Interactions among Return and Market Capitalization of Bitcoin and Turkish lira

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Submitted to the
Institute of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of

Master of Science
in
Banking and Finance

Eastern Mediterranean University
September 2022
Gazimağusa, North Cyprus

Approval of the Institute of Graduate Studies and Research

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ABSTRACT

The aim of this thesis is to distinguish the interactions between return and market capitalization of Bitcoin and Turkish lira, a quantitative study was conducted out. In order to conduct the study, the daily returns and market capitalization of Bitcoin and Turkish Lira were used for the timespan of May 31, 2019, to May 29, 2021. The thesis goal was accomplished using several methods. Initially, applying descriptive statistics to find out whether the data series are normally distributed or not. Second, unit root tests were applied to test the integration order and observe whether the variables are stationary or not, in addition to determining if the data have constant covariance or rather variance over time. Lastly, the recently discovered Granger causality in quantiles approach by Troster (2018) was applied. Furthermore, the findings demonstrate that Returns of Bitcoin have a significant impact on the Turkish lira and vice versa, indicating the cryptocurrency's predictive power over the exchange rate of the Turkish lira.

As a recommendation, the returns of cryptocurrencies should be closely monitored by investors who actively trade on the Turkish exchange market. Moreover, investors can follow the market capitalization of Bitcoin so they can have some ideas about returns of bitcoin for their investment decision.

Keywords: Cryptocurrency, Returns of Bitcoin, Market Capitalization, Turkish Lira, Granger Causality in Quantiles.

ÖZ

Bu çalışmanın amacı Bitcoin ve Türk lirasının getiri ve piyasa değerleri arasındaki etkileşimin ampirik bir çalışma ile incelenmesidir. Çalışmanın gerçekleştirilebilmesi için 31 Mayıs 2019 ile 29 Mayıs 2021 dönemini kapsayan değişkenlerin günlük verileri kullanılmıştır. İlk olarak, değişkenlerin normal dağılıp dağılmadığına bakılmış, ardından birim kök testleri uygulanarak değişkenlerin durağan olup olmadıkları incelenmiştir. Son olarak ise Troster (2018) tarafından geliştirilen Granger Kantil Nedensellik testi ile Bitcoin ve Türk lirası getiri ve piyasa değerleri arasındaki etkileşim incelenmiştir. Elde edilen sonuçlara göre Bitcoin getirilerinin Türk lirası üzerinde ve Türk lirası getirilerinin Bitcoin üzerinde anlamlı bir ilişkisi olduğu sonucuna varılmıştır. Bu sonuçlara göre kripto para biriminin Türk lirası döviz kuru üzerinde önemli bir tahmin gücü olduğu gözlemlenmiştir. Dolayısıyla, kripto para birimi getirilerinin ve piyasa değerinin aktif olarak Türk lirasına yatırım yapan yatırımcılar tarafından dikkate alınması önerilmektedir.

Anahtar Kelimeler: Kripto Para Birimi, Bitcoin, Türk Lirası, Granger Causality in Quantiles.

DEDICATION

To My Family …

ACKNOWLEDGEMENT

I want to express my gratitude to my supervisor, Assist. Prof. Dr. Nigar Taşpnar, for her overall supervision, valuable guidance, feedback, and direction throughout the thesis writing process. She provided me bright information and research techniques to apply.

I also want to thank my family and friends, especially my mother, father, sisters, who helped and supported me throughout the process and made it all possible.

Last but not least, I want to thank everybody who supported and encouraged me to work on this thesis.

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BTC	Bitcoin
EX	Turkish lira Exchange rate
MCBTC	Market Capitalization of Bitcoin
OLS	Ordinary Least Square
RBTC	Returns of Bitcoin
USD	United States Dollar

Chapter 1

INRODUCTION

1.1 The history and evolution of cryptocurrency markets

Money as a part of the finance world, it is one of the most complicated market systems, and no physical or legal organization is unaffected by monetary interactions on a daily basis. Money is perhaps one of the most important innovations of human intellect, with no analogues in live nature. The existence of money determines the whole structure of the modern economy. Money arose from commerce, and as trading is one of humanity's oldest activities, the monetary system's roots can be traced back millennia, but its structure like the kind of money itself has evolved numerous times (Guzikova & Lioukevich, 2018). Many artifacts have been assigned value and regarded currency in their own time, from cowrie shells to gold coins to paper money. Supply, safety, and convenience are the three most important aspects of the currencies under consideration. There have even been modifications in how currency can be moved, such as by checks, debit cards, or phone clicks. Money or currency can be anything that can be utilized to avoid bargaining by removing the necessity for a common coincidence of want. Bitcoin and several other cryptocurrencies are currencies in some areas of business and commerce under this definition (Allen & Bryant, 2019).

Although bitcoin and its underlying technology will most certainly become more streamlined and beneficial in the future, it is currently a very divisive topic. Cryptocurrency is the obvious next stage in the evolution of currency in a culture that

is getting more electronic, digital, and virtual every day. Cryptocurrency, in one form or another, may become the primary form of currency in the future. The market must first mature before this can happen (Allen & Bryant, 2019).

The global financial system has undergone significant changes as a result of advances in information and internet technologies. Modern financial instruments are employed more than traditional money and financial instruments in the new financial system. Economic and financial crises have occurred in both money and capital markets as a result of the introduction of new financial instruments, as well as severe structural issues in the economy (Dayi, 2019). The digital economy era has contributed to the recent rapid growth of the global financial system. In addition to new threats, this presents new opportunities for society. A new financial instrument called cryptographic money, or cryptocurrencies, has been produced as a result of advances in computer technology. Despite being a relatively new idea, virtual money has aroused the interest of many people. Additionally, there are various perspectives on their economic impact. Given the widespread use of digital technology in contemporary life, some people view it favorably. Others, on the other hand, are opposed to the use of cryptocurrencies because they think that digital money will harm the world's long-standing economic and financial associations (Luchkin et al., 2020), Due to the characterizing of the current stage of world growth by the fast functioning of all areas of society. As a result, today's society strives to be progressive and contemporary, and as a result, the world exposes us to cryptocurrency, a new form of money that is gaining popularity. Currently, mankind is attempting to develop a more advanced method of completing any financial transaction with the least amount of risk. Now, the cryptocurrency is in the same city as the first paper money when the notion

of "manufacturing money" was initially popularized. As a result, cryptocurrency computations become routine after a given amount of time (El Mahdy, 2021), the devaluation of the national currency resulted in poverty and the necessity to discover new methods to save money. The hunt for new forms of information-based financial instruments has escalated due to the rapid advancement of IT technology and the information economy. Cryptocurrency is one example of such a financial innovation. Moreover, the global dynamics of bitcoin market capitalization growth demonstrate that virtual currencies have their own position in payment systems and are competitive and promising financial instruments. Bitcoin is the most successful cryptocurrency application in the information economy to date (Perchuk et al., 2019).

For two reasons, cryptocurrencies have drawn the most attention. This mainly has to do with the idea of independence from other parties, like the government or financial institutions. Besides that, one of the most distinctive features of cryptocurrencies is that they act as a virtual currency, which is important in terms of potential investment profits, both legal and illegal. The cryptocurrency that is currently used the most on the planet is bitcoin. Cryptocurrencies are frequently used as examples when discussing the issue because they have the largest market capitalization and rate. The most well-known cryptocurrency in the universe is Bitcoin, was founded in 2008 where it is unknown who created it. However, more than 1500 cryptocurrencies are currently listed on more than 7,000 unique exchanges. Each one has its own set of benefits and, regrettably, drawbacks. A substantial number of cryptocurrencies, particularly local ones, have a brief history of operation before disappearing from the market. It has a detrimental impact on the cryptocurrency system as a whole, as there are numerous cases of it being used for financial fraud. There are, without a doubt,

advantages, the focus and full use of which would necessitate specific legal and technological solutions (Miciuła, 2019).

Compared to fiat money, cryptocurrency has a number of benefits. For starters, It is a self-governing currency, which indicates that the fundamental system is built on a complicated network of connected users that is impossible for any organization or government to control at any given time. Another benefit is that, in contrast to fiat currency, Cryptocurrencies are resistant to manipulation attempts. Owing to the fact that it has a fixed supply, that forbids any manipulation, including overprinting.

Cryptocurrency also has no transaction fees unlike fiat money, Virtual currencies are only printed virtually, which eliminates the need for printing and production costs. Another important factor in cryptocurrency's favor is the level of security it provides when compared to fiat money. In addition, it prevents any attempt at fraud because each transaction is verified and acknowledged as legitimate using blockchain technology. (Corelli, 2018).

1.2 Definition, history and evolution of bitcoin

The time on October 31st, 2008, when Satoshi Nakamoto posted the document "Bitcoin: A Peer-to-Peer Electronic Cash System," can be regarded as Bitcoin's birth. However, Bitcoin is not the first virtual money; several others have been developed throughout the years, but none have achieved the same level of success as Bitcoin. A software to use Bitcoins as a medium of exchange was released in the beginning of 2009. The establishment of this crypto currency was intended to allow users to conduct transactions without the involvement of financial institutions, which operate as middlemen in monetary transactions. This currency is built on a cryptographic

mechanism that assures both sides that the transaction is genuine, and the Bitcoin buying process is open to anybody, similar to fiat money that can be traded from hand-to-hand (Chohan, 2022).

When a user downloads the Bitcoin software on their computer, it is connected to other Bitcoin users in a decentralized network over the internet. Transactions can be carried out using two distinct keys, one public and the other private. The private one will be kept safe on the user's computer, while the public one will have an address that other users will be able to use to send Bitcoins. A Bitcoin transaction will take place between two public keys (addresses), but the personal computer's private key will be used to decrypt the Bitcoin before it can be utilized. Block Chain, a massive database maintained by a decentralized network of miners, is where these transactions are stored (Franco, 2014).

Although it wasn't the first attempt at a digital currency, Bitcoin was the most effective because many important stores now accept it. Bitcoin is a peer-to-peer virtual currency that operates on a peer-to-peer network. It has the potential to become a significant form of e-commerce payment because cryptographic algorithms, not governments, guarantee its security, as well as a fierce rival to conventional money-transfer services. Bitcoin benefits the entire world, not just a single or a small number of nations (Rose, 2015).

Bitcoin is a peer-to-peer electronic cash system. In a conventional payment system, like a credit card, like Visa, MasterCard, or even PayPal, there is a for-profit company in the middle that centralizes payments, runs the network, and makes sure it is dependable and secure. Bitcoin on the other hand, operates according to a completely

different model, with a cryptographic algorithm providing assurance of its security. (Rose, 2015).

1.3 Importance of bitcoin for economy and stock markets

Cryptocurrencies have been studied and debated for a long time, but they're only recently receiving widespread acceptance as financial instruments that non-crypto enthusiasts can use. Cryptocurrency has the potential to enable social and economic growth all over the world, even in underdeveloped nations, by improving access to finance and financial services. Bitcoin and other cryptocurrencies, in particular, have a very practical but disruptive quality that has started to slowly but steadily interfere with the current financial system. Cryptocurrencies are becoming more prevalent in economic activities where a whole industry has already been built around them and is regulated by agencies tasked with keeping an eye on all digital coin exchanges worldwide. The phenomenal rate at which the bitcoin industry is expanding can be attested by early adopters who became wealthy and discovered opportunities to increase their financial standing. The most well-known of these cryptocurrencies, Bitcoin, has already helped a lot of people and businesses flourish, and many of them rely on trading as a source of income. The economy is gradually adapting to these needs, and cryptocurrencies have a lot of potential to meet them (Lu, 2022).

Businesses all over the world can benefit from cryptocurrency in a number of ways. It has made it simpler for businesses to expand into international markets as opposed to just domestic ones. Developing nations have benefited greatly from this because it has given vendors the chance to establish trust and relationships with markets that were previously closed off. Furthermore, introducing a new technology-based way of doing business is cryptocurrency. The market has attracted a lot of new buyers and improved

the effectiveness of global trade. Even though the market has been growing, there is still a long way to go before it is a more widely accepted form of payment (Davis, 2021).

In conclusion, bitcoin's importance is linked to the advancement of domestic payments and the quick growth of alternative forms of international transfers. Bitcoin appears to have taken on the role of investment asset recently, based on its price appreciation, which is not the consequence of speculation because it is terrified and easily interchangeable. Bitcoin, on the other hand, is thought to be a useful vehicle for money laundering and terrorism financing, according to some sources (Cortez & Tulcanaza, 2018).

1.4 Macroeconomic determinants of bitcoin returns including exchange rate and bitcoin market capitalization as a determinant

Bitcoin has several characteristics that could make it useful in commerce, the most important of which is its cheap transaction costs. "There is low, if any, transaction costs connected with transfers" because there is basically no middleman when using Bitcoins. When compared to typical payment options, which might have much higher transaction fees, this is a huge savings. As a result, Bitcoin may be a more viable alternative payment option in some circumstances. In the industrialized world, this has ramifications, such as allowing consumers and businesses to conduct online transactions with little or no fees, lowering overall expenses. Bitcoin, in particular, could provide a simpler and more ubiquitous payment mechanism for transactions that need currency conversions where sometimes resulting in exchange rate costs (Chu et al., 2021).

Bitcoin has advantages as a global payment standard, but its erratic price raises the possibility that it may still have issues with traditional currencies. Bitcoin could therefore be regarded as a rate of exchange for different currencies. Furthermore, three conditions for Bitcoin to be considered a currency, namely, being a unit of account, a medium of exchange, and a store of value, are not met. Bitcoin's international adoption remains low, showing that "few individuals utilize it widely as a medium of exchange." Bitcoin can be traded on a variety of exchanges at varying prices; the daily exchange rate against the US dollar has no association with the rate of the US dollar versus other major currencies (Yermack, 2015).

Urquhart & Zhang (2019) draw attention to the potential use of leading cryptocurrencies as a form of currency hedging, through inflation, cryptocurrencies may be linked to other currencies, such as the American dollar. In fact, investors actually hoard their money in long-term, stable investments during difficult times due to the inflation caused by the government's excessive money issuing.

1.5 The sample selection

One factor contributing to the volatility of gold returns is the fact that the price of gold in nations like Turkey is impacted by both the rising USD exchange rate and the rising global gold prices. The demand for gold is rising in Turkish society, particularly during times of rising economic and political risks, and it can be said that the USD currency and its demand in Turkey have a volatile structure. Moreover, Turkey is one of the nations with a high demand for the USD due to a number of factors, including the fact that a sizable portion of its exports are paid for with the USD. However, one of the most significant factors contributing to the instability of the USD exchange rate is the US Federal Reserve's (FED) decision to gradually reduce its expansionary monetary

policies, which it instituted in response to the global financial crisis of 2008. And the Fed has been tightening monetary policy and gradually raising interest rate levels since October 2014. (Cikrikci and Ozyesil, 2018).

In the case of Turkey, it is possible to acknowledge that Bitcoin has evolved into a different type of savings and investment tool. As a result, it is reasonable to conclude that the moment has come for banks and the administration of the economy to put in place the required legislative framework in this area. The validity and recognition of crypto coins in official and private transactions should be improved in order for them to become more prevalent and stable. It's worth noting that Bitcoin has a lot of promise for preventing tax evasion, ending the black market, and lowering intermediation costs. Turkey as a nation can profit from China's and Japan's expertise in this field. (Cikrikci & Ozyesil, 2018).

Turkey's rising infatuation with Bitcoin may be due to political instability18 throughout the Turkish Republic's history, but only time will tell if this is a good fit or a prescription for disaster, because geopolitical risks remain negative and US-Turkey relations remain strained as a result of Turkey's military operations in Syria and the looming sanctions imposed by the US, the number of Bitcoin holders in Turkey will continue to rise. Currently, one in every five people owns Bitcoin or other digital coins. Nonetheless, a significant drop in the price of Bitcoin, comparable to the one that occurred between December 2017 and December 2018 (when the price fell from about $20,000 to $3,236), would result in a terrible financial disaster for Bitcoin holders (Taskinsoy, 2019).

The markets for fiat money and cryptocurrencies are a complex system in the fields of economics and finance. On the other hand, the global Covid-19 pandemic has had a significant negative impact on financial markets all over the globe. The Covid-19 crisis has specifically hurt the potential for cryptocurrencies to serve as diversifying investments. (Umar and Gubareva, 2020). Many Turks have resorted to cryptocurrencies in the last year, from construction laborers to hairdressers to serious merchants. Cryptocurrency market transactions in Turkey are estimated to be worth $1-2 billion each day. According to many studies, between 16 and 20% of Turkish population will use or own cryptocurrencies by 2020. The number of cryptocurrency investors in Turkey is estimated to be about 5 million, according to certain estimates (Ragip, 2021).

One of the main reasons for cryptocurrency's appeal in Turkey is its ability to guard against inflation. Many people were concerned about currency depreciation as governments and central banks throughout the world sought to mitigate the severe economic harm caused by the Covid-19 epidemic by opening the stimulus faucets to flow forth trillions. The usage of gold as a store of wealth has been one of the go-to safe havens in the setting of poor faith in fiat money. But what happened instead was the massive adoption of cryptocurrencies like Bitcoin, which began to act as a digital reserve asset, earning it the moniker "digital gold" as its value skyrocketed (one Bitcoin is presently worth $60,506). And it was the same in Turkey, where investors believe a weak currency and inflationary pressures, as well as the promise of fast returns, drove demand (Amar, 2021). Moreover, the year 2018 saw a major sell-off in cryptocurrencies, with bitcoin falling by as much as 33% in November, and its longevity in nations like Turkey suggests that money and the global financial system

have a bright future. Trading volumes on Turkish cryptocurrency platforms have grown by 37% since October, when bitcoin experienced record losses (Sara, 2018).

1.6 The aim of the study

The aim of this thesis is to investigate causal relationship between Return of Bitcoin, Market capitalization of Bitcoin and Exchange rate of Turkey for period 31 May 2019 to 29 June 2021. However, the research is motivated by certain trend models to explore the influence of Bitcoin as a cryptocurrency on the Turkish lira exchange. By applying a Granger-causality in quantiles analysis that evaluates causal relations in each quantile of the distribution. This method provides a more adaptable approach to obtaining a more complete picture of Exchange rate market and Bitcoin returns, allowing us to distinguish between causality affecting the conditional distribution's median and tails.

1.7 The gap in the literature and the contribution of the study

Contribution of this thesis is using Granger-Causality approach to study the effect of Bitcoin on the Turkish exchange rate volatility. To our knowledge, there is limited number of studies handling the effect of Cryptocurrency on economy of Turkey.

1.8 Structure of the study

The rest of this research is structured as follows: starting with the introduction as section 1. The literature, earlier researches are all reviewed in Section 2. Section 3 provides a methodology and data description. The outcomes are shown in Section 4. Discussion conclusion and suggestions are presented in Section 5.

Chapter 2

LITERATURE REVIEW

While Bitcoin the first cryptocurrency, was first envisioned since the financial crisis of 2008, it quickly attracted traders, academics, and practitioners from around the world. Since Bitcoin has the most developed and largest market capitalization, previous studies have only focused on it. Because Bitcoin is viewed as a new speculative asset, its effectiveness has recently attracted growing interest. The majority of studies looked into the effectiveness of the Bitcoin market (Delfabbro et al., 2021).

Different jurisdictions have different levels of usage and domestic and global impacts of crypto-assets, but adoption has unquestionably increased quickly. Various international financial governing bodies have emphasized the growing risk to global financial stability, with potential macroeconomic impacts, as this trend persists despite high volatility. The potential macroeconomic effects of cryptocurrencies and stable coins, as well as the corresponding policy responses, need to be evaluated promptly and prudently. (Shin and Rice, 2022).

2.1 Cryptocurrencies and macroeconomic determinants

There are several studies in the literature which investigate the relationship between macroeconomic determinants and cryptocurrencies. Andrikopoulos et al. (2018) studied the relationship between the returns and volatility of cryptocurrencies utilizing concepts from the inflation theory. By using daily data for the top six cryptocurrencies [Bitcoin (BTC), Ethereum (ETH), Ripple (XRP), Bitcoin cash, EOS, and Litecoin

(LTC)] in terms of market capitalization. But due to a lack of data, Bitcoin Cash and EOS aren't included in their sample. Data on Ripple and Bitcoin are available since 2010, but data on Litecoin is only available since 2013. Data for Ethereum is only available as of January 9, 2015. Due to this, the data period spans from January 9, 2015, to February 28, 2018. through using GARCH models application. According to the findings, Bitcoin and Litecoin returns behave as predicted by the Friedman-Ball hypothesis for a currency subject to inflation, showing a causal relationship between returns and volatility. For Ethereum and Ripple, however, the relationship runs from volatility to returns. Beside the study of Oh and Nguyen (2018), examined how cryptocurrency can serve as a medium of exchange, a unit of account, and a store of value, which are the three basic roles of money. Several techniques were used, including an IS-LM and MB models. They provided a money market model that takes cryptocurrency into account when calculating total money supply and demand. The model also looks at instances where governmental entities issue cryptocurrency as well as instances where non-governmental organizations can do so. By using an IS-LM model, they discovered that the introduction of a new cryptocurrency causes the total amount of money in circulation to rise while interest rates fall. On the other hand, according to the MP model, tightening monetary policies can be used to achieve target interest rates and counteract the effects of cryptocurrencies. This further clarified how cryptocurrency affects inflation.

Cheng and Yen (2020) examined the connection between cryptocurrency returns and economic policy uncertainty (EPU). Monthly data was used for Ripple (XRP), Litecoin (LTC), Ethereum (ETH), and Bitcoin (BTC) with the monthly EPU index. The sample period spans February 2014 to June 2019, while Ethereum spans

September 2015 to June 2019. They investigated how various countries' EPU indexes can predict the returns of significant cryptocurrencies. In accordance with the data used in their research, the EPU index in China can predict bitcoin returns, whereas the EPU indexes in the US, Japan, and Korea cannot. Furthermore, it appears that the September 2017 change in China's cryptocurrency trading regulations has enhanced the EPU's ability to predict Bitcoin returns. As a result, the findings of their research can help regulators regulate cryptocurrency market activity. Another study by Conlon et al. (2021) attempted to create a time series model that depicted the relation between cryptocurrency prices and forward inflation expectations. Using wavelet time-scale techniques besides regard to the vector autoregressive (VAR) model to measure the size, scope, direction, and any lead-lag effects between Bitcoin as well as timeline forward inflation expectations. Using yearly data for Bitcoin for a period of 18th July 2010 to 30th April 2021, and the Ethereum data spans the period from August 8, 2015, to April 30, 2021, including 5-Year Forward Inflation Expectation Rate (T5Y1FR). Focused on brief period of covid-19 crisis. The empirical findings indicated a concise positive relationship between forward inflation expectations and both Bitcoin and Ethereum, coinciding with the COVID-19 crisis's early stages. They discover very little evidence outside of this time frame that cryptocurrencies act as a hedge during times of rising forward inflation expectations. Moreover, these results imply that cryptocurrencies do not act as a hedge against increases in forward inflation expectations, but rather may derive information about prices from variables that affect forward inflation expectations frequently in times of crisis. Accompanied with a study about the cryptocurrency returns and inflation by Smales (2021), examined the relationship between changes in inflation expectations and the returns on Bitcoin and other cryptocurrencies. Using daily data for Dogecoin (DOGE), Binance Coin (BNB),

Ethereum (ETH), Bitcoin (BTC), and XRP (XRP), and the SPDR gold trust ETF (GLD), plus applying two different market-implied US inflation expectation estimates. First, they used the breakeven inflation rate calculated using constant maturity 5- or 10- years Treasury securities as well as constant maturity 5- or 10- years treasury inflation-indexed securities. The 5- and 10-year inflation swap rates are used in step two. The period of study spans from January 2013 to September 2021. The key findings show that changes in US inflation expectations are positively correlated with cryptocurrency and gold returns. This result holds after accounting for uncertainty in economic policy and financial markets. However, for short-term inflation expectations and when market-implied expectations or PCE are lower than 2%, the identified relationship is significant, unlike with gold. The findings imply that, under specific conditions, cryptocurrencies might be a better option than gold for hedging inflation.

2.2 Cryptocurrencies and stock markets

As the appeal of digital currencies, as well as their supply, demand, and values, changed significantly over time and had a greater impact on financial markets, studies on the price formation of cryptocurrencies became more relevant. Wong et al. (2018) studied whether digital currencies like Bitcoin (BTC), Litecoin (LTC), and Ripple (XRP), correspondingly to additional asset classes like stocks, gold, bonds, whether they are reliable investments that could be used as a hedging instrument (S&P 500), data runs from May 8, 2013, to August 1, 2018. The key findings show that Ripple could be used as a diversifier, while Bitcoin, Litecoin, and other cryptocurrencies can be used as hedges. Bitcoin has a strong negative correlation with the S&P 500 while having only a weak correlation with the other asset classes, making it a useful hedge against equities, bond funds, and gold. On the other hand, in order to protect against these financial assets, Litecoin has a strong negative correlation with bonds and gold

as well as a weak correlation with equities. Concluding that while Ripple might be a diversified investment, Bitcoin and Litecoin are hedging instruments. Another study by Tibay et al. (2018) examined the rapidly changing relationships between Bitcoin, the exchange rate, and the closing prices of the Philippine Stock Exchange. The Vector Auto Regressive (VAR) Model and the ADF along with Granger causality were three of the methods used with daily data runs from 1st of January 2014 to 26th of May 2018. According to the findings of the vector autoregressive (VAR) model demonstrate that a single increase in Bitcoin closed prices can cause increases in the Philippine stock exchange index for day 5 and decreases in the Philippine stock exchange index for two succeeding days, day 9 and day 10. However, this surprise does not last for very long on the Philippine Stock Exchange 25, due to its high fluctuation and unpredictability. whereas a one-time rise in the peso to dollar exchange rate will only result in a two-day rise in the Philippine stock exchange. Furthermore, the researchers have demonstrated that there is a connection between the exchange rate and the price of Philippine stocks. Besides that, it has been discovered that Bitcoin and exchange rates can account for a sizable portion of the stock market's variability. Beside the study of Tiwari et al. (2019) investigated the cyclical correlations between the markets for six cryptocurrencies and the S&P 500 index. Using daily data for Bitcoin, Litecoin, Ethereum, Stellar, Ripple, Dash, and the 500 S&P prices index with time spans from August 7, 2015 to June 15, 2018. By applying a copula-ADCC-EGARCH model, the researchers found that each cryptocurrency and the S&P 500 pair exhibit asymmetric volatility and weak positive correlations. This finding suggests that volatility in the cryptocurrency and equity markets reacts more powerfully to negative than the positive impacts. Demonstrating that bitcoin acts as a hedge against the hazard of the S&P 500 stocks sector. However, a study about the dynamic

interaction between various traditional financial assets and cryptocurrencies by Charfeddine et al. (2020), by applying various time-varying copula techniques and GARCH models with dynamic conditional connection. Based on daily data spans from July 18, 2010, to October 1, 2018 for the Bitcoin and for the Ethereum starting from 1st of September, 2015 to 1st of October, 2018. According to their analysis of portfolios demonstrates that, in the majority of the cases taken into account, cryptocurrencies are pretty poor hedging instruments. Moreover, they discovered that the correlation between cryptocurrencies and traditional assets is susceptible to shocks in the external financial and economic environment.

Sami and Abdallah (2020) analyzed how the cryptocurrency market has affected the Middle East and North Africa (MENA) region's stock market performance. Using a comparative study based on a daily data for period of 2014 to 2018. To achieve the study's objective, two strategies have been used. firstly, the tests strategy, which makes use of cointegration analysis and panel-specific forms of Granger causality and the second is the regression strategy, which makes use primarily of the instrument factor with generalized method of moments (IV-GMM) approach. The empirical findings indicated that there is a considerable correlation between the MENA region's stock market performance and the cryptocurrency market. Additionally, for the Gulf nations that assert complete adherence to Islamic Sharia law, each 1% increase in cryptocurrency returns lowers stock market performance by 0.15%. on the other hand, the stock market performance rises by 0.13% for every 1% increase in cryptocurrency returns, in contrast, for non-Gulf (other MENA) countries that have discretion over how to apply or disregard Islamic Sharia law. Accompanied with a study about the varying impacts of Bitcoin's up-side and down-side volatility on Sharia-compliant

stock markets in bull, neutral, and bear market conditions, by Ahmed (2021) applying a quantile regression approach based on daily data for the period starting on January 6, 2014, and ending on January 8, 2021. According to the findings for developed markets, upside volatility tends to have immediate and lag-time negative effects on Islamic stocks more frequently during bearish market conditions than during bullish market conditions, whereas the downside counterpart has a positive impact on returns during both bearish and bullish market conditions for Sharia-compliant equities. On the other hand, they find that for emerging markets, the positive (negative) effects of Bitcoin's upside (downside) volatility on returns have lagged across all market regimes. Followed study by Kumah and Odei (2021) examined the level of integration between African stock markets and cryptocurrencies. Applying several methods such as wavelet-based and frequency domain spillover index. Using daily data for Bitcoin, Litecoin, Ethereum and seven African stock market. The sample period runs from August 10, 2015 to February 2, 2019. According to results from wavelet-based methods, there is little market integration at higher frequencies, but at medium and lower frequencies, there is perfect integration. Moreover, the finding has the implication that African stock markets are particularly vulnerable to medium-term cryptocurrency market disruptions, and that foreign investors looking to use cryptocurrencies to manage their market risks in African stock markets may need to focus on the short term.

Maitra et al. (2022), investigating the relationship and risk of Bitcoin and Ethereum's impact on stock market returns both before and after COVID-19. Applying the best-fit copula for both static and cyclical dependence between each pair of cryptocurrencies and stock market. The sample contains eight stock market indices

and two cryptocurrencies (Bitcoin and Ethereum). The study's analysis of five-minute sample data from the pre-COVID-19 and COVID-19 durations. The sample period runs from August 1, 2019, to May 29, 2020. The key findings show that the risk of Bitcoin and Ethereum returns spreading to stock market returns has increased as a result of the COVID-19 pandemic. However, during the COVID-19 pandemic, the cost of hedging has increased while the optimal investments in Bitcoin and Ethereum have decreased. Additionally, the results demonstrate that cryptocurrencies cannot offer significant improvements by hedging equity market risk during the COVID-19 global epidemic.

2.3 Cryptocurrencies and exchange rates

Several studies have been published in the literature recently that look into the relationship between cryptocurrency and exchange rates. Erdas and caglar (2018), investigated the asymmetric causal relationships between Bitcoin and the following: gold, brent oil, the US dollar, the S&P 500 index, and the BIST 100 index for the weekly data among November 2013 and July 2018. According to the data analyzed, the findings only point to a causal relationship between the price of bitcoin and the S&P 500 index. As a result, a change in Bitcoin prices seems to affect investors' choices regarding the S&P 500 Index. Another study by Corelli (2018) examined the connections between the most widely used cryptocurrencies and a variety of chosen fiat currencies in an effort to spot any patterns or relationship between the series. Using daily data for different time span and applying several methods such as multivariate regression, Granger causality test and VECM model. According to the results of a multivariate regression, all but three nations have a significant relationship with some of the analyzed cryptocurrencies. The major countries that display no statistically significant coefficients are among the world's most important Commonwealth nations.

Moreover, there is a persistent causality effect of Asian fiat currencies on three cryptocurrencies, as shown by the Granger causality test on the cryptocurrencies with unit roots. The study's findings also demonstrate that the effect is typically bidirectional, with Bitcoin and Ethereum in particular causing the most important relevant currencies.

Vardar and Aydogan (2019), investigated the connections between Bitcoin and other asset classes with regard to Turkey. The researchers looked at the return and volatility transmission between Bitcoin, the most popular cryptocurrency, and other conventional asset classes, such as stocks, bonds, and currencies, from the perspective of Turkey between July 2010 and June 2018. Applying the recently developed VAR-GARCH multivariate econometric technique in measured framework with the BEKK interpretation. According to the empirical findings, there are positive unilateral return spillovers from the bond market to the bitcoin market. Furthermore, Strong evidence exists for the effects of shock and volatility spillovers in both directions between Bitcoin and all other financial asset classes, with the exception of the US Dollar exchange rate. Accompanied study with Taskinsoy (2019) studied the volatility of Cryptocurrency as well as the effects of Turkish lira fluctuations on Turkish economy. Using a comparative study to examine the similarity in fluctuations between top ten cryptocurrency and Turkish lira. Multiple regression, ANOVA, scatter plots, factorial and comparative analyses, correlation matrices, statistical, and mathematical techniques are just a few examples of the quantitative research techniques that have been used. Based on daily data spans from January 2018 through December 30, 2018. Empirical findings indicate that the standard error of the regression is low, and there is a positive correlation between the daily log returns on the Turkish lira and the log

returns on the top ten cryptocurrencies. Also results of the ANOVA test show a significant and positive correlation between the cases of volatility. Concluding that the researcher could determine the similarity in the fluctuations between Cryptocurrencies and Turkish lira.

Khaled (2020) examined the correlation between the returns for the top three cryptocurrencies (Ethereum, Bitcoin, and Ripple) and eight currencies from the Arabian region. in the following order: Egyptian Pound, Lebanese Lira, Iraq dinar, Omani Riyal, Tunisian Dinar, Saudi Arabian Riyal, Moroccan Dirham, and Qatari riyal against the US Dollar. Based on daily data in the period from January 1st, 2017, and January 1st, 2020. Various statistical techniques have been employed, including correlations, unit root tests, and multiple regression analyses. Empirical findings indicate that there were no correlations between the exchange rates of Arabian currencies and cryptocurrencies. However, the findings revealed a strong positive correlation between Ripple, Ethereum, and Bitcoin. In accordance with the study's findings, Ripple can benefit from hedging and diversification since there is a negative relationship between the Iraqi dinar and Ripple. The study came to the additional conclusion that the cryptocurrency markets in Arabian countries are not significantly impacted by their exchange markets. This finding may be related to the fact that these currencies are not recognized by governments legally or by the general public. Another study by Hussain (2020), analyzed the relationship between Indonesia's exchange rate, commodity prices, and cryptocurrencies. A quantitative study based on secondary data spans from 2016 to 2020. Several methods were applying such as Granger causality and Vector autoregression models. The study's findings showed that the prices of gold, cotton, oil, and exchange rates have no impact on Bitcoin's price. However, Prices for

gold are the only factor that significantly affects Ethereum. In this way, it is recommended that policymakers place more emphasis on gold prices in order to ensure the sustainability of cryptocurrency prices.

Wen and Shachmurove (2021) examined the dynamic correlations between 15 cryptocurrencies, other financial instruments, and macroeconomic factors like exchange rates, interest rates, and stock market indices. implementing the linear regression method to the top 15 the most frequently traded cryptocurrencies which are Bitcoin (BTC), Ethereum (ETH), Binance Coin (BNB), Ripple (XRP), Litecoin (LTC), Dogecoin (DOGE), AAVE (AAVE), Cryptocom Coin (CRO), Cardano (ADA), Uniswap (UNI), Chain Link (LINK), Stellar (XLM), EOS, Cosmos (ATOM), along with USD Coin (USDT). Using daily data spans between April 29, 2013, and February 27, 2021. According to the data used the researcher found that the price of cryptocurrencies is closely correlated with both volume and market capitalization. Moreover, a significant portion of the volatility of the cryptocurrency market is also influenced by stock markets and foreign exchange rates. Furthermore, because a large coefficient suggests that any regular change may result in a compelling fluctuation in the cryptocurrency market, keeping an eye on changes in stock prices and foreign exchange rates is essential for predicting the future pattern of the cryptocurrency market.

Mokni and Ajmi (2021), examined the causes of the top five cryptocurrencies' price movements in relation to the American dollar in various points in the distribution's returns. Applying the Granger-causality in quantiles approach prior to and throughout the current COVID-19 pandemic. The top five cryptocurrencies by market cap are represented by the daily prices of the following: Bitcoin (BTC), Ethereum (ETH),

Litecoin (LTC), Ripple (XRP), and Bitcoin Cash (BCH). As a stand-in for the traditional currency market, they also take into account the US dollar index (USDX). For BTC, LTC, XRP, and the USDX, the time frame started in January 1, 2015 through September 26, 2019. However, the data period for ETH and BCH was from July 8, 2015, to December 21, 2017. The empirical findings show a significant causal relationship, especially between the two markets during the COVID-19 global epidemic period. Additionally, the causality in quantiles test examines the upper and lower tails of the distribution to look for evidence of a relationship between the American dollar and cryptocurrencies by making distinctions between market asserts. Correspondingly, during the health crisis, cryptocurrencies have greater predictive power than the US dollar. which can serve as trustworthy forecasters and act as a hedge even against changes in the US dollar. determining that the relationship between cryptocurrencies and standard currencies has been significantly impacted by the recent COVID-19 crisis and has given cryptocurrencies a greater role in the financial system. Another study by Joseph et al. (2022), investigated the elasticity of cryptocurrency demand in Nigeria with regard to price and exchange rate hedging. The study used the Autoregressive Distributed Lag (ADRL) model to assess the demand's short- and long-term responses to changes in the price of cryptocurrencies, consumer spending, and the exchange rate. The key findings show that despite price inelasticity, changes in cryptocurrency price have a significant impact on cryptocurrency demand. Additionally, it was found that the demand for cryptocurrencies has a negative relationship with the real exchange rate of the Naira relative to the US dollar, meaning that as the real exchange rate declines, so does the demand for cryptocurrencies. The study comes to the conclusion that, even though price has a significant impact on cryptocurrency demand, demand changes are less frequent than price changes.

Followed by Ajayi et al. (2022), studied the connection between cryptocurrency shocks and Nigeria's exchange rate behavior. The most widely traded cryptocurrencies in Nigeria were chosen for the study: Bitcoin, Ethereum, Litecoin, Ripple, and Binance Coin. Applying several methods such as Johansen Cointegration, Vector Autoregressive (VAR), and Augmented Dickey-Fuller (ADF) tests to analyze the monthly data of exchange rates and chosen cryptocurrencies. The sample period runs between August 2017 and June 2021. According to the data used the results of the cointegration test showed that the variables had a long-term relationship. The Variance Decomposition also showed that Ripple has the largest short- and long-term exchange rate variations. In addition, the most significant exchange rate shocks are caused by Bitcoin and Ripple. In conclusion the result demonstrated that, over time, the exchange rate has both positive and negative reactions to shocks from cryptocurrencies.

Chapter 3

METHODOLOGY

3.1 Types and source of data

The data used in this thesis are returns and market capitalization of bitcoin and EX (Turkish lira) exchange rate on daily basis. The sample period runs from the period 31 May 2019 to 29 June 2021. The weekend days were excluded. EX (Turkish lira) was considered as USD over Turkish lira prices. Market capitalization for Bitcoin were taken and the cryptocurrency (Bitcoin) returns are calculated as follows:

RBTC = 100* dlog (closed price) or RBTC = (P1-P0)/P0. The variables' definitions and data sources are presented in Table 1.

Table 1: the definitions and sources of the variables

Variable	Definition	Data source
EX	Turkish lira is the fiat currency of Turkey	Thomson Reuters Data stream database
RBTC	Bitcoin is a digital currency with no central bank or single administrator.	Coingecko.com
MCBTC	market capitalization is the overall value of all share capital of a public enterprise.	Coingecko.com

3.2 Methodology

In this thesis three types of analysis have been used, firstly the summary statistics of the variables. Secondly, unit root tests which are Augmented Dickey and Fuller method (ADF), Phillips–Perron test (PP), and the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) in order to test the stationarity of the following variables, bitcoin returns,

market capitalization of bitcoin and Turkish lira exchange rate. Finally, Granger causality in quantiles to determine the causal relationship between the three variables, to see whether one variable is affected by the other variable.

3.3 The unit root tests

Prior to running the regression, the stationarity and order of integration of the variables are examined using the unit root tests. The primary function of the unit root test is to determine whether or not the variables are stationary. The Augmented Dickey Fuller method (ADF), the Phillips–Perron test (PP), and the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) have been included in the unit root tests. Enders (1995) proposes that testing unit roots begin with the most general model, which includes trend and intercept. The model can be expressed in the following way:

$$\Delta\bar{y}_{t-1} = a_0 + \lambda y_{t-1} + a_{2^t} + \sum_{t=2}^{p} \beta_j \Delta y_{t-1+1} + \in_t \qquad (1)$$

Where y is the dependent variable, t is the trend, a is the intercept, Et is Gaussian white noise, and p is the level of lag.

The ADF test is the most widespread used and known unit root test. It is a more enhanced form of the Dickey-Fuller test that could be implemented to a broader and more diverse set of time series models. The test's Augmented Dickey-Fuller (ADF) statistics are a negative number. The higher the number, the more strongly the unit root hypothesis is rejected at a certain level of confidence (Tripathy & Tripathy, 2016). Moreover, The ADF test is used to eliminate the possibility of incorrectly rejecting a correct null hypothesis (Gökmenoğlu et al., 2018). In the Augmented Dickey-fuller test (ADF), a parametric correction for a higher order correlation is made if the y-series is followed by an AR (1) process and p lagged variances conditions of the dependent variable are added for the test regression:

$$\Delta y_t = a + \beta t + \gamma Y_{t-1} + \delta \Delta Y_{t-1} + \cdots + \delta_P \Delta Y_t - p^{+\varepsilon} t \quad (2)$$

Where α is a constant, β the coefficient on a time trend, and p the autoregressive process's lag order.

The Phillips-Perron (PP) test accounts for error term distributions that are independent and identical. In the presence of weak autocorrelation and heteroskedastic residuals, the PP test outperforms the ADF. The PP test, unlike the ADF test, is not using the lagged differenced terminology to regulate for autocorrelation (Gokmenoglu & Hesami, 2019). Additionally, The Phillips-Perron (PP) unit root test, according to Tripathy and Tripathy (2016), differs from the ADF test primarily in how it handles serial correlation and heteroskedasticity in errors. The ADF tests are parametrically automatic in order to approximate the ARMA regression error structure, whereas the PP tests disregard any serial correlations. The test regression for the PP testing method is as follows:

$$\Delta y_t = \beta D_t + \pi y_{t-1} + u_t \quad (3)$$

Where u t is I (0) and possibly heteroskedastic. The PP test changes test statistics directly so that any serial correlation and heteroskedasticity in regression errors are corrected. tπ=0 and T ˆπ (Tripathy & Tripathy, 2016).

The Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test is performed to determine whether that time series is stationary around for a mean or linear trend, or non-stationary as a consequence of a unit root that was intended to be used as a stationarity test, particularly in comparison to stationary alternatives, it has markedly less power than the Dickey-Fuller I test (or similar tests). This makes intuitive sense. We would

anticipate a similar lack of standard unit root test statistics if the null hypothesis of stationarity were tested (Shin & Schmidt, 1992).

KPSS Test hypotheses could be stated as follows:

H0: The variable is stationary,

H1: The variable is not stationary.

3.4 Granger causality in quantiles

The proposed Granger-causality definition by Granger (1969) is the central concept in the investigation of dynamic time series relationships. In other words, it indicates that whether there is any relationship between two variables where one variable is affected by the other, practically it's answering whether our variables affect each other (it's between all of our variables and it is not similar with the cointegration idea. These assumptions must be met in order for the simple causality model to work as follows:

The Granger causality model is depicted below:

$$X_t = \sum_{j=1}^{m} a_j X_{t-1} + \sum_{j=1}^{m} b_j Y_{t-j} + \varepsilon_t \quad (4)$$

$$Y_t = \sum_{j=1}^{m} C_j X_{t-j} + \sum_{j=1}^{m} d_j Y_{t-j} + \eta_t \quad (5)$$

If b_j is greater than zero, Y_t causes x_t. If, on the other side, c_j is greater than zero, x_t causes Y_t. Gujarati (2003) suggests that the outcomes of the Granger causality test can be perceived in four ways: The variables will be independent if the coefficients of the lagged variables Xt and Yt are statistically irrelevant. If the coefficient of lagged Xt in equation 5 is statistically significant, (e.g., $\alpha_j \neq 0$), while the coefficient of lagged Yt in equation 6 is statistically insignificant (e.g., $d_j = 0$); there is one-way causality from Xt to Yt , On the other hand, if the coefficient of lagged Xt in equation 5 is statistically insignificant (aj=0), while the coefficient of lagged Yt in equation 6 (e.g., $dj \neq 0$) is

statistically significant, there is one-way causality from Yt to Xt. If the lagged Xt and Yt coefficients are significant, the two variables seem to have a bilateral causality between them.

Lee & Yang (2014) mentioned in their study that the Conditional quantile forecasting is increasingly popular in economic forecasting and finance. A calculation of value-at-risk(var) is used often in assessing portfolios and managing risk. The intention is to calculate the conditional quantile, $qa\ (Yt \mid Fi)$, where a is the probability of the left tail. The conditional quantile $qa\ (Yt \mid Fi)$, is derived from a conditional distribution functions in-verse function

$$q_a(Y|f_t) = F_Y^{-1}(\alpha|f_t), \tag{6}$$

where $FY\ (Y|f_t)$ is Yt's predicted conditional distribution function. The inversion is used to compute $qa\ (Y|f_t)$ from

$$\int^{q_a(y|f_t)} f_Y(y|f_t)\,\mathrm{d}y = a, \tag{7}$$

where $fY\ (y|f_t)$ is the forecasted conditional density function and by delineate GCQ for out-of-sample testing.

Chuang et al. (2009) suggest Granger causality in the distribution's quantiles. According to this method, a random variable x does not Granger-cause a random variable y at the τth ($0 < \tau < 1$) quantile of the conditional distribution of yt if and only if the following conditions are met:

$$Q_{y_t}(\tau|y_{t-1}, x_{t-1}) = Q_{y_t(\tau|y_{t^{-1}}),\forall\tau\varepsilon}[a, b] \tag{8}$$

where $Q_{y_t}\ (\tau|\Omega)$ is the τth quantile of the yt conditional distribution. If equation (9) is correct, it can be claimed that x does not Granger-cause y over the quantile range $[a, b]\subset(0,1)$.

Troster (2018) introduced the quantile Granger causality test, which is used to explore potential dependencies between bitcoin returns, market capitalization, and the Turkish lira exchange rate throughout the distribution's conditional tails. it is suggested a parametric omnibus Granger-causality test in quantiles. When all quantiles are investigated, the proposed method enables to analyze nonlinear causalities, causal relationships in conditional quantiles, and provides a sufficient condition for Granger-causality. The conditional mean-regression approach focuses on a particular component of the conditional distribution, while the quantile regression approach enables a more thorough and flexible examination of the complete conditional distribution. Furthermore, a quantile causal relationship may differ from a causality in the conditional distribution's mean. Despite the fact that a link with mean-causality shifts a significant number of quantiles, a tail causal relationship does not always imply mean-causality. Furthermore, when all quantiles are examined, the proposed test is equal to evaluating Granger-causality in distribution. Instead of testing a required condition for Granger-causality, the method examines a continuous set of conditional quantile functions that completely characterizes the idea of Granger-causality in distribution. by performing a Granger-causality in quantiles analysis, which evaluates causal relationships in each quantile of the distribution Using this method, we can distinguish between causality affecting the conditional distribution's median and tails.

According to Troster (2018), the test statistic is applied as follows:

$$s_T = \frac{1}{T_n} \sum_{j=1}^{n\cdot} \left| \varphi_j \Omega \varphi_j \right| \tag{9}$$

here Ω is the T×T matrix with elements Ωts= exp $[-0.5(I_t - I_S)^2]$, and φ_j is the j- the column of a T X n matrix with elements $\varphi_{i,j} = \psi_{T^j} \left(Y_i - M \left(I_i^Y, \hat{\theta}_0(T) \right) \right)' \psi_{T_j}$ (.) is

the function $\Psi_{T_j}(\varepsilon) = 1(\varepsilon \leq 0) - T_j$. The null hypothesis could be rejected when we get large values of s_T. The critical values for s_T are measured depending on subsampling of Troster (2018).

Chapter 4

THE EMPIRICAL RESULTS

4.1 Descriptive statistics results

The descriptive statistics test is an analytical test that provides a broad picture of the data. It uses the mean, median, maximum, minimum, standard deviation, skewness, kurtosis, Jarque-Bera, and probability to evaluate the various time series under test.

Table 2 shows the descriptive statistics for the selected variables, such as Bitcoin returns, market capitalization of Bitcoin, Exchange rate (Turkish Lira) for a period of 31 May 2019 to 29 May 2021. The results show that the mean value of Bitcoin returns is .33%, the average change in market capitalization of Bitcoin is 2.57%. While the average value of Exchange rate (Turkish Lira) is 6.87% which conclude that the highest mean value belongs to Exchange rate (Turkish Lira). Exchange rate has the highest value of median with 6.86%, and the Bitcoin return it shows the lowest median of 0.36. Finally, Market capitalization of Bitcoin with a Median of 1.19. Concerning the Maximum value, the highest value recorded in the return of Bitcoin by 20.12%, next to a Minimum Value of -41.67%.

Table 2: Summary statistics

	RBTC	MCBTC	EX
Mean	0.338	2.57E+12	6.870
Median	0.366	1.19E+12	6.860
Maximum	20.126	9.64E+12	8.771
Minimum	-41.679	5.88E+11	5.458
Std. Dev.	4.831	2.51E+12	0.956
Skewness	-1.275	1.407	0.191
Kurtosis	14.620	3.535	1.742
Jarque-Bera	3196.310	185.659	39.0867
Probability	0.000	0.000	0.000
Sum	183.612	1.40E+15	3730.493
Sum Sq. Dev.	12631.35	3.42E+27	495.398

Table 2 provides that the data are not normally distributed as shown by the Jarque-Bera test for all variables in all significance level, regrading Kurtosis for all of our variables was more than three except Exchange rate (Turkish Lira), Standard deviation shows that the deviation from the mean for each of the variables as the return of Bitcoin standard deviation was greater than both market capitalization of Bitcoin and Exchange rate (Turkish Lira).

4.2 Unit root tests results

The ADF, PP, and KPSS unit root tests were used in this thesis to investigate variables' integration orders. The results of the unit root tests are summarized in Table 3.

Table 3: Unit root tests

	Level Form		First Difference	
Variable (RBTC)	**Intercept & Trend**	**Intercept**	**Intercept & Trend**	**Intercept**
ADF	24.6595***	-24.6569***	-13.6338***	-13.6513***
PP	-24.6339***	-24.6306***	188.6815***	188.6381***
KPSS	0.1063	0.2139	0.0810	0.0818

	Level Form		First Difference	
Variable (RMCBTC)	**Intercept & Trend**	**Intercept**	**Intercept & Trend**	**Intercept**
ADF	-25.1014***	-25.0964***	-13.7016***	-13.7188***
PP	-25.0709***	-25.0657***	254.8817***	241.1831***
KPSS	0.1018	0.2013	0.0654	0.0675

	Level Form		First Difference	
Variable (REX)	**Intercept & Trend**	**Intercept**	**Intercept & Trend**	**Intercept**
ADF	-22.9856***	-22.9807***	-16.6439***	-16.6603***
PP	-22.9856***	-22.9808***	221.0304***	222.4280***
KPSS	0.0618	0.0999	0.0634	0.0675

(*) Significant at the 10%, (**) Significant at the 5%, (***) Significant at the 1% and (no) Not Significant.

Table 3 shows the unit root test results for the studied variables. Regarding RBTC (ADF, PP) tests are rejecting the null hypothesis at level form, so the variable is stationary which means that RBTC is integrated of order zero I (0). On the other hand, KPSS test fails to reject the null hypothesis at level form which is also means that the variable is stationary. Secondly, for RMCTC (ADF, PP) tests the null hypothesis is rejected which affirms that the variable is integrated of order zero I (0), and KPSS test is failed to reject the null hypothesis which means it is also stationary at level form. Finally, regards REX (ADF, PP) tests the null hypothesis is rejected means that the variable is integrated of order zero I (0), and in the KPSS test is failed to reject the null hypothesis showing that the variable is stationary at level form. In conclusion RBTC,

MCBTC and REX (ADF, PP, KPSS) tests confirmed that our variables are integrated of order zero, I (0).

4.3 Testing Granger-causality in quantiles

Based on granger causality in quantiles in mean approach that is suggested by Troster (2018) in order to study the causal relationship between two variables. Tables 4-9 show the p-values of the test for the logarithms of the three series. Following equally spaced grid of 19 quantiles T= [0.05, 0.95]. The subsample size resulting b is equal to 62 and n = 539 observations.

H0; There is no Granger-causality between the variables

H1; There is Granger-causality between the variables.

Table 4: Granger-Causality between ΔMCBTC and ΔRBTC; Subsampling P-Values

T	ΔMCBTC to $\Delta RBTC$	$\Delta RBTC$ to ΔMCBTC
[0.05; 0.95]	0.002*	0.002*
0.05	0.081	0.572
0.10	0.002*	0.002*
0.15	0.002*	0.002*
0.20	0.002*	0.002*
0.25	0.002*	0.002*
0.30	0.002*	0.002*
0.35	0.002*	0.002*
0.40	0.002*	0.002*
0.45	0.181	0.436
0.50	0.889	0.496
0.55	0.004*	0.064
0.60	0.002*	0.002*
0.65	0.002*	0.002*
0.70	0.002*	0.002*
0.75	0.002*	0.029*
0.80	0.002*	0.002*
0.85	0.158	0.01*
0.90	0.194	0.004*
0.95	0.517	0.242

*Notes: For the conditional quantiles in Troster's (2018), equation (9) this table shows the subsampling p-values for the ST test statistic. * Significant at 5%.*

Table 4 reports the test for Granger-causality p-values in quantiles for ΔMCBTC and ΔRBTC.

By taking into account all quantiles, there is a significant change from MCBTC to RBTC which implements that MCBTC is an important determinant of RBTC. The reason why MCBTC Granger caused the RBTC is that the market capitalization of a cryptocurrency roughly reflects the coin's popularity over time. Most of the investors consider large-cap coins to be safe cryptocurrency investments.

Furthermore, Typically, a cautious approach is taken when investing in coins with high market capitalizations, like Bitcoin. These cryptocurrencies are probably less volatile than others, however, they will continue to be more volatile than conventional assets like stocks. Furthermore, the market views a cryptocurrency as more dominant the

higher its market cap is. For this reason. Moreover, a significant bidirectional causality between RBTC and MCBTC considering the all quantiles.

Table 5 : Granger-Causality between ΔMCBTC and ΔRBTC; Subsampling P-Values

T	ΔEX to $\Delta RBTC$	ΔRBTC to ΔEX
[0.05; 0.95]	0.002*	0.002*
0.05	0.081	0.572
0.10	0.002*	0.002*
0.15	0.002*	0.002*
0.20	0.002*	0.002*
0.25	0.002*	0.002*
0.30	0.002*	0.002*
0.35	0.002*	0.002*
0.40	0.002*	0.002*
0.45	0.181	0.436
0.50	0.889	0.496
0.55	0.004*	0.064
0.60	0.002*	0.002*
0.65	0.002*	0.002*
0.70	0.002*	0.002*
0.75	0.002*	0.029*
0.80	0.002*	0.002*
0.85	0.158	0.016*
0.90	0.194	0.004*
0.95	0.517	0.242

*Notes: For the conditional quantiles in Troster's (2018), equation (9) this table shows the subsampling p-values for the ST test statistic. * Significant at 5%.*

In Table 5 it is observed that the Turkish Lira exchange rate Granger-causes Bitcoin returns and vice versa. However, there is a significant causality running in all quantiles [0.05; 0.95], indicating the predictive power of RBTC on Ex (Turkish Lira). As the Turkish lira is highly fluctuating leading in losing in value and increasing in the inflation, BTC attracts the investors who are looking for high returns to use it as a hedge fund instrument. Furthermore, another reason why Ex (Turkish lira) causes RBTC may be related to price changes and that the exchange rate determines how much Bitcoin you can buy, but this does not mean that changes in foreign currencies affect Bitcoin returns. In other words, Currency fluctuations do not affect the price of bitcoin. This suggests that when the value of the Turkish lira rose, bitcoin returns

would follow suit, and vice versa. However, if traders want to trade between cryptocurrencies, The cost of the currency conversion will be paid by them, just like institutional banks do when they trade money from different countries. Furthermore, when taking into account all quantiles, we observe a significant bidirectional causality between RBTC and EX. These results are consistent with the findings of Mokni and Ajmi (2021) as they found a significant causal relationship between crypto currencies and Us dollar exchange rate and they demonstrated that the effect was typically a bidirectional.

Table 6 : Granger-Causality between ΔMCBTC and ΔEX; Subsampling P-Values

T	ΔEX to ΔMCBTC	$\Delta MCBTC$ to ΔEX
[0.05; 0.95]	0.002*	0.002*
0.05	0.622	0.622
0.10	0.002*	0.002*
0.15	0.002*	0.002*
0.20	0.002*	0.002*
0.25	0.002*	0.002*
0.30	0.002*	0.002*
0.35	0.002*	0.002*
0.40	0.002*	0.002*
0.45	0.528	0.528
0.50	0.699	0.699
0.55	0.064	0.064
0.60	0.002*	0.0028
0.65	0.002*	0.002*
0.70	0.002*	0.002*
0.75	0.029*	0.029*
0.80	0.002*	0.002*
0.85	0.016*	0.016*
0.90	0.062	0.062
0.95	0.242	0.242

*Notes: For the conditional quantiles in Troster's (2018), equation (9) this table shows the subsampling p-values for the ST test statistic. * Significant at 5%.*

When all quantiles were considered at a 5% level of significance, Table 6 revealed a Granger-causality running from ΔEX or $\Delta MCBTC$, considering all quantiles of the distribution. On the other hand, by checking each quantile we do not find evidence of Granger-causality from bitcoin returns or changes in market capitalization at the

extreme tails of the conditional disruption T = [0.05] and in the medium quantiles at [0.45, 0.5, 0.55] and also in the highest quantiles at [0.85, 0.9, 0.95] for the market capitalization and [0.85, 0.95] in the bitcoin returns. This implies that there is a Granger-causality when both low and high growth rates of exchange rate prices and in the returns of bitcoin as well as the market capitalization. In addition, there is a bidirectional relationship between all the variable.

Chapter 5

CONCLUSION AND RECOMMENDATIONS

This study investigated Interactions among Return and Market Capitalization of Bitcoin and Turkish Lira. Applying the Granger causality in quantiles by Troster (2018) in order to study the causal relationship between two variables. The sample data period spans from 31 May 2019 to 29 May 2021. To examine the impact and effects of Bitcoin returns on Turkish lira fluctuations regards the causal connection between the conventional financial market and the digital market of cryptocurrency.

the analysis began with a descriptive statistical analysis, which confirmed that the series were not normally distributed, supporting the value of a quantile-based analysis. The results of Correlation matrix indicated that there was a positive strong correlation between MCBTC and EX and it is higher than 0.49 and also there is a positive correlation between RBTC and EX but it is weak. Besides, according to the Unit root tests it is confirmed that all the considered variables are stationary and integrated of order zero, I (0).

As a consequence, when analyzing the Granger causality between the Returns of Bitcoin and Turkish lira. Overall, findings show that the test does not disprove the non-causality null hypothesis., and indicating that Returns of Bitcoin have a significant impact on Turkish lira and the vice versa, which implementing the predictive power of the Cryptocurrency on Turkish lira exchange rate. The results generally show that

the causality is linear in all quantiles and in two directions among all the determined variables. However, it is found that the causality gets weaker in the extreme conditions and also at the median.

Finally, by looking for evidence of a causal relationship between the two markets, it is discovered that the traditional fiat currency has a significant impact on cryptocurrencies, as well as the opposite effect. Moreover, A bidirectional relationship was detected between all the variables and this supported by the study of Mokni and Ajmi (2021) indicated a bidirectional relation between Crypto currencies and US dollar exchange rate market.

As a recommendation, it is highly advised that investors who actively participate in the Turkish exchange market should closely monitor the prices of cryptocurrencies. In this instance, as demonstrated by Erdas and caglar (2018), It's essential to mention that cryptocurrencies are expected to keep progressing toward becoming a recognized form of payment everywhere. Moreover, investors can follow the market capitalization when cryptocurrency market is bearish so they can have some ideas about returns of bitcoin for their investment decision.

In fact, this study can help the policy makers in Turkey regarding the high fluctuations in Turkish lira in the past decades. Therefore, they might regulate and monitor the crypto currencies transactions in Turkey and or by taxing these transactions would be benefitable for the Turkish economic and may have a good impact on the strength of the Lira.

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