ISTANBUL BILGI UNIVERSITY
INSTITUTE OF SOCIAL SCIENCE
FINANCIAL ECONOMICS MASTER'S DEGREE PROGRAM

ANALYSIS OF THE RELATIONSHIP BETWEEN CRYPTOCURRENCIES AND BORSA ISTANBUL: BEFORE AND AFTER COVID-19

ÖNDER KARADENİZ
114620008

ASSOC. PROF. SERDA SELİN ÖZTÜRK

İSTANBUL
2021

ISTANBUL BILGI UNIVERSITY

INSTITUTE OF SOCIAL SCIENCE

FINANCIAL ECONOMICS MASTER'S DEGREE PROGRAM

Analysis Of The Relationship Between Cryptocurrencies And Borsa Istanbul: Before And After Covid-19

Borsa İstanbul ve Kripto Paralar Arasındaki İlişki: Covid-19 Öncesi ve Sonrası

Önder Karadeniz

114620008

Tez Danışmanı:	Doç. Dr. Serda Selin Öztürk İstanbul Bilgi Üniversitesi	(İmza):……
Jüri Üyesi:	Dr. Umut Keskin İstanbul Bilgi Üniversitesi	(İmza):……
	Doç. Dr. Ender Demir İstanbul Medeniyet Üniversitesi	(İmza): ……

Tezin Onaylandığı Tarih : 23.06.2021
Toplam Sayfa Sayısı : 85

Anahtar Kelimeler:

1) Bitcoin
2) Bist100
3) Garch & Arch
4) Covid-19
5) Kripto Parlar

Keywords:

1) Bitcoin
2) Bist100
3) Garch & Arch
4) Covid-19
5) Cryptocurrencies

PREFACE

Throughout the writing of my thesis, I have received great support and assistance.

I would like to thank;

- My supervisor Asoc.Prof. Serda Selin Öztürk for her guidance and advices. Her support during this process is highly appreciated. It was a great pleasure to work with her.
- Demet Arabacı for supports regarding the statistical models of my study,
- My dear sister for getting me prepared by her experience,
- My dear mom&dad for everything,

I really appreciate my wife for her endless support and continuous encouragement along the way of this challenging process. This achievement would not have been possible without her. Thank you!

This one is for you my lovely daughter Doğa!

Önder Karadeniz

May, 2021

İstanbul

Table of Contents

LIST OF ABBREVIATIONS

BTC: Bitcoin

BIST100: The BIST100 Turkish stock market index

XRP: Ripple Coin

LTC : Litecoin

DCC-GARCH: Dynamic Conditional Correlation

ADF: Augmented Dickey-Fuller Test

LIST OF TABLES

ABSTRACT

Today, cryptocurrencies are now used as an investment tool and it is thought that the crypto money sector will find investors in the future. Bitcoin, which is the oldest currency among cryptocurrencies, is 12 years old and is an investment tool accepted in the world market. In this study, it is aimed to examine the effects of fluctuations in cryptocurrencies on Borsa Istanbul Bist100 index.

The sample of the study included the Bist100 Index, Bitcoin, Ethereum, Ripple, Litecoin, Monero and Iota data within Borsa Istanbul in 17-12-2018 between 17-12-2020. There are total of 499 observations. This study is divided into 2 periods as pre-pandemic and post-pandemic. The reason for the study to be divided into 2 periods is how much the pandemic has affected the crypto money market and the Bist100 index. In order to reach a healthier result, the logarithm of the studied data was taken and the logarithmic return was evaluated.

In this study, Dynamic Conditional Correlation GARCH model was used. The focus of the study is "volatility". GARC & ARCH analyzes were performed on the financial data used for the 2018-2021 period of the data selected as a sample in the analysis. Before the DCC-GARCH analysis, the Augmented-Dickey Fuller test applied to measure the stationary and ARCH LM test were performed to check whether there was an ARCH effect in the series.

As a result of the study, it was concluded that the volatility between Bitcoin and Bist100 variables affect each other widely over time.

Key words: Bitcoin, Bist100, Garch&Arch, Covid-19, Cryptocurrencies

ÖZET

Günümüzde kriptoparalar artık bir yatırım aracı olarak kullanılmaktadır ve ilerleyen zamanlarda kripto para sektörünün büyük ölçüde yatırımcı bulacağı düşünülmektedir. Kriptoparalar içerisinde en eski para olan bitcoin 12 yaşında ve dünya piyasasında kabul görmüş bir yatırım aracıdır. Buradan hareketle, bu çalışmada kripto paralarda oluşan dalgalanmaların, Bist100 endeksi üzerindeki etkileri incelenmek amaçlanmaktadır.

Çalışma kapsamında örneklem 17-12-2018 / 17-12-2020 tarihleri arasında toplam 499 gözlemden oluşmaktadır. Borsa Istanbul bünyesindeki Bist100 Endeksi, Bitcoin, Ethereum, Ripple, Litecoin, Monero ve Iota verileri yer almıştır. Bu çalışma, pandemi öncesi ve pandemi sonrası olmak üzere 2 döneme ayrılmıştır. Çalışmanın 2 döneme ayrılma sebebi, pandeminin kripto para piyasasını ve Bist100 endeksini ne kadar etkilediğini anlamaya çalışmaktır. Daha sağlıklı sonuca ulaşmak için çalışılan verilerin logaritması alınarak, logaritmik getiri üzerinden değerlendirme yapılmıştır.

Bu çalışmada Dynamic Conditional Correlation GARCH modeli kullanılmıştır. Yapılan çalışmanın odak noktası "volatilite"dir. Yapılan analizlerde örneklem olarak seçilen verilerin 2018-2021 dönemi için kullanılan finansal verilerde GARC&ARCH analizleri yapılmıştır. DCC-GARCH analizi öncesinde durağanlığı ölçmek için Augmented Dickey Fuller testi uygulanmıştır daha sonra serilerde ARCH etkisi olup olmadığının kontrolü için ARCH LM testi yapılmıştır

Çalışma sonucunda kripto para birimleri ile Bist100 endeksi arasındaki ınaklığın zaman içende birbirini büyük ölçüde etkilediği sonucuna varılmıştır.

Anahtar kelimeler: Bitcoin, Bist100, Garch&Arch, Covid-19, Kripto Para Birimleri

INTRODUCTION

Money is almost as old as human history. There used to be a barter economy. Trade developed with the discovery of money. Developing trade has enabled more goods to meet with the needy. Money has evolved many times. Today, people hardly carry any money in their pockets. Payments by credit card, money order, etc. through products. Experts state that crypto coins will enter our lives very soon.

In the second part of the study, concepts such as the emergence of crypto money, cryptology and data mining are discussed. In addition, information was given about the cryptocurrencies that emerged after Bitcoin.

In the last part of the study, the effects of volatility experienced in Bitcoin on the index of the top 100 companies traded on Borsa Istanbul were examined. also; In this study, the effects of 5 cryptocurrencies (Ethereum, Ripple, Litecoin, Monero, Iota) other than bitcoin on Borsa istanbul 100 index were examined. Based on the literature, the econometric relationship between cryptocurrencies and Bist100 has been studied by looking at daily / monthly and annual variation. The study is divided into 2 periods as before and after the pandemic. In this way, it was tried to determine to what extent Borsa istanbul 100 index and crypto money markets were affected by the pandemic.

In the past, there was a barter economy called "barter". Money, the stage of history BC. It appeared in Anatolia in the 7th century and the first coin was minted by the Lydians by hammering. For this reason, the production of money today is called a mint. The circulation of money as paper, on the other hand, was M.S. It took place in China in the 7th century. The change and development of money has enabled the development of trade. The developing trade has enabled more goods to meet the needy. The money, which has existed as a banknote for many years, is mostly used digitally today. Payments are mostly made by credit cards or interbank money transfers. People these days hardly carry any money in their pockets. With

the impact of the pandemic, online commerce has increased by 66% in Turkey in 2020. With the widespread use of the Internet, today's assets have also been included in the digitalization process. As a result, Bitcoin, created by Satoshi Nakamoto in 2009, emerged as the first decentralized crypto currency. Crypto money is a digital asset, a virtual element, the way it works is designed as an alternative exchange tool to cash. With the emergence of Bitcoin, many crypto currencies have emerged. Crypto currencies other than Bitcoin are generally called altcoins. As of 2021, it is thought that there are an estimated 2,000 altcoins. The crypto currency exchange, which is dominated by high volatility, has attracted the attention of investors with high risk appetite, and payments can now be made with crypto money in online shopping and in some shops. "Teslan's founder Elon Musk has invested $ 1.5 billion in bitcoin and stated that they will be able to accept payments with cryptocurrencies in the future. it became completely unstoppable when it started to offer opportunities.

In the first part of the study, the history of money, its development and change are explained in detail.

In the second part of the study, the emergence of crypto money, how crypto coins are processed, crypto wallets, cryptology, data mining and blockchain are explained. In addition, information was given about the cryptocurrencies that emerged after Bitcoin. Also, which emerged after Bitcoin and used in the study information was given about crypto currencies.

1. DEFINITION AND HISTORY OF MONEY

1.1. Definition of Money

Money is a mind discovery for people because it has the power to build trust in the background rather than being seen as concrete. It observed that this trust leads people to trade, while trading societies avoid war. Money is a medium of exchange that has been used since ancient times. The most basic feature of money, which is generally defined according to its functions, is that it is a means of exchange, but it is also used as a means of payment, a unit of account and a wealth storage tool. It is stated that the basic idea underlying this historical line of development of money is actually hidden in the features mentioned in the previous sentence. In other words, it responded to the need as a payment tool in the first place. Then, the feature of being a common value in determining the values of the products comes to the fore. It is possible to understand that it is used to store wealth with the developing and growing commercial structure. Trying to understand these properties of money will make it easier to understand the development process. According to economists, real or full money should fulfill all these functions 4. However, we see that many types of money fulfill only some of these functions.

The central issue with money is to conceptualize its dual nature. Money is a phenomenon defined by the social quality that can be called as “money being” and the “money object” that will actually enable the realization of the relations it derives from. However, since this second quality of money, that is, the objective quality (material, reputation, digital, etc.) it has in economic relations, is directly observable and related to its direction used to fulfill its defined functions in economics, in theories of money, discussions on the object of money predominate. is seen. Given the fact that the quality of being money is not included in theory, as well as the variability of the forms that the money object takes depending on the circumstances, a theoretical conclusion that the money object is insignificant or meaningless is not surprising. Accordingly, the object of money is something that

can take different forms, as many of its types seen in history, and therefore, its entry into the monetary theory has no conceptual and methodological meaning. It is not possible to reach a conclusion that qualifies as money from this discussion based on the meaninglessness of developing a theory based on the money object. Because the quality of being money and the object of money can only reach a meaningful result when understood together.

Money is anything that is generally accepted in exchanging goods and services. Money is all that the public believes to be money. The functions of money also determine the trust of the people in money. Money is the generally accepted object of purchasing goods and services and repaying debts. Money is a unit of account and a means of accumulation. This change of definition is due to changes in money markets.

• First, derivative instruments (financial market instruments) have emerged with the liberalization process (globalization). These instruments have influenced the definition of money with their high liquidity characteristics.

• Secondly, as a result of technological developments, all kinds of active resources can be easily converted into liquidity (cash). Securitization: Thanks to technological developments, it has made it easier for banks to convert all kinds of fixed assets into securities.

• Third, the avoidance of legislation has significantly affected the definition of money. The tendency towards transactions such as deregulation, off shore banks, euro - dollar bonds, financing bills, overnight repo (the common feature of all of them is that they are not subject to reserve requirements) has increased. Fourth, the risk aversion has created future markets (future, option, hedge) and this development has been effective in the definition of money.

1.2. Function and Features Of Money

Money is any substance or verifiable record that, in the socioeconomic setting, is used to pay for the product, service, labor and debts, but can also be easily converted into another tool that can be used for this. One of the most popular definitions of money is John K. Galbrith's definition. This definition is: "Anything people will accept to use for money." In other words, the object or tool to be used as money must be accepted by the society. In order to call a vehicle money, it must have the following five characteristics.

1. Portability: Money must be portable so that it is easy to use.

2. Stamina: Money must be physically durable; because the money is exchanged and used for more than one deal.

3. Divisibility: In order for the money to be exchanged in different amounts, it must be divisible and converted into each other.

4. Standardization: Money should mean the same value everywhere. 5. Inimitable: This feature is related to security.

Money should not be easily imitated, otherwise counterfeit money will be easier to use. In order for a vehicle to have a money feature, it must fulfill certain functions. These functions are as follows;

1. Exchange Function: The goods or services received must be exchangeable with money.

2. Unit of Account Function: While pricing is being made, it must have a unit of money.

3. Wealth Accumulation Function: Money must maintain its purchasing power. In order to fulfill this function, it must maintain its own value.

Money fulfills the task of being the common measure of values in an economy. In other words, the value of all goods and services is expressed in money.

• Money as a Unit of Account; Money fulfills the task of being the common measure of values in an economy. In other words, the value of all goods and services is expressed in money. Braudel states that money is a good indicator since it is the subject of all kinds of economic activity. “First of all, money everywhere finds a way to immerse itself in all economic and social relations. This makes it an excellent indicator. A fairly accurate assessment of all human activities can be made by observing how quickly it wanders or when it runs out, how complex the channels through which it flows, or how little its supply is.

• As a Tool of Exchange; Money People's orientation to a production or expertise necessitates the exchange of products and services produced. First of all, it is necessary to know the exchange rates of goods or services to be exchanged, that is, how much will be given for one from the other. This can only be found by measuring these two values to be changed with the same measure. Once the exchange rates of goods have been determined, the mediation of money is no longer required for the exchange to take place. Goods can very well be exchanged directly (by barter).

• As a Saving Tool; Money Money is a way of transferring purchasing power from today to the future. A necessary consequence of the properties of money being a means of savings, a unit of account and a medium of exchange is a by-product of these two functions. Money has value because it is a measure of value and a medium of exchange; For this reason, saving money means accumulating value, and it also functions as a tool that provides people with this opportunity. In order for money to fulfill this function, its value must be stable. If the value of the money falls, people do not want to have money in their hands and the money starts to run. In this case, people prefer to borrow and the function of money as a borrowing instrument emerges. Under inflation and hyperinflation, where the general level of prices is constantly increasing, interest in money decreases. During these periods, people tend to dispose of money rather than keep it.

1.3. History of Money

In ancient times, the region surrounded by Kayra in the south of Western Anatolia, Phrygia in the east, Aiolia and Ionia in the west, Demnirci (Temos) and Murat (Diynmos) mountains in the north is called Lydia. The central area of the region consists of Gediz and Menderes basins, these lands are very rich in natural resources. Since the mountains are covered with forests, the wood required for house construction is provided from here, and from the abundant clay beds; the building is used for making pottery and pottery. There are also marble beds in the region.

It is accepted that the borders of the Lydian State extend to KütahyaÇavdarhisar in the east when the Lydian inscriptions are traced and the distribution of the tumuli is examined. During the reign of King Alyattes, the country border extended to Kızılırmak (Halys). During the reign of the last king of Lydia, Karun (Croesos), Lydia dominated the coastline along the Aegean Sea from the Marmara Sea (Propertis) in the west to Antalya (Lycia) in the south.

Lydian kingdom, which suddenly shined in the first half of the 7th century BC, is one of the most interesting cultures of the Asia Minor world. This kingdom is neither exactly eastern nor exactly like the western states; It is a new Anatolian Kingdom formed from the political and cultural influences of both blocs. Lydian information is based on ancient Greek myths. According to Herodotus, three king families dominated Lydia, namely the Atyads, the Heraclids (Tylonids) and the Mermnads.

The evidences that the first coins were minted by the Lydians are divided into two groups as "ancient sources" and "archaeological finds". The first information about the invention of the coin, BC. It is taken from Heredotos of Halicarnassus (Bodrum), who lived in the 5th century and became famous as the father of history. Heredotos says that it was the Lydians who first minted and used gold and silver coins. Finds from archaeological excavations also prove that the first coins were minted by the Lydian Kings. Among the electron (gold-silver alloy)

coins unearthed during excavations in the Temple of Artemis in Ephesus in 1904-1905, the most common depiction was the lion head, which we can call the coat of arms of the Lydian Kingdom. Lydian coins were found in archaeological excavations in Gordion, the capital of the Phyrg Kingdom, as well as Ephesos and Sardis.

The Lydian kingdom has neither a fully eastern nor a fully western culture. Lydian information is based on ancient Greek legends. Gold coin units were found in the Croesus period. As a result of these regulations made in the field of coin unit, a much more precise method of payment was born. The first Lydian coins, made of a mixture of gold and silver, called white gold, are elliptical in shape. There are one, two or three deep rectangular, rectangular or triangular pits on the reverse of these coins, the front faces of which are flat, then striped, and then embossed. On the obverse faces of the coins, there are reliefs of the lion's head, paw or the upper parts of two lions standing opposite each other, which were the coat of arms of the kingdom. On the obverse of the coins minted by Croesus, there is a bull and a lion lying back to back, with only the upper parts.

Although the invention of the coin was attributed to the Kingdom of Lydia, it was the cities of the Ionia region in Western Anatolia that gave it an identity and a habit of use. However, the Lydian Kingdom was erased from the history of civilization some time after the invention of the coin. The use of the coin and its adoption by everyone as a currency was mainly provided by the city states in Western Anatolia and Ionia. In the years following the collapse of the Mycenaean civilization in Greece, that is, in the period called the "Dark Ages", immigrants from continental Greece settled in the Ionian region and the cities they established here developed and prospered in a short time. After the Lydian civilization, the Persians came to the capital of Lydia and continued coinage. Therefore, while emphasizing the Lydian Kingdom, Ionia and Western Anatolia should not be ignored, the controversial issue is whether the coins belonged to the Lydian kingdom or its merchants.

As can be understood from here, the greatest contribution the Lydians made to history was the invention of money. The first coins of the Lydians, who minted an alloy of gold and silver called electron, were invented once, and quickly spread beyond the borders of Asia Minor to other countries around the Mediterranean. At the point where we say that the coin is the invention of the Lydian Kingdom based on the archaeological excavations, it is useful to emphasize the coins of the city states in Ionia.

In the historical evolution of money, the literature is limited to what is known only. With each passing day, our confident ideas about the past can change with a new historical finding found or understood. While this is the case, when we research people who produce ideas for money, think about money, we come across Aristotle. Aristotle said that money is one of the important building blocks for trade, and in his Politics book, he mentions that people's lives are facilitated by shopping. It has highlighted the feature of easy transportation of money. In Aristotle's Politics book; When residents of a country became more dependent on the population of others and imported what they needed and exported what they had too much, money began to be used necessarily. Because the various needs of life are not easily carried away and therefore people have decided to use portable easy money for themselves in their relations with each other; He spoke of the use of things that could easily be used for life purposes, for example, iron, silver, and the like.

Plato and Aristotle discussed the feature of money as a unit of value and investigated the determination of value. He thought how correct it was for Sophists to make education for money, that money should not be a unit of measurement on education, but he decided that human beings have the ability to measure, not because money is in the decision mechanism. It seems that the sophists' education for money was also dangerous for them, because the "virtue" to be learned for money, which is not an essential quality, "being moderate", in a sense, "determining the measure" actually means that everyone can determine the measure because those who do not have money had money. they could learn this too; So this is a skill

belonging to every human being. But Plato and Aristotle's and Plato's reaction was that they wanted their own measure to be absolute, the truth they defended about what was right for the world, the Greek man, or / and Athens, which is characteristic of every truth. Every truth absolutely establishes itself and imposes itself. Plato and Aristotle also thought they had some truths about the world and felt and defended them as immutable. Protagoras is no different from them in this respect, only that it requires him to adopt this attitude, whose truth also reveals the state of his truth: Humans have the ability to set an absolute, unchangeable measure.

By replacing the goods they made with the ones produced by other people before money, people were able to access goods they did not have. In the process, the emergence of some difficulties in this transaction necessitated the invention of a barter tool called money. Trade between societies gained momentum with the invention of money, and commodities produced in distant countries and brought to the country were put on the market.

After the idea of money was settled, people used every commodity that they can use in direct connection with the environment they live in as money. Before money was discovered, goods ranging from tree bark to precious metals were used as means of exchange. The first paper money M.S. It originated in China in 806. It is generally accepted that the printing and use of banknotes in the West coincided with the end of the 17th century. Karl Marx, one of the important figures of traditional economics, does not see the market economy as a system that maximizes the private welfare of individuals in Marxist theory, but sees it as a tool that enables the capitalist to benefit from surplus value and makes capital accumulation easier. Surplus value is formed as a result of an organized current in which money is held with the expectation of profit. In Marxist theory, a capital transformation (is defined in which money is directed towards the purchase of capital goods with the expectation of obtaining more money.

The difference between Para´ and Para in this chain shows the "surplus value". Surplus value shows the capitalist's income and target. The answer to the question of whether a person keeps money in order to buy goods that will satisfy his needs or for capital or profit maximization depends on what the person has (labor or capital) (Telatar 2004, 33).

Arguing that money shortens the time spent on exchanging goods or services, Keynes argued that money is a great means of holding value, and is also the most liquid asset. In addition to these, it has been observed that Keynes's ability to see money as a means of keeping value was not successful in periods of high inflation. Neoclassics' views on monetary policy are based on the quantity theory of money. According to this theory, the increase in money supply increases the general level of prices in the same direction and rate. Neoclassicists regard money as a veil covering events.

As one of the facts revealed by the history of economics, the necessity and indispensability of trade for society is beyond the existence of money. As a matter of fact, when money lost its value from time to time in history and disappeared, the clearing system was immediately activated, as in the early days. Even in today's modern societies, barter economy has been applied in different countries and at different times depending on the state of their economies. The exchange of money has taken place in different ways in different centuries in different parts of the world. There is a point that we can see in the travel book that while paper money and gold and silver coins were used in many places in China in the same period, seashells were used as money in some islands and salt was used as money in some parts of Africa. The development steps of money can generally be shown as follows:

Goods money -> Metal money -> Gold Certificate -> Paper money (Banknote) -> Credit Money -> Electronic Money

1.4. Electronic Money

There is no single agreed definition of money. However, a general definition of money in the doctrine is made as everything generally accepted and used in the payment of goods and services and in the payment of debts. The functions / functions of money; it can be counted as an exchange / exchange tool, a unit of account / value measure and a saving / value accumulation tool. Accordingly, money is a means of exchange in the purchase of goods and services. Money eliminates the difficulties of exchanging goods for goods. Thanks to money, it becomes easier for goods to change hands. The unit of account of money is related to the measurement of the value of goods and services produced by money. The money paid for the unit of goods and services is called the price. Prices provide a comparison for consumers.

As a means of savings, money provides the opportunity to purchase or invest in goods and services when desired. Apart from money, money is a preferred means of savings, although it is a means of saving such as real estate and jewelry. Because money itself is a medium of exchange, it does not need to be converted into anything. However, other means of saving may need to be converted into money5 Looking at the historical process of money, it is seen that first of all, commodity money is used. People used some animals, mussel shells, gold and silver metal coins. Other than that, representative money is used.

As an example of representative money, gold and silver mutual banknotes indicating that the gold or silver equivalent of the value written on it will be paid. It is seen that paper money other than various goods and metals was used in the historical process. With the development of the banking sector, bank money, that is, dematerialized money (money in demand deposits in the bank) has become widespread. With the advancement in technology and the spread of the Internet, electronic money is on the agenda today. When it comes to the properties of money, it can be considered that money is generally accepted first. It can be said that this

feature will continue as long as people have confidence in the money in circulation. The stable value of money facilitates the production and distribution of goods.

In economy with high inflation, the value of money falls and the prices of goods and services rise. Another feature of money is that it is portable. Thanks to this feature, shopping transactions can be done easily. Money has the feature of divisibility. This makes it possible to make small payments; Different scales can be exchanged. It is also a necessary feature for money to be physically durable and durable. In order for money to be used for a large number of shopping and to be a means of accumulating wealth, it should not be made of a perishable material. In addition, the homogeneity (uniformity) feature of money means that money is easy to recognize and that every part of the item it is made of has the same value.

Money must have the feature of not being imitated. Today, many security measures are taken to prevent the counterfeiting of banknotes7. The second half of the 20th century is a period of great developments in technology. For the first time in the world, American banks have started the transfer of money by electronic methods (EFT-electronic fund transfer). The use of credit cards other than electronic fund transfer was first used in America and then became widespread all over the world. In 1975, the first automatic teller machine (ATM-automatic teller machine) was used in the United States.

In the 1990s, products related to new payment methods have been developed especially by banks. The European Monetary Institute (EMI-European Money Institute), the predecessor of the European Central Bank, prepared a report in 1994 on the requirement that the authority to issue electronic money should be made by banks, which are depositors. However, subsequent developments were in the direction of the regulation of institutions that will issue electronic money other than banks. In 2000, the first Electronic Money Directive was adopted. In 2001, the Electronic Money Association (EMA-Electronic Money Association) was

established in England. In the later stages, regulations regarding money laundering and payment institutions within the European Union came to the fore.

1.5. Virtual Money

The record-breaking increase in the transaction volume and market value of virtual currencies in the world and in our country by the end of 2017 has led us to do this study. In our study, we will talk about the birth of virtual money, its historical development from yesterday to today, and the technology used. Bitcoin is a type of virtual electronic money with crypto, every virtual currency is an electronic money, but not every electronic money is a virtual currency. Electronic money are currencies such as Dollars, Euros and TL, but virtual money are digital currencies like bitcoin. Virtual money is a digital phenomenon that can be changed on the internet without being connected to any country or person, stored in encrypted digital wallets, fluctuating according to supply and demand, and trading is possible.

Another important issue with Bitcoin is the Blockchain technology, which records accounts such as a notary controlled by the users of the system, which can be considered as big as the invention of the internet. Blockchain is a digital ledger called peer to peer data transfer. Bitcoin is the first of more than one thousand three hundred crypto virtual currencies today, although the market value of a bitcoin was at the level of one dollar when it came into our lives in 2009.In 2013, it reached the level of one hundred and fifty dollars by gaining approximately 5290% value by creating awareness in the world and in our country. In order to ensure the continuity of the Bitcoin system, its creator Satoshi Nakamato, users who keep track of the transfers made on the Blockchain are given gift Bitcoins. The total amount of crypto virtual currencies has now exceeded eight hundred billion dollars, of which Bitcoin has reached a total volume of three hundred billion dollars as of 2017. It is known that Bitcoin is used as a means of payment by gun and drug traffickers because it cannot be controlled by any country and is very easy to transport and change hands.

With the development of technology, especially the money that can be used on the internet has started to be generally called electronic money or virtual money. In this context, we can say that virtual money is a type of electronic money. However, it is stated that virtual money is also an appearance of digital money. However, there are still some differences between virtual money and electronic money. Electronic currencies are mostly composed of legally circulating currencies. For example; The dollar, euro or Turkish lira consists of these currencies. However, when it comes to virtual currencies, there are units that were invented later and cannot be legally accepted today. Bitcoin (BTC) comes first among these currencies. There are hundreds of types of virtual currencies pioneered by Bitcoin today. Along with Bitcoin, virtual currencies such as Ethereum, Ripple, IOTA, Neo are mainly used. The most important difference that allows the separation of virtual money from electronic or other currencies is the principle of legality. While there are legal regulations for other currencies, there are no such regulations for virtual currencies yet. Virtual currencies are created in the private field with individual contributions.

While the supply of electronic money is fixed, this stability cannot be mentioned in the supply of virtual money. What determines the supply of virtual currency depends on the decision of the person making the virtual currency. In this context, we can also state that virtual money is not in control and is open to manipulation. In electronic money, the risk may be operational / operational. In virtual currency, there are risks in terms of both operational / operational aspects and legal aspects, credit and circulation capability.

Virtual money is a form of digital money. To put it more clearly, these coins constitute a subset of digital currencies. However, there are some differences among themselves;

• Digital currencies have an equivalent in terms of coins put into circulation by countries. Virtual currencies (such as Bitcoin) have no equivalent.

• Digital currencies are accepted and supported by their founders. Virtual currencies are accepted within the virtual group that interacts with.

• Digital currencies have a legal basis and virtual currencies do not have a legal basis.

While the supply of digital currencies is limited under certain conditions, the supply of virtual currencies depends on their founders.

• Digital currencies have a nominal value and government trust that gives this value, virtual currencies do not have a state guarantee.

• Supervision of digital currencies is possible, electronic money is almost nonexistent. The concept of financial technology is an abbreviation of finance and technology (Fintech), and it has been defined as using technological and innovative business models in the financial services sector. This concept has the potential to set up games for small businesses and is rapidly generating new players in developed and growth markets.

Virtual currencies are digital currencies, but virtual currencies do not have a physical reality they represent. Digital currencies other than virtual currency represent fiat banknotes. Although there is no consensus on the definition of virtual money, the European Central Bank used virtual money in 2012;

• usually controlled by their developers,

• adopted and used by limited virtual group members,

• Unregulated / unregulated digital money ”,

In the report published in February 2015, virtual money revised its statement that although it was not issued by any central bank, credit institution or e-money institution, it is a digital representation of a value that can be used in place of money in some cases.

Virtual money in the European Banking Authority's work published in 2014; It appears to be defined as a digital representation of the value that is not issued by the central bank or public authority, not necessarily linked to a fund, but accepted as a medium of exchange by natural or legal persons, and electronically transferable, stored, or traded.

The European Banking Authority (EBA) defines virtual money as a digital value representation that is not created by the central bank or public authority and does not need to be associated with legal tender. Virtual currencies are used by real and legal persons as a means of clearing and can be transferred, stored or traded electronically.

2. CRYPTOCURRENCIES

2.1. Crypto Money

Crypto money is called digital assets that allow secure transactions with encryption and the supply of additional virtual money. Crypto money is a brand new alternative currency. They are also digital and virtual. Cryptocurrencies are decentralized unlike money in the banking system. Therefore, transactions are carried out by a system called block-chain. Cryptocurrencies cannot be produced by governments or corporations, so they should be considered completely separate from coins minted by governments' central banks.

Since there is no structure that acts as an intermediary in crypto money like in the banking system, there is no mutual trust. However, when examined in terms of the system, nothing appears to pose an objection in terms of operations since it is a reliable system. According to another definition, crypto money is like coins and banknotes currently used by individuals and as a difference; They provide digital information exchange with certain cryptography principles. Cryptography was created to secure monetary transactions and to provide its control mechanism. So

crypto money is a digital currency. Many cryptocurrencies are designed to be less produced over time. The reason for this is the establishment of market value. In the central banks of the states, the situation works differently. Because it can print money whenever it wants. However, in the bitcoin market, at most 21 million units of conversion take place.

The most well-known among crypto currencies is bitcoin. It has an important place in the popularity and development of this currency worldwide. For this reason, when it comes to crypto currency, a few of the bitcoin and altcoins should be explained in detail. Especially in recent years, the reasons for the popularity of this currency, which has become widespread, should be investigated.

2.2. Bitcoin

Economy; In its simplest sense, it can be defined as a holistic network of producers, distributors and individuals consuming goods and services on a local, regional or national scale. Based on this definition, it would not be wrong to define the Bitcoin economy, which is the subject of the study, as a network of Bitcoin producers, users and companies that provide the services necessary for Bitcoin to function in the market. The aim of this study is to discuss the position of crypto currencies among the types of currencies currently used in the market. In addition to this, it is to make a prediction about the current state and future of this new economy by examining the service provider companies that provide the services necessary for the operation of the Bitcoin system and that emerged with the existence of Bitcoin in general and at the level of sub-sectors. Cryptocurrency is a currency that uses cryptography (the science of encryption) in its structure.

Cryptology is used in the process of creating money and ensuring the reliability of transactions made with it. The technical system that constitutes the infrastructure of all cryptocurrencies on the market today was established at the end of 2008 by a person or group known as Satoshi Nakamoto. Considering the

cryptocurrencies, the mechanisms and algorithms they carry out transactions, the computer software and hardware that ensure the continuity of the system, it is the subject of examination of mathematics and information technologies discipline. On the other hand, it is also in the field of economic sciences since it has a currency feature and creates an economic system that includes the service providers necessary for the sustainability of the system.

The block is verified by the nodes in the network, the miner who produced this block is now rewarded with 12.5 BTC, and the hash value of the previous block is used when creating a new block, so it is understood that the nodes accept the block. When a new block is generated after the accepted block, the person who will receive the Bitcoin as a result of the purchase understands that the transaction is valid and sends the product or service to the buyer that needs to respond to the virtual currency. The working principles of the electronic cash payment system Bitcoin are realized in this way and the same life cycle repeats for each transaction. The important terms in the Bitcoin system are discussed below.

Transaction: The Bitcoin transaction can be basically referred to as a bitcoin transfer between the receiver and the sender. Each transaction made is collected in blocks and digitally signed before being published on the point-to-point Bitcoin network. Bitcoin is exchanged during the transaction and the security of this transaction is based on the ECDSA signing algorithm.

The buyer party wants to be sure that Bitcoin is not used more than once, in this problem, as stated above, the list of all transactions is provided by transmitting to all points.

Block: It is a structure that did not exist in previous blocks or contains some Bitcoin transactions. New blocks are produced by Bitcoin mining and added to the block chain of previously accepted blocks. When the block in which the transactions are located is verified by a person, it is included in the block chain. The block chain solves the problem of using Bitcoin more than once. By the way, the most important part of the block is the very important title for Bitcoin mining. Each

block contains the summary of the header part of the previously produced block, thus enabling the formation of a chain structure.

Proof of Work and the Longest Chain: A proof of work is a hard-to-obtain piece of data in terms of time and cost achieving a certain goal. It has to be controllable in very simple ways that the obtained data hits the target. Producing a proof-of-work can be a random process with very low probability, thus requiring on average lots of trial and error to reach the goal. Proof of work in Bitcoin is realized by increasing the nonce field in the block header until the block header contains a certain number of zeros at the beginning of the summary value. Proof of work is used to create blocks. Proof of work attached to the data of each block is required for that block to be accepted by the network. The difficulty of this job is set to allow the Bitcoin network to generate blocks every 10 minutes on average. Since the probability of a successful block creation is extremely low, it is unpredictable which miner in the network will create the next block. For a block to be considered valid, the block summary must be less than its target value. If such a block summary value is found, it is understood that the proof-of-work problem has been solved and a certain amount of workload has been done. Each block contains a summary of the block that preceded it, so each block contains a blockchain and a high percentage of workload all together. Modifying a block (only possible by creating a new block containing the previous block) is possible by rebuilding all the blocks that follow it and redo all the workload they contain. With this method, the block chain is protected in a way that it cannot be tampered with.

Target: A 256-bit integer shared and published by the Bitcoin community. This value determines the difficulty of finding the solution to the proof of work problem in Bitcoin. A basic requirement by the Bitcoin protocol for a block to be accepted; The hash value of the block header is defined as less than the current target value. Therefore, the smaller the target value means that it becomes more difficult to create a new block with Bitcoin mining. A new value is assigned to the target value after the last 2016 block has been removed. Each block is extracted approximately every 10 minutes, so removing the 2016 block takes approximately

2 weeks. As a result, the problem of proof of work is made difficult by changing the target value after every two weeks.

2.2.1. Basic Technology Elements in the Structure of Bitcoin

Bitcoin is the first cryptocurrency. Its working principle is based on the cryptography (encryption) method. Bitcoin is a peer to peer electronic money transfer system. Peer to peer means that the new money supply is not made by any central authority and money transfer transactions are not followed by a central authority. Bitcoin ฿ is expressed as BTC.

Bitcoin was introduced in November 2008 by Satoshi Nakamoto in an e-mail sent to a closed mailing group. In 2009, the first Bitcoin software was published. When he was first introduced, there was no proven information about who or who Satoshi Nakamoto was.

The first currencies were produced by Satoshi Nakamoto, who was also the system developer, and this transaction earned him 50 gifts of Bitcoin. The first recorded Bitcoin bid price was sent on October 5, 2009, nine months after the establishment of the Bitcoin network. The initial bid price calculated according to variable mining costs is 13 Bitcoin for 1 penny and 1,309.03 Bitcoin for 1 dollar. In May 2010, Laszlo Hanyecz, a Florido programmer, purchased two pepperoni pizzas from Papa John's, spending 10,000 Bitcoin, the first transaction using Bitcoin. When Laszlo Hanyecz executed the transaction, the bitcoin required for the two pizzas was worth about $ 60, but its current value is about $ 89 million.

Bitcoin mining is a resource-intensive process, during which new Bitcoins are added to the Bitcoin pool around the world. To start mining, the user must download and run the custom mining software. According to Satoshi Nakamoto's article, following each Bitcoin transaction, a detailed record of the pending

transaction is created. Bitcoin miners create a block of pending transaction records. Then each newly created block in the network is added to the existing series of blocks collectively forming the blockchain. The main transaction log stores these universally broadcast blockchains indefinitely after being posted to all users on the network via public access. This process prevents the reuse of Bitcoins. To verify transactions, a mathematical problem that encrypts each pending transaction log, called "proof-of-work", must be solved. Independent servers run special software that solves the mathematical problem that encrypts each pending transaction.

The Bitcoin network is a system that enables and monitors the transfer of each Bitcoin property and acts as a distributed ledger that combines it with a timestamp server, keeping an overall record of transactions in chronological order. One of Bitcoin's strengths is that it is not centrally managed. Since no one is responsible for the Bitcoin network, users rely on the reliability of the Bitcoin protocol. Thus, Bitcoin is a centralized electronic currency that exists entirely on the internet and does not have any physical form and is not connected to any bank or government, but is produced and controlled by peer / peer computer software. According to the protocol, the rate of generation of Bitcoins is halved every four years.

When the system was installed, it was limited to 21 million Bitcoins. In order for new Bitcoins to circulate, it is necessary to decipher a 16-digit cipher, and the person who decrypts the code earns Bitcoin. Bitcoin's most distinctive advantage over real currencies is that it is not affected by the economic situation of any country since it is not dependent on any country's central bank. In addition, since it is not known to whom it belongs and is not monitored by a central authority, it is not possible to face a threat such as freezing or seizing accounts opened with Bitcoin. The confidentiality of identity information, not being under the control of an authority, makes the system open to all kinds of illegal financial transfers.

2.2.2. Bitcoin Technology

This concept is a common and distributed ledger tool that makes it easy to record and track transactions made in a business network. This tool can keep track of anything that is considered to have material value and can be the subject of a deal. With this method, trading risks are reduced. The foundations of blockchain technology are built on concepts such as consensus by users, users knowing the origin of the asset, and the transactions made are immutable and precise.

The differences of Bitcoin from other currencies can be explained as follows:

- Bitcoin is not bound by a central authority and uses P2P3 technology.
- Bitcoin currency is completely digital.
- Bitcoin currency has an upper limit of 21 million.
- Bitcoin is a complex product.
- Bitcoin currency has a limited network of uses.
- Bitcoin currency is not insured.

Bitcoin currency was launched in 2008 by Satoshi Nakamoto through an email sent to a closed email group and is available to willing users. In 2009, bitcoin currency software was offered to users. In the process of exchanging money, the owner of the money signs the account statement of the previous transaction and the public key of the next user with his own crypto, ie digital signature, while sending the money to the next person and adds this signature to the end of the bitcoin blockchain technology is used for this work.

There is no central structure in the Bitcoin system, it is only available on the internet. Therefore, as seen in other payment methods, many costs that concern the seller or the buyer are almost nonexistent. There are only very small commissions in terms of cost. In addition, the system's crypto technology blockchain ensures the

security and confidentiality of all transactions. All these synergistic benefits have increased the preference of the bitcoin currency. In addition, the process of creating the money supply takes place in front of everyone and with clear neutral rules.

Wallet accounts can be opened from some special applications and websites, some of the most used are Electrum, ArcBit, BTC.com. Honest nodes (computer systems) called miners undertake mathematical calculation tasks to ensure the continuity of the system in Bitcoin, which does not have any central authority, and to create new bitcoins by completing blocks. Miners are vital for the operation of the system. Miners are given incentives to cover the CPU (processor) power, GPU (graphics card) power and other expenses they spend as a result of their operations.

2.2.3. Blockchain

In order to understand the functioning of Bitcoin, it is necessary to understand the functioning and logic of the block chain. Since Cryptography is not used in digital currencies, there is a double spend problem and therefore it is easy to copy. The same applies to all information stored digitally. Situations like these are a critical vulnerability for a currency system. Despite the frequent use of digital payments, solving the double-spending problem without having to rely on third parties required finding a way out. Nakamoto, combining computer 13 networks and existing technology in Cryptography in an innovative way, has created a solution to this problem. The power of the technology resulting in the creation of transparent, reliable and immutable transactions as we know it as blockchain is based on the interaction between the following three elements: distributed ledger, a consensus protocol, and a new data structure (Pisa and Juden, 2017: 6-7).

The emergence of new virtual currencies is one of the application areas of peer-to-peer network distribution (P2P) technology that has led to a series of innovative developments in recent years (Mallard et al., 2014: 1). In a simple receiver-server model, resources are stored and shared only by the server. Whereas,

the P2P computation consists of an interconnected network where computers share resources and information without using a central server. In essence, computers are the same and all contain information of both the receiver and the server. Therefore, the information on the network can be mutually directed by any person who keeps the requested information. The system has the equivalents of the many-to-many distribution model, with all participants capable of responding to an investigation independently of a decentralized one.

Direct access to multiple sources of information instead of a single information provides faster execution and higher efficiency. Using this system provides communication and information sharing on task distribution and transaction execution.

Each chain block has an accounting record of previous transactions and in order for the chains to be added to each other, this information must match, that is, confirmed and verified. The first in this series of chains is the Genesis block. Genesis block, also known as "block 0", is the common ancestor of all new blocks created and if you go back in time, the Genesis block is finally reached. It is encoded in Bitcoin software and the message or information in the unchangeable first block was placed by the creator of Bitcoin, Satoshi Nakamoto.

A common key is needed to verify these transactions. The public key is used for communication between actors in the network, while the lead key is the activator or seal of approval of a transaction and is known only to the recipient. These are located in a user's computer system or Bitcoin wallets and are used for data encryption (public key) and decryption (private key).

2.2.4. Differences of Bitcoin from the Traditional Money System

Bitcoin is a decentralized digital currency that offers instant payments to anyone, anywhere. Bitcoin can be sold, bought, and traded in other currencies.

Bitcoin provides the desired level of privacy and anonymity, and thus the trust in Bitcoin increases. In addition, Bitcoin users can prove ownership of their operations in the Bitcoin network with their secret keys, spend their own Bitcoins and transfer them to their new owners after spending. In Bitcoin transactions, peer-to-peer network is used to manage transfers Independent individuals and companies that have management computing power and log into the Bitcoin network, also known as "miners", are motivated by rewards (release of new Bitcoin) and transaction fees paid in Bitcoin is happening. Anyone who wants can be a miner in this system and produce Bitcoin. The system works on this subject as open source. The system awards Bitcoin as a reward to miners who solve these problems, such as a math problem. Because Bitcoin is not a production center, the supply of Bitcoin is generated by the processing power of volunteer computers in the decentralized worldwide network. These miners can be thought of as the decentralized authority enforcing the credibility of the Bitcoin network. New Bitcoins are brought to the market as a result of the mixed codes that miners solve in the computer system.

Bitcoin is a set of concepts and topics that make up the digital money economy. Bitcoin consists of open source software. Their software runs on a wide range of processors including smart devices. It has no physical representation and is completely digital. The fact that the transaction costs are very low, it can be used worldwide, it is a value storage tool and the usage area is increasing rapidly day by day makes Bitcoin more popular. Bitcoin can be divided up to 8 digits, it is possible to make a transaction of 0.00000001 Bitcoin. The smallest unit is called Satoshi (satoshi is read). In other words, 1 BTC is 100 Million Satoshi. Although the theories on which Bitcoin is based are highly technical, they are very simple to use. With a simple program, Bitcoin can be converted into TL, US Dollar, Euro or other currencies at any time. Like the use of regular money, Bitcoin users can send BTC to each other to purchase a product or service. They can buy bitcoins and use them in exchange. The use of Bitcoin in business life is rapidly increasing as it provides easy access to the global market, protection against fraud and fraud, low commission rates, financial freedom and anonymity. Bitcoin is pushing the boundaries towards a new virtual economy. Since cryptology is used in the security

and production of Bitcoin transfers, it is also called cryptocurrency. Bitcoin does not have any management center, it is not a company or institution, it does not have a person or institution to which it is dependent. It is not affected by any country's economy as it is not associated with any country's central bank.

In the Bitcoin system, there are no delays, troublesome EFT, Money Order, bank transfers, account management, SWIFT charges and credit card fees. Anyone can send Bitcoin to someone else using a computer or mobile phone, 24/7, for free in a few minutes. No government official can confiscate these transfers and no bank or institution can block these transfers. Bitcoin transfers are mutually made between Bitcoin wallet addresses with the approval of miners. Anyone can see the transactions made all over the world, and the system is transparent in this regard.

Nobody, no authority, can supply money to the Bitcoin system from outside. Whereas, fiat money in the form of paper banknotes is printed by the central authorities and additional money is supplied when requested. The maximum number of BTC to be produced is 21 million. Therefore, the supply of Bitcoin continues to decrease and there will be no Bitcoin supply after 2140. Since there is not enough Bitcoin, if the demand for Bitcoin increases, it could become overvalued. In the system called block chain, all transfer transactions since 2009 are recorded. Block-Chain performs value generation, transfer and storage without a central recording and control mechanism. Anyone can create and control this notebook if they wish. This ledger is written by miners, in other words, miners provide the security of the Bitcoin network. In this respect, it is transparent and reliable and is the first example of an alternative to the monetary system of our age.

2.3. Alternative Crypto Coins

2.3.1. Ethereum

Ethereum is among the most well-known crypto currencies after Bitcoin. VitalikButerin, the founder of Ethereum, published the Bitcoin magazine magazine in 2011 and offered to write code into Bitcoin in 2013. However, when he could not find a positive response, he proposed a different crypto currency that can be encoded. In 2018, it was the second largest cryptocurrency with a market value of 100 billion. Ethereum's code is ETH, and the currency is Ether. Ethereum mining is done with the graphic processors unit, not the processors. Due to the high amount of technical equipment and investment for bitcoin mining, mining at home has decreased considerably recently. However, Satoshi Nakamoto set out to produce a completely decentralized production. The biggest criticism for Bitcoin is that a few large miners dominate the system. In Ethereum mining, since home computers are used, not ASICs (a kind of chip), Ether production is quite decentralized.

2.3.2. Ripple

Ripple (XRP), launched in 2012, is not based on Blockchain technology. They have a different structure from Bitcoin in this respect. Despite not having a centralized structure, Ripple distribution is carried out by Ripple laboratories. 20 percent of Ripple, which has 100 billion units, is in the founders of Ripple. 25 percent is located in Ripple labs, the rest is reserved for distribution to grow the system. In Ripple, all books are closed smoothly from the beginning. With Ripple, it is possible to make transactions in a short time, and payments can be made at a very high speed. Ripple is used by major banks and other corporate companies providing financial services. Ripple serves as a bridge between currencies that are

rarely traded and to prevent virtual attacks (Armknecht et al., 2015: 166). Ripple is actually the name of a company and there is a crypto currency that this company uses. This is called ripple. The creators of this project produced 100 billion XRPs before they started the ripple company.

When the Ripple company was founded, most of it was gifted to the company. More will not be produced. It has been suggested with ripple due to the long length of international foreign currency transfers and high commission cuts.

2.3.3. Litecoin

It was created by Charles Lee, a former Google engineer, to speed up Bitcoin. The speed of block creation is very advanced, so transactions are carried out very quickly. Its abbreviation is LTC. The biggest disadvantage of this cryptocurrency is that some of the blocks are abandoned due to Blockchain volume growth. Litecoin has a production limit of 84 million, not 21 million units like Bitcoin.

2.3.4. Iota

Internet of Things: They are objects that can connect to the Internet (obtain an IP address), have a sensor. These objects can be physical tools, cars, household items, wearable technology or any other object as well as communicate with each other. The fact that the number of eggs in the refrigerator falls below a certain amount and orders eggs to the market is a good example of the internet of things. The Internet of Things is the name given to the network of interconnected computers and interconnected objects, from which it extends from virtual to reality. There are many usage areas such as e-health, home automation, environment, water, agriculture, energy, smart cities.

IOTA, on the other hand, is a scalable, decentralized, modular and transaction fee-free crypto currency that operates for the internet of things. The biggest feature of this cryptocurrency is a technology called Tangle. This technology transfers assets without transaction fees. Thus, it is possible to process even very small quantities. One of the main features of IOTA is that it allows data transfer via Tangle. IOTA offers the user various options for data transfer. Thus, users communicate with each other in order to make a transfer between them. All data to be transferred through IOTA is fully verified and secured with protection protocols that make possible attacks impossible.

2.3.5. Monero

Monero is a decentralized open source cryptocurrency. Although it is a secure, personal and confidential currency, it can also be optionally transparent. The transaction of sending or receiving money is not visible to everyone through the Blockchain. Transactions are completely untraceable. For this reason, it is the most preferred crypto currency by criminal organizations.

2.4. Ecosystem in Cryptocurrencies

Bitcoin has created an economic field of activity in parallel with the increase in popularity over time and the increase in investment made in it. According to the Bitcoin ecosystem consists of six elements:

• Mining Companies: Mining companies undertake the task of both approving transactions carried out on the Bitcoin network and creating new Bitcoin in this way. From this point of view, they fulfill a kind of mint duty.

• Companies that Provide E-Wallet Services: Wallet are applications that provide the generation and storage of digital keys required for users included in the

Bitcoin network to make transactions. The way to use crypto coins is to have a wallet. Secure software used to store, send and receive cryptocurrencies similar to Bitcoin is called a crypto money wallet. This is done by means of a software. Although it is called a wallet, there is a cryptocurrency inside and it stores a private key for you. This is the proof that the public key that establishes a relationship with a certain amount of crypto money with this key belongs to you. If you lose this key specific to you, crypto coins become inaccessible. Meanwhile, a classification as hot and cold is made for wallets. Hot wallets are wallets that are connected to the internet and can be processed, while cold wallets are wallets that are not related to the internet and are used only for storing money. When you open an account on one of the cryptocurrency platforms (exchange), a wallet is automatically opened. You are not in control of such wallets. From time to time, there are doubts that the hacking was done from within.

• Firms Providing Financial Services: These firms are institutions that make transactions such as forex transactions, financial asset trading, stock trading with funds held in Bitcoin, similar to classical financial institutions and pay interest to Bitcoin. • Money Markets (Stock Exchanges): These companies are companies that enable Bitcoins to be exchanged with other currencies and receive commissions in return for this service.

• Payment Processors: These are companies that provide the services they need to parties who want to pay and buy goods and services with Bitcoin or other virtual currencies.

• Multi-Purpose Firms: These types of firms are firms that offer different combinations of the services listed above.

2.5. Risks Hosted by Bitcoin

There are aspects of Bitcoin that show the possibility of loss that potential users should consider. It has demonstrated substantial price instability since its creation. Unless new users are careful, there is a risk of storing incorrectly or even accidentally deleting bitcoins. In addition, there are concerns whether possible system attacks will weaken the bitcoin economy.

2.6. Facilitating Criminal Activities

The pseudonymity provided by Bitcoin and the ease of payments made it inevitable for law enforcement to be interested in the use of Bitcoin in facilitating criminal activities. Indeed, the most known criminal use of Bitcoin has been on the Silk Road website, a black market where illegal drugs and fake passports are sold. Silk Road has created a market for similar illegal goods and services by using the Tor network that prevents tracking the user with Bitcoin payments.

Another noteworthy aspect of Bitcoin is its use in money laundering and financing terrorist activities. Interest in these issues gained momentum after the Liberty Reserv, a private and centralized digital currency, was closed for money laundering allegations. However, bitcoins are like fiat money, and it is important to remember that money can be used for both legal and illegal purposes. Before Bitcoin was created, other money transfer methods were used to finance criminal proceeds and money laundering. However, the fact that most Bitcoin exchanges include anti-money laundering measures, such as keeping records of customers, into their business practices, making Bitcoin less attractive to criminals.

2.7. Legal Regulatory Approach

Because Bitcoin is new, the approach of legal enforcers is that they are not intrusive towards the bans. Legal regulations continue to change as states face the benefits and risks of Bitcoin to their countries. Initially, in some governments, regulators have started to set rules and guidelines for digital currency practices in their countries, especially in the prevention of money laundering and the fight against terrorism financing, as well as tax assessments. The work of regulators is aimed at minimizing the risk imposed while encouraging beneficial users and future developments. Laws and regulations do not cover technology such as Bitcoin. That's why Bitcoin today is in a legal gray zone. Bitcoin does not fully comply with the legal definitions of an existing currency, other financial instruments or institutions. This situation makes it uncertain which law will be applied and how.

2.8. Economic Risk

Bitcoin is quite different from the financial system experienced by regulators. The innovative use of bitcoins is said to have devastating effects on existing financial and payment markets. For example, when Bitcoin replaces money transfer and card payment services, and even stock exchanges, service providers will no longer be needed to take on this role. The rapidity of these changes increases the likelihood of confusion in the financial and payment markets and ultimately the risk of price instability in the market.

3. LITERATURE

Studies on the effects of cryptocurrencies on other investment instruments have increased in recent years. These studies have different results. The main reason for this is that there are many factors affecting the market.

In this section, the effects of volatility in cryptocurrincies on bist100 are discussed.

Studies on the effects of cryptocurrencies on other investment instruments have increased in recent years. These studies have different results. The main reason for this is that there are many factors affecting the market.

Chu,Chan,Nadarajah (2017), the study use Bitcoin, Dash, Dogecoin, Litecoin, Maidsafecoin,It shows the volatility of Monero and Ripple crypto coins between June 22, 2014 and May 17, 2017. IGARCH and GJR-GARCH models were applied in the study. As a result of the study, it shows that examined the crypto currencies are extremely volatile, especially in their daily prices.

Kristoufek (2015) In the study, a comparison of bitcoin and other financial assets has been made. The relationship between dollar and bitcoin has been investigated. Later, it was discussed which dollar, euro, yuan and bitcoin is a better investment tool. The wavelet model was used in the study.

Dirican and Canöz (2017) Bitcoin is an investment instrument such as stocks It was wanted to be analyzed as. Long-term analysis with Bitcoin and some leading stock market indices by ARDL boundary test due to the cointegration relationship, Bitcoin and other cryptocurrencies' money, e-commerce, payment systems It was also found meaningful to be examined in terms of dimensions.

Kocoglu and others (2016) In the study, the efficiency of the bitcoin market was examined. Bitfinex, bitstamp, btce and okcoin exchanges have been researched. The data used are daily data between 2014-2015. The work done to analyze the efficiency of the Bitcoin market as a result, it has been revealed that all exchanges except Okcoin are cointegrated with each other, that is, they act together in the long term.

Klein ,and others (2018)In the study, it was tried to investigate the effects of bitcoin on gold, silver and world stock markets. FIAPARCH, GARCH, BEKK GARCH models were applied in the study. As a result of the study, it has been observed that the movements of bitcoin are more sensitive to silver and gold. The difference of Bitcoin from gold and silver is that it is much more volatile than others.

Peng and others (2018), This study investigates the volatility of 3 cryptocurrencies (ethereum, dash coin, bitcoin) against exchange rates. In the study, svr-garch, egarch, garch and gjr-garch models were applied. In the study, it was tried to calculate the daily and hourly volatility of exchange rates and crypto currencies. As a result of the research, the effect of volatility in exchange rates on cryptocurrencies could not be denied.

Topaloglu(2019), Within the framework of the analyzes carried out and the findings provided, it has been revealed that the investors who will invest in Bitcoin should consider the changes in the Chinese Yuan more than the possible changes in other currencies. It is predicted that the study can be developed by including different exchange rates thought to affect Bitcoin in the analysis, supported by different econometric analysis and comparing Bitcoin with other crypto currencies.

Dhyrberg (2017) The study focuses on bitcoin's relationship with the price drop in December 2013. In the first part of the study, the situation of bitcoin before the price decrease in December 2013 and the situation after the price decrease were examined. In the study, it was concluded that bitcoin is a fragile structure. Asymmetric garch model was applied in the study. In the second part of the study, the relationship between bitcoin and 2 portfolios created from the US stock market was examined. The results highlight an inverse relationship between US stock portfolios and bitcoin volatility.

Koy,Yaman,Mete (2021) This study, which investigates the presence of US stock market returns in the volatility structure of BTC, the leader of the crypto money market, covers the daily data for the period between 10.03.2016 - 11.06.2019. DowJones Industrial's existence as variance variable was investigated. The results obtained show that all three indices are significant in explaining the volatility of BTC. Findings about the EGARCH model draw attention in the results of the study. While the volatility structure of BTC is not significant with EGARCH, when the US stock indices are added to the model as a variance variable, the EGARCH model turns into a model in which all variables are significant.

Anop S Kumar (2020) In this study, the relationship between world stock markets, bitcoin and gold has been examined in detail. How the pandemic affected these 3 variables was investigated. The analysis was carried out with the data between 2015-2020. DCC-GARCH model was used in the study. As a result of the study, it was concluded that gold is a safe haven among these 3 markets. It has been concluded that Bitcoin and world stock markets have been greatly affected by the pandemic.

Imran Yousaf, Shoaib Ali (2020) This research is divided into two periods, pre-pandemic and post-pandemic. In the study, volatility analysis was made between bitcoin, litecoin and ethereum. The VAR-DCC-GARCH model has been applied. The focus of the study is volatility. After the volatility analysis between the returns of 3 cryptocurrencies, a hedge analysis was made. As a result of the study, it was concluded that the pandemic had a significant impact on the crypto money market. It has been concluded that investors who will invest in Bitcoin should follow the post-pandemic results.

Table 1 List of Studies Examined

Study Title	Author(s)	Year Published	Methods	Results
Bitcoin - Asset or Currency?	Glaser and others	2014	GARCH	Users consider Bitcoin not as a currency, but as a speculative investment tool.
Crypto Money: Bitcoin and Currency Effects on Exchange Rates	Atik and others	2015	-Johansen cointegration test - Granger causality	A unilateral causality relationship has been observed between the

				Japanese Yen and Bitcoin
On the return-volatility relationship in the Bitcoin market around the price crash of 2013	Dyhrberg and others	2017	-GARCH	The study focuses on bitcoin's relationship with the price drop in December 2013.
GARCH Modelling of Cryptocurrencies	Chu,Chan,Nadarajah	2017	GARCH	As a result of the work different models inside the most available suitable models risk according to your estimates has been explained.
What are main drivers of bitcoin	Kristoufek	2015	WAVELET COHERCE ANALYSIS	Bitcoin is both financial and speculative

The cointegration relationship between bitcoin prices and major world stock indices: an analysis with ARDL model approach	Dirican and Canöz	2017	ARDL	It is concluded that there is a cointegration relationship between the Bitcoin price and the US and Chinese stock market indices.
Efficiency, Liquidity and Volatility of Bitcoin Markets	Kocoglu,Cevik,Tanrioven	2016	-Johansen cointegration test - Granger causality	There is cointegration as a result of the examination. There is no causality relationship.
Bitcoin is not the New Gold – A Comparison of Volatility, Correlation, and Portfolio Performance	Klein,Thu,Walther	2018	GARCH FIAPARCH BEKK-GARCH	As a result of the study, it has been observed that the movements of bitcoin are more sensitive to silver and gold. The difference of Bitcoin from gold and silver

				is that it is much more volatile than others.
Forecasting high frequency volatility for cryptocurrencies and traditional currencies with SVR	Peng and Others	2018	SVR-GARCH EGARCH GJR-GARCH	As a result of the study, it was aimed to compare the registered currencies with crypto currencies and to estimate the volatility.
Bitcoin and exchange rate relationship: an analysis of cointegration and causality with structural break	Topaloglu	2019	-Johansen cointegration test - Granger causality	A unilateral causality relationship has been observed between exchange rates and Bitcoin.
The place of us stock index in volatility model of crypto money:An application on bitcoin	Koy, Yaman,Mete	2021	-GARCH -TARCH -DCCGARCH	-Relationship between BTC and SP500,Nasdaq 100 and Dow Jones

Testing Safe Haven Property of Bitcoin and Gold during Covid-19 : Evidence from Multivariate GARCH analysis	Anop S Kumar	2020	- MULTIVARIATE GARCH	The relationship between gold and bitcoin after Covid-19 was examined
The Covid-19 outbreak and high frequency information transmission between major cryptocurrencies: Evidence from the VAR-DCC-GARCH approach	Imran Yousaf, Shoaib Ali	2020	-VAR DCC GARCH	Pre pandemic and post pandemic analysis of the volatility between Ethereum, Litecoin and Bitcoin was conducted.

4. DATA SET

The data set used in this study includes 2 different daily time series.

Pre and post pandemic. These series are:

- Stock Exchange Istanbul 100 index (BIST100)

-Bitcoin

-Ethereum

-Litecoin

-Monero

-Ripple

-IOTA

The purpose of dividing the study into 2 is to investigate how the pandemic affects the relationship between cryptocurrencies and stock market Istanbul.

The data set used in the study was created from the daily opening values of the Cryptocurrencies and Borsa Istanbul (BIST100) index for the period December 2018 – Dec 2020. There are 499 observations in total. The "Investing.com" web page was used to obtain the data and the analysis were carried out using the R programming language.

The variance in the daily frequency of the series was calculated. During this variance calculation, the natural logarithm of the models was taken and advanced.

5. METHODOLOGY

In this study, the relationship between the cryptocurrencies and Borsa Istanbul 100 index has been analysed. In this sense, the methodology of the analysis and hypotheses developed in line with this study have been explained below.

The DCC GARCH model is a generalization of the Constant Conditional Correlation (CCC) GARCH model. The conditional correlations obtained with the CCC GARCH model are constant, in other words, conditional correlations do not change over time. This is the main limitation of the CCC GARCH model, which makes it easy to predict the model. In addition, the DCC GARCH model is also suitable for estimating varying volatility. One of the major benefits of the DCC

GARCH model is that the number of parameters in the correlation process does not depend on the number of series to be correlated, so large correlation matrices can be calculated during prediction.

According to the descriptive statistics in the tables, the means of the variables were found to be positive. This shows that the returns on the variables are on average throughout 2018-2021. Before the DCC-GARCH analysis, Augmented Dickey-Fuller Test.

5.1. Augmented Dickey-Fuller Test

The Dickey Fuller test is a statistical procedure to test whether a time series contains a unit root. It was developed by D. A. Dickey and W. A. Fuller in the 1970s.

Y_t is a random walk, Y_{t-1} is subtracted from noth sides of equation, α is a constant, The augmented Dickey-Fuller model is reached,

$$\Delta Y_t = \alpha + \beta t + \delta Y_{t-1} + \sum_{j=2}^{p} \delta i \, \Delta Y_{t-j+1} + e_t$$

$H_0: \delta = 0 \quad if \quad t_\delta >$ t not stationary

$H_1: \delta < 0 \quad if \quad t_\delta <$ t stationary

5.2. Multivariate GARCH Model

Engle (1982) was the first to show that the constant variance assumption of time series could not be reached and developed the autoregressive conditional heteroscedasticity (ARCH) model. For this model, the time series must have a constant variance in order to achieve complete success in the prediction (Engle, 1982: 987-107).

Bollerslev (1986) expanded Engle's work by modeling conditional variances as an ARMA process to create a more flexible delay structure. The ARCH model has been expanded to the Generalized Autoregressive Conditional Heteroscopicity (GARCH) model, which provides more memory and more flexible delay structure in this study. In this study, GARCH model was used for modeling. The main purpose of using GARCH models is to predict and predict future volatility. There are two general GARCH models, one variable and multivariate GARCH models. While only one unique time series is needed for single variable GARCH models, multiple time series are used for multivariate GARCH models.

Using the multivariate GARCH series, it is possible to analyze fluctuation spreads and the dynamic correlation between markets (Bollerslev, 1986: 307-327).

$$\mathbf{r_t} = \boldsymbol{\alpha} + \sum_{\mathbf{i=1}}^{\mathbf{k}} \boldsymbol{\beta} \mathbf{r_{t-i}} + \mathbf{y_t}$$

$$y_{A,t} = \sqrt{h_{A,t}}\,\varepsilon_{A,t}$$

$$y_{B,t} = \sqrt{h_{B,t}}\,\varepsilon_{B,t}$$

$$\rho_t = \operatorname{cov}\left(\varepsilon_{A,t}, \varepsilon_{B,t}\right) = \left(1-\theta_1-\theta_2\right)\rho + \theta_1\rho_{t-1} + \theta_2\psi_{t-1}$$

$$\begin{bmatrix} h_{A,t} \\ h_{B,t} \end{bmatrix} = \begin{bmatrix} \gamma_1 \\ \gamma_2 \end{bmatrix} + \begin{bmatrix} \phi_{11}\ \phi_{12} \\ \phi_{21}\ \phi_{22} \end{bmatrix} \begin{bmatrix} y^2_{A,t-1} \\ y^2_{B,t-1} \end{bmatrix} + \begin{bmatrix} \delta_{11}\ \delta_{12} \\ \delta_{21}\ \delta_{22} \end{bmatrix} \begin{bmatrix} h_{A,t-1} \\ h_{B,t-1} \end{bmatrix}$$

Place in show, $\mathbf{r_t} = \boldsymbol{\alpha} + \sum_{\mathbf{i=1}}^{\mathbf{k}} \boldsymbol{\beta} \mathbf{r_{t-i}} + \mathbf{y_t}$ model on the screen is the average model that follows a k. order vector autoregressive process. ρ_t is the non-constant correlation coefficient that changes with time. ρ is a positive definite matrix with $N \times N$ dimensional diagonal elements "1", and ψ_{t-1} is a $N \times N$ dimensional matrix whose elements are functions of past values of variable y_t (Tse and Tsui 2002: 352). In order for the ρ correlation matrix to be positively defined, $0 \le \theta_1, \theta_2 < 1$ and $\theta_1 + \theta_2 \le 1$ conditions must be obtained.

$\mathbf{r_t} = \left(r_{A,t}, r_{B,t}\right)'$ and $\mathbf{y_t} = \left(y_{A,t}, y_{B,t}\right)'$ denote the bivariate structure. $h_{A,t}$ represents the volatility of variable A. $h_{B,t}$ represents the volatility of variable B.

In the DCC-GARCH model, A are the parameters ϕ_{11} and δ_{11} parameters that measure the persistence (continuity) of the volatility of the financial asset. The parameters that measure the permanence of volatility of financial asset B are the ϕ_{22} and δ_{22} parameters. The fact that the ϕ_{11}, δ_{11} and ϕ_{22}, δ_{22} parameters are

statistically significant and the values close to 1 means that volatility clusters are formed for financial assets A and B, respectively.

The ϕ_{12} and δ_{12} parameters are the parameters that express the volatility interaction, and the statistical significance of these parameters indicates the presence of volatility transfer from financial asset B to financial asset A. On the other hand, ϕ_{21} and δ_{21} parameters are also parameters that show the volatility interaction, and the fact that these parameters are statistically significant indicates the presence of volatility transfer from financial asset A to financial asset B.

The most important feature of DCC-GARCH models is that these models can determine the volatility interaction and transfer between financial assets, as well as present the relationship between the returns of financial assets with the estimation of the time-dependent varying correlation coefficient. The Most Similarity Method is used in the prediction of DCC-GARCH models and iterations (iterations) in the prediction phase can be made by Berndt-Hall-Hall-Hausman (BHHH) and Broyden-Fletcher-Goldfarb-Shanno (BFGS) algorithms.

6. RESULTS & ANALYSIS

In this section of the research, descriptive statistics for pre-model variables and model results related to the hypothesis will be included.

6.1. Augmented Dickey-Fuller Test and Data Stationary

6.1.1. Pre Pandemic Results

Augmented Dickey-Fuller test at 95% confidence interval has been implemented on the data set using the Eviews program. P-values less than 0.05 lead to the rejection of the null hypothesis. Results of the test are as follows:

	Level	
Time Series	t-statistic	p-value
Bist100	-16.90126	0.0
BTC	-17.08667	0.0
ETHEREUM	-16.81850	0.0
LITECOIN	-18.01731	0.0
IOTA	-15.83039	0.0
MONERO	-18.26596	0.0
RIPPLE	-17.66781	0.0

According to the Augmented Dickey-Fuller test results, the null hypothesis proposing that the time series have unit roots can be rejected on the following levels:

-Bist100, Bitcoin, Ethereum, Litecoin, Iota, Monero, Ripple can be rejected on Level.

This means that, all return of time series is stationary at the level. The reason of this situation, that in this study we work with logarithmic returns.

6.1.2. Post Pandemic Results

Augmented Dickey-Fuller test at 95% confidence interval has been implemented on the data set using the Eviews program. P-values less than 0.05 lead to the rejection of the null hypothesis. Results of the test are as follows:

	Level	
Time Series	t-statistic	p-value
BIST100	-11.69743	0.0
BTC	-23.10688	0.0
ETHEREUM	-20.58819	0.0
LITECOIN	-20.04112	0.0
IOTA	-19.61880	0.0
MONERO	-23.64382	0.0
RIPPLE	-13.83633	0.0

According to the Augmented Dickey-Fuller test results, the null hypothesis proposing that the time series have unit roots can be rejected on the following levels:

-Bist100, Bitcoin, Ethereum, Litecoin, Iota, Monero, Ripple can be rejected on Level.

This means that, all return of time series is stationary at the level. The reason of this situation, that in this study we work with logarithmic returns.

6.2 Dcc-Garch Model Analysis

In this section, the results of the DCC-GARCH model will be examined.

6.2.1 Pre Pandemic Results

Table 2 The Estimation Results of DCC-GARCH Model for BIST and BITCOIN Returns

	Coefficients	**Standard Errors**	**t-statistics**	**Probability**
γ_1	0.58443	0.26682	2.19034**	0.02850
γ_2	2.23742	1.14132	1.96037**	0.04995
ϕ_{11}	0.06112	0.04104	1.48925	0.13642
ϕ_{12}	- 0.04182	0.00922	-4.53455**	0.00001
ϕ_{21}	-0.84978	0.08235	-10.31905**	0.00000
ϕ_{22}	0.12663	0.03010	4.20662**	0.00003
δ_{11}	0.94673	0.06184	15.30952**	0.00000
δ_{12}	3.66835	1.62809	2.25316**	0.02425
δ_{21}	-11.27319	8.70382	-1.29520	0.19525
δ_{22}	0.67294	0.06332	10.62704**	0.00000
θ_1	0.01102	0.00480	2.29823**	0.02155
θ_2	0.17306	0.36538	0.47364	0.63576

Note: *denotes statistically significance at the 10% level. ** denotes statistically significance at the 5% level. *** denotes statistically significance at the 1% level.

According to the results in table 2, BIST volatility 0.94673, BITCOIN volatility 0.12663 + 0.67294 = 0.79958. Effect of BIST volatility on BITCOIN volatility: -

0.84978. The 1% shock that increases the BIST volatility reduces the BITCOIN volatility by 0.84% on the next trading day.

According to the results, the effect of BITCOIN volatility on BIST volatility: -0.04182 + 3.66835 = 3.62653. The 1% shock, which increases the BITCOIN volatility, reduces the BIST volatility by 3.62% on the next trading day. There is a time-dependent correlation relationship between BIST and BITCOIN returns: There is a positive relationship of 0.01102.

Table 3 The Estimation Results of DCC-GARCH Model for BIST and ETHEREUM Returns

	Coefficients	**Standard Errors**	**t-statistics**	**Probability**
γ_1	0.68268	0.14304	4.77273**	0.00000
γ_2	7.54069	1.48236	5.08694**	0.00000
ϕ_{11}	0.12226	0.03804	3.21407**	0.00131
ϕ_{12}	0.10758	0.01839	5.85017**	0.00000
ϕ_{21}	-1.14856	0.11732	-9.78982**	0.00000
ϕ_{22}	0.22911	0.04919	4.65809**	0.00000
δ_{11}	0.62666	0.03005	20.85651**	0.00000
δ_{12}	-1.81995	0.26407	-6.89185**	0.00000
δ_{21}	-58.89290	5.57193	-10.56956**	0.00000
δ_{22}	0.11898	0.03046	3.90563**	0.00009
θ_1	0.00559	0.00033	16.77434**	0.00000
θ_2	0.78473	0.05025	15.61784**	0.00000

Note: *denotes statistically significance at the 10% level. ** denotes statistically significance at the 5% level. *** denotes statistically significance at the 1% level.

According to the results in table 3, BIST volatility 0.62666 + 0.12226 = 0.74892

ETHEREUM volatility 0.22911 + 0.11898 = 0.34809. Effect of BIST volatility on ETHEREUM volatility: -1.14856--58.89290 = -60.04145. A 1% shock that increases BIST volatility reduces the next trading day ETHEREUM volatility by 60%.

According to the results, the effect of ETHEREUM volatility on BIST volatility: 0.10758-1.81995 = -1.71237

The 1% shock that increases the ETHEREUM volatility decreases the BIST volatility by 1.71% on the next trading day. Time-dependent correlation between BIST and ETHEREUM returns: 0.00559 + 0.78473 = 0.79032. There is a positive relationship.

Table 4 The Estimation Results of DCC-GARCH Model for BIST and IOTA Returns

	Coefficients	**Standard Errors**	**t-statistics**	**Probability**
γ_1	0.85128	0.00277	307.52715**	0.00000
γ_2	-5.29502	0.01025	-516.55581**	0.00000
ϕ_{11}	0.00137	0.00000	313.30670**	0.00000
ϕ_{12}	0.03715	0.00110	33.86821**	0.00000
ϕ_{21}	-0.01004	0.00233	-4.30834**	0.00002
ϕ_{22}	-0.01408	0.00041	-34.71646**	0.00000
δ_{11}	1.11289	0.00189	590.06769**	0.00000
δ_{12}	-6.25663	0.00749	-835.65109**	0.00000
δ_{21}	32.96459	0.10422	316.29083**	0.00000
δ_{22}	0.97544	0.00038	2595.18800**	0.00000
θ_1	0.00004	0.00000	131.36218**	0.00000
θ_2	0.99996	0.00852	117.37342**	0.00000

Note: *denotes statistically significance at the 10% level. ** denotes statistically significance at the 5% level. *** denotes statistically significance at the 1% level.

According to the results in table 4, BIST volatility 0.00137 + 1.11289 = 1.11289 IOTA volatility -0.01408 + 0.97544 = 0.96136 The effect of BIST volatility on IOTA volatility: -0.01004 + 32.96459 = 32.95455 The 1% shock that increases BIST volatility increases the IOTA volatility by 32% on the next trading day.

According to the results, the effect of IOTA volatility on BIST volatility: 0.03715-6.25663 = -6.21948

The 1% shock that increases IOTA volatility reduces the next trading day BIST volatility by 6.21%. There is a time-dependent correlation between BIST and IOTA returns: 0.99996 + 0.00004 = 0.99999 positive relationship.

Table 5 The Estimation Results of DCC-GARCH Model for BIST and LITECOIN Returns

	Coefficients	**Standard Errors**	**t-statistics**	**Probability**
γ_1	1.73772	1.01845	1.70624	0.08796
γ_2	12.81544	6.80469	1.88333	0.05966
ϕ_{11}	0.09768	0.00303	32.25626**	0.00000
ϕ_{12}	0.12947	0.00609	21.25511**	0.00000
ϕ_{21}	-0.50128	0.14159	-3.54048**	0.00040
ϕ_{22}	0.01393	0.02415	0.57700	0.56394
δ_{11}	0.84965	0.23191	3.66377**	0.00025
δ_{12}	-3.10147	3.62709	-0.85508	0.39250
δ_{21}	-2.09574	7.19939	-0.29110	0.77098
δ_{22}	0.67592	0.11937	5.66239**	0.00000
θ_1	0.00648	0.01160	0.55817	0.57673
θ_2	0.71228	0.42957	1.65814	0.09729

Note: *denotes statistically significance at the 10% level. ** denotes statistically significance at the 5% level. *** denotes statistically significance at the 1% level.

According to the results in table 5, BIST volatility 0.09768 + 0.84965 = 0.94733 LITECOIN volatility 0.67592 , The effect of BIST volatility on LITECOIN volatility: -0.50128 ,A 1% shock that increases BIST volatility reduces LITECOIN volatility by 0.50% on the next trading day. The effect of LITECOIN volatility on BIST volatility: 0.12947

The 1% shock that increases LITECOIN volatility increases the BIST volatility by 0.12% on the next trading day. There is no correlation between BIST and LITECOIN returns.

Table 6 The Estimation Results of DCC-GARCH Model for BIST and MONERO Returns

	Coefficients	**Standard Errors**	**t-statistics**	**Probability**
γ_1	0.97799	0.38575	2.53527**	0.01124
γ_2	4.83231	2.78547	1.73483	0.08277
ϕ_{11}	0.07584	0.03692	2.05399**	0.03998
ϕ_{12}	0.06630	0.01969	3.36698**	0.00076
ϕ_{21}	-0.69621	0.21610	-3.22174**	0.00127
ϕ_{22}	0.06409	0.04364	1.46862	0.14193
δ_{11}	0.73095	0.09887	7.39285**	0.00000
δ_{12}	-1.77420	2.72164	-0.65189	0.51447
δ_{21}	5.28643	18.54953	0.28499	0.77565
δ_{22}	0.74519	0.06521	11.42777**	0.00000
θ_1	0.01293	0.02284	0.56613	0.57130
θ_2	0.12884	0.40319	0.31955	0.74931

Note: *denotes statistically significance at the 10% level. ** denotes statistically significance at the 5% level. *** denotes statistically significance at the 1% level.

According to the results in table 6, BIST volatility 0.07584 + 0.73095 = 0.80679, MONERO volatility 0.74519 ,The effect of BIST volatility on MONERO volatility: -0.69621 ,The 1% shock that increases the BIST volatility reduces the next trading day MONERO volatility by 0.69%. Effect of MONERO volatility on BIST volatility: 0.06630

The 1% shock that increases the MONERO volatility increases the BIST volatility by 0.06% on the next trading day. There is no time-dependent correlation between BIST and MONERO returns.

Table 7 The Estimation Results of DCC-GARCH Model for BIST and RIPPLE Returns

	Coefficients	**Standard Errors**	**t-statistics**	**Probability**
γ_1	0.49807	0.10577	4.70910**	0.00000
γ_2	8.44822	3.28363	2.57283**	0.01009
ϕ_{11}	0.10016	0.02176	4.60343**	0.00000
ϕ_{12}	0.07678	0.00677	11.33777**	0.00000
ϕ_{21}	-0.58805	0.08791	-6.68911**	0.00000
ϕ_{22}	0.19597	0.07485	2.61806**	0.00884
δ_{11}	0.81883	0.08915	9.18444**	0.00000
δ_{12}	-1.15597	1.13458	-1.01885	0.30827
δ_{21}	54.94676	19.39143	2.83356**	0.00460
δ_{22}	-0.26973	0.17762	-1.51855	0.12888
θ_1	0.00519	0.00412	1.25998	0.20768
θ_2	0.42205	0.54689	0.77172	0.44028

Note: *denotes statistically significance at the 10% level. ** denotes statistically significance at the 5% level. *** denotes statistically significance at the 1% level.

BIST volatility 0.10016 + 0.81883 = 0.91899 RIPPLE volatility 0.19597

The effect of BIST volatility on RIPPLE volatility: -0.58805 + 54.94676 = 54.35871. A 1% shock that increases BIST volatility increases the next trading day

RIPPLE volatility by 54.35%. Effect of RIPPLE volatility on BIST volatility: 0.07678

A 1% shock that increases RIPPLE volatility increases BIST volatility by 0.07% on the next trading day. There is no correlation between BIST and RIPPLE returns.

6.2.2 Post Pandemic Results

Table 8 The Estimation Results of DCC-GARCH Model for BIST and BITCOIN Returns

	Coefficients	**Standard Errors**	**t-statistics**	**Probability**
γ_1	0.41610	0.34282	1.21375	0.22484
γ_2	22.36258	3.23826	6.90575**	0.00000
ϕ_{11}	0.17832	0.04266	4.18043**	0.00003
ϕ_{12}	-0.01663	0.04295	-0.38715	0.69864
ϕ_{21}	0.66154	0.12256	5.39753**	0.00000
ϕ_{22}	0.66942	0.19431	3.44502**	0.00057
δ_{11}	0.76609	0.07347	10.42678**	0.00000
δ_{12}	-0.02037	0.08593	-0.23702	0.81264
δ_{21}	-2.37434	0.51625	-4.59924**	0.00000
δ_{22}	0.07652	0.16530	0.46292	0.64342
θ_1	0.18024	0.08414	2.14217**	0.03218
θ_2	0.16951	0.07367	2.30095**	0.02139

Note: *denotes statistically significance at the 10% level. ** denotes statistically significance at the 5% level. *** denotes statistically significance at the 1% level.

According to the results in table 8, BIST volatility 0.76609 + 0.17832 = 0.94440, BITCOIN volatility 0.66942 ,The effect of BIST volatility on BITCOIN volatility: 0.66154-2.37434 = -1.71280

The 1% shock that increases the BIST volatility reduces the BITCOIN volatility by 1.71% on the next trading day. According to the results, BITCOIN volatility does not affect BIST volatility. There is a time-dependent correlation relationship between BIST and BITCOIN returns: 0.18024 + 0.16951 = 0.34975.

Table 9 The Estimation Results of DCC-GARCH Model for BIST and ETHEREUM Returns

	Coefficients	**Standard Errors**	**t-statistics**	**Probability**
γ_1	0.95393	0.35395	2.69510**	0.00704
γ_2	20.79455	2.87804	7.22525**	0.00000
ϕ_{11}	0.33943	0.11055	3.07039**	0.00214
ϕ_{12}	0.12981	0.03451	3.76126**	0.00017
ϕ_{21}	1.37190	0.25606	5.35774**	0.00000
ϕ_{22}	0.31316	0.16923	1.85049	0.06424
δ_{11}	0.54507	0.12758	4.27240**	0.00002
δ_{12}	-0.08831	0.03111	-2.83875**	0.00453
δ_{21}	-1.76925	0.29413	-6.01517**	0.00000
δ_{22}	0.40344	0.10318	3.90996**	0.00009
θ_1	0.40704	0.07335	5.54934**	0.00000
θ_2	0.30910	0.12798	2.41525**	0.01572

Note: *denotes statistically significance at the 10% level. ** denotes statistically significance at the 5% level. *** denotes statistically significance at the 1% level.

According to the results in table 9, BIST volatility 0.33943 + 0.54507 = 0.88449 ETHEREUM volatility 0.40344 + 0.31316 = 0.71660 , The effect of BIST volatility on ETHEREUM volatility: 1.37190-1.76925 = -0.39735

The 1% shock that increases BIST volatility reduces the next trading day ETHEREUM volatility by 0.39%. According to the results, the effect of ETHEREUM volatility on BIST volatility: 0.12981-0.08831 = 0.04150

The 1% shock that increases the ETHEREUM volatility increases the BIST volatility by 0.04% on the next trading day. There is a time-dependent correlation relationship between BIST and ETHEREUM returns: 0.40704 + 0.30910 = 0.71614 There is a positive relationship.

Table 10 The Estimation Results of DCC-GARCH Model for BIST and IOTA Returns

	Coefficients	**Standard Errors**	**t-statistics**	**Probability**
γ_1	0.64800	0.39008	1.66120	0.09667
γ_2	1.51209	1.12247	1.34711	0.17794
ϕ_{11}	0.23537	0.10360	2.27197**	0.02309
ϕ_{12}	0.02181	0.04809	0.45355	0.65015
ϕ_{21}	-0.34398	0.21500	-1.59993	0.10962
ϕ_{22}	0.05579	0.02421	2.30379**	0.02123
δ_{11}	0.60020	0.13712	4.37722**	0.00001
δ_{12}	-0.00066	0.09930	-0.00666	0.99468
δ_{21}	0.08598	0.35918	0.23938	0.81081
δ_{22}	0.90167	0.04760	18.94070**	0.00000
θ_1	0.07743	0.05779	1.33994	0.18026
θ_2	0.88862	0.06996	12.70259**	0.00000

Note: *denotes statistically significance at the 10% level. ** denotes statistically significance at the 5% level. *** denotes statistically significance at the 1% level.

According to the results in table 10, BIST volatility 0.60020 + 0.23537 = 0.83556 IOTA volatility 0.90167 + 0.05579 = 0.95745 , BIST volatility has no effect on IOTA volatility. IOTA volatility has no effect on BIST volatility. Time-dependent correlation between BIST and IOTA returns: There is a positive correlation of 0.88862.

Table 11 The Estimation Results of DCC-GARCH Model for BIST and LITECOIN Returns

	Coefficients	**Standard Errors**	**t-statistics**	**Probability**
γ_1	0.53443	0.28344	1.88553	0.05936
γ_2	24.33819	4.31161	5.64480**	0.00000
ϕ_{11}	0.22038	0.09464	2.32861**	0.01988
ϕ_{12}	-0.00453	0.03077	-0.14716	0.88300
ϕ_{21}	1.54083	0.18959	8.12719**	0.00000
ϕ_{22}	0.52874	0.10849	4.87365**	0.00000
δ_{11}	0.63315	0.11695	5.41374**	0.00000
δ_{12}	0.03807	0.05826	0.65331	0.51356
δ_{21}	-0.20038	0.29026	-0.69035	0.48998
δ_{22}	-0.00691	0.07597	-0.09092	0.92755
θ_1	0.12091	0.07091	1.70518	0.08816
θ_2	0.81638	0.11112	7.34714**	0.00000

Note: *denotes statistically significance at the 10% level. ** denotes statistically significance at the 5% level. *** denotes statistically significance at the 1% level.

According to the results in table 11, BIST volatility 0.63315 + 0.22038 = 0.85353

LITECOIN volatility 0.52874. The effect of BIST volatility on LITECOIN volatility: 1.54083

The 1% shock increasing BIST volatility increases the LITECOIN volatility by 1.54% on the next trading day. LITECOIN volatility has no effect on BIST

volatility. Time-dependent correlation between BIST and LITECOIN returns: There is a positive correlation of 0.81638.

Table 12 The Estimation Results of DCC-GARCH Model for BIST and MONERO Returns

	Coefficients	**Standard Errors**	**t-statistics**	**Probability**
γ_1	0.73393	0.31432	2.33499**	0.01954
γ_2	17.62245	2.42537	7.26588**	0.00000
ϕ_{11}	0.24138	0.10188	2.36922**	0.01783
ϕ_{12}	0.01108	0.03574	0.30991	0.75663
ϕ_{21}	0.69886	0.50709	1.37818	0.16815
ϕ_{22}	1.11140	0.20232	5.49335**	0.00000
δ_{11}	0.59884	0.12681	4.72215**	0.00000
δ_{12}	-0.00591	0.03418	-0.17279	0.86282
δ_{21}	0.67242	0.37008	1.81696	0.06922
δ_{22}	-0.12257	0.03279	-3.73817**	0.00019
θ_1	0.32778	0.08311	3.94390**	0.00008
θ_2	0.58741	0.10298	5.70438**	0.00000

Note: *denotes statistically significance at the 10% level. ** denotes statistically significance at the 5% level. *** denotes statistically significance at the 1% level.

According to the results in table 12, BIST volatility 0.59884 + 0.24138 = 0.84021 MONERO volatility 1.11140-0.12257 = 0.98883

BIST volatility has no effect on MONERO volatility. MONERO volatility has no effect on BIST volatility. There is a time-dependent correlation between BIST and MONERO returns: 0.58741 + 0.32778 = 0.91519.

Table 13 The Estimation Results of DCC-GARCH Model for BIST and RIPPLE Returns

	Coefficients	**Standard Errors**	**t-statistics**	**Probability**
γ_1	0.42766	0.19549	2.18765**	0.02870
γ_2	16.09897	2.63358	6.11297**	0.00000
ϕ_{11}	0.18399	0.06262	2.93805**	0.00330
ϕ_{12}	0.03955	0.02729	1.44921	0.14728
ϕ_{21}	-0.16790	0.12179	-1.37863	0.16801
ϕ_{22}	0.90356	0.11829	7.63881**	0.00000
δ_{11}	0.71965	0.09793	7.34849**	0.00000
δ_{12}	-0.01906	0.05596	-0.34069	0.73334
δ_{21}	-2.83041	0.62808	-4.50645**	0.00001
δ_{22}	0.21852	0.08116	2.69236**	0.00709
θ_1	0.27215	0.06434	4.23023**	0.00002
θ_2	0.53223	0.12642	4.20994**	0.00003

Note: *denotes statistically significance at the 10% level. ** denotes statistically significance at the 5% level. *** denotes statistically significance at the 1% level.

According to the results in table 13, BIST volatility 0.18399 + 0.71965 = 0.90364

RIPPLE volatility 0.90356 + 0.21852 = 1.12209. The effect of BIST volatility on RIPPLE volatility: -2.83041

The 1% shock that increases BIST volatility reduces the next trading day RIPPLE volatility by 2.83%. RIPPLE volatility has no effect on BIST volatility. There is a time-dependent correlation between BIST and RIPPLE returns: 0.27215 + 0.53223 = 0.80439.

7. CONCLUSION

In this study, the relationship between the cryptocurrency market and bist100 has been subjected to a deep analysis. For this purpose, firstly, the emergence, development and pricing system of money has been examined in detail.

6 cryptocurrencies were used in the study. These are Bitcoin, monero, litecoin, iota, ripple and ethereum. It has been investigated how these coins affect the bist100 index. At the same time, it has been investigated whether the bist100 index has an effect on cryptocurrencies. In order to reach the correct conclusion, the crypto money market data, which is open at the weekend, were not taken into account in the study. The focus of the research is volatility. In this context, DCC-GARCH model is used and ADF Test used.

The sample of the study was formed by crypto currencies and bist100 data between 2018-2021. There are 499 samples in this study. In this study, the opening price of the data was not used. The logarithm of the data used in the study was taken to obtain a healthier result. In this study, the effect of crypto currencies data in the sample on bist100 was examined empirically.

The study is divided into two as pre-pandemic and post-pandemic. The purpose of this is to measure how much the pandemic has affected the cryptocurrency market. When the pre-pandemic and post-pandemic results were compared, it was revealed that the results of the other 5 crypto currencies other than bitcoin were not very significant. The extreme volatility in prices indicates that cryptocurrencies are a high-risk currency subject to speculation. When the pre-pandemic and post-pandemic results are compared, it is observed that the correlation between the bist100 index and bitcoin has increased, but it is not possible to say this for other cryptocurrencies. It is possible to say that crypto currencies, which did not have a correlation relationship with the bist100 index

before the pandemic, created the opposite situation after the pandemic. In order for the study to give a healthier result, it was deemed appropriate to examine the crypto money prices formed after the pandemic and the bist100 index in a long term.

8. REFERENCES

Anoop, S. K. (2020). Testing Safe Haven Property of Bitcoin and Gold during Covid-19 : Evidence from Multivariate GARCH analysis. *Economics Bulletin*, 40(3), 2005-2015.

Ansi, (2005). X9.62: The Elliptic Curve Digital Signature Algorithm (ECDSA), Public Key Cryptography for the Financial Services Industry.

Antonopoulos, A. M. (2014). Mastering Bitcoin. O'Reilly Media.

Aren, S. (1986). 100 Soruda Para Ve Para Politikası. Gerçek yayınları.

Aslan, V. U. Parayı Bir Toplumsal İlişki Olarak Tanımlamak. Yildiz Social Science Review, 5(2), 263-286.

Ateş, B. A. (2016). Kripto para birimleri, bitcoin ve muhasebesi. *Journal of Institute of Social Sciences*, 7, 349-366.

Atik, M., Köse, Y., Yılmaz, B., & Sağlam, F. (2015). *Kripto Para: Bitcoin ve Döviz Kurları Üzerine Etkileri,* Bartın Üniversitesi İ.İ.B.F. Dergisi, 6, 11, 247-261.

Badzar, A. (2016). Blockchain for securing sustainable transport contracts and supply chain Transparency.

Barber, S., Boyen, X., Shı, E. & Uzun, E. (2012). Bitter To Better—How To Make Bitcoin A Better Currency. In Financial Cryptography and Data Security. 399- 414

Bonneau, J., Miller, A., Clark, J., Narayanan, A., Kroll, J. A., & Felten, E. W. (2015). Research Perspectives and Challenges for Bitcoin and Cryptocurrencies, In Proceedings of the 36th IEEE Symposium on Security & Privacy.

Braudel, F., & Özel, M. (1991). Maddi Medeniyet ve Kapitalizm. Ağaç Yayınları.

Bollerslev, T. (1986). Generalized autoregressive conditional heteroskedasticity. *Journal of Econometrics*, 31(3), 307-327

Chuen, D. L. K. (Ed.). (2015). Handbook of digital currency: Bitcoin, innovation, financial instruments, and big data. Academic Press.

Chu, J., Chan, S., Nadarajah, S., & Osterrieder, J. (2017). GARCH Modelling of Cryptocurrencies. *Journal of Risk and Financial Management,* 1-15.

Cho, J., & Parhizgari, A. (2008). East Asian Financial Contagion under DCC-Garch. *International Journal of Banking and Finance.* 6(1), 17-30.

Çakracıoğlu, A. (2016). Kripto Para Bitcoin. Sermaye Piyasası Kurulu Araştırma Dairesi. http://www.spk.gov.tr/SiteApps/Yayin/YayinGoster/1130

Dirican, C., & Canöz, İ. (2017). The Cointegration Relationship Between Bitcoin Prices and Major World Stock Indices: An Analysis With ARDL Model Approach. *Finance and Accounting (JEFA),* 377-392. http://doi.org/10.17261/Pressacademia.2017.748

Dyhrberg, A.H., Bouri, E., & Azzi, G. (2015). On The Return-Volatility Relationship in The Bitcoin Market Around The Price Crash of 2013. *Open-Assessment E-Journal, 11* , 1-16. http://dx.doi.org/10.5018/economics-ejournal.ja.2017-2

European Central Bank. (1998). Report On Electronic Money. https://www.ecb.europa.eu/pub/pdf/other/emoneyen.pdf

Engle, R. (1982). Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation. *Econometrica, 50*(4), 987-1007.

Engle, R. (2002). Dynamic Conditional Correlation: A Simple Class of Multivariate Generalized Autoregressive Conditional Heteroskedasticity Models. *Journal of Business & Economic Statistics,* 20(3), 339-350. https:// doi.org/10.1198/073500102288618487

Gandal, N., & Halaburda, H. (2014). Competition in the Cryptocurrency Market . *Bank of Canada Working Paper*. 1-33.

Gennaro, R., Goldfeder, S., & Narayanan, A. (2016). Threshold-optimal DSA/ECDSA Signatures and An Application to Bitcoin Wallet Security. *In International Conference on Applied Cryptography and Network Security*. 156-174.

Alberto, G., & Turtelboom, B. (Ed) (1994). The Handbook of International Macroeconomics. Blackwell Publishers.

Glaser, F., Zimmerman, K., Haferkorn, M., Weber. M. C., & Siering, M. (2014). Bitcoin- Asset or Currency ? *Twenty Second European Conference on Information Systems,* 1-14.

Graf, K. S. (2013). On the Origins of Bitcoin Stages of Monetary Evolution, http://nakamotoinstitute.org/static/docs/origins-of-bitcoin.pdf

Grinberg, R. (2012). Bitcoin: An innovative alternative digital currency. Hastings Sci. & Tech.

Gupta, M. (2017). Blockchain for dummies. John Wiley & Sons,Inc

Gültekin, Y. & Bulut, Y. (2016). Bitcoin Ekonomisi: Bitcoin Ekosisteminden Doğan Yeni Sektörler ve Analizi. *Adnan Menderes Üniversitesi, Sosyal Bilimler Enstitüsü Dergisi*, 3(3), 88-92.

Güven, D. V. & Şahinöz, E. (2018). Blok zincir Kripto Paralar Bitcoin. Kronik Yayınevi.

Şüheda, H. (2018). Bitcoin Piyasasındaki Oynaklığın Analiz , *Çankaya Üniversitesi Sosyal Bilimler Enstitüsü.*

Hurlburt, G. F., & Bojanova, I. (2014). *Bitcoin: benefit or curse?* University of Maryland University College http://fac.comtech.depaul.edu/yhwang1/Articles_KHU/article_1.pdf

Yousaf, I., & Ali, S. (2020). The Covid-19 outbreak and high frequency information

transmission between major cryptocurrencies: Evidence from the VAR-DCC-GARCH approach, *Journal Borsa Istanbul Review,* 1-20.

Jakobsson, M., & Yung, M. (1996). Revokable and Versatile Electronic Money. *ACM Conference on Computer and Communications Security*. 76-87

Jarecki, S., Kiayias, A., Krawczyk, H., & Xu, J. (2016). Highly-efficient and composable password-protected secret sharing (or: How to protect your bitcoin wallet online). *In 2016 IEEE European Symposium on Security and Privacy*, 276-291.

Klein, T., Thu, H.P., & Walther, T. (2018). Bitcoin is not the New Gold – A Comparison of Volatility, Correlation, and Portfolio Performance. 1-29.

Kocaimamoğlu, S. (1980). Bankacılık ansiklopedisi Türkiye İş Bankası Kültür Yayınları.

Kocoglu, Ş., Cevik, Y.E., Tanrioven, C. (2016). Efficiency, Liquidity and Volatility of Bitcoin Markets, *Journal of Business Research,* 3-96.

Koy, A., Yaman, M., & Mete, S. (2021). The place of us stock index in volatility model of crypto money:An application on bitcoin, *Finansal Araştırmalar ve Çalışmalar Dergisi* 3(24) 159-170.

Kristoufek, L. (2015). What are main drivers of bitcoin. *Plos One Article,* 1-15.

DOI:10.1371/journal.pone.0123923

Marian, O. (2016). Is Cryptographıc Currency an Outstandıng Tax Heaven? *İstanbul Üniversitesi Hukuk Fakültesi Dergisi,* 74 (2), 919-930.

Nakamoto, S. (2000). Bitcoin - A Peer-to-Peer Electronic Cash System, https://bitcoin.org/bitcoin.pdf

Nebil, F. S. (2018). Bitcoin ve Kripto Paralar. *İstanbul: Pusula 20 Teknoloji*.15-39.

Öztürk, N. & Koç A. (2006). Elektronik Para, Diğer Para Türleriyle Karşılaştırılması ve Olası Etkileri, *Selçuk Üniversitesi İktisadi ve İdari Bilimler Fakültesi Sosyal ve Ekonomik Araştırma Dergisi*, 207- 243.

Özyurt, H. (2006). Para Teorisi ve Politikası. Derya Kitapevi.

Pamuk, Ş. (2012). Osmanlı İmparatorluğu'nda Paranın Tarihi. Tarih Vakfı Yurt Yayınları.

Peng, Y., Henrique, P., Albuquerque, M., Camboim de Sa, M., Padula, A.J.A., & Montenegro, M.R. (2018). Forecasting high frequency volatility for cryptocurrencies and traditional currencies with SVR. *Elsevier Journal*. 177-192. https://doi.org/10.1016/j.eswa.2017.12.004

Rose, C. (2015). The Evolution of Digital Currencies: Bitcoin, a Cryptocurrency Causing a Monetary Revolution. *International Business & Economics Research Journal*. 14(4) 617-622.

Sing, S. & Singh, N. (2016). Blockchain: Future of financial and cyber security Conference: 2016 2nd International Conference on Contemporary Computing and Informatics. Researchgate.

Oğuz, T. (2006). Coinler, Devletler, Hükümdarlar: Eskiçağda Anadolu'da Paranın Siyasal, Kültürel ve Ekonomik Rolü, http://www.obarsiv.com/pdf/vct_oguz_tekin.pdf

Telatar, F. (2004). Politik İktisat Politikası. İmaj Yayıncılık.

Topaloglu, E.E. (2019). Bitcoin and exchange rate relationship: an analysis of cointegration and causality with structural break. *CBÜ Sosyal Bilimler Dergisi*, 17(2) 1-382. Doi:10.18026/cbayarsos.585306

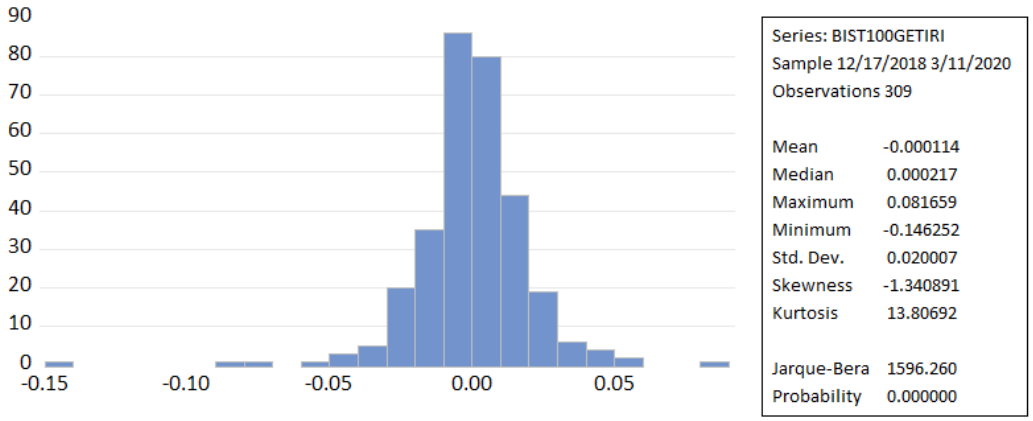
Ülgen, Kıvanç (2010). *Elektronik Para: Türkiye Ve Dünya Uygulaması*, İnönü Üniversitesi Sosyal Bilimler Enstitüsü İktisat Anabilim Dalı.

Volety, T., Saini, S., McGhin, T., Liu, C. Z., & Choo, K. K. R. (2018). Cracking Bitcoin wallets: I want what you have in the wallets, *Future Generation Computer Systems*, 91, 136–143,

9. APPENDIX

ADF Test & Descriptive Statistic Results

Pre Pandemic Results



Null Hypothesis: BISTGETIRI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=15)

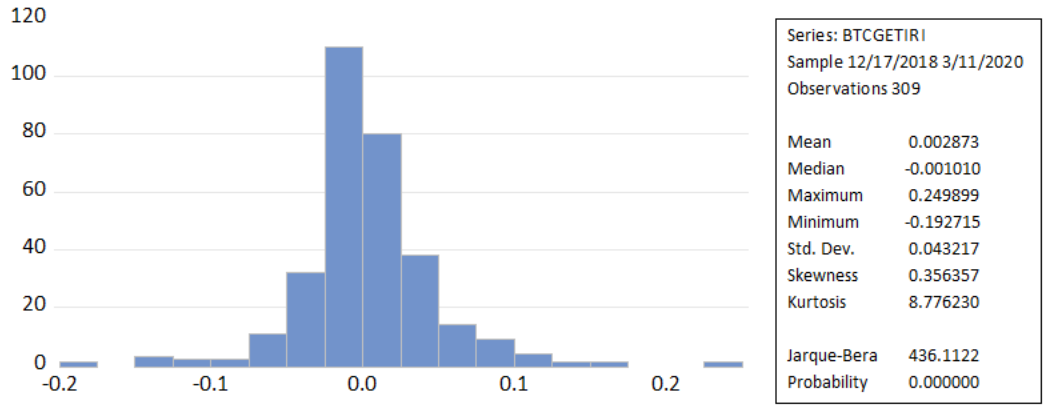
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-16.90126	0.0000
Test critical values:	1% level	-3.988134	
	5% level	-3.424482	
	10% level	-3.135292	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(BISTGETIRI)
Method: Least Squares
Date: 06/03/21 Time: 19:04
Sample (adjusted): 12/19/2018 3/11/2020
Included observations: 308 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BISTGETIRI(-1)	-0.978971	0.057923	-16.90126	0.0000
C	0.001390	0.002305	0.602907	0.5470
@TREND("12/17/2018")	-9.45E-06	1.29E-05	-0.734354	0.4633

R-squared	0.483717	Mean dependent var	-0.000146
Adjusted R-squared	0.480331	S.D. dependent var	0.027845
S.E. of regression	0.020073	Akaike info criterion	-4.969193
Sum squared resid	0.122892	Schwarz criterion	-4.932861
Log likelihood	768.2558	Hannan-Quinn criter.	-4.954666
F-statistic	142.8805	Durbin-Watson stat	1.966342
Prob(F-statistic)	0.000000		



Null Hypothesis: BTCGETIRI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=15)

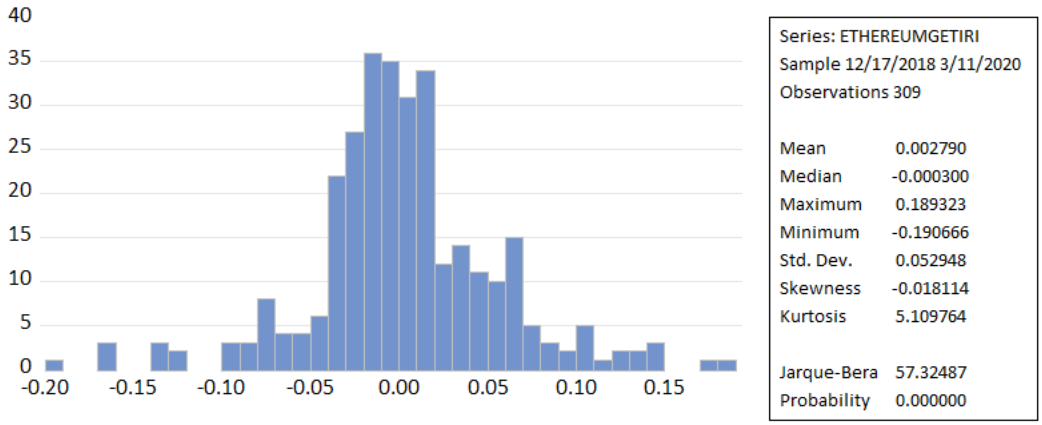
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-17.08677	0.0000
Test critical values:	1% level	-3.988134	
	5% level	-3.424482	
	10% level	-3.135292	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(BTCGETIRI)
Method: Least Squares
Date: 06/03/21 Time: 19:01
Sample (adjusted): 12/19/2018 3/11/2020
Included observations: 308 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BTCGETIRI(-1)	-0.973398	0.056968	-17.08677	0.0000
C	0.007792	0.004970	1.567802	0.1180
@TREND("12/17/2018")	-3.38E-05	2.77E-05	-1.220113	0.2234

R-squared	0.489099	Mean dependent var	-0.000283
Adjusted R-squared	0.485749	S.D. dependent var	0.060052
S.E. of regression	0.043064	Akaike info criterion	-3.442575
Sum squared resid	0.565620	Schwarz criterion	-3.406243
Log likelihood	533.1566	Hannan-Quinn criter.	-3.428048
F-statistic	145.9922	Durbin-Watson stat	2.005008
Prob(F-statistic)	0.000000		



Null Hypothesis: ETHEREUMGETIRI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=15)

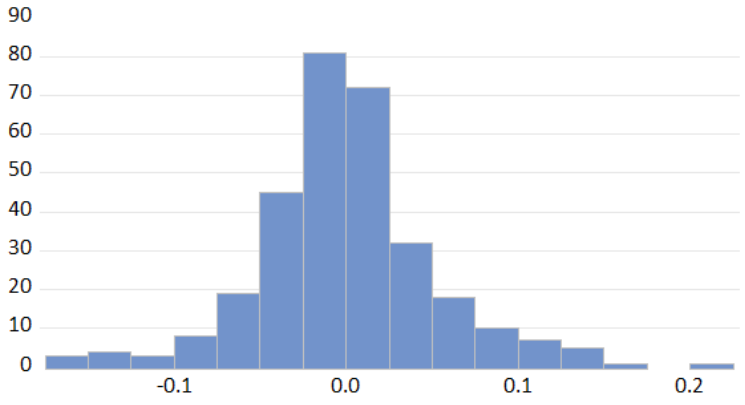
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-16.81890	0.0000
Test critical values:	1% level	-3.988134	
	5% level	-3.424482	
	10% level	-3.135292	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ETHEREUMGETIRI)
Method: Least Squares
Date: 06/03/21 Time: 19:06
Sample (adjusted): 12/19/2018 3/11/2020
Included observations: 308 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ETHEREUMGETIRI(-1)	-0.956545	0.056873	-16.81890	0.0000
C	0.006762	0.006074	1.113352	0.2664
@TREND("12/17/2018")	-2.85E-05	3.39E-05	-0.842592	0.4001

R-squared	0.481208	Mean dependent var	-0.000387
Adjusted R-squared	0.477806	S.D. dependent var	0.072993
S.E. of regression	0.052747	Akaike info criterion	-3.036942
Sum squared resid	0.848573	Schwarz criterion	-3.000610
Log likelihood	470.6890	Hannan-Quinn criter.	-3.022414
F-statistic	141.4523	Durbin-Watson stat	2.012267
Prob(F-statistic)	0.000000		



Series: IOTAGETIRI
Sample 12/17/2018 3/11/2020
Observations 309

Mean	-0.000402
Median	-0.002882
Maximum	0.222735
Minimum	-0.173393
Std. Dev.	0.052709
Skewness	0.114741
Kurtosis	5.080798
Jarque-Bera	56.42316
Probability	0.000000

Null Hypothesis: IOTAGETIRI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=15)

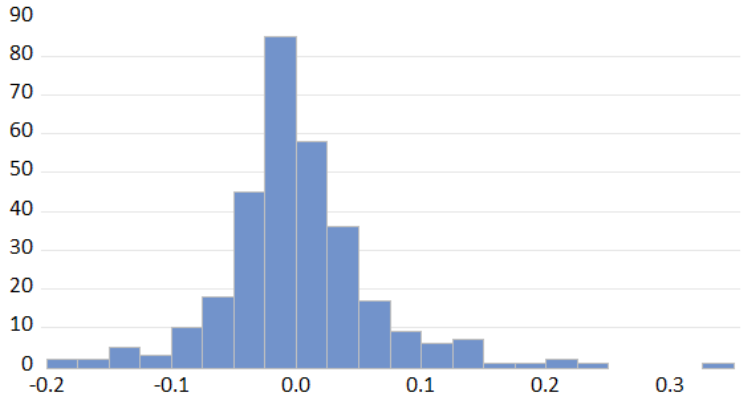
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-15.83039	0.0000
Test critical values:	1% level	-3.988134	
	5% level	-3.424482	
	10% level	-3.135292	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IOTAGETIRI)
Method: Least Squares
Date: 06/03/21 Time: 19:09
Sample (adjusted): 12/19/2018 3/11/2020
Included observations: 308 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IOTAGETIRI(-1)	-0.891606	0.056322	-15.83039	0.0000
C	0.002879	0.005973	0.482015	0.6301
@TREND("12/17/2018")	-2.37E-05	3.34E-05	-0.710733	0.4778

R-squared	0.451149	Mean dependent var	-0.000369
Adjusted R-squared	0.447550	S.D. dependent var	0.069914
S.E. of regression	0.051965	Akaike info criterion	-3.066800
Sum squared resid	0.823610	Schwarz criterion	-3.030468
Log likelihood	475.2873	Hannan-Quinn criter.	-3.052273
F-statistic	125.3530	Durbin-Watson stat	2.018068
Prob(F-statistic)	0.000000		



Series: LITECOINGETIRI
Sample 12/17/2018 3/11/2020
Observations 309

Mean	0.002187
Median	-0.003103
Maximum	0.340852
Minimum	-0.196867
Std. Dev.	0.061542
Skewness	0.840897
Kurtosis	7.603256
Jarque-Bera	309.2369
Probability	0.000000

Null Hypothesis: LITECOINGETIRI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=15)

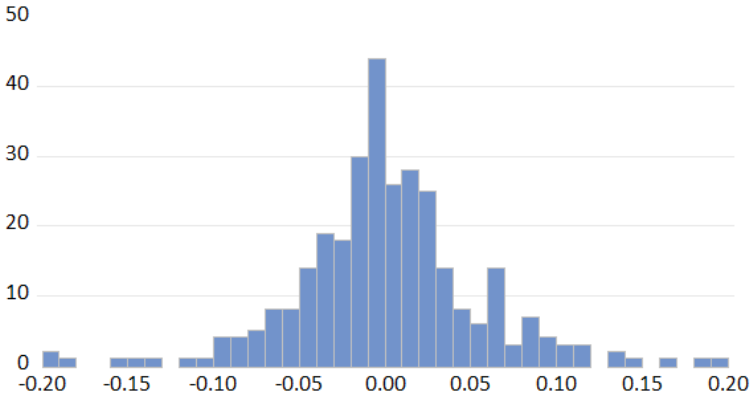
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-18.01731	0.0000
Test critical values:	1% level	-3.988134	
	5% level	-3.424482	
	10% level	-3.135292	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LITECOINGETIRI)
Method: Least Squares
Date: 06/03/21 Time: 19:11
Sample (adjusted): 12/19/2018 3/11/2020
Included observations: 308 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LITECOINGETIRI(-1)	-1.025346	0.056909	-18.01731	0.0000
C	0.011534	0.007059	1.633985	0.1033
@TREND("12/17/2018")	-6.24E-05	3.94E-05	-1.583354	0.1144

R-squared	0.515611	Mean dependent var	-0.000433
Adjusted R-squared	0.512435	S.D. dependent var	0.087596
S.E. of regression	0.061165	Akaike info criterion	-2.740800
Sum squared resid	1.141043	Schwarz criterion	-2.704468
Log likelihood	425.0832	Hannan-Quinn criter.	-2.726273
F-statistic	162.3298	Durbin-Watson stat	2.005568
Prob(F-statistic)	0.000000		



Null Hypothesis: MONEROGETIRI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=15)

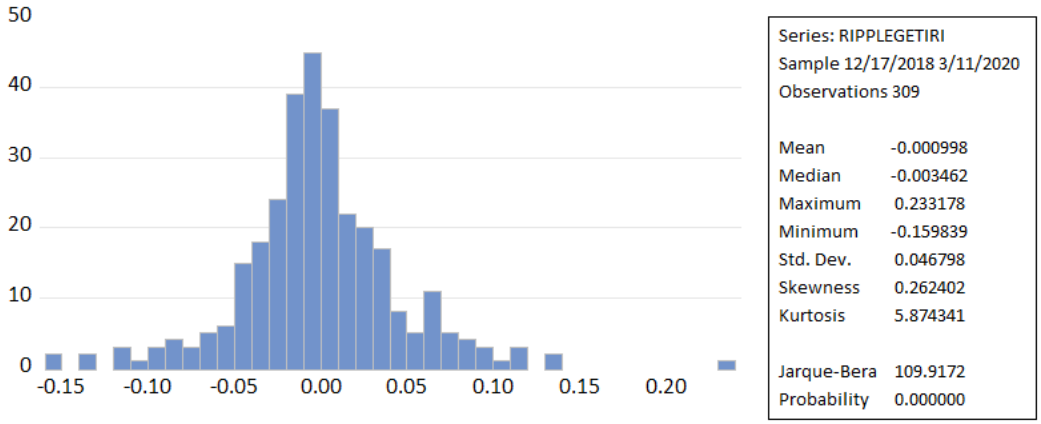
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-18.26596	0.0000
Test critical values:	1% level	-3.988134	
	5% level	-3.424482	
	10% level	-3.135292	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(MONEROGETIRI)
Method: Least Squares
Date: 06/03/21 Time: 19:12
Sample (adjusted): 12/19/2018 3/11/2020
Included observations: 308 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MONEROGETIRI(-1)	-1.039063	0.056885	-18.26596	0.0000
C	0.006115	0.006122	0.998910	0.3186
@TREND("12/17/2018")	-3.45E-05	3.42E-05	-1.009481	0.3135

R-squared	0.522450	Mean dependent var	-0.000378
Adjusted R-squared	0.519319	S.D. dependent var	0.076746
S.E. of regression	0.053209	Akaike info criterion	-3.019486
Sum squared resid	0.863515	Schwarz criterion	-2.983154
Log likelihood	468.0008	Hannan-Quinn criter.	-3.004959
F-statistic	166.8384	Durbin-Watson stat	2.006620
Prob(F-statistic)	0.000000		



Null Hypothesis: RIPPLEGETIRI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=15)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-17.66871	0.0000
Test critical values:	1% level	-3.988134	
	5% level	-3.424482	
	10% level	-3.135292	

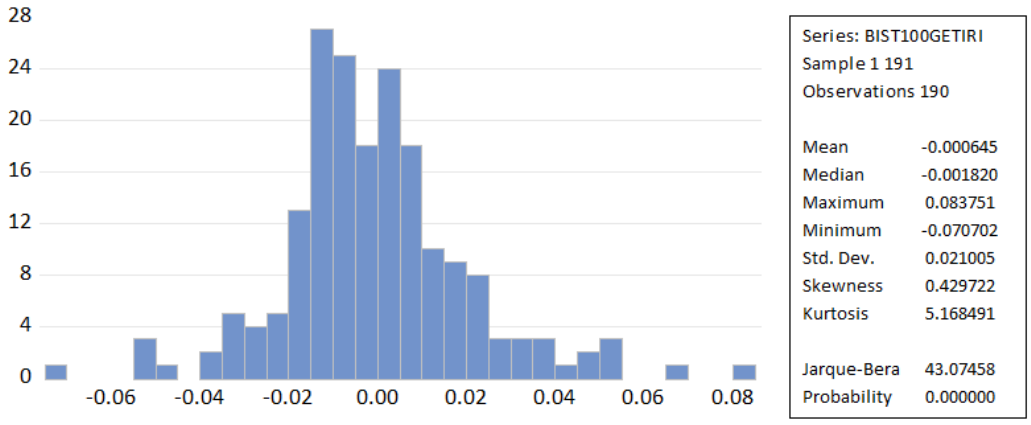
*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RIPPLEGETIRI)
Method: Least Squares
Date: 06/03/21 Time: 19:14
Sample (adjusted): 12/19/2018 3/11/2020
Included observations: 308 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RIPPLEGETIRI(-1)	-0.998792	0.056529	-17.66871	0.0000
C	0.000659	0.005326	0.123762	0.9016
@TREND("12/17/2018")	-1.34E-05	2.98E-05	-0.451877	0.6517

R-squared	0.505896	Mean dependent var	-0.000399
Adjusted R-squared	0.502656	S.D. dependent var	0.065766
S.E. of regression	0.046380	Akaike info criterion	-3.294222
Sum squared resid	0.656075	Schwarz criterion	-3.257890
Log likelihood	510.3102	Hannan-Quinn criter.	-3.279695
F-statistic	156.1395	Durbin-Watson stat	2.019468
Prob(F-statistic)	0.000000		

Post Pandemic Results



Null Hypothesis: BIST100GETIRI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=14)

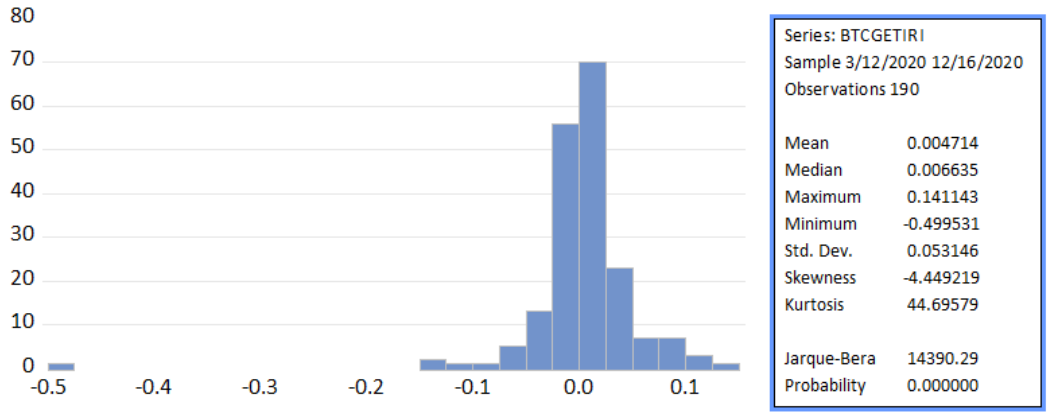
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.69749	0.0000
Test critical values:	1% level	-4.007347	
	5% level	-3.433778	
	10% level	-3.140772	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(BIST100GETIRI)
Method: Least Squares
Date: 06/03/21 Time: 19:16
Sample (adjusted): 3 191
Included observations: 189 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BIST100GETIRI(-1)	-0.873421	0.074667	-11.69749	0.0000
C	-0.003205	0.003090	-1.037219	0.3010
@TREND("1")	2.85E-05	2.80E-05	1.020800	0.3087

R-squared	0.424063	Mean dependent var	0.000409
Adjusted R-squared	0.417870	S.D. dependent var	0.027432
S.E. of regression	0.020930	Akaike info criterion	-4.879494
Sum squared resid	0.081482	Schwarz criterion	-4.828038
Log likelihood	464.1122	Hannan-Quinn criter.	-4.858648
F-statistic	68.47595	Durbin-Watson stat	1.975513
Prob(F-statistic)	0.000000		



Null Hypothesis: BTCGETIRI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=14)

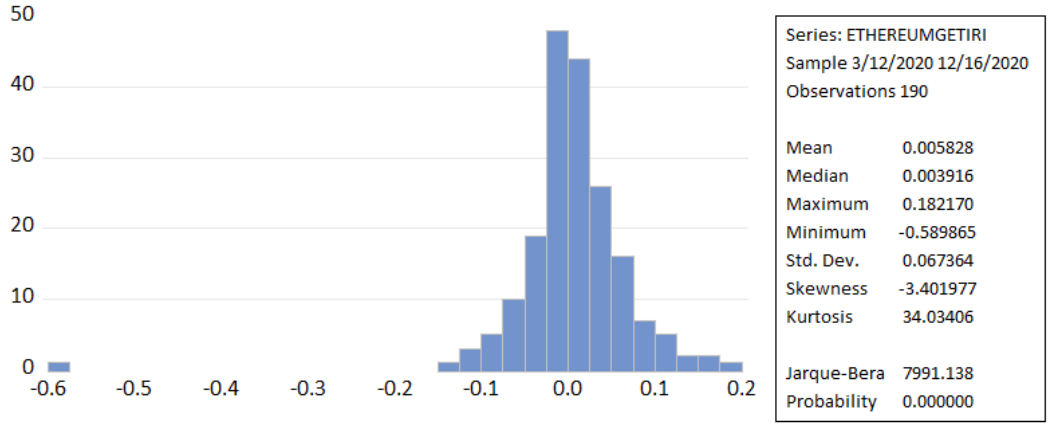
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-23.10688	0.0000
Test critical values:	1% level	-4.007347	
	5% level	-3.433778	
	10% level	-3.140772	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(BTCGETIRI)
Method: Least Squares
Date: 06/03/21 Time: 19:28
Sample (adjusted): 3/16/2020 12/16/2020
Included observations: 189 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BTCGETIRI(-1)	-1.184127	0.051246	-23.10688	0.0000
C	0.009719	0.005502	1.766411	0.0790
@TREND("3/12/2020")	-1.53E-05	4.99E-05	-0.307222	0.7590

R-squared	0.742670	Mean dependent var	0.002687
Adjusted R-squared	0.739903	S.D. dependent var	0.073283
S.E. of regression	0.037374	Akaike info criterion	-3.719923
Sum squared resid	0.259812	Schwarz criterion	-3.668466
Log likelihood	354.5327	Hannan-Quinn criter.	-3.699076
F-statistic	268.4034	Durbin-Watson stat	1.937027
Prob(F-statistic)	0.000000		



Null Hypothesis: ETHEREUMGETIRI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=14)

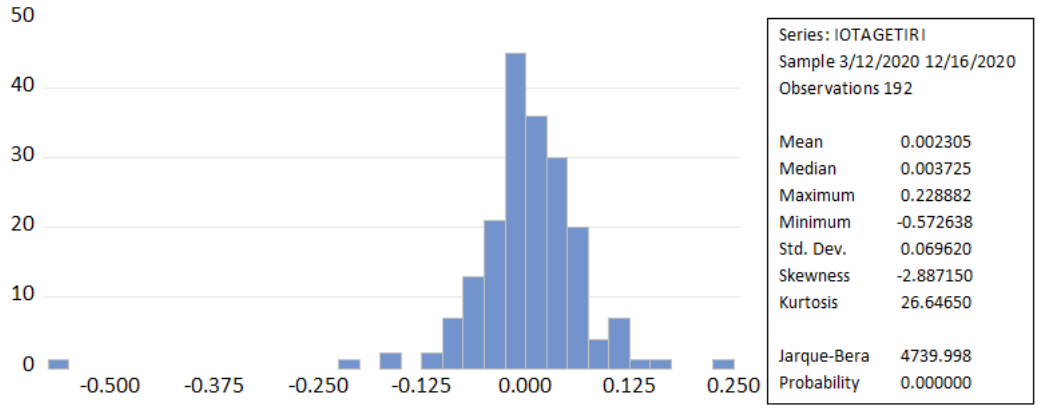
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-20.58819	0.0000
Test critical values:	1% level	-4.007347	
	5% level	-3.433778	
	10% level	-3.140772	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ETHEREUMGETIRI)
Method: Least Squares
Date: 06/03/21 Time: 19:30
Sample (adjusted): 3/16/2020 12/16/2020
Included observations: 189 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ETHEREUMGETIRI(...	-1.135085	0.055133	-20.58819	0.0000
C	0.013702	0.007510	1.824537	0.0697
@TREND("3/12/2020")	-4.10E-05	6.81E-05	-0.601990	0.5479

R-squared	0.696114	Mean dependent var	0.003144
Adjusted R-squared	0.692846	S.D. dependent var	0.092044
S.E. of regression	0.051012	Akaike info criterion	-3.097766
Sum squared resid	0.484014	Schwarz criterion	-3.046310
Log likelihood	295.7389	Hannan-Quinn criter.	-3.076920
F-statistic	213.0358	Durbin-Watson stat	1.834315
Prob(F-statistic)	0.000000		



Null Hypothesis: IOTAGETIRI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=14)

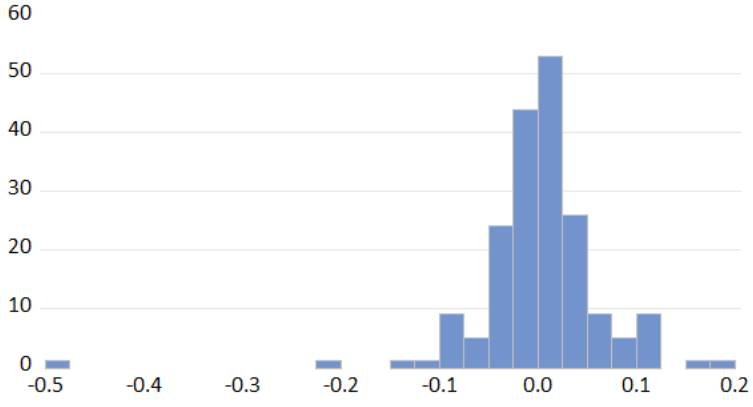
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-19.61880	0.0000
Test critical values:	1% level	-4.006824	
	5% level	-3.433525	
	10% level	-3.140623	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IOTAGETIRI)
Method: Least Squares
Date: 06/03/21 Time: 19:32
Sample (adjusted): 3/16/2020 12/16/2020
Included observations: 191 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IOTAGETIRI(-1)	-1.126571	0.057423	-19.61880	0.0000
C	0.014360	0.008091	1.774881	0.0775
@TREND("3/12/2020")	-9.03E-05	7.25E-05	-1.245056	0.2147

R-squared	0.672806	Mean dependent var	0.003040
Adjusted R-squared	0.669325	S.D. dependent var	0.096079
S.E. of regression	0.055249	Akaike info criterion	-2.938335
Sum squared resid	0.573870	Schwarz criterion	-2.887252
Log likelihood	283.6110	Hannan-Quinn criter.	-2.917644
F-statistic	193.2914	Durbin-Watson stat	1.945907
Prob(F-statistic)	0.000000		



Series: LITECOINGETIRI
Sample 3/12/2020 12/16/2020
Observations 190

Mean	0.002717
Median	0.003724
Maximum	0.198070
Minimum	-0.486404
Std. Dev.	0.061968
Skewness	-2.466465
Kurtosis	23.15350
Jarque-Bera	3408.104
Probability	0.000000

Null Hypothesis: LITECOINGETIRI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=14)

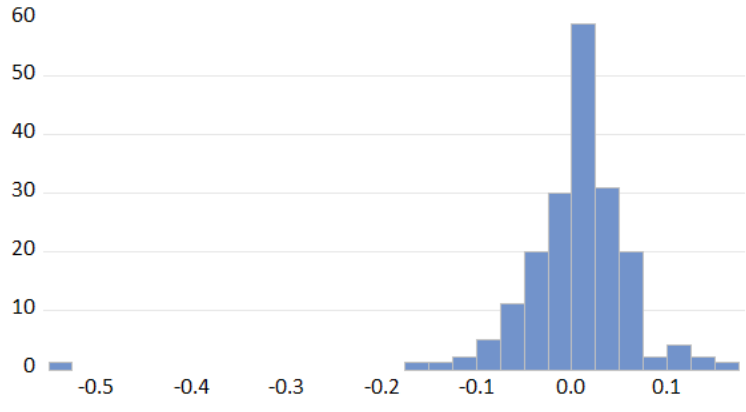
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-20.04112	0.0000
Test critical values:	1% level	-4.007347	
	5% level	-3.433778	
	10% level	-3.140772	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LITECOINGETIRI)
Method: Least Squares
Date: 06/03/21 Time: 19:34
Sample (adjusted): 3/16/2020 12/16/2020
Included observations: 189 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LITECOINGETIRI(-1)	-1.176404	0.058700	-20.04112	0.0000
C	0.005100	0.007348	0.694045	0.4885
@TREND("3/12/2020")	7.27E-06	6.67E-05	0.109107	0.9132

R-squared	0.684363	Mean dependent var	0.002509
Adjusted R-squared	0.680969	S.D. dependent var	0.088309
S.E. of regression	0.049880	Akaike info criterion	-3.142663
Sum squared resid	0.462763	Schwarz criterion	-3.091207
Log likelihood	299.9817	Hannan-Quinn criter.	-3.121817
F-statistic	201.6425	Durbin-Watson stat	1.714142
Prob(F-statistic)	0.000000		



Series: MONEROGETIRI
Sample 3/12/2020 12/16/2020
Observations 190

Mean	0.005372
Median	0.011217
Maximum	0.167454
Minimum	-0.525235
Std. Dev.	0.061024
Skewness	-3.483542
Kurtosis	32.04266
Jarque-Bera	7061.794
Probability	0.000000

Null Hypothesis: MONEROGETIRI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=14)

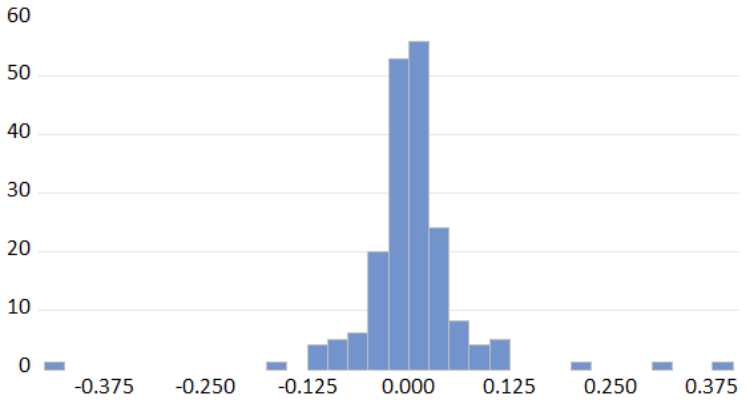
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-23.64382	0.0000
Test critical values:	1% level	-4.007347	
	5% level	-3.433778	
	10% level	-3.140772	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(MONEROGETIRI)
Method: Least Squares
Date: 06/03/21 Time: 19:35
Sample (adjusted): 3/16/2020 12/16/2020
Included observations: 189 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MONEROGETIRI(-1)	-1.261078	0.053336	-23.64382	0.0000
C	0.013054	0.006581	1.983596	0.0488
@TREND("3/12/2020")	-3.59E-05	5.96E-05	-0.602007	0.5479

R-squared	0.751152	Mean dependent var	0.002713
Adjusted R-squared	0.748477	S.D. dependent var	0.089129
S.E. of regression	0.044700	Akaike info criterion	-3.361932
Sum squared resid	0.371648	Schwarz criterion	-3.310476
Log likelihood	320.7026	Hannan-Quinn criter.	-3.341086
F-statistic	280.7226	Durbin-Watson stat	1.901298
Prob(F-statistic)	0.000000		



Series: RIPPLEGETIRI
Sample 3/12/2020 12/16/2020
Observations 190

Mean	0.004262
Median	0.002218
Maximum	0.384786
Minimum	-0.426784
Std. Dev.	0.066207
Skewness	0.219131
Kurtosis	19.67373
Jarque-Bera	2202.460
Probability	0.000000

Null Hypothesis: RIPPLEGETIRI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=14)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-13.83633	0.0000
Test critical values:	1% level	-4.007347	
	5% level	-3.433778	
	10% level	-3.140772	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RIPPLEGETIRI)
Method: Least Squares
Date: 06/03/21 Time: 19:37
Sample (adjusted): 3/16/2020 12/16/2020
Included observations: 189 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RIPPLEGETIRI(-1)	-0.891358	0.064422	-13.83633	0.0000
C	0.005584	0.008586	0.650327	0.5163
@TREND("3/12/2020")	4.77E-06	7.80E-05	0.061230	0.9512

R-squared	0.508727	Mean dependent var	0.001934
Adjusted R-squared	0.503445	S.D. dependent var	0.082714
S.E. of regression	0.058286	Akaike info criterion	-2.831174
Sum squared resid	0.631883	Schwarz criterion	-2.779718
Log likelihood	270.5460	Hannan-Quinn criter.	-2.810328
F-statistic	96.30427	Durbin-Watson stat	1.741560
Prob(F-statistic)	0.000000		