Analysis Of The Relationship Between Cryptocurrency Index (CCI30) Bist 100 And Nasdaq With Granger Causes Test

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Abstract

Virtual currency movements, which have intensified recently, are in relation to many macroeconomic variables. The decentralized nature of the cryptocurrency market does not eliminate the variables that affect the market. Macro and microeconomic events and variables affect the cryptocurrency market. The cryptocurrency market can also interact with and affect other markets and variables. Indices, which are the indicator indices of the markets, are important in terms of examining the relationship between the markets. The index, which is the indicator of the cryptocurrency market and includes 30 cryptocurrencies, is called the Cryptocurrencies Index (CCi30). The aim of the study is to examine the relationship between the CCi30 index, BIST 100, and Nasdaq Indices. In the study conducted using Granger Causality Analysis, data between the years 2015-2022 were used. According to the analysis result; It was concluded that CCi30 and Nasdaq indices affect each other in a bidirectional way.

Key Words: Cryptocurrencies, Cryptocurrency Index, BIST 100, NASDAQ, Granger Causes Test

1. Introduction

Since ancient times, various inventions have been made to make people's lives easier. However, one of the most important situations that made people's lives easier in history is considered to be the adaptation of technology to human life. Technology has influenced many areas in human life, from social life to education, from economy to health. Technological processes that develop day by day have caused abuse as well as benefits. However, the increased susceptibility to technology has made people more dependent on technology at the stage of their transactions. Technological innovations, especially in the economic field, have led to new developments day by day at the point of meeting investors and fund seekers.

The use of technology in the field of the economy has spread to a wider area, starting with stock market transactions over various networks. Such that, with the mobile banking services of physically located banks, the services needed can be reached almost without going to the branches. Likewise, almost all transactions in company public offerings are carried out electronically. Investment services, borrowing services, and other transactions that come to mind are also carried out using technological infrastructures and are recorded in digital environments. While the existence of new technological transactions continues every day, hesitations in the field of security are also considered a factor preventing transactions. For this reason, various systems have begun to be developed for safer economic transactions in networks. Systems have been developed under the name of Cryptology and various economic transactions made in the digital environment have

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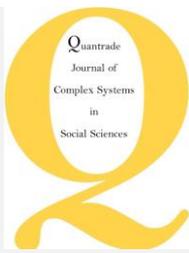
been tried to be made secure by means of encrypted networks. After the cryptology system started to be developed, Bitcoin entered our lives with the Blockchain system, which uses the cryptology infrastructure. Bitcoin, the pioneer of the first virtual money movement, has attracted attention because it has a reliable, fast, and cost-reducing functionality. Upon the attention of Bitcoin, the virtual money market started to host many coins and altcoins. This has created the virtual money market, which is another area to invest in and is expressed as reliable. With the start of trading in more than one virtual currency, an index called Cryptocurrencies Index (CCi30) was created in 2015 and it is aimed to be an indicator for observing the price movements of cryptocurrencies. At this stage, the aim of the study is to analyze the relationship between the CCi30 Index, Nasdaq, and BIST 100 indices. Within the scope of the purpose, in the first part of the study, information about how the CCi30 Index is created and calculated will be given in the second part of the study about cryptocurrencies and Blockchain. Another part of the study is aimed to give a piece of brief information about the other variables used, BIST 100 and Nasdaq, and the last part, it is aimed to give information about the analysis results and the general results of the study.

2. Cryptocurrency Market and Blockchain Technology

The integration of the Internet into all areas of life has many beneficial aspects. Quick access to information, dissemination of technological tools, and their use in most activities in social life are some of them. However, it was inevitable that there would be abused points as well as good ones. With the widespread use of the Internet and the increase in its use, problems such as theft, interference between accounts, and violations of people's assets have been encountered in economic terms. These economic negativities were tried to be eliminated with the discovery of a secure network called "Cryptology". This system, which allows secure network transactions between people, is not only untraceable but also enables people who make transactions to view their transactions transparently. The first study in this sense in Turkey was the electronic signature application in 2004. This application was made according to the cryptology system and aimed to prevent negative situations such as imitating the signatures of people and making unauthorized transactions. A cryptology system is also defined as a system that allows the realization of interpersonal information or any data flow in a secure and unalterable way (Turan, 2018).

The concept of "Cryptocurrency", which allows the reliability of the cryptology system to be made through monetary transactions, first came to the fore in 2008. Bitcoin was the first currency to be mentioned as a cryptocurrency. Developed by a person who is thought to be Japanese named Satoshi Nakamoto, the currency allows money transfer using a cryptology system (Doğan, 2020, p. 861). The emergence of Bitcoin was with an article. An article titled "Bitcoin: End-to-End Electronic Money System" by Satoshi Nakamoto has attracted the attention of those interested in the cryptology system. Then, on January 3, 2009, the initial stage of Bitcoin was completed with the development of the first source code of 30,000 lines. Bitcoin operates as a virtual currency that is not issued by anyone or institution, is not managed from a domain, or is allowed to be transacted over a decentralized online network. It is stated that one of the most important features is that it is not affiliated with an institution and operates in a decentralized manner (İşgör, 2019).

Bitcoin is actually a virtual currency within a system that enables secure data exchange over virtual networks called Blockchain. The blockchain system can be interpreted as a system that has the potential to be used in many areas, thanks to its complex and secure structure. At the same time, the fact that it has a reliable structure contributes to the reliability of the system, thanks to the codes called keys directed only to them. The functioning of the blockchain system actually proceeds in the form of recording data between blocks and transferring the data to another block by changing the data in each block. The "Genesis" block, called the starting block, is called the 0 blocks and the process starts from this block. Afterward, each time a transaction is made, the data is transferred to other blocks as a piece of the information in the starting block. New blocks are created for each transaction made in this way. However, each block carries the information of previous blocks, including the genesis block. In other words, even the last block contains information about the genesis block. People who want to take advantage of the system badly by outside intervention should obtain the information in all blocks up to the genesis block. However, this is not possible because the information between blocks is transferred with different ciphers. The reliability of blockchain technology also comes to the fore at this stage and can be called a reliable transmission system (Şahin and Özkan, 2018).

The emergence of Blockchain technology, which follows the cryptology system, and virtual money services such as Bitcoin as an extension of it, has had a positive effect on both investors and project owners. However, as in all financial systems, there can be positive as well as negative aspects in this system. If we look at the beneficial aspects of cryptocurrencies (Erkuş and Gümüş, 2019, p. 47):
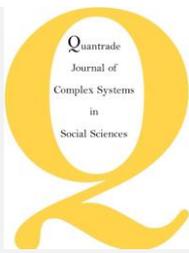
- It has a decentralized structure. In other words, it is not monopolized by any institution or person, it does not have a center.

- It saves time as it allows transactions to be carried out quickly.

- There is no time limit during the transaction. Transactions can be made on the desired day and time.

- It reduces information and transaction costs.

- It allows fewer operational transactions during the execution of transactions.

The negative aspects of cryptocurrencies can be listed as follows.

- Being decentralized means that it is not dependent on any supervisory authority.

- High volatility can cause investors to lose their money as well as make high profits within seconds.

- It can be considered as a system that attracts attention in cases such as not being able to launder money laundering, tax evasion and not being able to trace transfers.

- The usage areas of cryptocurrencies are still limited.

- In transactions made with cryptocurrencies, it may be necessary to constantly update the record, since the money value is volatile during the accounting period.

Cryptocurrencies, which started with Bitcoin, started to increase day by day with the rise of the crypto money market. In addition to the virtual currencies that emerged to support various projects, there were also cryptocurrencies that could not provide continuity. The concentration experienced in virtual money transactions has also enabled the formation of different financial transactions by using the cryptology system. Projects for the public offering system and the realization of securities with a cryptological system infrastructure have come to the fore, and infrastructures for the realization of projects have begun to be established. Projects with the aim of digitalization of securities and realization of the first public offering activity in the virtual environment are among the innovations that have come to the fore recently.

### 2.1.Cryptocurrencies Index (CCi30)
CCi30 is a rules-based index designed to objectively measure the overall growth and daily and long-term movement of the blockchain industry. It does this by tracking the top 30 cryptocurrencies by market cap, excluding stable coins. It serves as a vehicle for passive investors to join this asset class and an industry benchmark for investment managers.

To achieve its goals, the CCi30 is designed with 5 main features:

1. Diversified

2. Repeatable

3. Transparent

4. Provides in-depth coverage of the entire industry

5. Deliver the best possible risk-adjusted-performance profile.

2.2.Component Selection
The top 30 cryptocurrencies are automatically selected and included in the index based on the adjusted market value. All so-called "stable coins" pegged to the fiat currency are not considered. To calculate the weights of each cryptocurrency, the adjusted market value must first be calculated. Market cap is not calculated as an instant number – the volatility in the cryptocurrency market is such that it will destabilize the index composition too much. Instead, the CCi30 uses an exponentially weighted moving average market cap. Weighted average Market Capitalization helps smooth out volatility
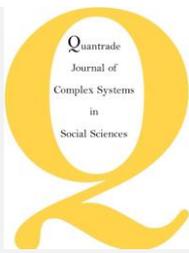
to give the most accurate portrait of market value at any given point. The formula used to obtain the market capitalization is:

$$M^*(t) = \frac{\sum_{i=0}^{\infty} M\,(T-i)e^{-ai}}{\sum_{i=0}^{\infty} e^{-ai}}$$

where M(t) is the actual market value at time t, M* is our adjusted market value, and α is the exponential moving average decay rate determined by a 3-day half-life.

The number of components was set at 30 as this is the minimum required for statistical significance. Using more components results in higher wages without a significant increase in performance, and fewer than thirty risks poor performance, insufficient diversity, compromised statistical significance, and missed opportunities to pick the next rising star.

By including the top 30 cryptocurrencies, CCi30 captures a very high percentage of the cryptocurrency market cap. The index statistically represents the entire cryptocurrency market with a confidence level of 99% and a confidence interval of 1.11. In other words, the margin of error of the index value as an indicator of the market is only 1.11%.

2.3.Weight Calculation Of Components

The weight of each cryptocurrency generated is measured by the square root of the adjusted market value, so at time t the cryptocurrency's weight is 0:

$$\omega_0(t) = \frac{-b \pm \sqrt{M_0^*(t)}}{\sum_{i=0}^{N} \sqrt{M_i^*(t)}}$$

where Mi* is the adjusted market value of a given cryptocurrency at time t.The square root function was chosen as a hybrid that most accurately weights the components according to current cryptocurrency market conditions.A simple market-cap-weighted index will be dominated by the top two cryptocurrencies, while a slower decreasing weight, or in the extreme case equal weight, will give too much weight to small, illiquid cryptocurrencies below the range.

In order to accurately capture market movements, no cap or base is imposed on cryptocurrency weightings.

Calculate index value

Calculate index value

$$I_t = \sum_{j=1}^{30} W_j \frac{P_j(t)}{P_j(0)}$$

Where I_t is the value of the index at time t, W_j is the weight of the jth name in the index, and P_j is the price of the jth name as a function of time. On rebalancing dates, the weights are normalized in such a way that the index value is the same, whether it is computed with old or with new weights. The index is calculated in realtime. closing price of the previous day, which is considered 0000 GMT.

It's no surprise that the index is a better investment vehicle than Bitcoin itself and a much safer approach than trying to pick a single coin. Investing in the index allows you to benefit from the unpredictable rises of some cryptocurrencies while limiting losses from falls in others.

CCi30 is the most accurate tool for measuring the entire cryptocurrency market and the blockchain industry in general. It provides a useful tool for investors, a benchmark for traders and money managers, and a repeatable index for passive funds and ETFs. In short, it is the industry standard for cryptocurrencies (https://cci30.com/)
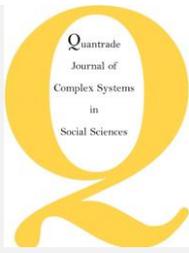
3. BIST 100 Index and Nasdaq

The stock market activities, which can be carried out under the name of the first institution in Turkey in a modern and organized manner, were established in 1873 under the name of Dersaadet Tahvilat Borsası. Afterward, in 1985, stock market transactions started to be carried out under the name of the Istanbul Stock Exchange (ISE). On April 5, 2013, ISE changed its name to Borsa Istanbul (BIST) and started its activities. In the stock market, where various commodities, precious metals, and valuable papers were traded, various indices were also calculated on a weekly basis (www.borsaistanbul.com). Initially, the ISE-100 Index was expressed in 1896 as the Combined Index, which was first calculated based on the stocks of 40 companies. Over time, with the increase in the number of companies, it was expanded to represent 100 companies. The fact that the indices, which were calculated weekly until 1987, started to be calculated on a daily basis, can mean that indices are an important indicator among investors and companies (Çulha, 2019).

BIST 100 Index is an index calculated based on the stock prices of 100 companies whose shares are traded in Borsa Istanbul. Companies included in the index are also among Turkey's largest companies traded on the stock exchange. The index calculation is based on the market value of the actually circulating part of the company shares included in the index and the average daily trading volumes (Gülpınar and Kır, 2016).

The shares of companies in Borsa Istanbul are divided into four classes in terms of the classification of companies. As a result of the decision taken by the Capital Markets Board in 2014, the shares were divided into four classes A, B, C, and D. A category shares, 30 Million TL or more shares, B category shares; Shares between 30-10 Million TL, C category shares represent 10 Million TL and below shares. Shares in category D represent the shares traded outside the stock market. As a rule, companies included in the BIST 100 Index must be in the category of A and B stocks at the end of the valuation period (Çulha, 2019).

Another variable of the study is the Nasdaq 100 Index, which is included in the National Association of Securities Dealers Automated Quotations (NASDAQ). Nasdaq is the largest and most automated exchange in the United States. Founded in 1971, this stock market continues its activities as the second-largest stock exchange in the world. The Nasdaq stock market includes many technology companies, small or large. With the feature of being a fully automatic stock market, all transactions are carried out in an online environment and online. For this reason, the shares of globally known technology companies such as Microsoft, Oracle, Apple, Intel, Adobe, Netflix, Facebook, and Yandex are traded on this stock exchange. One of the features that make the Nasdaq exchange so important is the flexibility experienced in terms of acceptance to the exchange. The terms of being listed on the stock exchange are adjusted in a reliable way to support new technology companies instead of being ordinary (www.isbank.com.tr).

4. Literature Review

In the literature part, previous studies were examined. Among the previous studies within the scope of the review, other close and related studies were included, since no similar study could be found for the data set and method used in our study.

Korkmazgöz et al. (2022) aimed to examine the relationship between Bitcoin and Borsa Istanbul Indices. From Borsa İstanbul Indices; BIST 100 (XU100), BIST Financial (XUMAL), and BIST Technology (XUTEK) indices and Bitcoin prices between the years 2012-2021 were used. The relationship between BIST indices and Bitcoin prices was examined using the ARDL bounds test approach. As a result of the findings, a long-term relationship was reached between Bitcoin prices and the BIST Financial Index, while no relationship could be detected between other indices.

Akdağ and Yıldırım (2021) aimed to investigate the effects of uncertainties in the field of the economy on investor behavior. For this purpose, the effect of the EPU Index, which expresses the uncertainty in the economic policies of European countries, on the BIST 100 index was analyzed using the Johansen Cointegration Test. It is also among the results that the EPU Index has a negative effect on BIST 100.

Tuncel and Gürsoy (2020) aimed to analyze the relationship between BIST 100, Bitcoin Prices, and Fear Index (VIX) in their study. Within the scope of the purpose, index data and Bitcoin prices between the years 2010-2020 were included in the analysis. As a result of the study tested using Toda-Yamamoto causality analysis, no causality relationship was found between Bitcoin prices and the BIST 100 Index.
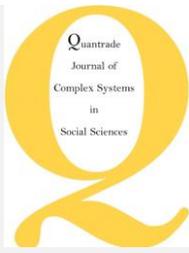
Ayaydın et al. (2020) aimed to test the existence of a short- and long-term relationship between the Borsa Istanbul 100 Index and the stock markets of G-7 countries. For this purpose, using Fourier ADL cointegration analysis and Toda and Yamamoto causality analyses, the data for the variables between 2000 and 2008 were evaluated within the scope of analysis. As a result of Toda and Yamamoto's causality analysis; A bidirectional causality relationship was observed between the BIST 100 and the indices of the USA, France, Germany, and England stock markets. In addition, the existence of a one-way relationship from FTSEMIB to BIST100 between the Italian FTSEMIB Stock Exchange and BIST 100 is among the other results.

Oner et al. (2018) aimed to examine the relationship between stocks in developing country markets and the VIX (Volatility Index), also known as the fear index. In the study, Turkey BIST100 Index, Chile IPSA Index, South Africa JALSH Index, South Korea KS11 Index, Russia MICEX Index, Argentina MERVAL Index, Mexico MXSE Index, Thailand SETI Index, Taiwan TWII Index, and Poland WIG20 indices were used to represent the developing country stock markets in the study. . The Engel-Granger Co-integration Test and Granger Causality Test were used as the data set, using the data between 2006-2017. According to the analysis result; It has been determined that there is a relationship between VIX and all indices except Argentina MERVAL Index..

5. Analysis and Method

In the study; Daily data of BIST 100, CCi 30, and Nasdaq variables between the years 2015-2022 were used. The data was obtained from the Yahoo Finance site. Analyzes were made with the Eviews Package Program. The unit root test was performed as the first step in the analysis. Nasdaq, which is the world's largest traded stock exchange with the indices selected in the variables (https://www.dunya.com/foto-galeri/ekonomi/iste-dunyanin-en-buyuk-20-borsasi-galeri-623195?p=12), BIST 100, which is used as an indicator index in Turkey, and CCi30, which is the index of the crypto money market, were used. The time-series properties of the variables were examined and a unit root test was performed to avoid spurious regression problems. This is because the presence of a unit root in the data causes the analysis to be misinterpreted for 2 reasons:

- There may be a problem of misinterpretation with the spurious regression problem
- Incorrect approaches: The presence of a unit root may cause the assumptions made for the analysis to be invalidated.

ADF- Fisher Chi-square panel unit root test and PP- Fisher Chi-square panel unit root test. The hypotheses of the Levin, Lin & Chu panel unit root test are as follows (Bulut, 2019):

H0: The series has a unit root, it is not stationary. (H_0: $\rho i = \rho = 1$)

H1: There is no unit root in the series, it is stationary. (H_1: $\rho i = \rho < 1$)

According to the p probability value of the table results, H0 is rejected.

As mentioned above, the first step in performing Granger Causality tests starts with determining the stationarity of the series used in the study. The fact that the series is not stationary can lead to the spurious regression problem. For this reason, the existence of the unit root problem is tested using unit root tests such as ADF and PP, and models containing these problems are recovered from the unit root by taking the lagged values of the variables. The unit root test model is shown in Equation 1 (Temurlenk and Lögün, 2021: 490):

$$\Delta Y_t = (\rho-1)\ Y_{(t-1)} + u_t \qquad\qquad (1)$$

In this study, the Augmented Dickey-Fuller unit root test will be used as a unit root test. The second step before proceeding to the Granger causality test is selecting the appropriate lag length. Before making a VAR model, the appropriate lag length must be determined for each model. In order to establish the VAR model, the appropriate lag length will be determined according to the Akaike information criterion. After the lag length is selected and the VAR model is established, the autocorrelation test for the model is performed and if there is autocorrelation, various adjustments should be made. If all these conditions are met, Granger Causality analysis can be done (Çilingir, 2021)

There are some differences between the Granger approach and correlation. Although both basically express the effect between variables, the Granger test focuses on the lagged values of two variables expressing the relationship between each other. In other words, it expresses the extent to which two variables, X and Y, explain each other. However, this situation can be interpreted as expressing whether these variables lead to each other rather than being interpreted as X or Y variables being the cause or result of each other. The formula for the Granger Causality test is given below as Equation 2 and Equation 3:

$$X_t = \sum_{j=1}^{m} a_j X_{t-j} + \sum_{j=1}^{m} b_j Y_{t-j} + \varepsilon_t \qquad\qquad (2)$$
$$Y_t = \sum_{j=1}^{m} c_j X_{t-j} + \sum_{j=1}^{m} d_j Y_{t-j} + \mu_t \qquad\qquad (3)$$

Equations 2 and 3 express the existence of a relationship between the X and Y variables, and if so, in which direction, according to the Granger Causality test. Two equations have been established to determine the relationship. The reason

for this is to detect if there is a one-way relationship between the variables. If there is a unidirectional relationship between X and Y from X to Y, it may not be obtained in a single model. For this reason, two models are established and it can be observed how the variables affect each other (Aslan, 2018).

5.1.Granger Causality Test

Granger (1969) causality; is defined as "If the prediction of Y is more successful when the past values of X are used than when the past values of X are not used, then X is the Granger cause of Y". After testing the correctness of this expression, its marrow is shown as X» Y. Although regression analysis is concerned with the dependence of one variable on another, it is clear that this does not imply causation. Here, whether the two variables affect each other with a lag, is X the cause of Y (X» Y), whether Y is the cause of X (Y» X), or is it the feedback between the two variables (both X» Y, as well as Y» X) are investigated.

H_0: There is no long-term relationship between dependent and independent variables.

H_1: There is a long-term relationship between dependent and independent variables.

Table 1. Unit Root Test Results

Method	Statistic	Prob.**
ADF - Fisher Chi-square	281.993	0.0000
ADF - Choi Z-stat	-15.2978	0.0000

According to the unit root test results in Table 1, the probability value being less than 0,05 significance level indicates that there is a unit root problem in the model. In order for the results to be meaningful, the unit root problem was eliminated by taking the first differences of the variables and included them in the analysis.

Table 2. Granger Causality Results

Dependent variable: B_ST_100			
Excluded	Chi-sq	df	Prob.
CC_30	1.526186	2	0.4662
NASDAQ	0.063234	2	0.9689
All	7.819498	6	0.7991
Dependent variable: CC_30			
Excluded	Chi-sq	df	Prob.
B_ST_100	0.514231	2	0.7733

NASDAQ	0.419987	2	0.0306
All	36.11484	6	0.0003
Dependent variable: NASDAQ			
Excluded	Chi-sq	df	Prob.
B_ST_100	1.696333	2	0.4282
CC_30	1.094887	2	0.0584
All	51.28813	6	0.0000

Table 2 shows the Granger Causality test results. According to the test results, since the probability values of CCi30 and Nasdaq variables are less than 0.05 statistical significance level, it is interpreted as the existence of a bidirectional effect between each other. No statistically significant effect was observed between BIST 100 and Nasdaq and CCi30 Index.

**Figure 1.** Representation of the Direction of Causality

As a result of the analysis, as seen in Figure 1, there is bidirectional causality between Nasdaq and CCi30. No causality was found between BIST 100 and other indices.

6. Conclusion and Evaluation

Technological developments have affected human life in many ways. One of the affected areas has been the economy. While the operations in the economic field were more complicated and required physical effort in the past, with the development of technology, it has become more automated. So much so that those banking transactions, which were made by waiting in line for hours, are now done in seconds thanks to mobile banking services. In addition to the rapid execution of monetary transactions thanks to technological breakthroughs, it also benefits the parties in terms of costs. Although it reduces costs in many areas, the fact that transactions are carried out in a digital environment pushes businesses and households to take efforts and precautions in order not to suffer from security vulnerabilities. While companies providing services in the economic and digital environment pay high costs in terms of security, other economic units also receive various security services.

Various transactions have been tried to be developed in order to close the security gap at the stage of economic transactions. One of these processes is the Cryptology system, which includes an encrypted network. The cryptology system aims to deliver the data to the other party in an unbreakable way thanks to various encryption processes. The system, which was first used in electronic signature transactions in Turkey, was later developed to be used in the
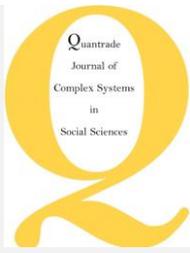
infrastructure of many activities. One of these areas is Blockchain technology. Blockchain technology allows the processing of data on blocks and the mutual exchange of information and data between the parties. Encrypting information transfer between blocks contributes to the reliability of the system. The development of blockchain technology has accelerated with the emergence of the first virtual money called Bitcoin. The use of virtual money between accounts using the blockchain infrastructure has accelerated with the emergence of Bitcoin and many virtual money projects have been implemented. In this context, CCi30, a crypto money index for virtual currencies, has also been calculated since 2015. In this context, it is aimed to observe whether there is any relationship between BIST 100 Nasdaq and CCi30 indices. Data between 2015 and 2022 were analyzed with Granger Causality analysis. According to the results of the analysis, while there was a bidirectional relationship between the Nasdaq and CCi30 Index, no relationship was found between BIST 100 and CCi30. Likewise, no relationship was observed between BIST 100 and Nasdaq. The relationship between CCi30 and Nasdaq can be interpreted as the effect of technology companies in the Nasdaq stock exchange, and the technology infrastructure of cryptocurrencies in the CCi30 index.

The results obtained may vary during the diversification of the variables used in the study. The limited number of studies with the CCi30 index creates an opportunity for further studies in this area. Other major stock market indices can be included in the studies and contribute to the studies in this field.

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