

CAPITAL UNIVERSITY OF SCIENCE AND  
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Bitcoin a Diversifier, a Hedge, or  
a Safe Haven? Evidence From  
Currencies, Equity and Gold  
Prices

by

Qudsia Bano

A thesis submitted in partial fulfillment for the  
degree of Master of Science

in the

Faculty of Management & Social Sciences  
Department of Management Sciences

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*To My Beloved Parents*



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## *Acknowledgement*

*“So which of the favors of your Lord will you deny”*

I owe it all to my Creator, my life Coach, ALLAH SWT, The Omniscient and Omnipotent! I owe it all to you, Thank you!

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I would like to convey my heartfelt gratitude to everyone who made it possible for me to complete this report.

**(Qudsia Bano)**

# *Abstract*

The purpose of this study is to examine the diversifying, hedge or safe haven properties of bitcoin with the emerging countries e.g., BRICS currencies, BRICS stock prices and gold prices. The study employs historical daily prices of bitcoin, currencies, equity and gold prices for the period of September, 2014 to July, 20220. The DCC GARCH Model is used to explore the long-run relationship and Asymmetric Dynamic Conditional Correlation model is used to examine the time varying correlation between the instruments under study. Moreover, Quantile regression is used to examine the diversifying, hedge and safe haven properties of bitcoin. The finding from DCC GARCH Model shows that there exists the time varying correlation between bitcoin and seven of the eleven instruments under study (Brazilian Currency, Brazilian Index, South African Currency, South African Index, Indian Index, Chinese Index and Gold). The results of ADCC GARCH Model show that there exists an asymmetric conditional correlation among bitcoin and nine of eleven commodities under study (Brazilian Currency, Russian Currency, Indian Currency, South African Currency, Brazilian Index, Indian Index, Russian Index and South African Index). This study also shed light on the diversifying, hedge and safe haven properties of bitcoin. It thoroughly investigated the effects of presence and absence of bitcoin in a portfolio of currencies, indices and commodity market like gold and recommends that investors may find it optimal to invest in BRICS currencies, Indices because of their emerging markets and other commodities. However, the results conclude that the bitcoin is a strong hedge against Russian Ruble and Brazilian Real for BRICS currencies, while there is weak hedge between bitcoin and Indian Rupee, Chinese Yuan and South African Rand. Moreover, bitcoin has a strong hedge against Brazilian Index and Indian Index for BRICS Indices, while it has weak hedge against Russian Index, Chinese Index and South African Index. The studies also suggest that bitcoin is diversifier against gold while it is a strong safe haven for Brazilian Currency, Chinese Index and South African Index.

**Keywords:** Cryptocurrency, Bitcoin, DCC GARCH Model, ADCC Model, Quantile Regression, Arch Effect.

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# Abbreviations

<b>AIC</b>	Akaike Information Criterion
<b>ADCC</b>	Asymmetric Dynamic Conditional Correlation
<b>ARCH</b>	Autoregressive Conditional Heteroscedasticity
<b>BRICS</b>	Brazil Russia Indian China South Africa
<b>BRL</b>	Brazilian Real
<b>BSI</b>	Brazilian Subtropical Index
<b>CNY</b>	Chinese Yuan
<b>DCC</b>	Dynamic Conditional Correlation
<b>FinCEN</b>	Financial Crimes Enforcement Networks
<b>GARCH</b>	Generalized Autoregressive Conditional Heteroscedasticity
<b>INR</b>	Indian Rupee
<b>JSE</b>	Johannesburg Stock Exchange
<b>MSE</b>	Moscow Stock Exchange
<b>RUB</b>	Russian Ruble
<b>SEN</b>	Sensitive Index India
<b>SSE</b>	Shanghai Stock Exchange
<b>RAND</b>	South African Rand

# Chapter 1

## Introduction

Since the invention of the currency, one of the biggest things that hit the market is Crypto currency. Crypto currency has attracted many investors either they are individual or investment investors because of high magical price increase (Dastgir, Demir et al. 2019). It also provides the technological and potential benefits. Crypto currencies are forms of the financial assets that have been made in the virtual world. It is completely secure, decentralized, and digital money, in view of the block chain technology and innovation. The 1st digital currency, bitcoin was developed by Satoshi Nakamoto in 2008 which for all time changed the world's speculation universe to incorporate simply virtual resources. Crypto market is the most unregulated financial market.

As the conventional currencies are designed and operated by any of governing bodies but bitcoin is emerged as totally decentralized currency with some attractive features for the investors and it highly depends on the sophisticated protocol. To understand the features of bitcoin as diversifier, a hedge or a safe haven, we learn to focus on its correlation with other assets like stock prices, conventional currencies, and gold prices. A diversifier is defined as an asset which hold a no or negative correlation with other asset, A weak(strong) hedge is an asset which has an uncorrelated (negatively correlated) relationship with another asset, A weak(strong) safe haven is an asset that is uncorrelated(negatively correlated) with another Asset on average when there is a time of stress (Bouri, Jalkh et al. 2017). Cryptocurrency is a digital resource that is aimed to work as a mode of

trade while utilizing the cryptography to control the production of extra units of the cash and to verify the exchanges (Greenberg 2017). It's worth noting that a hedge must hold on average, whereas a safe haven must only hold in specific periods. Baur (2010) go into great detail on this. Because a hedge may show a positive correlation during times of market stress or upheaval, it does not have the ability to reduce losses during these times. The non-positive correlation of a safe haven asset with a portfolio in extreme market situations, implying that the correlation might be either positive or negative on average.

Bitcoin is a digital communication technology that allows using a virtual money and making electronic payments with it easier. Bitcoin's regulations were devised by engineers with no apparent input from legal or regulatory authorities. Bitcoin is based on a network of computers sharing a distributed transaction record. It includes safeguards against power concentrations, as well as mechanisms to encourage genuine engagement and bootstrap early adopter uptake. Bitcoin's design includes irreversible transactions, a predefined path of money production through time, and a public transaction history. Bitcoin has piqued the interest of economists since it is a virtual currency that has the potential to disrupt current payment and monetary systems. Virtual currencies provide a wealth of information about market architecture and buyer and seller behavior even at this early stage. Since its beginnings as a digital currency in 2009, the Bitcoin market has continuously developed. The most frequently used and most valuable virtual currency in terms of market capitalization. The euphoria surrounding Bitcoin frames the ambitions and desires of altcoin marketplace players, and the fresh altcoin crop has been directly influenced by Bitcoin. Bitcoin's success has sparked the rise of a slew of new digital currencies, including Bitshare, Ripple, Litecoin, Monero, Dash, Dogecoin, Byte coin, Digi byte, Mona coin, and a slew of others.

In past years, among the most experienced speculators, the most interesting area of today's research is cryptographic money. Money is generally used as a means of exchange, legal tender for debt repayment, cost equivalent, accounting unit and a means of investing and retaining buying power (Phillips and Gorse 2018). Cryptocurrencies incorporates high security architecture, innovative technology, prosperity in functionalities, different opportunities as an investment asset that

makes them attractive for venture capitalists, computer scientists, and investors. However, the unregulated and decentralization markets add an additional uncertainty layer to its projection of application as well as pricing. Closure exchanges in China based are major examples for changing the legal situation which causes prices reaction of large magnitude worldwide. Large shocks and bubbled prices movements are observed especially in last years. The ledger technology distribution idea is transferred to many other fields in finance. The key concepts of cryptocurrencies and Bitcoin, we refer to Fernández, Basgall et al. (2017) Chuen (2015) and Dwyer (2015) Cryptocurrencies are like virtual, digital and alternative currencies. Cryptocurrencies are not protected by any regulatory bodies that distinguish them from conventional fiat currencies or gold (Sontakke and Ghaisas 2017). Cryptographic money has become a popular topic of study among more experienced traders in recent years. In recent years, cryptographic forms of money have been a prominent topic of study among more experienced traders.

## 1.1 Historical Background

Bitcoin is one more miracle on the worldwide monetary business sectors. They work outside of joined financial establishments by giving an elective money and adventure opportunity. While virtual financial principles are more cheap than customary money related guidelines as far as trade costs, the expenses of virtual financial norms are expanding more irregularly and changes are more broad than regular monetary forms Bouoiyour, Selmi et al. (2014) Ciaian, Rajcaniova et al. (2016). Bitcoin is the most widely used decentralized digital currency. The Bitcoin market has grown steadily since its inception in 2009 as a digital currency. Bitcoin remains the most widely used virtual currency and the most valuable in terms of market capitalization. The new altcoin crop has been directly inspired by Bitcoin, and the excitement surrounding Bitcoin frames the ambitions and desires of altcoin marketplace participants.

The achievement of Bitcoin has prompted the rise of numerous digital currencies, such as Bit share, Ripple, Litecoin, Monero, Dash, Dogecoin, Byte coin, Digibyte, Monacoin and a lot more. The majority of altcoins rely on the same or similar

blockchain technology as Bitcoin, and they aim to complement or strengthen key Bitcoin features. Many altcoins, on the other hand, are based on modest modifications to Bitcoin's source code (Krafft, Della Penna et al. 2018). Byte coin, for example, is one of the first digital currencies to be developed. The Byte coin group is seeking to address a variety of issues that have arisen in the bitcoin community, mainly the issue of overall security. Ripple is a digital platform that supports fiat currency, cryptocurrency, or other value units such as frequent flier miles or mobile minutes, and is based on a blockchain. Litecoin aims to save computing energy required for coin mining, Dash aims to provide faster transaction processing and improved privacy protection, and Bit shares and Ethereum provide additional features to operate smart contracts. Unpredictability is a big factor for financial experts when it comes to investing in the cryptocurrency market.

Billions of dollars have been filled in excess of 1,000 new computerized coins. These coins copy the development of Bitcoin, which means they can be uninhibitedly exchanged on advanced trades and have no national bank remaining behind them. This has brought up numerous questions and issues about present and eventual fate of decentralized cryptographic forms of money. There are two noteworthy perspectives about digital currency. One side contends that it is an air pocket with no genuine resources that unavoidably will end with burst. The opposite side opines that cryptographic money markets will turn into a road that will offer a huge number of individuals a chance to partake in a worldwide monetary system worth several trillions of dollars. From youthful twenty- to thirty-year-old in creating countries with little investment funds and huge desire to mother and-pop entrepreneurs looking to reinvest a few benefits in promising crypto-ventures, these sorts of individuals will be the foundation of this industry. There is broad agreement that the cryptocurrencies would influence not only the trade activities of various countries and business groups, but also the complexities of international relations.

There are still many individuals who never get the notion that cryptocurrencies will transfigure the way we do business. They cannot find out how the entire technology of blockchain and other annexes operates. Moreover, technological advances introduce digital tools that businesses can use to interact better with

their clients. A growing shift from classical systems to digital platforms has also resulted in an abundance of data from sources such as social networks, portable devices, online shopping platforms, etc. Because of advances in technology in the fields of data collection, storage and distribution, large data sets are easily transferred among businesses in each sector or country for little to no charge. Data's widespread accessibility has also raised concerns about individual's data privacy and their online payments. Since every online activity or transaction ends up leaving a digital footprint, people choose more anonymous methods of using the internet and conducting online transactions.

The Bitcoin cryptocurrency has been launched to address the privacy issue. Even though the decentralization of cryptocurrencies, transaction anonymity and payment's irreversibility offer many benefits, Brill and Keene (2014) are of the opinion that these attributes also encourage illegal acts (cybercrime) such as laundering money, drug trafficking, weapons procurement and smuggling. This problem has caught the attention of prominent regulatory agencies as well as other government agencies including the Financial Crimes Enforcement Networks (FinCEN). Economists argue that Bitcoin will never replace cash issued by the government because it "will make collecting taxes and combating criminal activity extremely difficult". Cryptographic forms of money are likely the most unpredictable resource in presence today. Along with here exists long-run relationships between many variables of interest. Then the point behind cointegration is the recognition and investigation of long run connections among financial time series factors.

Ciaian, Rajcaniova et al. (2016) use an Autoregressive Distributed Lag model to study interdependencies between Bitcoin and other cryptocurrencies and discover that Bitcoin and other cryptocurrencies, such as Ether, are mutually dependent. Recently, a study is conducted in the background of Fractional integration and cointegration by Yaya, Ogbonna et al. (2019). Bitcoin is another marvel on the overall financial business areas. They work outside of joined monetary foundations by offering an elective cash and experience chance. While virtual monetary standards are more modest than standard cash related rules the extent that exchange costs, the costs of virtual monetary standards are growing more sporadically and changes are more wide than ordinary financial structures. The study of Yaya et

al. (2019) considers Bitcoin's accident period and observes higher persistency of shocks in the personalities of advanced money sellers are expected later the accident. Investigation of cointegration among elective money and Bitcoin happens during the two stages with helpless relationship is generally viewed as later the accident. A few investigations have uncovered the bitcoin value relationship with monetary factors.

Su, Li et al. (2018) says that four blasting air pockets happened in the U.S. market and China during periods of monstrous expansions in bitcoin costs. Prior, a review analyzes the capacity to expand seven digital forms of money with the most elevated market size against financial danger factors like cost of gold, rough costs, pace of revenue, Dollar strength and S and P 500. Utilizing week after week information of Bitcoin, Litecoin, Ripple, Stellar, Monero, Dash and Byte coin from August 2014 to June 2018. The review reports that every cryptographic money has primary parts and ARCH variances, demonstrating an orderly danger on the computerized cash market and digital currencies have immaterial monetary relationships (Canh, Binh et al. 2019).

We will discuss phenomenon of Bit coin in the theoretical background of major finance theory in the view of different asset classes e.g., Currencies, Stock Prices and Gold prices etc., so the theories of Asset allocation are used.

## 1.2 Theoretical Background

The theory which is known as Modern Portfolio Theory is proposed by Harry Markowitz in 1952, and it is a technique of allocating the asset according to Risk and Return factors, such as The expected return for a given level of risk is maximized, or the expected risk for a given level of return is minimized. According to Profitability Risk Criterion, we can manage the Financial Instruments of Portfolio. Hence Markowitz in 1952 identify the set of Efficient Portfolios which are also called Efficient Portfolio Frontier on which each portfolio's Risk at Required Return in Minimum (Turcas, Dumiter et al. 2017). Markowitz theory clearly prove that do not put all the eggs in one basket, go for portfolio diversification. The benefit of portfolio can be measured if securities are not correlated or negatively

correlated. This theory also identifies the systematic risk or covariance risk and says that benefits of diversification is not linked with the number of securities but it is due to the correlation among these securities. He also proposes the method for the estimation of portfolio risk and portfolio return.

Every investor, portfolio manager and Investment institution want to create a diversified portfolio and for that they are keen to understand the effects of presence and absence of certain securities. Investors can create a diversified portfolio of Currencies, stock Prices, Gold prices and other commodity market and also create a hedge or linkage with Bitcoin to understand the effects of Bitcoin in its presence and absence in the Portfolio in terms of Risk and Return, it will be an optimal portfolio if the investors sum up all these securities under one. It can also be identified that where does the Risk of this Portfolio as well as the Individual rate will move.

### 1.3 Gap Analysis

Since the Invention of Bitcoin, most of the studies has been done e.g., effects of Bitcoin before and after the crash, bitcoin a safe haven or hedge or diversifier for Currency prices, bitcoin a diversifier, a hedge or a safe haven for oil prices. Urquhart and Zhang (2019) study the relationship of Bitcoin for currency prices as Hedge or Safe haven. Bouri, Jalkh et al. (2017) identify the relationship of Bitcoin with energy commodities during the time of stress, while some of other researchers study the aspect of Bitcoin as digital Gold but there is limited literature available on the Hedging of Bitcoin as per the Portfolio Restructuring of different asset classes like (Conventional Currency, Virtual Currency, Gold Prices and Stock Prices), therefore the study is aimed to identify and investigate the relationship of Bitcoin as hedge or diversifier for different asset classes, basically the study's main focus is to examine that how the presence of Bitcoin affect the other securities as well as Risk in a portfolio. Crypto currencies are forms of money or the financial assets that have been made in the virtual world. It is completely secure, decentralized, and digital money, in view of the block chain technology and innovation (Joma, 2018). The 1st digital currency, bitcoin is developed by

Satoshi Nakamoto in 2008 which for all time changed the world's speculation universe to incorporate simply virtual resources. Bitcoin is as of now the most across the board unregulated digital money.

## 1.4 Problem Statement

During several financial and economic crises, Bitcoin's controversial characteristics have been used as a hedge or safe haven, similar to gold. However, there exists a lack in previous literature. Most of the studies show the effects of bitcoin during harsh times for example as of crash etc., but as the world in developing globally and many of the developed and developing countries are heading towards the best possible ways of financing so different policy makers and practitioners focus on savvy ways for investment in different markets. From the global financial market perspective, weak securities exchange linkage in the considerably less than the best connection between their profits gives possible additions from overall portfolio development, though benefits of diversification are wiped out through strong market linkage or co-development in the returns.

There are three bigger markets for Investments, like Stock Markets, Commodities Markets and Currency Markets. Bitcoin is an emerging asset and for investment, Investors are interested in creating a portfolio using bitcoin. How this addition may have the correlation with other commodities in a way that if we add Bitcoin in the Portfolio, what will be the effect? Risk can be controlled through Bitcoin addition or not? This study may help investors to restructure the portfolio to optimize risk through diversification.

## 1.5 Research Questions

This study will provide answers to the following questions:

### **Research Question: 1**

Does there exist time varying dynamic correlation between bitcoin and currencies of BRICS countries?

### **Research Question: 2**

Does there exist time varying dynamic correlation between bitcoin and stocks of BRICS countries?

**Research Question: 3**

Does there exist time varying dynamic correlation between bitcoin and Gold Prices?

**Research Question: 4**

Does time varying conditional correlation among bitcoin and currencies of BRICS countries is asymmetric?

**Research Question: 5**

Does time varying conditional correlation among bitcoin and stocks of BRICS countries is asymmetric?

**Research Question: 6**

Does time varying conditional correlation among bitcoin and Gold is asymmetric?

**Research Question: 7**

Is bitcoin a diversifier, a hedge or a safe haven for BRICS Currencies?

**Research Question: 8**

Is bitcoin a diversifier, a hedge or a safe haven for BRICS stocks?

**Research Question: 9**

Is bitcoin a diversifier, a hedge or a safe haven for Gold?

## 1.6 Objectives of Study

**Research Objective: 1**

To analyze if there exist time varying dynamic correlation between bitcoin and currencies of BRICS countries.

**Research Objective: 2**

To analyze if there exist time varying dynamic correlation between bitcoin and stocks of BRICS countries.

**Research Objective: 3**

To analyze if there exist time varying dynamic correlation between bitcoin and Gold Prices.

**Research Objective: 4**

To study if time varying conditional correlation among bitcoin and stocks of BRICS countries is asymmetric.

**Research Objective: 5**

To study if time varying conditional correlation among bitcoin and stocks of BRICS countries is asymmetric.

**Research Objective: 6**

To study if time varying conditional correlation among bitcoin and Gold is asymmetric.

**Research Objective: 7**

To examine that if bitcoin is a diversifier, a hedge or a safe haven for BRICS Currencies.

**Research Objective: 8**

To examine that if bitcoin is a diversifier, a hedge or a safe haven for BRICS Stock Prices.

**Research Objective: 9**

To examine that if bitcoin is a diversifier, a hedge or a safe haven for Gold.

## 1.7 Significance of the Study

Bitcoin provides the opportunities to two individuals or speculators to make the transaction freely without any type of the involvement of the third party (Nakamoto 2009). Bitcoin due to their unique factors has become highly popular among different investors. Internet and E-commerce has curb over the hand-to-hand trading of currencies and stocks and to compete and survive in this modern era of technology, Bitcoin are leading instruments which help investors perform their operations through cell phone or through any other electronic source (Manimuthu, Rejikumar et al. 2019). The crypto currency market is a very volatile sector with both positive and negative implications for investors.

The crypto currency market has the potential to generate a large amount of profit, but it also has the potential to deprive an investor of their funds. As a result, volatility is a key aspect of the crypto currency market. In the crypto currency market, which is marked by high volatility, the major collision in 2018 was a

terrifying experience. Since last year, the price of crypto currencies has been rapidly shifting. Cryptocurrency is regarded as a challenging, volatile, and smart technology that has benefited a large number of individuals.

As a result, it's not unexpected that many investors are drawn to the volatility and risk of cryptocurrencies. The purpose of digital currencies is to provide a decentralized alternative to traditional forms of money, and standardization is an important part of that. This entails the unrestricted use of digital forms of money as a medium of exchange for essential goods and services. It may be argued that retail appropriation is the primary driver of standard acknowledgement in this way. The main impediment is the instability of the digital money market; it's difficult for businesses to accept, and for purchasers to spend, in an environment where prices are constantly fluctuating. In 2017, utilization of cryptographic forms of money has expanded drastically. Individuals are "contributing" tremendous aggregates of cash into "resources" that have no history of creating income, and those benefits are ascending in cost simply because other individuals are likewise consuming cash into them.

Due to increasing popularity of bitcoin and as of its importance in investments, it has attracted investors as well as the researchers and practitioners to understand its effects through finance and economics, in past studies the researchers examined the advantages and disadvantages of bitcoin by comparing it with alternative monetary standards. But it has been seen that as for the emerging countries like Brazil, Russia, China India, and South Africa (BRICS), the study on bitcoin as hedge or safe heaven have not been conducted and because these countries are emerging rapidly so the global investors are keen to make investment in these countries in diversified portfolio by managing the Risk and Return, so it is necessary to investigate the effect of Bitcoin with other commodities for emerging countries.

Officials and financial experts are quick to portray Bitcoin as a cash or a ware in light of the fact that to its intricacy. Bitcoin has demonstrated its value as a money in the worldwide market on numerous events.

Bitcoin, as per Popper (2015), is "computerized gold." Yermack (2013) and Baek and Elbeck (2015), then again, assert that Bitcoin acted more like a theoretical venture than a cash. Bitcoin was classed as an item by the US Commodity Futures

Trading Commission in 2015. While some examination focused on deciding the utility of Bitcoin for market members, others investigated the significant drivers of Bitcoin cost. Bitcoin depends on a decentralized framework, where finishing a Bitcoin exchange requires tackling testing computational issues across a decentralized information base simultaneously.

## 1.8 Bitcoin for Diversification

Following the financial instability of the previous decade, investors are still looking for new investment instruments that can provide diversification and hedging benefits. Bitcoin, like commodities in the early 2000s, could be a valuable tool for portfolio management due to its high average return and minimal correlation with major financial assets. Despite its high potential for diversification, Bitcoin is still too volatile to be included in a low-risk portfolio. A minor increase in an investor's risk tolerance, on the other hand, is linked to a significant rise in the average returns gained for a given level of risk.

Despite the fact that many people believe Bitcoin has attributes similar to gold, the two are not identical in key aspects. Tangibility, history, intrinsic value, volatility, use in the manufacturing process, and recognition as a global monetary reserve are the most significant differences between gold and Bitcoin. Bitcoin is an intangible asset with a relatively short and uncertain history.

## 1.9 Plan of Study

The research is broken down into five sections. The first chapter defines and introduces the topic, as well as providing information on the following topics: Introduction, Historical Background, Theoretical Background, Gap Analysis, Problem Statement, Research Questions, Research Objectives, and Research Significance. The study's second chapter consists of a review of all relevant empirical studies related to the research topic and research hypothesis in order to produce a testable statement. The third chapter of this study contains information on variables, data, the study's time range, and the econometric models used to achieve at the results.

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Econometric models that used in this study are DCC GARCH Model, ADCC Model and Quantile Regression. The results of econometric models, as well as their reporting, are discussed in Chapter 4 of this study, and the conclusion of the results and policy implications are discussed in Chapter 5.

# Chapter 2

## Literature Review

Bitcoin is recognized as an appealing and alternative investments tool for differentiation and diversification of different portfolio risks because it shows various different dynamics of profits that present lower correlations compared to other traditional financial assets. (Dyhrberg 2016). The most surprising aspect of Bitcoin is that mining is limited by the basic protocol's design. (Dwyer 2015). Academics and financial brokers as well as investors critically recommend that Bitcoin is turning into a safe haven or hedge resource for outrageous economic situations (Bouri, Jalkh et al. 2017). Since 2015, there has been a broad literature on digital currency valuation with its returns. This examination has concentrated on whether Bitcoin and other crypto monetary forms can fill in as a hedge against other mainly and rapidly established money related resources, for example, stocks and outside cash. In addition, financial researchers have concentrated on whether Bitcoin and other digital currency resources are described by productivity, that is, regardless of whether the costs of these assets reflect all the significant information or not (Swammy, Thompson et al. 2018).

Dyhrberg (2016) analyze that there are greater possibilities of bitcoin to be hedged with or against the stocks markets, US dollars and this will be the main use of bitcoin for the diversification of a portfolio. Liew, Li et al. (2019) infer that there is a complex daily result of returns underlying the bitcoin and he also finds some interesting facts and one of them is that as the hedge fund returns suffers from the hidden risk Beta, the crypto currency also suffers from it that is known as "Beta in the Tails". Kristoufek (2013) examine the connection between the changes in

the popularity of Bitcoin on the two referenced stages and the variances in the cost of Bitcoin comparative with traditional currency. For liquidity-instability or the volatility direct low liquidity will in general improve the figures of low unpredictability, but this result is preferred for information over in week by week one (Wang, Xu et al. 2021). They examine more grounded causality from instability to liquidity than the other way round: both unpredictability and volume draw in the financial specialists. Direct exposure to volatility has been made quite easier for a wide range of underlying assets, by creating the standardized instruments. As the liquidity usage shows that new investors are taking high interest in various types of variance swaps and volatility.

Brière, Burgues et al. (2010) and Baek and Elbeck (2015) study the S&P500 to look at relative unpredictability and volatility with Bitcoin utilizing de-trend proportions to find that Bitcoin is internally driven by sellers and purchasers, consequently reasoning that the Bitcoin market is speculative highly. Blau (2017) explore the unpredictability of Bitcoin crosswise over time while testing with respect to whether the unusual degree of the product's volatility is credited to speculative exchanging. Utilizing information in view of the period July 2010 through June 2014, it is discovered that this speculative exchanging didn't have any association with the 2013 cost increments nor the dramatic increments in volatility. Prybila, Schulte et al. (2020) explore runtime check for a business procedure using the Bitcoin block chain which is acknowledged using a completely functional software model. The author's show that their block chain-based methodology empowers a consistent execution observing and check of movements while simultaneous preserving anonymity and independence of the procedure members.

## 2.1 Exchange Rates and Stock Prices

The exchange rate standard is the cost of a country's money as far as another cash (Oxford dictionaries online, 2017). The exchange rate is just in the fluctuation in the currencies that continues the conversion and fluctuation until it reaches the equilibrium point. With the conversion of currencies and fluctuation in the rates, and the risk variations are in form of Appreciation and Depreciation depending

upon the performance of the country. The exchange rate might be affected by various other factors and one of them is Stock Prices. Traditional theories suggest that the exchange rate and stock prices have a lead-lag relationship. On the other hand, the portfolio balance approach claims that currency rates are determined by market mechanisms. It means exchange rate movements are being affected by the changes in stock prices. According to this approach, stock prices lead the exchange rates having a negative association because lower the domestic money demand and interest rates are caused by the reduction in domestic wealth and a decrease in the stock prices as well.

The demand of the different investors for domestic assets and domestic currencies also becomes lower due to a decrease in domestic stock prices. So as a result, variations in the mechanism of demand and supply cause the domestic currency to depreciate and capital outflow takes place. In contrast, the willingness of foreign investors to invest in a country's equity securities rises because of the increase in security prices. Thus, the international diversification takes place and investors get benefits from it. In result, these types of mechanism cause the currency to appreciate and capital inflows take place as well (Granger, Huangb et al. 2000). Most of the previous studies show that there is a strong negative relationship in both these variables but the existence of bitcoin may affect the performance based on different models because bitcoin is seemed to have the properties of Speculative Investments. Certain studies show that the price or the value of the bitcoin can also be examined by other markets factors such as gold prices, Stock prices and exchange rates.

## **2.2 Bitcoin's Significance in Well-Diversified Portfolios**

Bitcoin in most of the studies is examined as diversifier or a safe haven for many financing in different countries along with various other market securities. Kajtazi and Moro (2019) explore the effect of bitcoin using mean VAR approach in the portfolio of different countries and concluded that by adding the bitcoin, the performance of portfolio improves and this is because the return increases than the

reduction in the volatility, he also concludes that the study shows that bitcoin has some speculative characteristics but it must have a role in portfolio diversification. In time window considered (2013-2016), it has seen that the generation of higher returns and higher volatility are based on the presence of bitcoin in any portfolio. The major driver of the bitcoin is its speculative demand and that is the reason it is considered as the investible asset but some studies also show that as bitcoin does not have a proper intrinsic value, thus it does not represent a proper asset class.

Kristoufek (2015) says that bitcoin price is correlated with the trade volume. Thus, Bitcoin is only utilized as a medium of exchange to a limited extent. As a result, speculative demand (driven in part by currency exchange) is the primary driver of bitcoin's value, and it must be considered an investible asset. Bitcoin's value, on the other hand, fluctuates dependent on supply and demand. As a result, if bitcoin is classified as a speculative asset, it may offer diversification benefits. (Corbet, Meegan et al. 2018). Price formation is influenced by the cryptocurrency's liquidity, according to Brauneis and Mestel (2018). while bitcoin pricing tends to cluster around zeros, according to (Urquhart and Zhang 2019).

Liquidity has been proven to affect the returns of cryptocurrencies, with bitcoin being the biggest gainer due to its high liquidity (Wei 2018). The fact that prices are discovered to be affected by media mood adds to the asset nature of cryptocurrencies in line with previous research that explore sentiment's impact on price of traditional assets (Karalevicius, Degrande et al. 2018).

Researchers who study bitcoin's association with other assets discover that cryptocurrencies have a low correlation with other assets, suggesting that bitcoin might be used to help diversify a portfolio (Baumöhl, Kočenda et al. 2018). Research on spillovers between bitcoin and other assets Burnie (2018) and Bedoui, Braeik et al. (2018) supports the potential benefit of including bitcoin in a portfolio because it allows for risk hedging. Overall, the research reveals that bitcoin is a well-diversified asset class that may be incorporated in a portfolio. When compared to other risk metrics such as the Omega Ratio. Wu, Pandey et al. (2014) and versions of the Sharpe ratio where VaR and CVaR substitute the standard deviation as a risk measure, Bitcoin is found to improve portfolio efficiency. However,

bitcoin's financial features, such as volatility, have changed significantly since the 2013 "collapse," when some of the properties that made it a safe haven vanished totally. This suggests that bitcoin's value as a diversifier may have been harmed as well. As a result, events in the Chinese economy have a direct impact on the CNY bitcoin market, which might have a substantial impact on the USD market (Kristoufek 2015). Similarly, European markets and assets are in a similar scenario. As a result, it's critical to investigate if the benefits of bitcoin inclusion are influenced by portfolio localization. There is currently no research that compares the role of bitcoin in portfolio diversification in European and Chinese assets, and research on the United States is quite restricted. It has been shown in prior research that bitcoin may be used as a store of value and does not exhibit the same volatility as bubbles and collapses. Investors seek assets that are uncorrelated or negatively correlated with their portfolio's assets as diversification prospects dwindle in market volatility.

### **2.3 Bitcoin for Hedging in Emerging Countries**

Due to the increasing popularity of bitcoin, it is given the substantial attention because of having features like transparency, simplicity and innovative nature (Cheah and Fry 2015). However, certain market efficiency analyses reveal that Bitcoin returns are random in the second subsample, indicating that Bitcoin may become more efficient. Nonetheless, Bitcoin's inefficiency is considerable. Because it is a new investment asset that is still in its early stages, it is comparable to an emerging market, hence the inefficiency finding is not surprising. Bitcoin will grow more efficient over time as more investors evaluate and trade it, according to this thesis. Further empirical study of the evolving degree of market efficiency, as well as comparisons of Bitcoin to emerging markets and other alternative investments, may be part of future studies.

This research adds to the debate over Bitcoin's involvement in capital markets investments. To the best of our knowledge, this work is the first attempt to examine the relationship between the price of Bitcoin and the behaviour of big Bitcoin users using a graph of Bitcoin users, which adds to previous research on the connections

between Bitcoin and capital markets by looking at the actions of large Bitcoin users as shown in the Bitcoin users' graph.. It investigates the effect of the major Bitcoin players' lead on Bitcoin's pace of return utilizing GARCH models. Other exploration has observed that different connections exist in industrialized and developing business sectors, and these discoveries might back up prior discoveries. This investigation discover that Bitcoin is a powerless fence on created markets and a solid support on developing business sectors, in view of week by week paces of return, as indicated by meanings of Baur and McDermott (2010) diversifier, support, and place of refuge. We observed that the direct of large players on the Bitcoin market, as proven by buy and deal exchanges, is a higher priority than the condition of the monetary business sectors. Therefore, our examination upholds the hypothesis that major Bitcoin clients affect the cost of Bitcoin. The discoveries might highlight the need for more examination on the conduct of critical players in the Bitcoin market. This review, as we would see it, opens up new roads for extra market microstructure research, with an attention on financial backer conduct.

## 2.4 Bitcoin and Other Financial Assets

Dyhrberg (2016) demonstrates that Bitcoin has hedging capabilities comparable to gold and the dollar, and may thus be used for risk management. Cryptocurrencies, such as Bitcoin, are getting popular as a financial asset and have been named the "New Gold" by some. The majority of studies, on the other hand, claim that the two assets are fundamentally opposed. Several news sources, banks, and data firms have called cryptocurrencies, particularly Bitcoin, the "New Gold" in recent years. While large gains in a gold rush-like atmosphere may encourage this thinking, this paper examines Gold and Bitcoin from an econometric standpoint, focusing on the economic benefits of cryptocurrencies as an investment asset. As a result, unlike Brandvold, Molnár et al. (2015) and Ciaian, Rajcaniova et al. (2016), this study focus on the link between cryptocurrencies and other asset classes cryptocurrencies are not related to any monetary policy instruments or fundamentals in any manner. As a result, establishing similarities between virtual currencies and other sorts of financial assets is challenging. The Commodity Futures Trading Commission

(CFTC) has declared virtual money to be a commodity, similar to crude oil or gold, on the regulatory front. Bitcoin is a digital representation of value, according to the Commission, that can be used as a medium of exchange, a unit of account, or a store of value, but it is not considered legal tender in any state. There is a lot of research on gold as a hedge and safe haven against assets like stocks, bonds, and the US dollar (Baur and Lucey 2010 ;Baur and McDermott, 2010).

However, according to more recent data, the safe haven effect appears to be dissipating. Meanwhile, research into the use of cryptocurrencies for investment purposes is expanding. Dyhrberg (2016) for example, compares the hedging capabilities of Bitcoin and Gold to stocks and the US Dollar. According to Bouri, Jalkh et al. (2017) Bitcoin can only be used as a diversifier, not as a hedge. However, Bouri et al. (2017a) and Demir et al. (2018) point out that in extreme market scenarios, Bitcoin may be used as a short-term hedge. According to the findings of Corbet, Meegan et al. (2018), cryptocurrencies are not linked to traditional markets and may provide short-term diversification benefits. Short positions in Bitcoin, according to Guesmi et al. (2018), offer hedging potential. Short positions will be discussed at a later time.

The total amount of Bitcoins is limited to 21 million. This is a serious economic concern, according to (Basu, Easley et al. 2019). “If Bitcoin becomes phenomenally successful and displaces sovereign fiat currencies, it would have a deflationary effect on the economy because the money supply will not increase in tandem with economic growth. “At the same time, this limit indicates that there can be no “inflationary” or “deflationary” manipulation of the quantity of Bitcoins, and that no central authority may create new money. This is commonly regarded as a benefit within the Bitcoin community. For example Lo and Wang (2014) outline the Bitcoin community’s viewpoints: National governments frequently impose unfavorable restraints, while central banks may assist a currency overstock, resulting in hyperinflation.” Furthermore, existing payment methods are frequently dominated by banks (Lo and Wang, 2014). Investment in Bitcoins, according to Buchholz, Delaney et al. (2012) was a political statement about the role of government in finance and the economy.

Kroll, Davey et al. (2013) finally point out that, like any fiat currency, Bitcoins

have value based on consensus and the capacity to use them to buy goods and services. The fact that there is a fixed total quantity of Bitcoins isn't the only feature worth looking into: "All of the numbers and growth rates of Bitcoins are known with confidence by the public," writes (Basu, Easley et al. 2019). To put it another way, the risks in this market are significantly lower than in other markets, and there are no concerns about political intervention. This is illustrated in further detail in the following continuation of the comparison of Bitcoin and gold, which is important in the "asset vs. currency" discussion. Meech and Gu (2014) go into great detail about the similarities between Bitcoin and gold. They point out that gold and Bitcoin are both "mined" – mining is the name for the process through which Bitcoins become available: Bitcoins are given out for completing cryptographic riddles. On the one hand, this mining process is linked to cost, and on the other, it is linked to technological advancement - the parallels to gold mining are evident.

Furthermore, both gold and Bitcoin are used as investment vehicles; Yermack (2013), for example, investigates the relationship between gold and Bitcoin prices. However, the analogy may be extended further: gold is a natural resource with a finite global supply. Both reserves and resources, on the other hand, are in question, as is the above-ground gold stock. These ambiguities do not exist in the Bitcoin market: the total amount of Bitcoins in circulation, as well as the number now in circulation, are both known with certainty to the public. Furthermore, the "production rate" of Bitcoins is guaranteed to remain constant over time: if Bitcoin mining becomes more appealing, for example due to increased Bitcoin values, the complexity of the cryptographic puzzles adapts proportionally. To put it another way, market fundamentals are much easier to see than in other markets, and the degree of uncertainty is far lower. As a result, examining this market has the potential to produce a wealth of information that goes beyond the "asset vs. currency" debate. As a starting point, this study examines the price behavior of Bitcoin and compares it to the price behavior of other commodities.

Economists have also been paying close attention to bitcoin pricing. Yermack (2013) investigates the relationships between Bitcoin prices and numerous currencies, as well as the price of gold, as previously mentioned. One of the most

important results of the report is that Bitcoin values are unrelated to gold prices. In two other researches, broad public interest and investor attractiveness are found to be important factors. Buchholz, Delaney et al. (2012) analyses the links between transaction volumes, Google hits, and Bitcoin prices using vector autoregression models. One of the more intriguing findings is that Google's hits on Granger result in increased transaction volumes. Similar findings arise from (Bouoiyour, Selmi et al. 2014). ) VAR application: they discover that investor appeal, as assessed by Google views, is a key determinant of Bitcoin prices. They come to the conclusion that "Bitcoin behaves like a speculative bubble" In contrast, Kristoufek (2014) finds that Bitcoin prices are not solely influenced by speculative forces, but also by basic factors such as trade utilization, money supply, and price level. Finally, Dwyer (2014) analyses the monthly standard deviations of gold and Bitcoin prices, finding the latter to be significantly greater than the former.

## **2.5 Bitcoins as a Determinant of Stock Market Movements**

Carrick (2016) suggest that Bitcoin's distinctive traits make it more suitable for trading in global financial markets. He investigates the impact of global stock indices on Bitcoin trading prices. The Dow Jones Index has a considerable impact on Bitcoin prices, according to the study. Dirican and Canoz (2017) investigate the impact of Bitcoin on investor decision-making in terms of stock indexes. They look at if there is a level of cointegration between Bitcoin and US and Chinese market indices. The study's positive empirical findings indicate the existence of co-integration and provide support for the significance of Bitcoin's price impact on global stock investors' long-term investment behavior. Lim and Masih (2017) investigate the relationship between Bitcoin trading return and the Malaysian stock market. The study examines the data that ranged from January 2013 to January 2017. The stock market and the price of Bitcoin have a negative correlation, according to statistical data. The study's findings suggest that Bitcoins are important for diversifying investment risk and increasing portfolio return when Bitcoin is included in the portfolio.

Yarovaya, Brzeszczyński et al. (2016) express their concern about the development of a speculation bubble in crypto-currencies such as Bitcoin, citing it as a major cause of financial instability when compared to equity and other tradable assets. Phillips and Gorse (2018) investigate the characteristics of numerous crypto-currencies and discovered a novel risk-reward trade-off as compared to other financial assets like stocks, bonds that are traded in global financial markets.

Baek and Elbeck (2015) examine the significant volatility of crypto-currencies and concluded that Bitcoins are suitable for speculation and investment. Corbet, Meegan et al. (2018) investigate the nature of the interaction between various financial assets traded on the stock exchange and cryptocurrency. The study's findings show that crypto-currencies can be used to diversify portfolios for investors with a short-term investment horizon. Kurka (2019) look at the degree to which crypto-currencies and stock indices are linked. The study's empirical findings reveal a low degree of co-integration between stock market indexes and a variety of worldwide crypto-currencies.

Gil-Alana, Abakah et al. (2020) look at the degree of co-integration between six crypto-currencies and global stock indices and found no correlation. They also mention how crypto-currency is being used as a financial instrument for diversification in financial portfolios. Earlier research looks at the degree of co-integration between crypto-currencies and stock market indices but, a couple of studies check out whether there is a drawn-out connection between significant cryptographic forms of money and developing business sector securities exchange records.

Cheah and Fry (2015) complete the most recent analysis on Bitcoin prices. They describe cross-market Bitcoin pricing as long-memory processes with dynamic dependency using a fractionally cointegrated VAR framework. According to their findings, long-memory can be found in both individual market and five-market systems, indicating non-homogeneous informational inefficiency and a cointegration relationship with slow shock adjustment. Other research, such as Katsiampa (2017) claim that recent Bitcoin price volatility is a result of market sentiments, with the latter being linked to strong "memory." The "memory" of Bitcoin price shocks, according to those studies, is a semi-important determinant of Bitcoin prices. According to Dyrberg (2016) for risk-averse investors, Bitcoin can act

as a buffer against negative market shocks, while it can also act as a hedge against market-specific risk. The majority of the Bitcoin price impacting elements, according to Van Wijk (2013) are tied to the US economy.

Bouri, et al (2017) uses daily and weekly data within a DCC model (Engle 2002) to show that Bitcoin can function as an effective diversifier in the majority of cases. Ciaian, et al. (2016) discover that three primary drivers of Bitcoin prices are market forces of supply and demand, arrival of fresh information (trust), and speculators. Furthermore, they reject the prior conclusions that Bitcoin's price is driven by global macro-financial developments. This study adds the impact of fear and uncertainty in the markets, as assessed by the VIX index and actual gold spot prices, on Bitcoin prices to the current literature.

## 2.6 Bitcoin and Stock Market Indices

Because Bitcoin is in the headlines and has become a global trend, governments are interested in the future of finance and are developing strategies to incorporate cryptocurrencies into their economies (Cheah and Fry 2015). Many people own digital currencies or use them in transactions, with bitcoins being the most popular. In many transactions, many people prefer digital currency to paper currency, and there is a shift toward using digital currency. Digital currencies are also becoming more popular in a number of countries, including Japan, the United States, and South Korea. Digital currencies do not yet constitute a substantial danger to financial stability, but as technology progresses, these free-floating digital currencies may become an asset price that calls attention to financial stability in the near future. (Ali, Barrdear et al. 2014).

Since January 2016, analysts at Data trek, an economic and financial consulting firm, have separated the relationship between bitcoin and the S&P 500 into three holding periods: 10 days, 30 days, and 90 days. There is a strong link between two variables in the analysis. The proportion is 79 percent after ten days. It is steadily declining over a 30-day and 90-day period, with correlation ratios of 52% and 33%, respectively. Financiers and brokers, according to analysts, are responsible for bitcoin's expanding popularity and the continuation of its correlative trend

“Since investors have just one brain to analyses risk,” analysts write, “they will make identical conclusions concerning cryptocurrencies and equities when they experience price volatility in the latter” (Sharma and Park 2018).

According to the ECB (2012), one of the functions of virtual currencies is to act as a medium of exchange and a unit of account in the virtual currency universe. Investors are more willing to trade exchange currencies now than in prior days due to the spike in bitcoin prices. However, there is a lot of false information regarding the price of Bitcoin, and this disagreement causes fear in the financial sector and, in many cases, causes bubbles. The Winklevoss twins, on the other hand, have made over a \$1 billion on bitcoin since 2011, making them the first bitcoin billionaires (Akinci and Li 2018) . Some people do not believe in the reality of Bitcoin in its early stages, but one thing is certain: if a person invests \$100 in Bitcoin, it is not a waste of money. Even if many individuals do not believe in this idea, the maturity of this new virtual currency offers gain greater than most reliable stocks. The maturity of bitcoin has an impact on macroeconomic indicators, and the link is growing stronger.

The logical explanation for this situation is that the maturity of the S&P 500 and Bitcoin’s economic performance may reflect on macro levels, influencing the US economy. In a variety of ways, bitcoins and stock exchange indices are linked. A stock exchange index is a statistic that assesses the stock market’s overall worth or the value of a specific industrial or service sector (Alexandru 2012). According to Peter Fortune, Director of Research at the Boston Federal Reserve, stock market indices and bitcoin are similar. He looks into the correlations between the returns of stock price indices. Several indexes, according to Fortune (1998), have similar connections with bitcoin. There is, however, a distinct market segment that is unrelated to the others.

Investors have been looking for stock exchange indexes that offer a high level of quality and concentrated engagement flows throughout the day. Monitoring the evolution of the value of a stock exchange index, which is represented by the direction of the general movement of the prices of securities, usually shares, in the respective market or in the analysed sector, can be used to determine the overall trend of a stock exchange or one of its sectors for bitcoin. Granger causality is

used to see if one time series may be used to forecast another and if there is a link between them. Most study in the field of stock market analysis has focused on the greater integration, international dependencies, and efficiency of the three markets.

Although many claim that Bitcoin has qualities that make it analogous to gold, the two are not identical in several ways. The most significant distinctions between gold and Bitcoin are tangibility, history, inherent worth, volatility, use in the manufacturing process, and recognition as a worldwide monetary reserve. Bitcoin is an intangible asset with a relatively short and shaky history (Bhaskar, Linacre et al. 2019) .

Because it is not backed by any established body, its intrinsic value is a topic of continuing debate, but recent research reveals that the price of Bitcoin is not simply influenced by speculation (Barnes, 2018) . The volatility of Bitcoin, as a leading cryptocurrency, is unheard of in the financial markets, and while it had been on a somewhat consistent downward trend until the end of 2016, it has been on a significant upsurge since the beginning of 2017 (Urquhart, 2017). Such a shift in volatility dynamics is surprising, given that 2017 is marked by an infusion of new investors and, as a result, greater liquidity (Urquhart, 2017). This shows that, despite the fact that the traded volumes of Bitcoin and other cryptocurrencies and tokens have been continuously increasing, the implied liquidity of these assets and instruments remains low when compared to other traditional financial assets and vehicles — which is both a problem and a window of opportunity for additional growth and development, as well as a red flag for institutional investors. However, even if there are territorial limitations, the options for utilizing Bitcoin as a payment method have grown, and its acceptability cannot yet be considered global. We can treat gold as the polar opposite of most of these things. The most problematic characteristics of Bitcoin from the standpoint of an ideal hedging asset are its dubious history although many investors appear to trust its reliability and high volatility which implies that Bitcoin would ideally need to be negatively correlated with the rest of a portfolio (Popper, 2015).

Gold and Bitcoin, on the other hand, share a number of characteristics, including being classified as a commodity by the US Commodity Futures Trading

Commission and being produced through a process known as mining even though in reality the physical mining of gold is completely different from the CPU and GPU-based digital mining of Bitcoin, a positive return-volatility connection, the capacity to hedge inflation and stock market risks, an inverted asymmetric reaction to positive and bad news, and an inability to create cash-flows as in conventional assets such as shares and bonds (McNally, 2018). The most crucial of these features is that gold and Bitcoin are both effective inflation and stock market risk hedges. This presupposes that both are deflationary (or at least not inflationary) and that they are unrelated to, if not even adversely related to, stock markets. These features are well-known for gold, but not so much for Bitcoin, which economists consider deflationary because its circulating quantity is known and determined by an algorithm, and its amount cannot be artificially increased, i.e., there is no inflationary "money printing." As long as there is reasonable demand, this leads to an increase in price in the long run (McNally, 2018).

According to some studies, Bitcoin has a very low correlation with other financial assets (Dyhrberg, 2016; Bouri et al., 2017a, 2017b; Ji et al., 2018). Interestingly, according to Kristoufek (2015), Bitcoin is only weakly connected with gold and only for very short periods of time, making it appropriate to regard gold and Bitcoin as risk diversifiers even when used together.

Cryptocurrencies are a different class of assets with characteristics that differ from those of traditional financial assets and instruments. Many of these qualities, such as decentralization, minimal regulation, low transaction fees, and anonymity, are considered breakthroughs in the financial industry. There are also factors that limit Bitcoin's and crypto assets' adoption and utility. Liquidity difficulties, an unknown foreign tax status, and technological specifics are the most relevant issues and constraints with regard to a hedge label (Hu, 2019). Liquidity in the crypto space is still minimal when compared to traditional financial instruments. This illustrates that there is still room for growth in the crypto sector, as well as how little it is right now.

Such illiquidity is reflected in price differentials between exchanges that are not arbitrated away, despite the fact that they can be significant. This isn't strictly due to a lack of liquidity, but rather to a mix of exchanges' inconsistent transfer

and withdrawal periods, as well as excessive volatility. Arbitrageurs, in fact, do not clear the differential unless it is deemed big enough to prevent it from disappearing before the transfer between exchanges is completed (Hu, 2019).

The virtual non-existence of many (fiat) currency pairs with Bitcoin is another issue related to liquidity and potential utility as a hedging asset. In actuality, only a handful Bitcoin pairs – the US dollar, Euro, Japanese Yen, and South Korean Won — are considered liquid enough by economists, in this case, with significant market depth (historically, the pair with the Chinese Yuan was important until the Chinese government issued such firm restrictions on it) (Shahzad, 2020).

The USD pair is the most important of these, which means that, while Bitcoin is stock market agnostic, the US dollar's exchange rate risk is indirectly pass to Bitcoin holdings as well (unless hedging against a USD-based portfolio). Another important aspect of Bitcoin as a possible effective hedge is its ambiguous classification, particularly in terms of tax systems and taxes in general. This is a scenario in which anonymity collides with government regulations and the aim to collect taxes and prevent money laundering (Shahzad, 2020).

The question of how-to tax cryptocurrency remains relevant and of interest to academics. Large institutional investors are unlikely to consider Bitcoin (or any other cryptocurrency) as an investment outlet until the tax dilemma, which is primarily a financial asset classification dilemma (currencies, stocks, and properties are usually taxed differently), is resolved or reasonably harmonized internationally. The technical crypto world idiosyncrasies, which are not found in other financial assets, are the last intriguing component of Bitcoin (and cryptocurrencies in general) that might be considered a barrier to entry for the big players. The current state of the crypto world suggests that the appealing qualities will survive and the problematic properties will vanish (Barnes, 2018).

## 2.7 Hypothesis of Study

The following are the research hypothesis:

### **Research Hypothesis: 1**

There exists time varying dynamic correlation between bitcoin and currencies of

BRICS countries.

**Research Hypothesis: 2**

There exists time varying dynamic correlation between bitcoin and stocks of BRICS countries.

**Research Hypothesis: 3**

There exists time varying dynamic correlation between bitcoin and Gold Prices.

**Research Hypothesis: 4**

Time varying conditional correlation among bitcoin and currencies of BRICS countries is asymmetric.

**Research Hypothesis: 5**

Time varying conditional correlation among bitcoin and stocks of BRICS countries is asymmetric.

**Research Hypothesis: 6**

Time varying conditional correlation among bitcoin and Gold is asymmetric.

**Research Hypothesis: 7**

Bitcoin a diversifier, a hedge or a safe haven for BRICS Currencies.

**Research Hypothesis: 8**

Bitcoin a diversifier, a hedge or a safe haven for BRICS stocks.

**Research Hypothesis: 9**

Bitcoin a diversifier, a hedge or a safe haven for Gold.

# Chapter 3

## Research Methodology

Research methodology is a process in which various tools, techniques and concepts are used in a study to explore the answer of the research question in a systematic manner. This section includes the methods and procedures which are applied in this study to explain the volatility and its dynamics. The discussion contains details about the population of study, sample size, other tools and techniques used to meet the objectives of the study considered under this research.

### 3.1 Population and Sample of the Study

Gold market, oil market, and currency market are the population of the study and sample of this study consist of Bitcoin Daily Data, BRICS Currencies, BRICS Stock Prices and Gold Prices. Gold prices represent the gold market and the data is retrieved from the database. As the bitcoin is introduced in 2014 so the data of all the variables cover the period from September 2014 to July 2020. The prices of bitcoin and BRICS Currencies and Indices are taken in dollar terms, the return of the Bitcoin, BRICS Currencies and Stock Prices are calculated from the following formula:

$$R_t = \ln \frac{P_t}{P_{t-1}}$$

Where,

$\ln$  = Natural log

$P_t$  = The price of bitcoin, BRICS Currencies, Indices and Gold at time 't'

$P_{t1}$  = The price of bitcoin and BRICS Currencies, Indices and Gold at time “t – 1”

$R_t$  = Return of bitcoin and BRICS Currencies, Indices and Gold compounded continuously.

TABLE 3.1: Sample Description

No.	Asset	Symbol	Sample Data
1	Bitcoin	BTC	Sep 18, 2014 to July 1,2020
2	Gold	GLD	Sep 18, 2014 to July 1,2020
3	Brazilian Real	BRL	Sep 18, 2014 to July 1,2020
4	Russian Ruble	RUB	Sep 18, 2014 to July 1,2020
5	Indian Rupee	INR	Sep 18, 2014 to July 1,2020
6	Chinese Yuan	CNY	Sep 18, 2014 to July 1,2020
7	South African Rand	RAND	Sep 18, 2014 to July 1,2020
8	Brazilian Index	BSI	Sep 18, 2014 to July 1,2020
9	Russian Index	MSE	Sep 18, 2014 to July 1,2020
10	Indian Index	SEN	Sep 18, 2014 to July 1,2020
11	Chinese Index	SSE	Sep 18, 2014 to July 1,2020
12	South African Index	JSE	Sep 18, 2014 to July 1,2020

## 3.2 Econometric Models

The empirical analysis is conducted between bitcoin and each of the eleven instruments, pairwise dynamic conditional correlations (DCCs) are calculated. The second stage evaluates Bitcoin’s hedging and safe-haven features against these commodities by regressing the pairwise DCCs on the returns of these variables.

The model used in this study is a bivariate asymmetric DCC model presented by Cappiello, Engle et al. (2006) in extension of the standard DCC of Engle (2002) used by Ratner and Chiu (2013). It also specifies the asymmetric DCC model’s conditional mean equation as an autoregressive-moving average (Liew, Li et al.) process. This systemic method in this review is significant for keeping away from one-sided assessments of dynamic relationships coefficients.

### The DCC GARCH Model

The dynamic conditional correlation (DCC) model of Engle (2002) mirror the time-shifting and dynamic connection between return series (Cho and Parhizgari 2009). Notwithstanding, due to the huge number of return series, the DCC model is assessed independently for sets of bring series back.

There are two steps to estimate the bivariate DCC model. A univariate GARCH (1,1) model is estimated in the first step. The standardized residuals from the first-stage estimation are used to compute a time-varying correlation matrix in the second step. We can, however, incorporate asymmetry into the DCC's correlation dynamics and convert the model (called the ADCC model) into quadratic form, in line with Cappiello, Engle, and Sheppard (2006). The mean condition of the ADCC model (1) is determined as an ARMA process .The above statement suggests that the correlation is consistent over time, but that the correlation may vary over time. Thus, in this case, the Dynamic Conditional Correlation DCC GARCH approach is used and the possibility of any asymmetry in the model is recorded by the ADCC GARCH model.

Dynamic Conditional Correlation method or DCC, models the volatilities and correlations in two steps. The detail about the dynamics of correlation reached out to permit asymmetries vital for financial practice. The DCC furnishes a joint thickness work with tail dependence more prominent that the ordinary. This is investigated both by simultaneously and experimentally. At a point when two stocks move same way, the correlation is positive. On the opposite side, when similar two stocks move inverse way, this correlation is negative. In down markets, thus effect of movement of stocks can be stronger. Th correlations often are assumed to only temporarily deviate from a long run mean. In the case of upper as well as lower tail of the multiperiod joint length, a symmetric DCC model offers greater dependence on the upper neck, while an asymmetric DCC or ADCC gives greater dependence on the intensity from the lower neck. This is in accordance with crafted by Kyrtsou and Labys (2007), who proposes that ignoring this trademark might sabotage a portion of the elements of the connections between the inspected factors .

$$k_t = \alpha_t + \varphi k_{t-1} + \gamma \varepsilon_{t-1} + \varepsilon_t \quad (3.1)$$

where  $k_t$  is the vector of the price return of Bitcoin and that of the other commodities,  $\alpha_t$  is the conditional mean vector of  $k_t$ , and  $\varepsilon_t$  is a vector of residuals.

The variance equation is specified as

$$\sigma_t^2 = \beta_o + \lambda_1 \varepsilon_{t-1}^2 + a \sigma_{t-1}^2 + \mu \varepsilon_{t-1}^2 l_{t-1} \quad (3.2)$$

Where  $\sigma_t$  is the conditional variance;  $\beta_o$  is the constant;  $\lambda_1$  is the parameter that captures the ARCH effect;  $\mu$  represents the GARCH effect;  $\mu = 0$  is the parameter that measures the asymmetric effect, with a symmetric impact if  $\mu = 0$ , and otherwise, the asymmetric impact is significant if  $\mu \neq 0$ .

The ADCC (1, 1) equation is specified for  $P_t$ , which is an asymmetric square positive-definite matrix:

$$P_t = (1 - \phi_1 - \phi_2) \bar{P} - K \bar{M} + \phi_1 \varepsilon_{t-1} \varepsilon'_{t-1} + \phi_2 P_{t-1} + K m_{t-1} m'_{t-1} \quad (3.3)$$

Where  $\phi_1, \phi_2$  and are  $K \times K$  parameter matrices,  $\bar{P}$  is the sample covariance matrix of the standardized residuals  $\varepsilon_t, = I[\varepsilon_t < 0]$

$\varepsilon_t, I[\bullet]$  is a  $K \times 1$  indicator function taking value 1 if the argument is true and 0 otherwise, indicates the Hadamard product, and  $\bar{P} = E[m_{t-1} m'_{t-1}]$

The pairwise dynamic conditional correlation between assets p and q is given by

$$\int_{pq,t} = \frac{f_{pq,t}}{(\sqrt{f_{pp,t}} \sqrt{f_{qq,t}})} \quad (3.4)$$

### 3.2.1 Diversifier, Hedge or Safe Haven

The advanced form of ordinary least square is Quantile regression which is used to estimate models for different conditional quantile function by considering the effects of a covariates impact on a dependent variable. However, the ordinary least square estimation method provides information about the change in the conditional mean of the endogenous variables due to the change in the independent variables; additionally, quantiles regression also specifies the variation in the conditional quantile regression.

Due to this reason, various quantiles can be estimated by using quantile regression in order to provide complete information that how the response distribution is impacted by the independent variable from the obtained information related to the variation in locations, spread and change. Regression analysis are used to look at Bitcoin's potential diversified, hedging, and safe-haven properties.

the ADCC model and relapsed on factors (D) that address outrageous descending and up developments in the lower tenth, fifth, and first percentiles of the return circulation, just as outrageous vertical and descending developments in the 90th, 95th, and 99th percentiles of the bring dissemination back. The relapse is given as where ADCC is the pairwise contingent connection between's Bit coin and every one of the three ware files considered, and where ADCC is the pairwise restrictive relationship between's Bit coin and every one of the three product lists under research (BRICS index, BRICS Currencies and Gold), rseries is the return of each of the other series, and qt is the disturbance term.

If c is weakly positive, bitcoin acts as a hedge against movements in the other index. If c is zero, bitcoin is a poor hedge against movements in the other index; if c is negative, bitcoin is a strong hedge. If the n1, n2, or n3 coefficients are not significantly different from zero, Bitcoin is a weak safe haven against movements in the other index, and a strong safe haven if these coefficients are negative.

$$ADCC_k = c + n_1D(r_{series}P_{10}) + n_2D(r_{series}P_5) + n_3D(r_{series}P_1) + n_4D(r_{series}P_{90}) + n_5D(r_{series}P_{95}) + n_6D(r_{series}P_{99}) + q_t \quad (3.5)$$

# Chapter 4

## Results and Discussion

This chapter presents the result of the study. The chapter contains the descriptive statistics for all variables (Bitcoin, Gold, Brazilian Currency, Brazilian Index, Russian Currency, Russian Index, Chinese Currency, Chinese Index, South African Currency, and African Index) in order to see the structure and behavior of the data. Moreover, after providing the insight related to nature of the data, empirical results of the Bivariate DCC – GARCH model and Quantile regression are reported.

In Finance research, seeing the behavior of data is the first essential phase. The time series may be stationary or non-stationary. The log series of bitcoin and other variables should be non-stationary for further analysis. For non-stationary time series, mean, standard deviation and auto correlation is not constant and indicates an increasing or decreasing trend with the passage of time. Graphs for the prices, Indices and returns for each series are shown below:

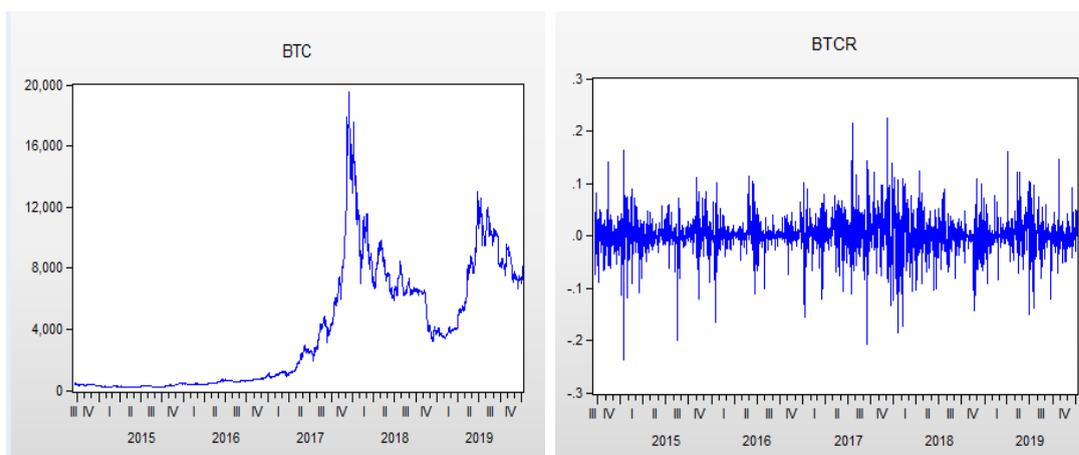


FIGURE 4.1: BTC and BTCR

Figure 4.1 show the trends of Bitcoin and Bitcoin return series and they clearly show that these series are non-stationary. As the trend shows that BTC series have the rise and fall trends, from 2017 to 2018, high rise have seen in the series while 2019 onwards, fall is captured.

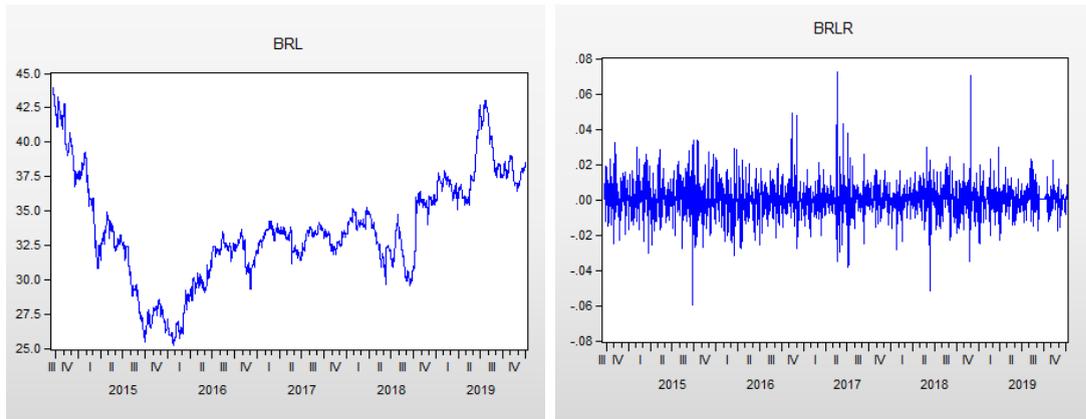


FIGURE 4.2: BRL and BRLR

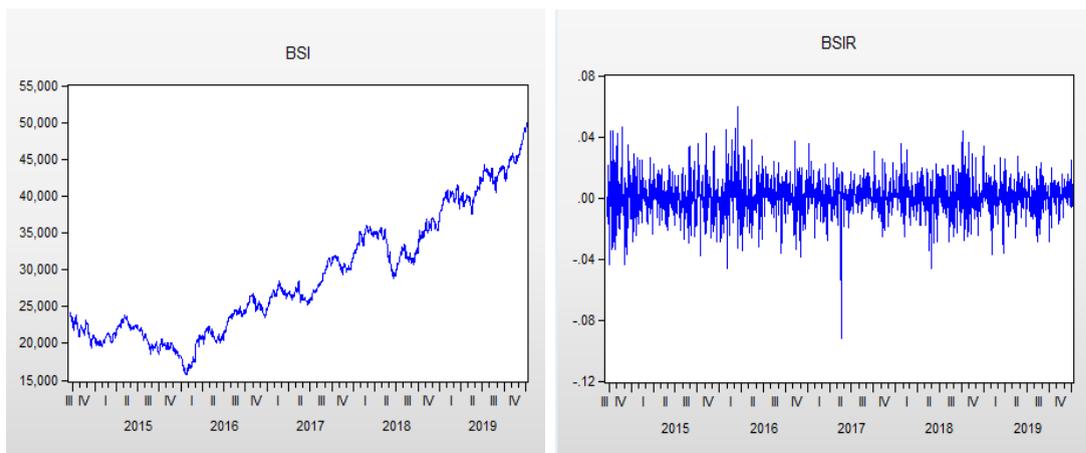


FIGURE 4.3: BSI and BSIR

Figure 4.2 and 4.3 show the trends of Brazilian currency and Brazilian Index return series and they clearly show that these series are non-stationary. As the trend shows that Brazilian currency and Brazilian Index have periods of rise and fall trends which are not uniform in general. And it clearly indicates the non-stationarity of the series. There are the periods of high volatility and low volatility.

Figure 4.4 and 4.5 show the trends of Russian currency and Russian Index return series and they clearly show that these series are non-stationary. As the trend shows that Russian currency and Russian Index have periods of rise and fall trends

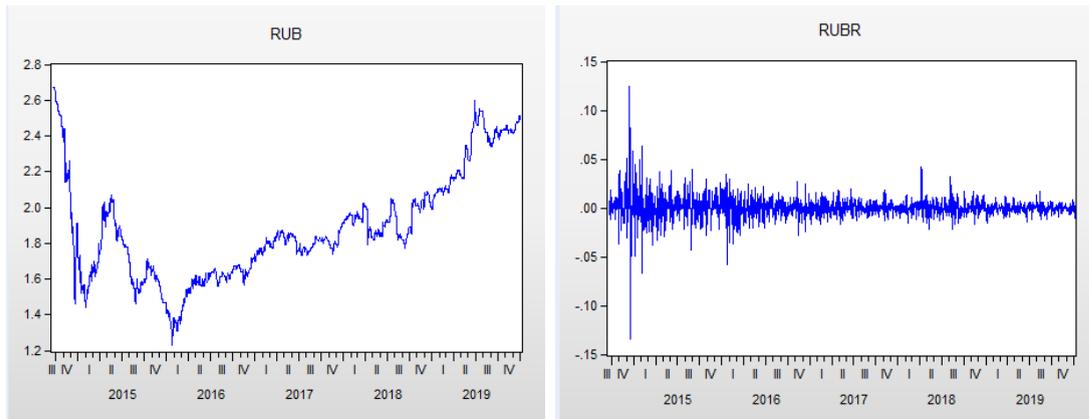


FIGURE 4.4: RUB and RUBR

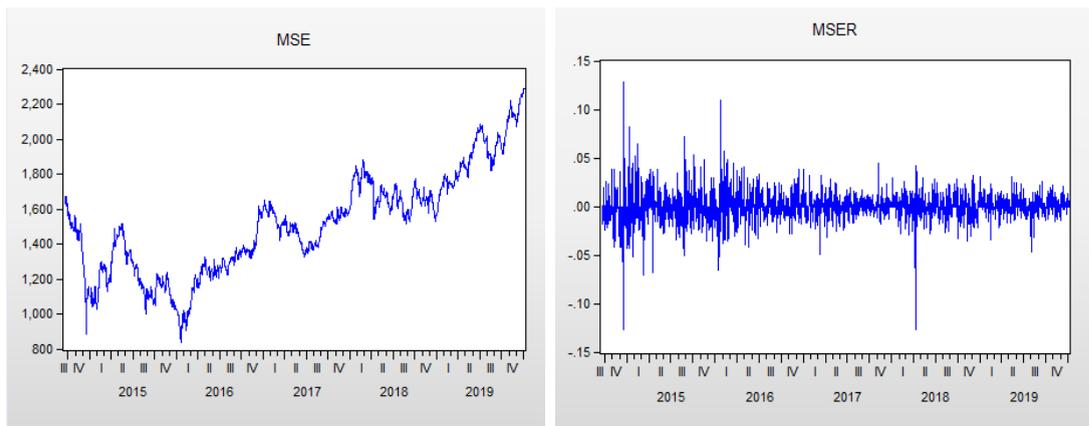


FIGURE 4.5: MSE and MSER

which are not uniform in general. And it clearly indicates the non-stationarity of the series. There are the periods of high volatility and low volatility.

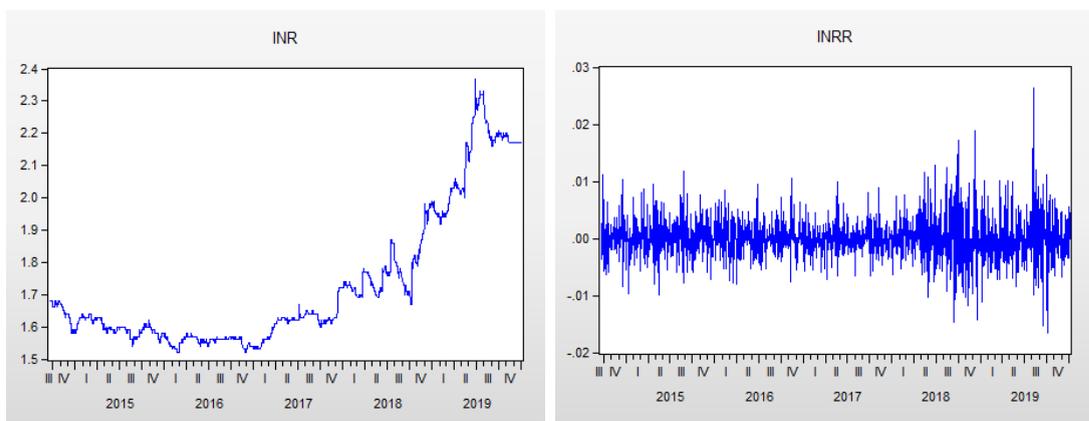


FIGURE 4.6: INR and INRR

These graphs 4.7 and 4.8 show the trends of Indian currency and Indian Index return series and they clearly show that these series are non-stationary. As the trend shows that Indian currency and Indian Index have periods of rise and fall trends

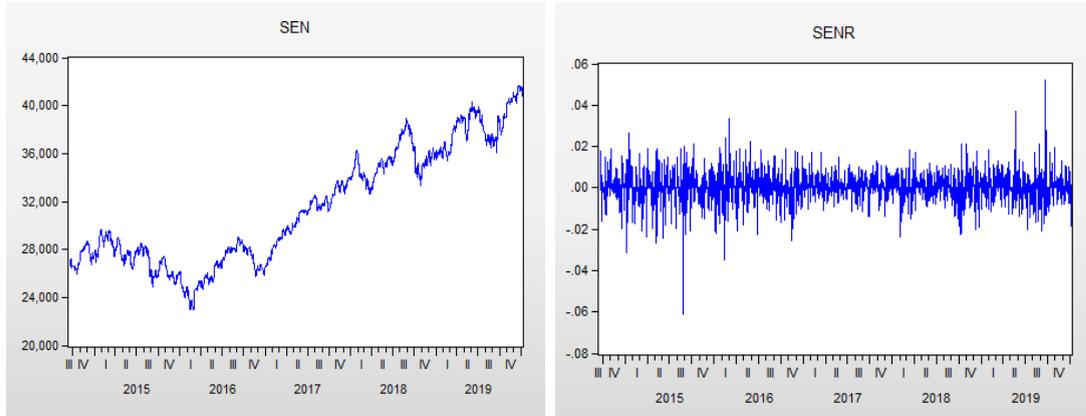


FIGURE 4.7: SEN and SENR

which are not uniform in general. And it clearly indicates the non-stationarity of the series. There are the periods of high volatility and low volatility.

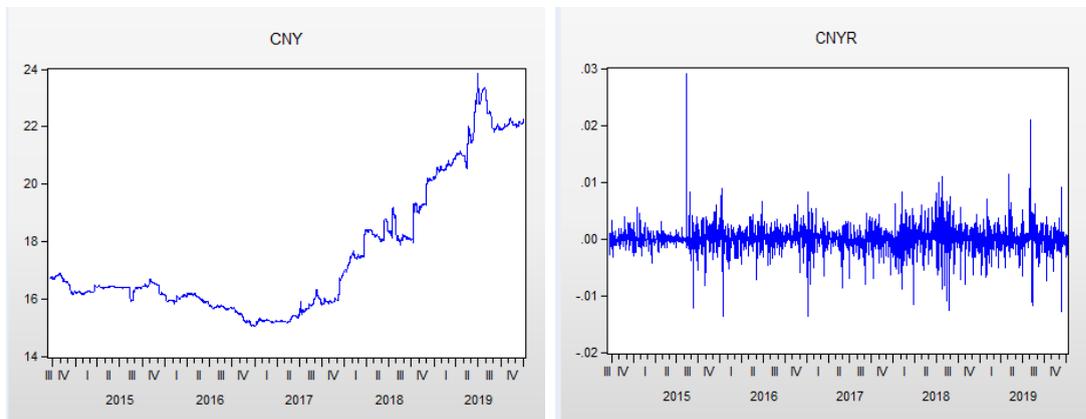


FIGURE 4.8: CNY and CNYR

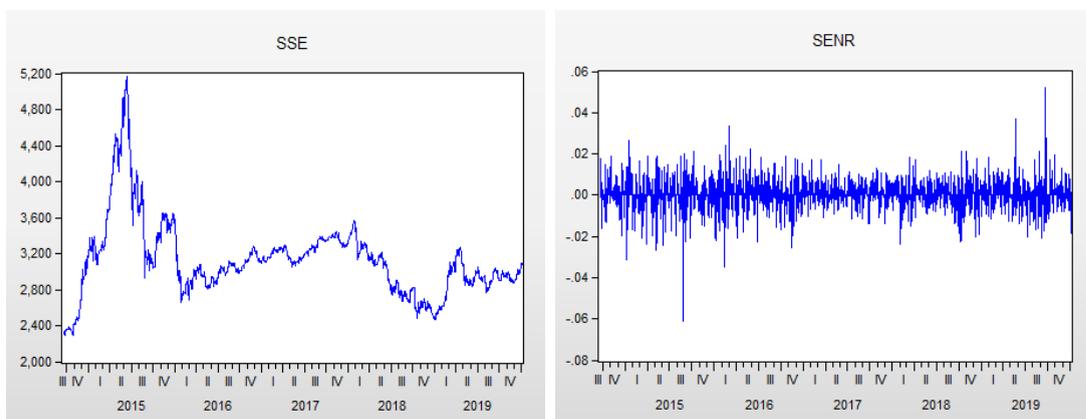


FIGURE 4.9: SSE and SENR

Above graphs 4.8 and 4.9 show the trends of Chinese currency and Chinese Index return series and they clearly show that these series are non-stationary. As the trend shows that Chinese Yuan and Shanghai Stock Exchange have periods of

rise and fall trends which are not uniform in general. And it clearly indicates the non-stationarity of the series. There are the periods of high volatility and low volatility.

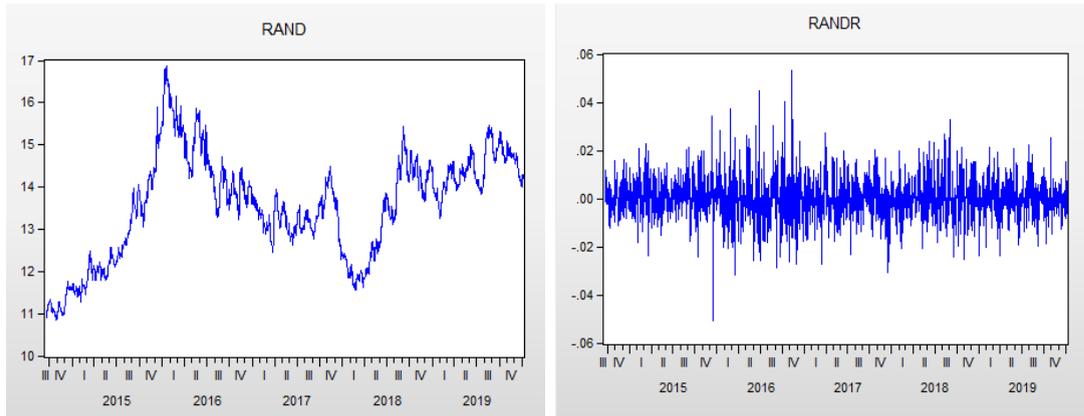


FIGURE 4.10: 10 RAND and RANDR

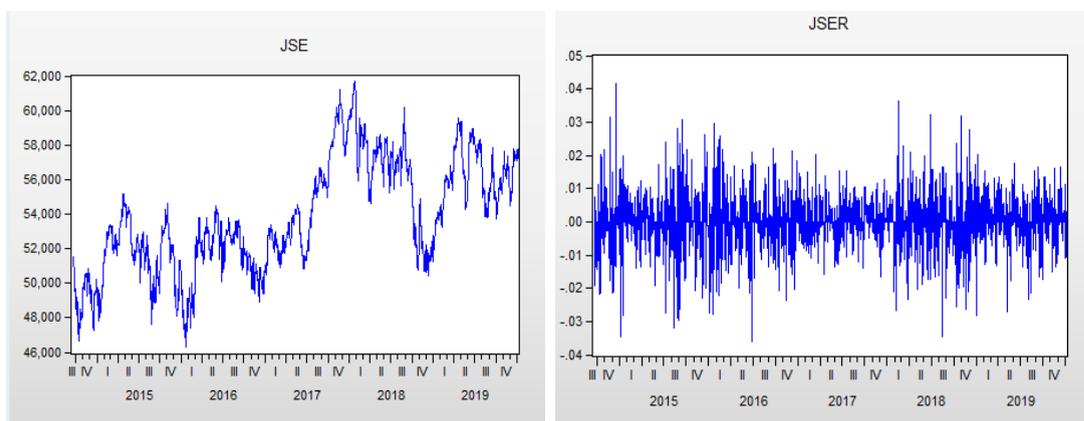


FIGURE 4.11: JSE and JSER

Graphs in Figure 4.10 and 4.11 show the trends of South African currency and South African Index return series and they clearly show that these series are non-stationary. As the trend shows that South African Rand and South African Index have periods of rise and fall trends which are not uniform in general. And it clearly indicates the non-stationarity of the series. There are the periods of high volatility and low volatility.

Above graphs 4.12 clearly indicate that all the series are non-stationary. The trend of these series is not same. These are bubbles and burst. There are periods of rise and fall which are not uniform in general. The return graph indicate that the volatility is not constant overtime. There are periods of high volatility and low volatility. Volatility clustering is also visible in most of the currencies.

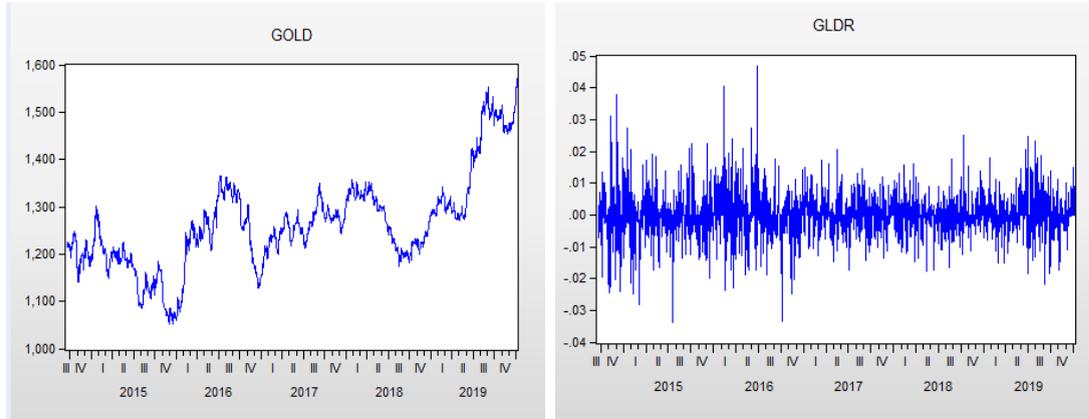


FIGURE 4.12: JGLD and GLDR

## 4.1 Descriptive Statistics

The second step is to analyze the characteristics of each series using descriptive statistics. Table 4.1 reveals the descriptive statistics of returns of the series i.e., Bitcoin, Gold, Brazilian Currency, Brazilian Index, Russian Currency, Russian Index, Chinese Currency, Chinese Index, South African Currency, and African Index. Table 4.1 include the Mean, Median, Standard Deviation, Skewness and kurtosis. Furthermore, Maximum & Minimum average results are also reported for the distribution of returns.

TABLE 4.1: Descriptive Statistics

Variables	Mean	Max.	Min.	Std. Dev.	Skewness	Kurtosis
BTCR	0.0015	0.2251	-0.2375	0.0385	-0.2788	8.2447
BRLR	0.0002	0.0724	-0.0597	0.0093	0.4059	9.8681
BSIR	0.0003	0.0597	-0.092	0.0114	-0.1854	7.6024
CNYR	6.19E-05	0.029	-0.0136	0.0024	0.6426	20.69
GLDR	0.0001	0.0467	-0.0339	0.0067	0.3097	7.8421
INRR	8.36E-05	0.0263	-0.0166	0.0033	0.4505	7.8999
JSER	5.91E-05	0.0415	-0.0362	0.0079	-0.1561	6.0895
RANDR	0.0014	0.053	-0.0507	0.0085	0.3169	6.2934
RUBR	0.0002	0.124	-0.1341	0.0103	-0.0638	32.332
SENR	0.0002	0.0518	-0.0611	0.0069	-0.2448	10.02
SSER	0.0001	0.056	-0.0887	0.0123	-1.402	14.559

The mean value determines variables average return. The negative mean value indicates negative average returns from these variables. South African Index returns, Chinese currency returns and Indian currency returns show the lowest average returns of 5.91E-0, 6.19E-05 and 8.36E-05, respectively. Brazilian Index tops the

sample with 0.036% in terms of the mean return value, followed by Brazilian Currency and Russian Currency with the returns of 0.028% and 0.024% respectively. Bitcoin tops the sample in terms of maximum return earned in a day with 22.5% followed by Russian Ruble and Brazilian Real with 12.4% and 5.98% respectively. Maximum loss per day is earned by bitcoin with 23.7% followed by Brazilian Index and Chinese Index with 9.2% and 8.8% respectively. The standard deviation indicates the risk of investment in these variables. The descriptive statistics reveal that bitcoin is the riskiest variable for investment from the sample with a standard deviation of 3.86% followed by Chinese Index (Shanghai Stock Exchange) and Russian Ruble with standard deviations of 1.23% and 1.03% respectively. The two least risky variables in the sample are Indian Currency and Chinese Currencies with standard deviations of 0.033% and 0.024% respectively.

Ideally, there should also be high returns when there is high risk. However, the descriptive statistics indicate an inefficient connection between risks and average returns of variables in the sample. Skewness tells of data's asymmetrical behavior. Skewness values of Brazilian Real, Chinese Yuan, Gold, Indian Rupee and South African Rand show positive skewness, meaning that the mean here goes beyond the mode, however Bitcoin, Brazilian Index, South African Index, Russian Ruble, Indian Index and Chinese Index show negative skewedness, meaning that the mean is less than mode.

The negative skew trend depicts Bitcoin's continual depreciation in returns, i.e., Bitcoin's price fell by nearly 65 percent during the 2018 cryptocurrency war (from 6 January to 6 February 2018 during the month). The tailedness of a probability distribution is indicated by kurtosis. For all the Variables, the value of kurtosis is greater than 3, which means that all series of variables are leptokurtic i.e., fat tails and are extremely affected with cryptocurrency market bubbles. In this sample, Russian Ruble is the most leptokurtic variable with a kurtosis value of 32.33 followed by Chinese Yuan and Chinese Index values 20.69 and 14.55 respectively.

## **4.2 Application of Pairwise Dynamic Conditional Correlation DCC GARCH**

To see the diversifying, Hedge and safe haven properties of bit coin with different products, the investigation is directed in two phases. In first stage the Pairwise Dynamic Conditional Correlation is led between Bit coin and every one of the other eleven instruments. For the subsequent stage, the fence or place of haven properties of Bit coin against every one of the products are dissected through the relapse of those pair shrewd ADCCs on the factors addressing the super descending and up developments in the bring dispersion back's.

Table 4.2 reports the results of ARCH test that depicts the presence of heteroscedasticity in Bitcoin, Gold, Brazilian Currency (Real), Brazilian Index, Russian Currency (Ruble), Russian Index, Indian Currency (Rupee), Indian Index, Chinese Currency, Chinese Index, South African Currency (Rand), and South African Index. The presence of the ARCH effect leads towards the application of volatility models. After testing the ARCH effect, further DCC GARCH is applied to find the hedge or safe haven properties of Bitcoin.

TABLE 4.2: ARCH Effect

<b>Series</b>	<b>Value</b>	<b>Prob</b>
BTC	147.410	0.000
BRL	26.250	0.000
BSI	3.070	0.040
CNY	63.400	0.000
GLD	7.330	0.000
INR	26.240	0.000
JSE	11.940	0.000
MSE	262.670	0.000
RAND	11.090	0.001
RUB	53.970	0.000
SEN	6.540	0.000
SSE	68.850	0.000

*This table displays the Arch Effect of Bitcoin and other commodities e.g., Bitcoin BRICS Currencies, BRICS Indices and Gold. Whereas, all these series are the log returns of daily data sample.*

### 4.2.1 The DCC GARCH Model

This study employs the Bivariate Asymmetric DCC model which was proposed by Engle, Cappiello and Sheppard (2006) in the extension of standard DCC Model of Engle (2002).

Engle (2002)'s dynamic conditional correlation (DCC) model has been shown to reflect the time-varying and dynamic relationship between return series. However, because of the large number of return series, the DCC model is estimated separately for pairs of return series rather than all of them at once for the purposes of this study. As a result, there's less of a chance of generating biased estimations of parameters in higher dimensions. There are two steps to estimating the bivariate DCC model.

A univariate GARCH (1, 1) model is estimated in the first step. The standardized residuals from the first-stage estimation are used to compute a time-varying correlation matrix in the second step. However, in accordance with Cappiello, Engle, and Sheppard, we add asymmetry to the DCC's correlation dynamics and convert the resulting model (called the ADCC model) into quadratic form (2006).

This is in line with the findings of Kyrtsov and Labys (2007), who claim that ignoring this characteristic may undermine some of the dynamics of the studied relationships. Table 4.3 reports the results of DCC GARCH along with the appropriate model for measuring the dynamic conditional correlation. The best model for all the series is chosen on the criteria of lowest AIC. GARCH, T-GARCH, and E-GARCH are used to estimate the DCC GARCH for the Bitcoin and other eleven instruments. This table also reports the values of coefficients along with their p-value and best-fitted model for all the pairs of Bitcoin and BRICS currencies and Stock prices as well as gold.

The best-fitted model for estimating the DCC GARCH for the pair of Bitcoin with Gold is GARCH and for the pair of Bitcoin and Russian Currency, South African Currency and Chinese Index is T-GARCH while for the pair of bitcoin with Brazilian Currency, Brazilian Index and Indian Index is E-GARCH. For all the series past residual shock is denoted by  $\alpha$  and lagged dynamic conditional correlation is denoted by  $\beta$ . The most important stability condition of DCC which

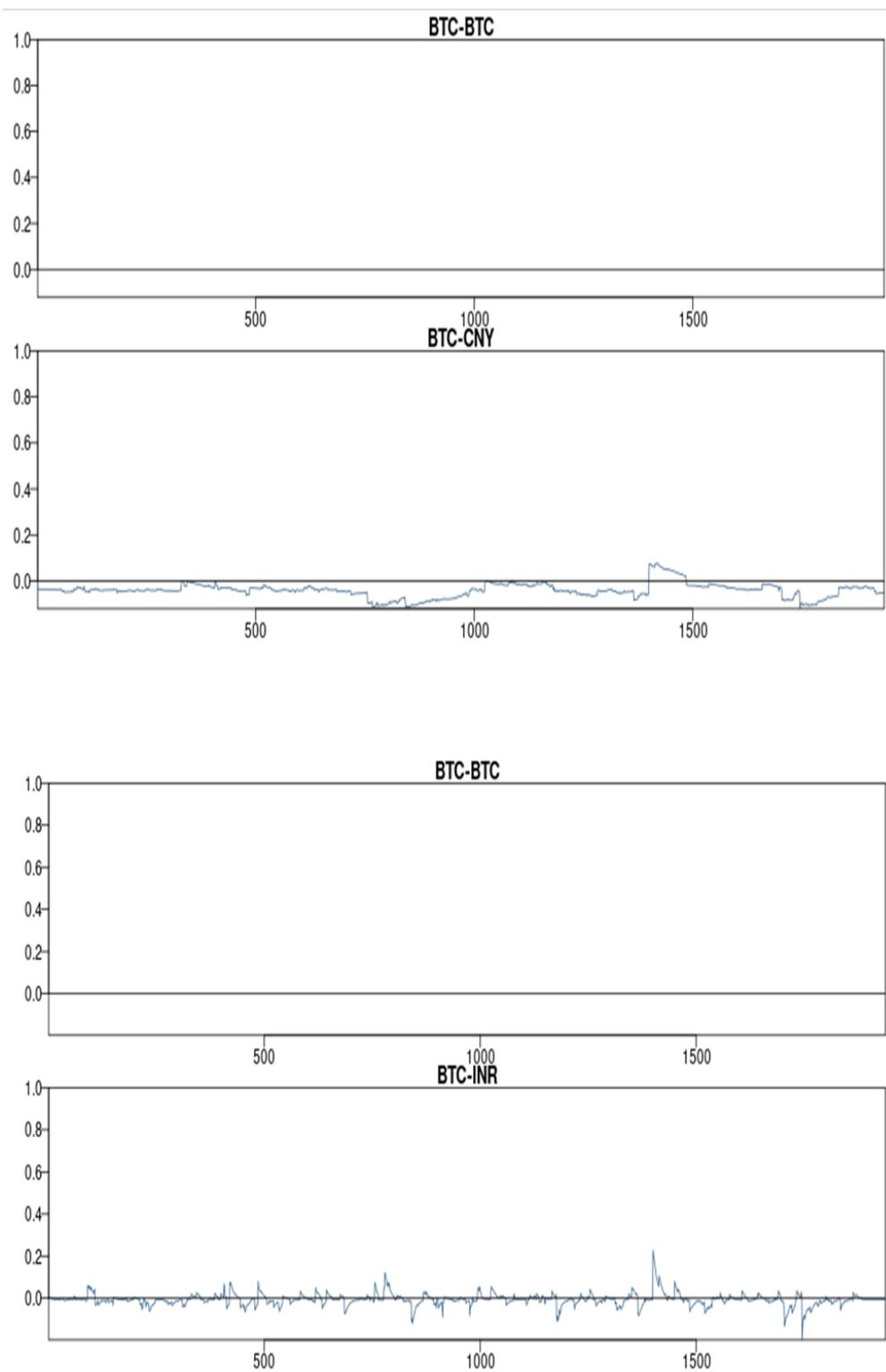
is  $\alpha + \beta < 1$  is met by seven of eleven series of Bitcoin and other instruments.

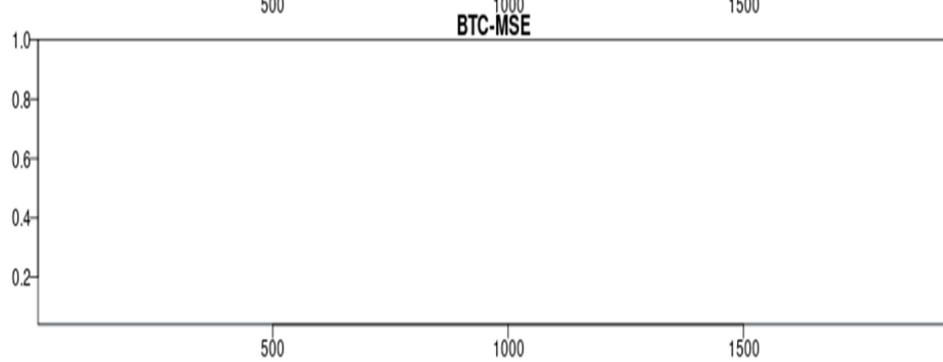
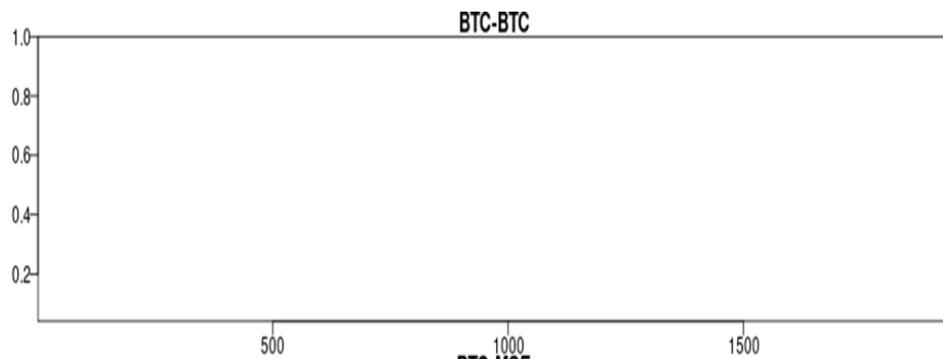
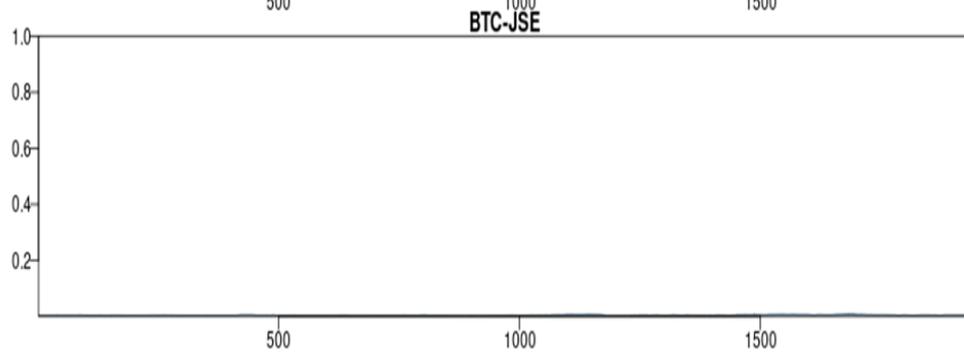
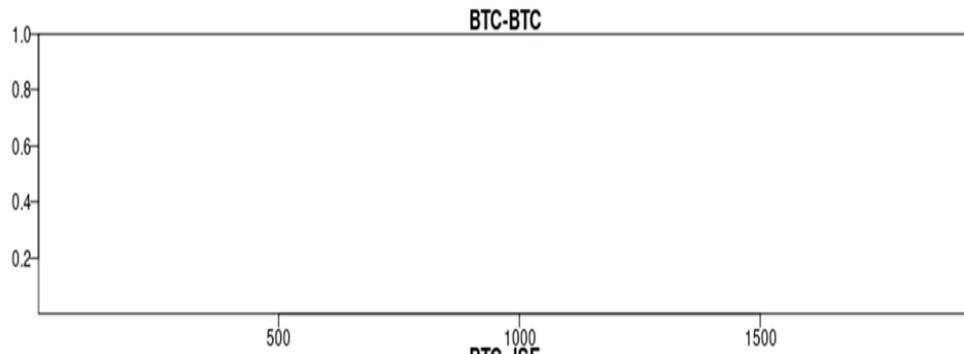
TABLE 4.3: DCC GARCH Model

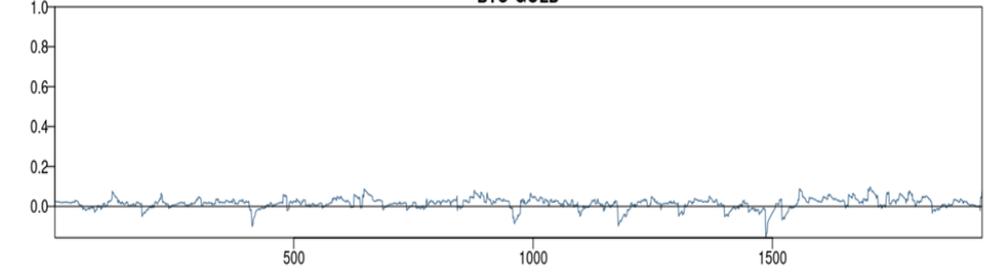
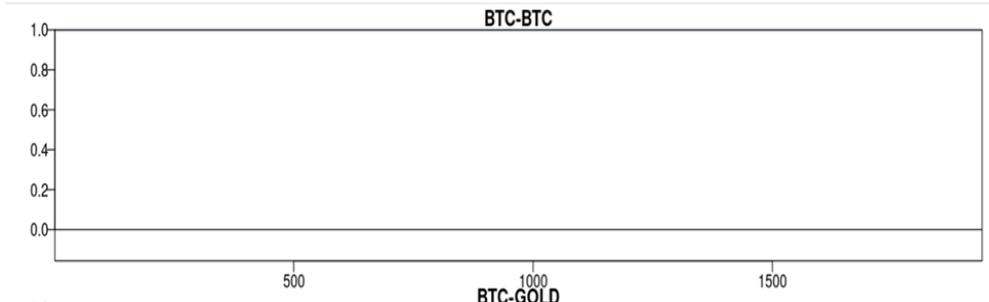
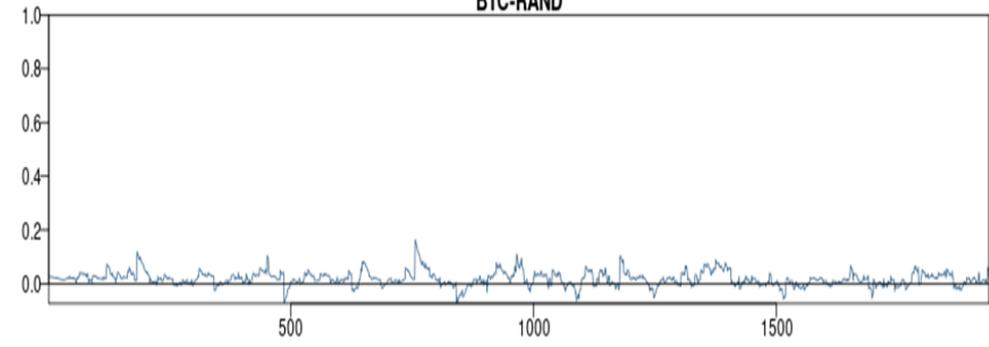
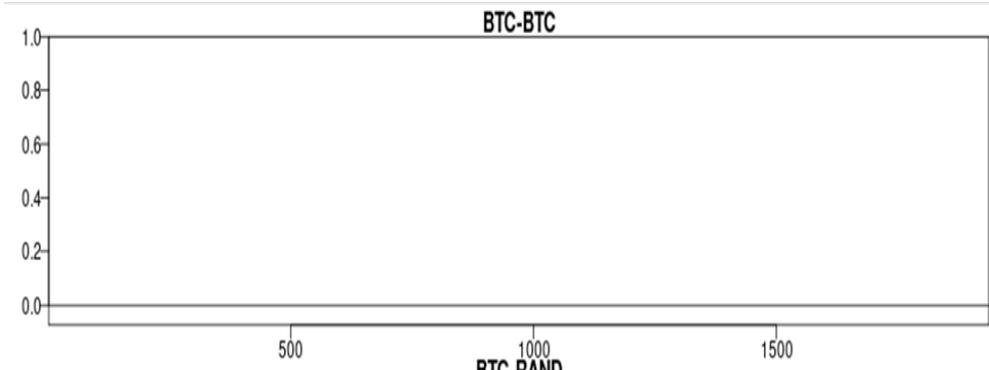
Series		$\beta$	Selected Model
Bitcoin and Gold			
BTC & GLD	0.0064 (0.6593)	0.9005 (0.0045)	GARCH
Bitcoin and Currencies			
BTC & BRL	-0.0158 (0.0000)	0.7954 (0.0000)	EGARCH
BTC & RAND	-0.0089 (0.0226)	0.9906 (0.0000)	TGARCH
Bitcoin and Indices			
BTC & BSI	0.0153 (0.2932)	0.8758 (0.0000)	EGARCH
BTC & JSE	-0.0072 (0.6237)	0.5761 (0.4512)	TGARCH
BTC & SEN	0.0739 (0.0365)	-0.1448 (0.4889)	EGARCH
BTC & SSE	-0.0004 (0.9736)	0.7992 (0.4814)	TGARCH

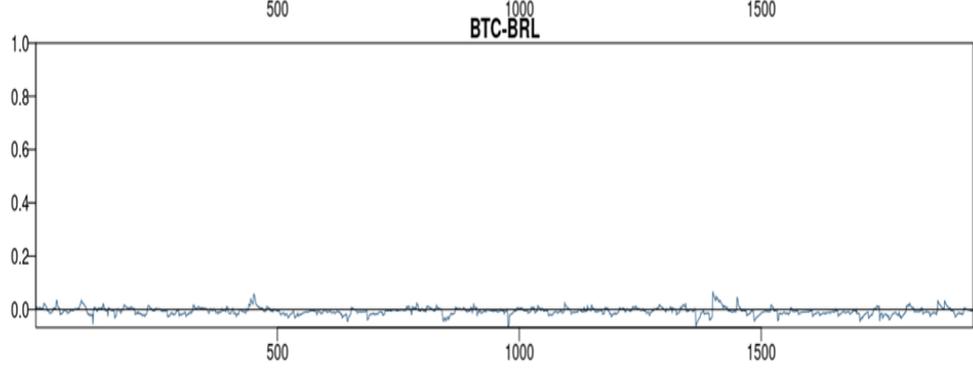
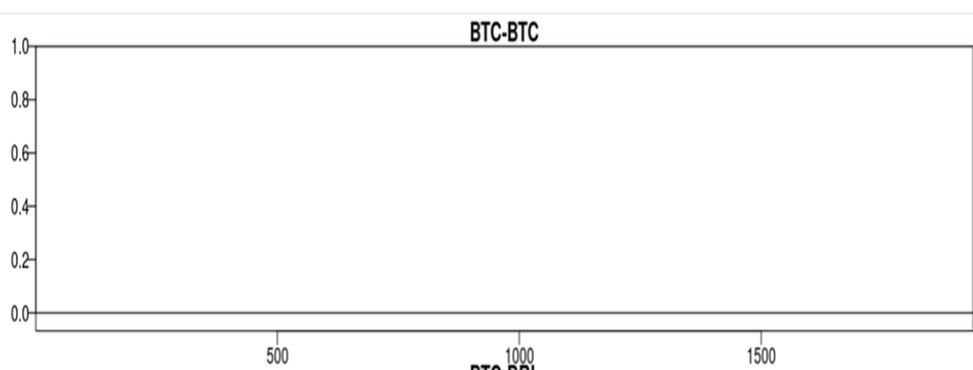
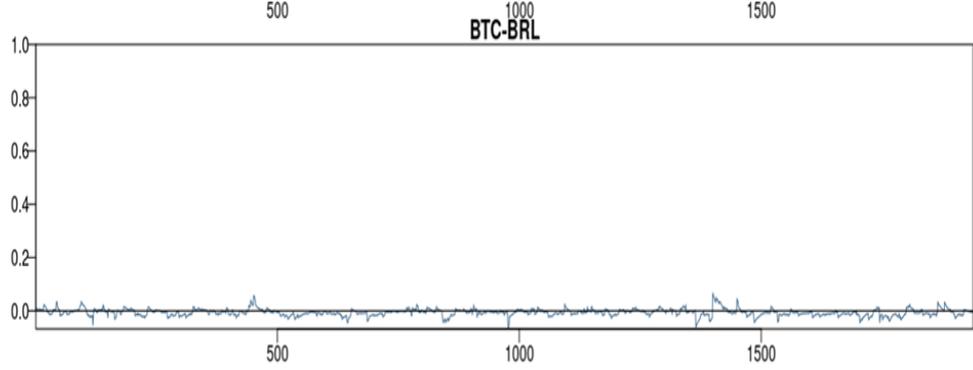
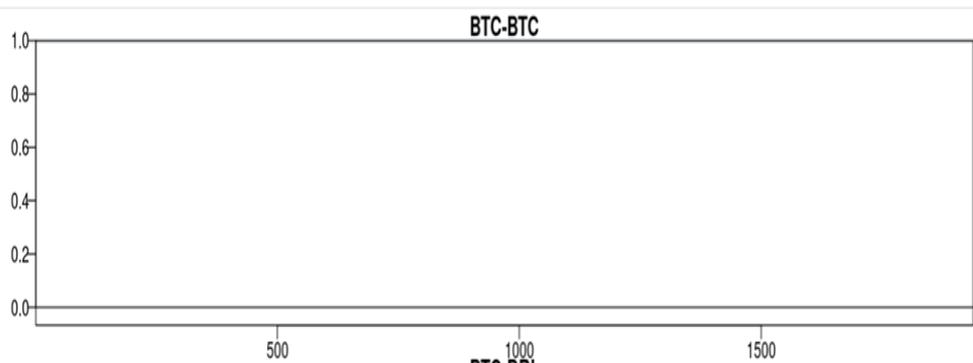
For all the series past residual shock is denoted by  $\alpha$  and lagged dynamic conditional correlation is denoted by  $\beta$ , the most important stability condition of DCC which is  $\alpha + \beta < 1$  is met by seven of eleven series of Bitcoin and other commodities. Past residual shocks for all the series is statistically significant which tell us about the impact of residual shocks on current volatility except for the pair of bitcoin and Chinese currency, Chinese Index, Russian Currency and Indian Currency, which is statistically insignificant as its p-value is greater than 0.05 indicates that there is no relationship of past residual shock on current volatility. Lagged dynamic correlation for all the pairs is statistically significant and positive which tells us about the existence of time-varying correlation in all pairs of

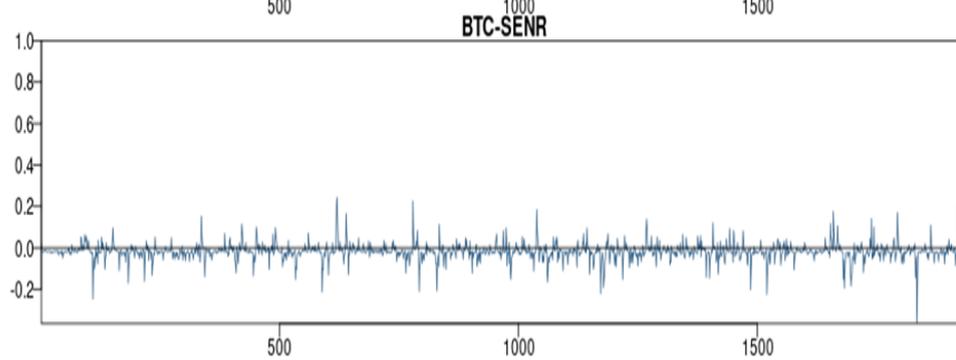
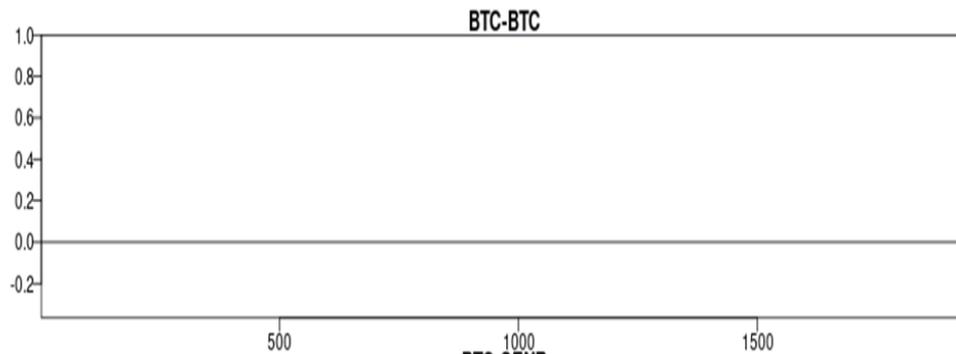
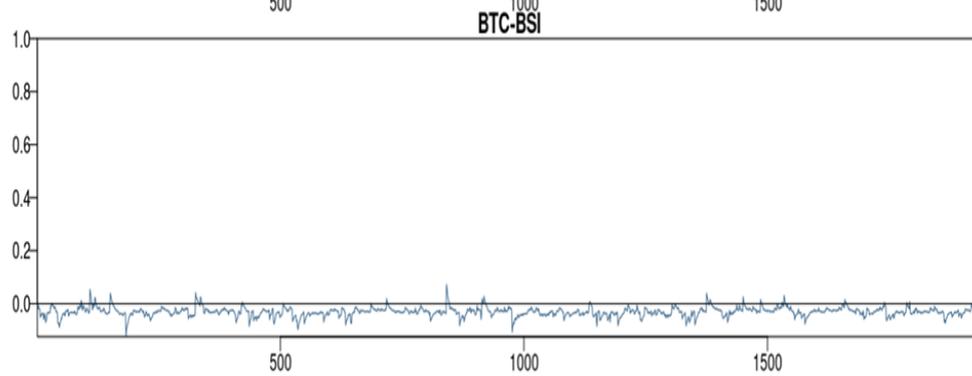
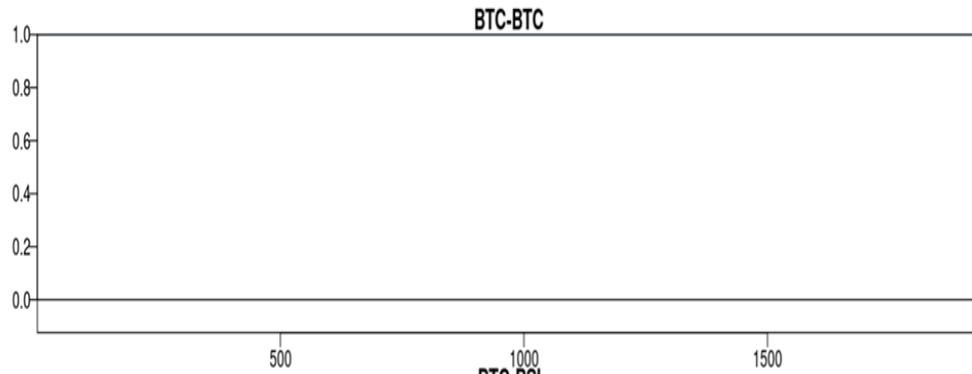
Bitcoin with BRICS Currencies, BRICS Stock Prices and Gold Prices except for the pair of bitcoin and Chinese currency, Chinese Index, Russian Currency and Indian Currency.











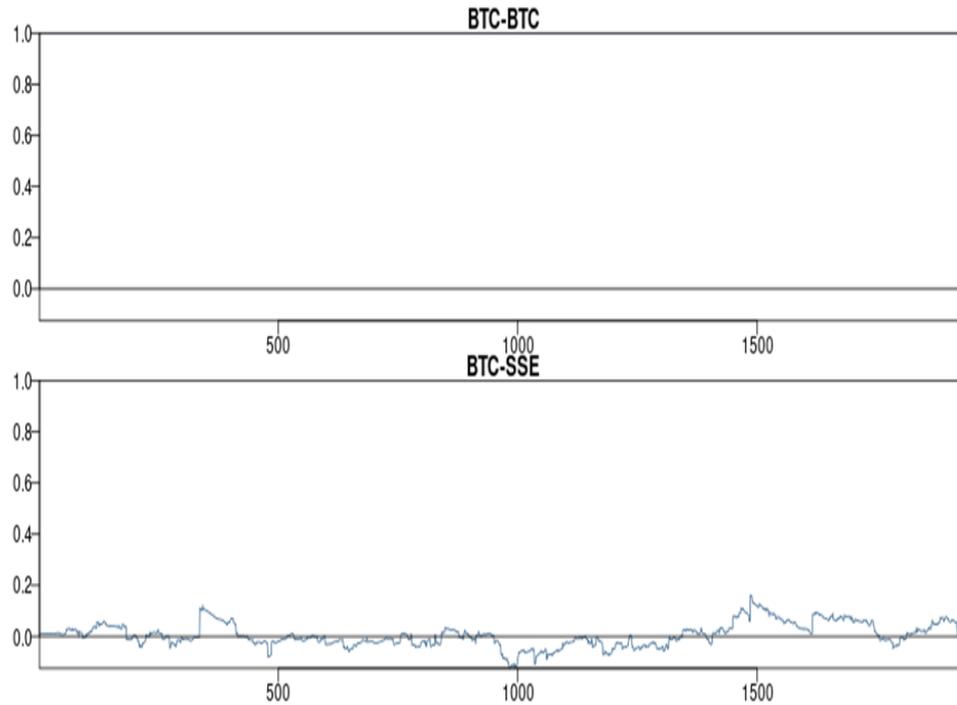


FIGURE 4.13: DCC outputs of Bitcoin and BRICS (Currencies and Indices) and Gold

### 4.2.2 The Asymmetric DCC Model

Table 4.4 reports the results of Asymmetric DCC GARCH Model along with the appropriate model for measuring the dynamic conditional correlation. The best model for all the series is chosen on the criteria of lowest AIC. GARCH, T-GARCH, and E-GARCH are used to estimate the ADCC GARCH Model for the Bitcoin and other eleven instruments. This table also reports the values of coefficients along with their p-value and best-fitted model for all the pairs of Bitcoin and BRICS currencies and Stock prices as well as gold. The best model for all the series is chosen on the criteria of lowest AIC.

The best-fitted model for estimating the Asymmetric DCC GARCH for the pair of Bitcoin with Gold is GARCH and for the pair of Bitcoin and Russian Currency, Indian Currency, South African Currency and South African Index is T-GARCH while for the pair of bitcoin with Brazilian Currency, Brazilian Index, Russian Index, and Indian Index is E-GARCH. For all the series past residual shock is denoted by  $\alpha$  and lagged dynamic conditional correlation is denoted by  $\beta$ . The most important stability condition of ADCC which is  $\alpha + \beta < 1$  is met by nine

TABLE 4.4: Asymmetric DCC GARCH Model

Series	$\alpha$	$\beta$	$\delta$	Selected Model
Bitcoin and Gold				
BTC & GLD	0.0028 (0.7109)	0.9764 (0.0000)	-0.0036 (0.6139)	ASY GARCH
Bitcoin and Currencies				
BTC & BRL	-0.0175 (0.0000)	0.9517 (0.0000)	0.0086 (0.0000)	ASY EGARCH
BTC & INR	0.0038 (0.8308)	-0.5311 (0.1616)	0.0670 (0.049)	ASY TGARCH
BTC & RAND	-0.0135 (0.3995)	0.6251 (0.3813)	0.0160 (0.5432)	ASY TGARCH
BTC & RUB	-0.0160 (0.0000)	0.7799 (0.0000)	0.0180 (0.0000)	ASY TGARCH
Bitcoin and Indices				
BTC & BSI	0.0107 (0.5164)	0.9000 (0.0000)	0.0079 (0.5965)	ASY EGARCH
BTC & JSE	-0.0138 (0.0000)	-0.3494 (0.5021)	0.0312 (0.2627)	ASY TGARCH
BTC & MSE	0.0358 (0.3798)	0.6112 (0.0146)	-0.0706 (0.1541)	ASY EGARCH
BTC & SEN	0.0666 (0.0646)	-0.0481 (0.8911)	0.0879 (0.4507)	ASY EGARCH

of eleven series of Bitcoin and other instruments. Past residual shocks for all the series is statistically significant which tell us about the impact of residual shocks on current volatility except the pair of bitcoin and Chinese Currency and Chinese Index which is statistically insignificant as its p-value is greater than 0.05 which indicates that there is no relationship of past residual shock on current volatility. Lagged dynamic correlation for all the pairs is statistically significant and positive which tells us about the existence of time-varying conditional correlation in all pairs of Bitcoin with BRICS Currencies, BRICS Stock Prices and Gold Prices.

### 4.3 Bitcoin a Diversifier, Hedge or a Safe Haven

The following section deals with empirical results of the Quantile regression in order to conclude the Diversifier, Hedge or safe Haven properties of bitcoin with BRICS Currencies, BRICS Indices and Gold return series. Quantile regression is an empirical methodology used to estimate the relationship between independent variables with a conditional quantile of an endogenous variable without considering any specific conditional distribution.

The major difference between ordinary least square regression and quantile regression is the estimation of quantiles, instead of mean which is computed in ordinary least square methodology and the violation of the assumption of the standard regression such as homoscedasticity of the data are violated in order to estimate the relationship between exogenous and endogenous variables in the outer region of the conditional distribution enables quantile regression to provide insight about the relationship/dependencies more effectively and appropriate as compared to the standard regression (Waldmann 2018).

Following the assessment of the ADCC model, the pairwise dynamic restrictive relationships are produced into independent occasions series and afterward utilized in Equation (5) to survey the diversifier, hedge or safe haven properties of Bitcoin. For instance, the series of the ADCC among Bitcoin and BRICS Currencies, BRICS Indices and Gold Prices general series return is relapsed on: a consistent (c), three factors (n1, n2, n3) that address outrageous descending developments in the overall ware record costs in the tenth, fifth and first quantiles of the return dispersion, separately, and another three factors (n4, n5, n6) that address outrageous vertical developments in the overall product file costs in the 90th, 95th and 99th quantiles of the return circulation, individually. A similar examination is directed exclusively for the ADCC series of the Bit coin and BRICS Currencies just as for the ADCC series of the Bitcoin and BRICS Indices and Gold.

Table 4.5 presents the coefficient estimates from the regression model in Equation (5). We first discuss the diversification and hedging abilities of Bitcoin against commodities, as captured by the coefficient of the constant term. For currency returns, the coefficient of the constant term of three countries (India, China and

South Africa) is significantly positive 0.014, 0.008 and 0.008 respectively, suggesting that Bitcoin is no more than a diversifier against these countries' currencies. Bit coin is a strong hedge against Russian Ruble and Brazilian Real as their coefficient of constant term is negative -0.014 and -0.019 respectively.

TABLE 4.5: Bitcoin a Diversifier or Hedge

	10% Q (n1)	5% Q(n2)	1% Q(n3)	Constant	90% Q (n4)	95% Q(n5)	99% Q(n6)
Panel A: BRICS Currencies							
BRL	0.006 (0.006)	-0.004 (0.009)	0.031 (0.014)	-0.014 (0.013)	7.62E-06 (0.006)	-0.009 (0.009)	-0.006 (0.014)
RUB	0.001 (0.003)	<b>7.30E-05</b> (0.005)	0.003 (0.008)	-0.01 (0.007)	0.000 (0.000)	0.013 (0.005)	-0.003 (0.003)
INR	0.003 (0.004)	0.002 (0.006)	-0.001 (0.009)	0.014 (0.008)	0.003 (0.004)	-0.002 (0.006)	-0.008 (0.009)
CNY	<b>-8.07E-05</b> (0.001)	0.001 (0.001)	-0.004 (0.002)	0.008 (.002)	<b>5.48E-05</b> (0.002)	-0.001 (0.019)	0.001 (0.031)
RAND	0.002 (0.001)	0.001 (0.002)	0.003 (0.003)	0.015 (0.003)	0.001 (0.001)	-0.003 (0.002)	-0.003 (0.003)
Panel B: BRICS Indices							
BSI	0.001 (0.003)	-0.005 (0.004)	0.007 (0.007)	-0.025 (0.007)	0.001 (0.003)	0.002 (0.004)	-0.014 (0.007)
MSE	-0.001 (0.004)	0.02 (0.006)	0.02 (-0.01)	0.019 (0.009)	0 (0.004)	0.006 (0.006)	-0.035 (-0.01)
SEN	0.004 (0.006)	-0.025 (0.01)	0.033 (0.016)	-0.022 (0.014)	0.013 (0.006)	-0.016 (-0.01)	-0.006 (0.016)
SSE	0.004 (0.002)	0.001 (0.001)	0.001 (0.001)	0.005 (0.001)	-0.002 (0.002)	<b>9.20E-05</b> (0.002)	-0.001 (0.001)
JSE	0.000 (0)	-0.004 (0.002)	-0.003 (0.004)	0.013 (0.004)	<b>-1.37E-05</b> (0.001)	0.003 (0.002)	0.001 (0.001)
Panel C: GOLD							
Gld	0.000 (0.000)	-0.001 (0.001)	-0.001 (0.003)	0.012 (0.003)	-0.001 (0.001)	0.002 (0.002)	0.000 (0.000)

*This table exhibit the estimation results from quantile regression in equation (5) based on the dcc (1, 1) model; figures in bold shows the significance at the 5% level.*

We then investigate BRICS Indices and Gold prices separately and report the followings two results: Bitcoin is also a strong hedge for two countries' indices, Brazilian Index and Indian Index because coefficient of the constant term is significantly negative -0.025 and -0.022 respectively while for the Russian Index, Chinese Index and South African Index the coefficient of constant term is positive which show that bitcoin is a diversifier for these indices. However, Bitcoin is no more than a diversifier for Gold because the coefficient is significantly positive 0.0125.

For safe haven properties of Bitcoin, we follow the results of Quantiles e.g., 10%, 5%, 1% and so on. According to Panel A, Bitcoin is weak safe haven for Brazilian

Currency, Russian Currency, Indian Currency and South African Currency at 10% quantile while it is strong safe haven for Chinese Currency at 10% quantile. Bitcoin exhibit strong safe haven for Brazilian Real and Russian Ruble at 5% quantile while it is weak safe haven for Indian Currency, Chinese Currency and South African currency in this quantile. The results show that bitcoin is weak safe haven for Brazilian Currency, Russian Currency and South African Currency at 1% quantile while it is strong safe haven for Indian Currency and South African Currency in this quantile.

According to Panel B, Bitcoin is weak safe haven for Brazilian Index, Indian Index, Chinese Index and South African Index at 10% quantile while it is strong safe haven for Russian Index at 10% quantile. Bitcoin exhibit strong safe haven for Brazilian Index and Indian Index at 5% quantile while it is weak safe haven for Russian Index, Chinese Index and South African Index in this quantile. The results show that bitcoin is weak safe haven for Brazilian Index, Russian Index, Indian and Chinese Index at 1% quantile while it is strong safe haven for South African Index at this quantile.

For Panel C, bitcoin exhibit weak safe haven against gold at 10% quantile while it depicts strong safe haven relationship with gold at 5% and 1% quantiles.

# Chapter 5

## Conclusion and Recommendation

To understand the features of bitcoin as a hedge, a safe haven or a diversifier, we focused on its correlation with other assets like stock prices, conventional currencies, and gold prices. Every investor, portfolio manager and Investment institution want to create a diversified portfolio and for that they are keen to understand the effects of presence and absence of certain securities. Investors can create a diversified portfolio of Currencies, stock Prices, Gold prices and other commodity market and also create a hedge or linkage with Bitcoin to understand the effects of Bitcoin in its presence and absence in the Portfolio in terms of Risk and Return, it will be an optimal portfolio if the investors sum up all these securities under one. It can also be identified that where does the risk of this portfolio as well as the Individual rate will move.

### 5.1 Conclusion

Therefore, the present study aims to provide an insight related to the behavior of Bitcoin in terms of a hedge, a diversifier or a safe haven tool for other securities. It examined the effect of bitcoin's presence and absence in a portfolio with other currencies, Indices and commodities e.g.; BRCIS currencies, BRICS indices and Gold Prices. To achieve the intended objectives of the study, the daily returns of Bitcoin, BRICS Currencies, BRICS Indices and Gold Prices for the for the period of September 2014 to July 2020 are used. To estimate the results, the analysis of data is divided into three stages which are Pairwise DCC GARCH

Model, Application of ADCC Model, and Quantile Regression.

First stage of the analysis deal with examining the behavior of Bitcoin with other eleven commodities. For this, ARCH test is applied priory with the pair of bitcoin and other commodities separately and ARCH test depicts the presence of heteroscedasticity in Bitcoin, Gold, Brazilian Currency (Real), Brazilian Index, Russian Currency (Rubber), Russian Index, Indian Currency (Rupee), Indian Index, Chinese Currency, Chinese Index, South African Currency (Rand), and South African Index. The presence of the ARCH effect leads towards the application of volatility models. After testing the ARCH effect, further DCC GARCH is applied to find the hedge or safe haven properties of Bitcoin. the results of DCC GARCH along with the appropriate model for measuring the dynamic conditional correlation. The best model for all the series is chosen on the criteria of lowest AIC. GARCH, T-GARCH, and E-GARCH are used to estimate the DCC GARCH for the Bitcoin and other eleven commodities. This analysis also reported the values of coefficients along with their p-value and best-fitted model for all the pairs of Bitcoin and BRICS currencies, Stock prices as well as Gold.

The best-fitted model for estimating the DCC GARCH for the pair of Bitcoin with Gold is GARCH and for the pair of Bitcoin and Russian Currency, South African Currency and Chinese Index is T-GARCH while for the pair of bitcoin with Brazilian Currency, Brazilian Index and Indian Index is E-GARCH. The most important stability condition of DCC which is  $\alpha + \beta < 1$  is met by seven of eleven series of Bitcoin and other commodities. Past residual shocks for all the series is statistically significant which tell us about the impact of residual shocks on current volatility except the pair of bitcoin and Chinese Currency, Indian Currency, Russian Currency and Russian Index which is statistically insignificant as its p-value is greater than 0.05 indicates that there is no relationship of past residual shock on current volatility.

For second stage, ADCC GARCH Model is applied and the results of Asymmetric DCC GARCH along with the appropriate model for measuring the dynamic conditional correlation. The best model for all the series is chosen on the criteria of lowest AIC. GARCH, T-GARCH, and E-GARCH are used to estimate the Asymmetric DCC GARCH for the Bitcoin and other eleven commodities. This also

reported the values of coefficients along with their p-value and best-fitted model for all the pairs of Bitcoin and BRICS currencies and Stock prices as well as gold. The best-fitted model for estimating the Asymmetric DCC GARCH for the pair of Bitcoin with Gold is GARCH and for the pair of Bitcoin and Russian Currency, Indian Currency, South African Currency and South African Index is T-GARCH while for the pair of bitcoin with Brazilian Currency, Brazilian Index, Russian Index, and Indian Index is E-GARCH.

The further section dealt with empirical results of the Quantile regression in order to conclude the Diversifier, Hedge or safe Haven properties of bitcoin with BRICS Currencies, BRICS Indices and Gold return series. Quantile regression is an empirical methodology used to estimate the relationship between independent variables with a conditional quantile of an endogenous variable without considering any specific conditional distribution.

Generally, this study investigate the nine-hypothesis related to the behavior of bitcoin with other instruments. According to Panel A, Bitcoin is weak safe haven for Brazilian Currency, Russian Currency, Indian Currency and South African Currency at 10% quantile while it is strong safe haven for Chinese Currency at 10% quantile. Bitcoin exhibit strong safe haven for Brazilian Real and Russian Ruble at 5% quantile while it is weak safe haven for Indian Currency, Chinese Currency and South African currency in this quantile. The results show that bitcoin is weak safe haven for Brazilian Currency, Russian Currency and South African Currency at 1% quantile while it is strong safe haven for Indian Currency and South African Currency in this quantile.

According to Panel B, Bitcoin is weak safe haven for Brazilian Index, Indian Index, Chinese Index and South African Index at 10% quantile while it is strong safe haven for Russian Index at 10% quantile. Bitcoin exhibit strong safe haven for Brazilian Index and Indian Index at 5% quantile while it is weak safe haven for Russian Index, Chinese Index and South African Index in this quantile. The results show that bitcoin is weak safe haven for Brazilian Index, Russian Index, Indian and Chinese Index at 1% quantile while it is strong safe haven for South African Index at this quantile. For Panel C, bitcoin exhibit weak safe haven against gold at 10% quantile while it depicts strong safe haven relationship with gold at 5% and 1%

quantiles.

## 5.2 Recommendation

Since 2015, there has been a broad literature on digital currency valuation with its returns. This examination has concentrated on whether Bitcoin and other crypto monetary forms can fill in as a hedge against other mainly and rapidly established money related resources, for example, stocks and outside cash. Many studies have recently been undertaken to better understand the elements that influence Bitcoin returns and volatility. Economists seem to be interested in Bitcoin because its virtual money attribution with the potential to disrupt established payment as well as monetary systems. At the early stage, virtual currencies give a lot of information regarding buyer and seller behavior and market design. To date, academics have looked into a wide range of topics, including financial market architecture, user behavior, including several legal and regulatory issues. Many problems remain unanswered, particularly for academics that combine a thorough understanding of Bitcoin with technological data collection skills and a strong social scientific background.

This study thoroughly investigated the effects of presence and absence of bitcoin in a portfolio of currencies, indices and commodity market like gold and recommends that investors may find it optimal to invest in BRICS currencies, Indices because of their emerging markets and other commodities. However, the above results conclude that the bitcoin is a strong hedge against Russian Ruble and Brazilian Real for BRICS currencies, while there is weak hedge between bitcoin and Indian Rupee, Chinese Yuan and South African Rand. Moreover, bitcoin has a strong hedge against Brazilian Index and Indian Index for BRICS Indices, while it has weak hedge against Russian Index, Chinese Index and South African Index. The studies also suggest that bitcoin is diversifier against gold while it is a strong safe haven for Brazilian Currency, South African Index, Chinese Index and South African Index.

This suggests that investors may have the benefit of diversification for Indian Currency, Chinese Currency, South African Currency, Brazilian Index and Indian

Index. It also provides the benefit to investor if they go for portfolio management with Bitcoin and gold, while risk can be managed through the addition of Indian Rupee, Chinese Yuan, South African Rand, Russian Index, Chinese Index and South African Index.

Future studies may focus on the pricing behavior of bitcoin and Asian countries with other commodities like energy and oil etc. as well as the Pre and Post COVID Effects in the presence and absence of bitcoin and other cryptocurrencies with oil market and energy commodities.

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