volatile than other markets. [20] argues that the Bitcoin is way too volatile and lowly correlated to hard currencies, making it more of a speculative investment rather than a currency. Bitcoin appeared inferior to hard currency and its speculative nature has given it a bad name in the media in the early days. Furthermore, unlike the hard currencies, the digital nature of Bitcoin makes it susceptible to hacking [21], and hence vulnerable to media scrutiny. Regardless of its recent popularity, mainstream institutional investors are still not getting into the game because they think that Bitcoin lacks proper regulation, way too volatile and highly illiquid [22].

In [23] finds Bitcoin investment to be beneficial to a U.S. diversified portfolio where a small Bitcoin component can offer a small improvement in the risk-return trade-off. In [24] suggest that Bitcoin is less useful as a currency but it can help

enhance the performance of an investment portfolio. In [25] finds a strong indication that Bitcoin has been used by uninformed users as alternative investment. In [26] suggest that high volatility seen in USD-denominated Bitcoin prices (traded from 2010 to 2013) is met with high returns, and USD-denominated Bitcoins exhibit high average return and volatility behaviour and low correlation with traditional assets (e.g. gold, oil and hedge funds), making it a good diversifier. In [27] suggests that Bitcoin is speculative in nature but it facilitates how financial transactions are done. In [28] suggest that regardless of higher Conditional Value at Risk, CVaR13, Bitcoin should be included in an optimal portfolio as the additional risk can be compensated by high return.

Apart from that, China opened its stock market in late 1990, and since then many indices have been established. Nevertheless, the stock market in China is mainly represented by three indices (see Table 1) and the composition varies from index to index. SSE reflects the overall performance of the Shanghai stock market, while SZSE reflects the overall performance of the Shenzhen stock market. CSI 300 on the other hand, reflects the performance of the 300 selected stocks from SSE and SZSE. SSE consists of large-cap and state-owned companies, SZSE comprises of small, joint ventures and export oriented companies and finally, CSI 300 is made up of the companies listed in SSE and SZSE.

**Table 1.** Three main China stock market indices

Ticker	Name	Established in	Number of Companies
000001.SS	SSE Composite Index (SSE)	July 15, 1991	1,342*
399001.SZ	Shenzhen Stock Exchange (SZSE)	July 20, 1994	1,938**
000300.SS	CSI 300 Index (CSI 300)	April 8, 2005	300

Figure 1 depicts the performance of the three indices from January 1st, 2012 to December 31st, 2016. The three indices have been performing almost parallel to each other with varying degree of standard deviation. The indices were seen up more than 100% from 2014 to 2015, pushing the prices to unsustainable level.



**Figure 1.** Performance of SSE, SZSE and CSI 300 from Jan 2012 to Dec 2016

In China, the investor structure is dominated by individual investors [29]

with limited knowledge in investing. In [30] find Chinese investors (both individual and institutional) irrational and often exhibit biases such as disposition effect (acknowledge gains but not losses), overconfident (lack of diversification) and representative bias (preference towards recent winners). In [31] find that positive feedback trading leads to irrational investing behavior among individual investors. With limited knowledge in investing, these individual investors appear to be chasing illusive trends and adding noise to the indices [32]. In [33] find that herding behavior exists in Chinese stock market especially when the market is falling and trading volume is high. Many of such individual investors ended up buying at higher prices and selling at lower prices. In [34] suggest that herding

behavior in investing can lead to excess volatility and arbitrage opportunities.

## 2.2. Conceptual Framework

Based on the literature review, two conceptual models are proposed. The first model provides a conceptual framework to describe the differences in trading characteristic among the Bitcoin denominated in CNY, EUR and USD. The model starts with descriptive statistics of the CNY-, EUR- and USD-denominated Bitcoin for comparison, and it ends with a volatility analysis (through symmetric and asymmetric GARCH models) of the CNY-denominated Bitcoin.

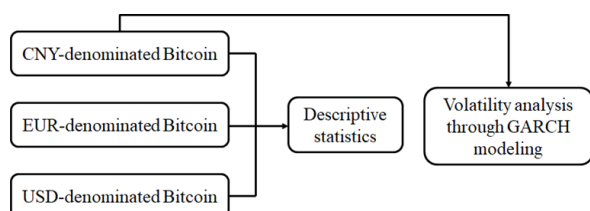


Figure 2. Conceptual framework

## 2.3. Hypothesis

Bitcoins are currently traded all over the globe, denominated in various currencies under different market conditions and jurisdictions. The differences in market fundamentals are likely to impact the trading characteristics and price returns of Bitcoin traded in different currencies [35]. Regardless, like other financial assets, the price movement of Bitcoin should reflect the future expectation of its return. Recently, there has been great utilization by Chinese companies in the Inner Mongolia region for Bitcoin mining due to cheap electricity

and labor [36]. Many are seen to have treated Bitcoin as a form of alternative investment and perhaps a diversifier of Chinese equities risk. Therefore, hypothesis H1 is developed as follows:

H1: The CNY-denominated Bitcoin exhibits different trading characteristics than the ones denominated in EUR and USD. This hypothesis tests three of the biggest Bitcoin exchanges denominated in CNY, EUR and USD to see if they present different trading behaviors (namely standard deviation, volatility, kurtosis and skewness).

## 3. DATA COLLECTION AND RESEARCH SAMPLING

Two sets of data are collected for analysis: Closing rates of Bitcoin denominated in CNY, EUR and USD; and closing rates of Chinese stock exchange indices. Daily and weekly closing rates of Bitcoin are collected from BitcoinCharts.com website. Due to the late induction of Bitcoin exchanges, data of up to five years from January 2012 to December 2016 are included for analysis. The period gives a total of 1,825 and 260 observations of daily and weekly returns respectively. The period saw multiple crises causing dramatic swings not only in Bitcoin value, but also the value of various traditional investment assets in China. As the depth of the historical data is utmost important, the raw daily and weekly closing price data are collected from three of the oldest Bitcoin exchanges around.

Table 2. Bitcoin exchange

Currency	Symbol	Description
CNY	btcnCNY	Established in 2011 by BTC China, this was the oldest Bitcoin exchange denominated in CNY, with mostly domestic Chinese clients [37]. Nevertheless, trading was halted by the government in September 2017 [38]
EUR	btcdeEUR	Established in 2011 by Bitcoin Deutschland AG, this is a Bitcoin exchange denominated in EUR, with a global clientele.

USD	bitstampUSD	Established in 2011 by Bitstamp Limited, this is a Bitcoin exchange denominated in USD, with clients all over the world.
-----	-------------	--

Bitcoin exchanges operate 24/7, and the closing prices are quoted as per midnight UTC19. The daily closing prices are used to analyze the characteristics of Bitcoin denominated in CNY, EUR and USD. Using the daily closing prices from BitcoinCharts.com website, natural logarithm of return from the three exchanges btcnCNY, btcdeEUR and bitstampUSD (with respective trading volume of approximately 11%, 2% and 9%20) are included for the study. These exchanges serve as proxies for the Bitcoin price listed in China, Europe and the U.S. The weekly closing prices of the CNY-denominated Bitcoin and the selected Chinese stock exchange indices are used to analyze the cointegration between variables. Weekly closing prices of the CNY-denominated Bitcoin and the selected Chinese stock indices will be collected from BitcoinCharts.com website and Yahoo! Finance respectively. For a better matchup with Bitcoin, stock index series of up to five years from January 2012 to December 2016 will be used for analysis. The period gives a total of 260 observations of weekly returns.

For the CNY-denominated Bitcoin, the price represents the return in the form

**Table 3.** Chinese stock indices chosen for the study

Name	Description
SSE Composite Index (SSE)	Representing the overall performance of the Shanghai stock market, SSE consists of large-cap and state-owned companies.
Shenzhen Stock Exchange (SZSE)	Representing the overall performance of the Shenzhen stock market, the SZSE comprises of small, joint ventures and export oriented companies.
CSI 300 Index (CSI 300)	Representing the performance of the 300 of the largest and most liquid stocks from SSE and SZSE.

Contrary to Bitcoin, stocks are traded on designated hours and days, based on time-zone and regional security and exchange policies. The three China's stock

of price appreciation. For the Chinese stock indices (namely, SSE, SZSE and CSI 300), the price measures the price returns of the stock markets. Regardless of all the differences in the fundamentals, the common denominator for both assets remains the price and hence, log price will be used for the cointegration analysis. Of course, the differences in trading hours do present a challenge for the analysis. Early literature on Chinese stock market suggested that the highest daily returns were observed on Thursday for the SSE and SZSE [39]. In [40] on the other hand argue that the A-share in both SSE and SZSE showed higher returns on Friday. In [41] argue that the volatility seen in stock markets did vary based on the day of the week. As a result, the weekly log prices are used in this study to avoid the inherent intraday volatility. As the time of this writing, there are a dozen stock indices<sup>21</sup> in China, both old and new. Nevertheless, three indices are chosen for the study and the selection criteria are based on the market capitalization and the availability of the data series.

exchange indices are regulated by the China Securities Regulatory Commission (CSRC) and the trading hours start from 9:30 a.m. to 11:30 a.m. and 1:00 p.m. to

3:00 p.m. for Shanghai Stock Exchange<sup>23</sup>, Shenzhen Stock Exchange<sup>24</sup> and CSI 300 Index<sup>25</sup>, from Monday to Friday (except Chinese holidays). The descriptions of variables and data sources are presented in Table 4. The daily price returns of Bitcoin

are transformed into natural logarithmic form. The weekly prices of Bitcoin and the Chinese stock indices too are converted into natural logarithmic form.

**Table 4.** Descriptions of variables and data sources

Acronym	Construction of Variables	Data Source
CNYPRC	The daily closing price of the CNY-denominated Bitcoin.	Bitcoincharts.com
EURPRC	The daily closing price of the EUR-denominated Bitcoin.	Bitcoincharts.com
USDPRC	The daily closing price of the USD-denominated Bitcoin.	Bitcoincharts.com
LOGCNYRET	Natural logarithm of the daily return of CNY-denominated Bitcoin.	Bitcoincharts.com
LOGEURRET	Natural logarithm of the daily return of EUR-denominated Bitcoin.	Bitcoincharts.com
LOGUSDRET	Natural logarithm of the daily return of USD-denominated Bitcoin.	Bitcoincharts.com
BTCPRC	The weekly closing price of the CNY-denominated Bitcoin.	Bitcoincharts.com
SSEPRC	The weekly closing price of the Shanghai Stock Exchange.	Yahoo! Finance
SZSEPRC	The weekly closing price of the Shenzhen Stock Exchange.	Yahoo! Finance
CSIPRC	The weekly closing price of the CSI 300 Index.	Yahoo! Finance
LOGBTC	Natural logarithm of the weekly price of CNY-denominated Bitcoin.	Bitcoincharts.com
LOGSSE	Natural logarithm of the weekly price of the Shanghai Stock Exchange.	Yahoo! Finance
LOGSZSE	Natural logarithm of the weekly price of Shenzhen Stock Exchange.	Yahoo! Finance
LOGCSI	Natural logarithm of the weekly price of the CSI 300 Index.	Yahoo! Finance

## 4. RESULTS AND DISCUSSION

### 4.1. Descriptive Statistics

Descriptive statistics are generated and the results are included depicted in Table 5. All prices are found to be platykurtic (i.e. kurtosis lower than 3) with flatter distribution and shorter tails. The prices of the CNY-, EUR- and USD-denominated Bitcoin are positively skewed, indicating asymmetrical distributions with long tails to the right. Of the three, CNY appears to

have the highest kurtosis and skewness. From the skewness, it is obvious that Bitcoin prices are not normally distributed. Furthermore, the Jarque-Bera statistics are highly significant, rejecting the null hypothesis that the distributions are normal. In general, all prices are considered skewed and the Jarque-Bera test confirmed that the prices and returns are not normally distributed.

**Table 5.** Descriptive statistics for the CNY-, EUR- and USD-denominated Bitcoin

Variable	Mean	Max	Min	Standard Deviation	Skewness	Kurtosis	Jarque-Bera	n
CNYPRC	1979.112	7395.00	26.21	1677.882	0.557169	2.374324	119.9056	1762
EURPRC	259.8143	944.00	3.30	216.4887	0.505605	2.367267	104.4643	1762
USDPRC	308.6031	1132.01	4.23	257.0236	0.490711	2.252606	111.7245	1762

Descriptive statistics are generated and the results are included depicted in Table 5. All prices are found to be platykurtic (i.e. kurtosis lower than 3) with flatter distribution. For a normally distributed series, skewness is expected to be 0 and kurtosis is expected to be around 3. The series understudied are positively skewed, implying a long right tail and a deviation from normality. The kurtosis values slightly lower than the normal value of three indicating that the distribution of Bitcoin denominated in CNY-, EUR- and USD are less peaked with thinner tails. Both the skewness and kurtosis show that the prices are mostly non-symmetrical with infrequent small or extreme gains or losses. All the above results suggest that the series are platykurtic, less peaked with thinner tails and not normally distributed, making a case for the use of ARCH and GARCH models for further analysis.

#### 4.2. Volatility Analysis

The above analyses show that the prices of the CNY-, EUR- and USD-denominated Bitcoin are not normally distributed and non-symmetrical, with frequent small gains or losses and a few extreme gains or losses. There are many possible reasons behind such volatility, and one of the main suspects is the speculative nature of cryptocurrency. Bitcoin clearly works more like a financial asset than a cryptocurrency and furthermore, its limited supply contributes to the drastic fluctuation in price. As volatility works both ways, it can cause drastic losses for some and handsome

gains for others. The question now remains, does the volatility of the CNY-denominated Bitcoin exhibit clustering, long memory and leverage effect. To answer the question, time series modeling through ARCH and GARCH are necessary.

Prior to performing a GARCH model, it is necessary to perform a heteroscedasticity test to see if ARCH effects are present in the series. The results of an ARCH (5) model show F- statistic values that are higher than the critical value and P-values that are lower (all at zero) than 1% significance (see Table 8). The results reject the null hypothesis of homoscedasticity (i.e. no ARCH effect), and accept the alternative hypothesis of heteroskedasticity (i.e. presence of ARCH effect). The preliminary analyses show that the selected Bitcoin data series are non-linear (from the BDS test in Table 6) and are irregular with strong ARCH effects. Data series with such behavior are ideal for GARCH type analysis.

**Table 6.** ARCH test results for CNY-, EUR- and USD-denominated Bitcoin

Variable	F-Statistic
CNY	31.90121 (0.0000)
EUR	41.33805 (0.0000)
USD	50.27473 (0.0000)

GARCH (1, 1) model is applied on the daily log returns of the CNY-, EUR- and USD- denominated Bitcoin. The



coefficients ( $\alpha$  and  $\beta$ ) are highly statistically significant and the sum of the two is close to 1 (i.e. unity), indicating that volatility shocks are quite persistent (commonly observed in high frequency financial data). As a result, a large positive or negative return will cause future forecasts of variance to be high. Overall,

the CNY-, EUR- and USD-denominated Bitcoin returns appear to have ARCH and GARCH effects that are close but not equal to each other, indicating that they are similar yet different. The subsequent analysis looks deeper into the behavior of CNY-denominated Bitcoin.

**Table 7.** GARCH (1, 1) results on the CNY-, EUR- and USD-denominated Bitcoin

Coefficients	CNY	EUR	USD
$\omega$ (constant)	0.000108	0.000134	0.000110
$\alpha$ (ARCH effect)	0.171726 (0.0000)	0.217988 (0.0000)	0.226044 (0.0000)
$\beta$ (GARCH effect)	0.788402 (0.0000)	0.777080 (0.0000)	0.741940 (0.0000)
$\alpha + \beta$	0.960128	0.995068	0.967984
Log likelihood	3254.667	2880.234	3337.277
Akaike info criterion (AIC)	-3.689747	-3.264738	-3.783515
Schwarz info criterion (SIC)	-3.677319	-3.252311	-3.771088

The above standard symmetric GARCH modeling may not be ideal here as non-negativity conditions may not hold and leverage effects may not be supported. To account for the case that a negative shock creates a larger volatility than a positive shock, asymmetrical GARCH modeling should be used for analysis. For this purpose, asymmetrical GARCH models such as CGARCH, EGARCH and GJR-GARCH are used and the results are depicted in Table 10. The coefficients of all models for period studied are significant at all levels implying the strong validity of the models.

The results from the descriptive statistics are apparent. The maximum and minimum values of the daily data series indicate high variability of price changes in Bitcoin. All three series are positively skewed with long right tail indicating a deviation from normality. The Jarque-Bera Test further confirms that the prices and returns of the series are not normally

distributed. All the three currency denominators are found to be platykurtic with flatter distribution and thinner tails. Of the three, the CNY-denominated Bitcoin seems to have higher skewness and kurtosis. The results from the symmetric GARCH model show that volatility shocks are quite persistent. The results from the asymmetric CGARCH, EGARCH and GJRGARCH models confirm the presence of ARCH effects with reasonably high shock and positive spill-over effect. The highly significant GARCH coefficient on all models implies persistent volatility clustering in the series. In fact, the sum of the ARCH and GARCH coefficients is more than 1 for all models suggesting that an explosive conditional variance. The results from the asymmetric CGARCH, EGARCH and GJRGARCH models confirm that the data series are not symmetric. The leverage coefficients for both GJR- GARCH and CGARCH are negative and are highly statistically

significant, indicating the presence of leverage effects in the return series. Of the three asymmetric GARCH models, CGARCH (i.e. with the lowest AIC and SIC, and the highest log likelihood) seems better at explaining the asymmetric volatility process.

### 4.3. Discussion

The studies of return and volatility and cointegration are essential in finance as they provide important inferences for asset pricing, risk management and portfolio allocation. Such studies are not limited to just the traditional bonds, currencies and stocks, but also the emerging cryptocurrencies. The immense volatility of Bitcoin is one of the most talk-about topics in cryptocurrency in recent days. Of course, the higher the volatility, the more investors are demanding for enduring the risk. Clearly, the volatility in Bitcoin's price can be detrimental to Bitcoin and affect its risk and reward dynamic. In terms of cointegration, the presence (absence) of a cointegrating vector indicates less (more) diversification benefit and hence, less (more) benefits for investors.

The maximum and minimum values of the daily data series (CNY-, EUR- and USD- denominated Bitcoin) indicate high variability of price changes. In general, the series are positively skewed, implying a long right tail with higher values and a deviation from normality. All the three currency denominators are found to be platykurtic with flatter distribution (less peaked) with lower values and thinner tails. Among the three denominators, the price of the CNY-denominated Bitcoin is found to have higher skewness and kurtosis. Nevertheless, both skewness and kurtosis show that the prices are mostly non-symmetrical with infrequent small or extreme gains or losses. The Jarque-Bera Test further confirms that the prices and returns of these series are not normally distributed.

The fact that Bitcoin is highly susceptible to shocks from scandals and government interventions, it is natural to expect a not normal distribution. This can also be inferred from the maximum and minimum values of the series, suggesting high variability of price changes. As the government crackdowns are drastic, frequent and usually large scale in China, the between the transaction and the price of Bitcoin was found to have faded over time between 2011 and 2014, it remained in the positive territory. Such relationship should be reintroduced to better understand the impact of a rise in transaction volume on the price of Bitcoin post 2014.

### 5. CONCLUSION

Finally, a larger sample size could reduce non-normality and division of sample could potentially remove heteroscedasticity. For instance, the sample understudied could have been divided into sub-samples based on the pre, during and post of major events such as scandals and local government interventions. A good example of government intervention is the ban on Bitcoin exchanges on September 2017, and a good division would include the period before the intervention, during the intervention and after the intervention. Such division would provide insightful volatility analysis and how these sub-samples contribute to the overall volatility, providing more interesting insights and findings.

Further studies can be conducted with the following in mind. Firstly, the categorisation of Bitcoin ownership into individual and institutional would provide more granularities on the research. The information on who owns what and by how much is important because it implies the kind of risk the minority holders are undertaking. According to Aaron Brown, former managing director and head of financial markets research at AQR Capital

Management, about 40% of the Bitcoin is held by a small number of users and their actions (intentional or unintentional) may create massive swings in Bitcoin price [42]. All these may not be quantifiable but they may have different implications for the price of Bitcoin.

Secondly, information on the trade volume by owner category would provide information on whether Bitcoin is being used more as a store of value or medium of exchange in China. The price of Bitcoin will increase if investors expect an appreciation in the store of value. At the same time, an increase in the use of Bitcoin as a medium of exchange would increase the transaction, pushing trade volume up and driving up the price.

#### REFERENCES

- [1] Bovaird, C., 2017. Why Bitcoin Prices Have Risen More Than 400% This Year. Forbes: <https://www.forbes.com/sites/cbovaird/2017/09/01/why-bitcoin-prices-have-risen-more-than-400-this-year>.
- [2] Rogoff, K.S., 2017. The curse of cash: How large-denomination bills aid crime and tax evasion and constrain monetary policy. Schumpeter: Princeton University Press.
- [3] Chakravorti, B., Chaturvedi, R.S. and Mazzotta, B., 2016. The countries that would profit most from a cashless world. Harvard Business Review, <https://hbr.org/2016/05/the-countries-that-would-profit-most-from-a-cashless-world>.
- [4] Wong, W. H., 2015. New tech 'need not spell end of traditional banking. <http://www.straitstimes.com/business/new-tech-need-not-spell-end-of-traditional-banking>.
- [5] Sapuric, S. and Kokkinaki, A., 2014. Bitcoin is volatile! Isn't that right? International Conference on Business Information Systems, pp. 255-265.
- [6] Baur, D.G., Hong, K. and Lee, A.D., 2018. Bitcoin: Medium of exchange or speculative assets?. Journal of International Financial Markets, Institutions and Money, 54, pp. 177-189.
- [7] Wheelan, C., 2016. Naked Money: A Revealing Look at Our Financial System. New York: WW Norton & Company.
- [8] Stafford, P., 2017. US regulator gives green light for bitcoin futures trading. <https://www.ft.com/content/43d69af8-d6b0-11e7-8c9a-d9c0a5c8d5c9>.
- [9] Rooney, K., 2018. Bitcoin is down more than 80% from last year's high, nearing its worst-ever bear market. <https://www.cnbc.com/2018/11/26/bitcoin-nears-its-worst-ever-bear-market-down-more-than-80percent-from-the-high.html>.
- [10] Buchholz, M., Delaney, J., Warren, J.P.J. and Parker, J., 2012. Bits and Bets Information, Price Volatility, and Demand for Bitcoin. Economics, 312, pp. 2-48.
- [11] Van Wijk, D., 2013. What can be expected from the BitCoin. Netherlands: Erasmus Universiteit Rotterdam.
- [12] Frehen, R.G., Goetzmann, W.N. and Rouwenhorst, K.G., 2013. New evidence on the first financial bubble. Journal of Financial Economics, 108(3), pp. 585-607.
- [13] Hanley, B.P., 2013. The false premises and promises of Bitcoin. <https://arxiv.org/ftp/arxiv/papers/1312/1312.2048.pdf>.
- [14] Kristoufek, L., 2013. BitCoin meets Google Trends and Wikipedia: Quantifying the relationship between phenomena of the Internet era. Scientific Reports, 3, pp. 1-7.
- [15] Baker, M. and Wurgler, J., 2006. Investor sentiment and the cross-section of stock returns. Journal of Finance, 61(4), pp. 1645-1680.
- [16] Bhalla, V.K., 2008. Investment management. New Delhi: S. Chand Publishing.
- [17] Cheung, A., Roca, E. and Su, J.J., 2015. Crypto-currency bubbles: An application of the Phillips-Shi-Yu (2013) methodology on Mt. Gox bitcoin prices. Applied Economics, 47(23), pp. 2348-2358.
- [18] Bouoiyour, J., Selmi, R., Tiwari, A.K. and Olayeni, O.R., 2016. What drives Bitcoin price. Economics Bulletin, 36(2), pp. 843-850.
- [19] Carrick, J., 2016. Bitcoin as a complement to emerging market currencies. Emerging Markets Finance and Trade, 52(10), pp. 2321-2334.
- [20] Yermack, D., 2018. The potential of digital currency and blockchains. National Bureau

- of Economic Research (NBER), Reporter, 1, pp. 14-17.
- [21] Blowers, M., 2015. Evolution of cyber technologies and operations to 2035. Amsterdam: Springer.
- [22] Kelly, J. & Keidan, M., 2017. Big money stays away from booming bitcoin. <https://finance.yahoo.com/news/big-money-stays-away-booming-051012541.html>.
- [23] Chowdhury, A., 2016. Is Bitcoin the “Paris Hilton” of the currency world? Or are the early investors onto something that will make them rich? *Journal of Investing*, 25(1), pp. 64-72.
- [24] Wu, C.Y., Pandey, V.K. and Dba, C., 2014. The value of Bitcoin in enhancing the efficiency of an investor’s portfolio. *Journal of Financial Planning*, 27(9), pp. 44-52.
- [25] Glaser, F., Zimmermann, K., Haferkorn, M., Weber, M.C. and Siering, M., 2014. Bitcoin-asset or currency? revealing users' hidden intentions. *Revealing Users' Hidden Intentions. Twenty Second European Conference on Information Systems*, pp. 1-14.
- [26] Briere, M., Oosterlinck, K. and Szafarz, A., 2015. Virtual currency, tangible return: Portfolio diversification with bitcoin. *Journal of Asset Management*, 16(6), pp. 365-373.
- [27] Popper, N., 2015. *Digital gold: The untold story of Bitcoin*. London: Penguin.
- [28] Eisl, A., Gasser, S. and Weinmayer, K., 2015. Caveat emptor: Does Bitcoin improve portfolio diversification? WU Vienna University of Economics and Business.
- [29] He, D., 2016. *Financial Security in China: Situation Analysis and System Design*. Berlin: Springer.
- [30] Chen, G., Kim, K.A., Nofsinger, J.R. and Rui, O.M., 2007. Trading performance, disposition effect, overconfidence, representativeness bias, and experience of emerging market investors. *Journal of Behavioral Decision Making*, 20(4), pp. 425-451.
- [31] Nofsinger, J.R. and Sias, R.W., 1999. Herding and feedback trading by institutional and individual investors. *Journal of Finance*, 54(6), pp. 2263-2295.
- [32] Shiller, R.J., Fischer, S. and Friedman, B.M., 1984. Stock prices and social dynamics. *Brookings Papers on Economic Activity*, 1984(2), pp. 457-510.
- [33] Lao, P. and Singh, H., 2011. Herding behaviour in the Chinese and Indian stock markets. *Journal of Asian Economics*, 22(6), pp. 495-506.
- [34] Tan, L., Chiang, T.C., Mason, J.R. and Nelling, E., 2008. Herding behavior in Chinese stock markets: An examination of A and B shares. *Pacific-Basin Finance Journal*, 16(1-2), pp. 61-77.
- [35] Pieters, G. and Vivanco, S., 2017. Financial regulations and price inconsistencies across Bitcoin markets. *Information Economics and Policy*, 39, pp. 1-14.
- [36] Li, C. and March, G., 2017. In China’s hinterlands, workers mine Bitcoin for a digital fortune. *The New York Times*.
- [37] Hill, K., 2013. From Walmart To Bitcoin: The CEO Behind The Chinese Exchange Sending BTC To New Highs. <https://www.forbes.com/sites/kashmirhill/2013/11/08/from-walmart-to-bitcoin-the-ceo-behind-the-chinese-exchange-sending-bitcoin-to-new-highs>.
- [38] Roberts, D., 2017. Japan is poised to become the leading bitcoin market. <https://finance.yahoo.com/news/japan-poised-become-next-bitcoin-market-leader-174825798.html>.
- [39] Mookerjee, R. and Yu, Q., 1999. An empirical analysis of the equity markets in China. *Review of Financial Economics*, 8(1), pp. 41-60.
- [40] Chen, G.M., Lee, B.S. and Rui, O., 2001. Foreign ownership restrictions and market segmentation in China's stock markets. *Journal of Financial Research*, 24(1), pp. 133-155.
- [41] Berument, H. and Kiyamaz, H., 2001. The day of the week effect on stock market volatility. *Journal of Economics and Finance*, 25(2), pp. 181-193.
- [42] Kharif, O., 2017. The Bitcoin Whales: 1,000 People Who Own 40 Percent of the Market. *Bloomberg Businessweek*.