

# Utilization of Forecasting Methods for Cryptocurrencies

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## Abstract

Electronic money has evolved in one of the relevant ways to achieve electronic payment, that is, a form of payment with significantly lower online transactions. The idea for the development of the above has consolidated the segment of retaining all the favourable characteristics of cash while eliminating deficiencies. The paper purpose is to discuss the relevance of electronic money or alternative currencies, cryptocurrencies, and to present statistical processing the most 30 influential cryptocurrencies with an emphasis on the most popular cryptocurrency called Bitcoin. We elaborate on the main differences between the virtual currency and electronic money after we present the historical development of cryptocurrencies. In the end, we present the statistical and forecasting analysis of the most important cryptocurrencies.

**Keywords:** cryptocurrency, statistical processing, electronic money, BitCoin, forecasting

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## Introduction

Money, as a fundamental medium of exchange, has marked history. However, the emergence, development and application of new technologies have enabled the creation of new investment instruments and greater availability of investment as an activity to a wider share of the world population, which has resulted in the popularization of investment and market development of emerging instruments such as cryptocurrencies. The basis for creating cryptocurrencies is in the process of data mining. The data mining process involves combining hardware, such as computers and graphics cards, and software in the form of advanced mathematical algorithms, resulting in the creation of a specific value expressed in cryptocurrency (Voras, 2017).

The aim of this paper is to compare the most influential cryptocurrencies as investment instruments based on market value criteria and trading volume. The main goal of this paper is to establish the most significant cryptocurrency based on the analysis of the 30 most influential cryptocurrencies using the criterion of market value and capitalization in the period from 2014 to 2020. In order to support business decision-making in the process of investing in the cryptocurrency market, this paper presents certain forecasting methods in order to enable the selection of the most important cryptocurrencies.

## Literature review

Fintech organizations represent technologically empowered companies entering or trying to enter the financial market (Marrara et al., 2019; WEF, 2017).

Competition within the financial market no longer occurs only in the segment of payment transactions, but covers 30 different segments of the financial market in order of probability of entry including (EFMA, 2017): a) Transactions (digital wallets, mobile payments, cards, transaction processing); b) Corporate and mass banking (money management, digitalization of loans, savings); c) SMEs (digital money management, P2P corporate financing); d) Asset management (robotic consulting, sociologically sensitive investment, group financing, consulting); e) Capital markets (intermediation and analysis of securities trading, collateral management); f) Foreign exchange market, and g) Insurance (digital prevention, telematics).

Banks profit because they do not have to develop certain technological solutions themselves, and the actual service providers profit using the bank's reputation (Buchak et al., 2018). Many clients will certainly have more confidence in innovative financial products if they are backed by a reputable bank. Given that different Fintech organizations are nevertheless the designers of these innovative products, it can be expected that banks will imply their responsibility for customer safety with the expectation that the possibility of fraud will be minimal (Gai et al., 2018). Consequently, to the financial strength of a Fintech organization that cannot be compared to banks, the contract between the bank and the Fintech organization will not be relevant to creating an adequate level of trust by customers (Lee et al., 2018). Although Fintech organizations are accountable for their products to the bank, banks will provide direct guarantees to customers. Furthermore, API systems that integrate the financial market can result in multiple benefits. Customers get a higher quality experience of using the service and products (more innovation), and banks have access to new information. Based on access to additional information (all customer transactions that have been out of reach so far), banks will be able to better assess the creditworthiness of customers or reduce the burden of written-off debts. Fintech organizations as technology experts bring new skills, experience, and

methods to the financial environment beyond the traditional approach of banks by creating innovations, and in turn take a share of the financial market (Wilkinson, 2017). Fintech organizations have shown that a customer in banking can experience a technologically enhanced quality experience similar to what is expected of companies such as Google and Apple. On the one hand, in markets where there was no high concentration of established financial service providers or some customer segments were dissatisfied, Fintech organizations occupied negligible market shares. On the other hand, due to the lack of financial incentives, the willingness of clients to change service providers was overestimated and it was shown that Fintech organizations were more successful in improving existing systems than building alternative infrastructure. Although the emergence of Fintech organizations has created an innovation market and enabled talent trading, the dynamics of change pose a threat to the bank's insufficiently flexible strategies (WEF, 2017).

The expansion of Fintech's operations includes operations, but also infrastructure. Fintech organizations use DLT / Blockchain technology, AI (artificial intelligence), RPA (robotic process automation), GPS (Global positioning system), VA (verbal assistance), VR / AR (virtual reality / augmented reality) and API (application programming interface). Furthermore, Fintech organizations use CC (cloud computing) and advanced analytics tools. They also often offer innovative services, such as career counselling and networking for career development and new distribution channels or the integration of multiple communication channels.

Technologies like DLT, AI, RPA, GPS, VA, VR / AR and API have been tested for years within various industries including banking. DLT (distributed ledger technology) technology attracted \$ 1.4 billion in the capital by the end of 2016, and because of the development of the technology, over two and a half thousand patents were invested. In banking, it is used for digital identity (smooth login, AML (anti-money laundering), KYC (know your customers)), increase security and check processing, smart contracts, autonomous execution of contracts, no prior trust of partners required, historical course registration of claims in the name of collateral, AML), implementation of international transactions (cost reduction, micropayments) and regulatory harmonization (process automation, transparency, cost reduction). Although DLT offers the ability to execute payment transactions in near real-time with lower transaction execution costs (in 2016, the average transaction cost of a traditional global payment system was 7.68% and the market value was \$ 601 billion), the level of technology adoption for a specific purpose is currently almost negligible. Furthermore, regardless of whether the information recorded with DLT technology is public or access is restricted to key participants, once entered the record remains unchanged and newly created transactions cannot change the record of previously conducted, at the same time reduces information asymmetry, and eliminates the need for reconciliation. Also, five most promising areas of future application of DLT technology have been identified: shared repository as an information platform for recording assets and their owners which can be accessed by internal or external participants, multiple participants with legal registration in a shared repository (payment system managed by a small number of banks, and thousands of clients perform transactions with a single bank), transactions that require trust (goods collection that makes the market \$ 18 trillion), activities where reliable intermediaries guarantee the fulfilment of obligations (execution of trading transactions, global payments), transaction dependence where verification of targeted transactions is associated with previous transactions (WEF, 2016).

Given that the adoption of technology requires the cooperation of established institutions, innovators and regulators, there is currently a low level of adoption, and it is important to note that DLT has a tendency to decentralize or reduce the importance of intermediaries in providing financial services. Several divergent scenarios for the development and use of DLT technology are expected. The first scenario assumes that banks retain existing infrastructure, and DLT technology becomes a competition primarily in payment transactions of alternative channels Fintech and other non-financial organizations. The second scenario involves how banks will incorporate technology into their communication channels by taking into account risks and adapting to regulatory measures. In order to increase the efficiency of its processes, the digital bank Fidor is already using Ripple (DLT protocol) for internal account settlement. The third scenario implies that the bank of independent Bitcoin technology will create a network of financial institutions that will have better characteristics of inter-institutional communication or value transfer (WEF, 2015).

Artificial intelligence is used in computer programs to encourage conversation with clients, simulation of natural speech, referrals to clients, creating a greater degree of personalization, for trading securities and foreign exchange based on algorithms and tools to prevent fraud (EFMA, 2017). Japanese bank Jibun designed an AI-based application that predicts exchange rate movements, and its accuracy in the tested period was 80% with ten thousand transactions performed daily by 1500 unique users (Ein Presswire, 2017). Deutsche Bank (DB) has designed a robo-advisor under the commercial name ROBIN, which according to the client's affinities has the task of creating an ETF (Exchange-traded funds) portfolio (Deutsche Bank, 2017). The product is based on information available to the DB Chief Investment Officer and advanced algorithms. Despite advanced analysts, ROBIN's suggestions are not without the supervision of financial experts. Vanguard Personal Advisor, the most popular robo-advisor to manage the largest share of assets to date, covers a value of \$ 47 billion. Charles Schwab also launched a robo-advisor for the retail market and the richest clients with a minimum investment of five thousand dollars. The assets managed by CS (Charles Schwab) have reached \$ 12.3 billion and make up the second-largest investment portfolio managed based on robo advisors. Charles Schwab's target competitor is Fintech, an organization called Wealthfront with \$ 4.4 billion in assets, while Betterment is in third place with \$ 6.7 billion in assets. In addition to ETF fees, CS has no hidden costs and offers 24/7 access to professional investment advisors (WEF, 2017). Some of the brokerage houses like Robinhood or N26 in 2018 have offered securities trading at zero transaction costs.

Since the financial crisis in 2008, investment advice has been marked by a high level of dynamism. Restoring confidence in the financial system and stabilizing the market have been accompanied by the development of innovative technology that is changing the structure of the market. Almost any process that has so far been considered the key competencies of traditional investment management (investment or classic banks) because of technology development can be externalized: data collection, analysis, trading and implementation strategies, supervision, risk assessment and regulatory compliance. The size of an investment management institution is no longer directly related to quality. Founded in 2013 as a result of a collaboration between Harvard and MIT, Fintech Kensho has been named the most promising private AI company, specializes in computational data analysis and has next-generation analytical algorithms that can perform mass-parallel statistical computational operations, near-unlimited scale infrastructure and user-accessible interface with which, with a high level of accuracy in a short period of

time, it models market trends at the level of quality of the largest investment institutions (Kensho, 2018). Using leverage technology, almost any investment firm can produce state-of-the-art quantitative analyzes with minimal involvement of quantitative experts. There are open platforms that offer a free risk management service and are funded by fees for support, education and training of employees whose task is to implement these capacities for the purpose of tailored needs of individual organizations. Outsourcing, consolidation, and communalization have equalized opportunities for all institutional investors regardless of size, and differentiation remains the result of personal contact. Until recently, the aforementioned high level of investment advisory quality was available only to the largest investors and most clients achieved returns primarily at the level of deposit interest rates, which were often lower than the inflation rate (resulting in negative real returns). It can be said that the use of AI technology has revolutionized the investment-banking segment (WEF, 2015).

In this work, we focus on cryptocurrencies as one of the most important aspects of Fintech markets.

## Methodology

The findings of empirical research based on data from Coinmarket enabled the realization of the main purpose of this paper. For the purpose of the analysis, data on market capitalization and the value or price of the 30 most influential cryptocurrencies of currencies were used, with special reference to Bitcoin in the period from 2014 to 2020.

To find the answer to one of the most frequent questions of forecasting cryptocurrencies: quantitative and intuitive techniques, some forecasting models are presented. In financial business, as well as in business with cryptocurrencies, there is a great need and possibility to get to know objective laws and predict their operation and impact in the future, so forecasting is an integral part of economic theory and practice is becoming increasingly important. The limits and possibilities of forecasting are limited. Due to the great uncertainty of the realization of future events, forecasts have the characteristic of probability. Good knowledge of the theory, practice, methods and techniques of forecasting can significantly help to increase the efficiency of forecasting. The advantages are: (a) Well-constructed forecasts can be used to make certain predictions, plan and make business decisions in all areas of business; (b) Forecasts deal with those processes and phenomena that may in some way connect the past, present and future. Disadvantages: It is important to emphasize that future development that has nothing to do with past and present developments cannot be subject to forecasting. Quantitative forecasting methods use historical data and forecasting models. The model formally summarizes the patterns in the data and expresses the statistical correlation. Forecasting models are used to extrapolate past and current behaviours of observed data into the future. General Time Series Models (average rate of change, linear and exponential trend) and movable were used in this paper. The described forecasting methods are relatively often used due to their extreme simplicity. It should be emphasized, however, that they are only suitable for a very limited time horizon.

## Results

The changes in the market value of cryptocurrencies in the financial market were analyzed by comparing data on market capitalization and prices of the 30 most influential traded cryptocurrencies in the period between 2017 and 2020.

Using the descriptive statistics indicators, Table 1 shows the market capitalization statistics of the 30 most influential cryptocurrencies. Based on the data, the changes of the average market capitalization expressed in US dollars (USD) in the selected period starting from 2017 when it amounted to 567,130,553.7 dollars, in 2018 24,710,672,704 dollars, while in 2019 it amounted to 2.12 billion dollars and in 2020 it grew to \$ 6.3 billion. The minimum market capitalization in 2020 was \$ 305,240,316 (VeChain) while Bitcoin had a maximum market capitalization of \$ 134,469,548,249. Table 2 presents the same changes in the market price in the same period.

Table 1

Indicators of the Market Capitalization of the 30 Most Influential (Traded) Cryptocurrencies for 2017 to the 2020 Year (Quoted in USD).

	Market Capitalization 8.1.2017.	Market Capitalization 8.1.2018.	Market Capitalization 6.1.2019.	Market Capitalization 5.1.2020
<b>Mean</b>	567,130,553.7	24,710,672,704	2.12E+09	6.30E+09
<b>Median</b>	20,235,409	6,011,491,582	6.67E+08	8.31E+08
<b>Standard Deviation</b>	2,707,385,504	57,347,642,673	3.95E+09	2.44E+09

Source: Authors' work according to CoinMarketCap (N/A)

Table 2

Indicators of the Market Prices of the Most 30 Influential (Traded) Cryptocurrencies from 2017 to 2020. Year (Quoted in USD)

	Market Prices 8.1.2017.	Market Prices 8.1.2018.	Market Prices 6.1.2019.	Market Prices 6.1.2020.
<b>Mean</b>	213.52	54.52	176.79	284.216
<b>Median</b>	3.64	92.35	2.62	2.81
<b>Standard Deviation</b>	618.73	1654.87	743.48	1349.185

Source: Authors' work according to CoinMarketCap (N/A)

The conducted analysis revealed that when all the currencies currently traded are taken into account, Bitcoin is still the most influential cryptocurrency. Compared to Maker, which holds the second position for two years, Bitcoin has almost ten times the market value. From a market capitalization perspective, only Ethereum came close to Bitcoin in the short term in July 2017 and again in 2020. The situation on the cryptocurrency market in 2020 is to some extent stable and there is a downward trend in the value of most cryptocurrencies.

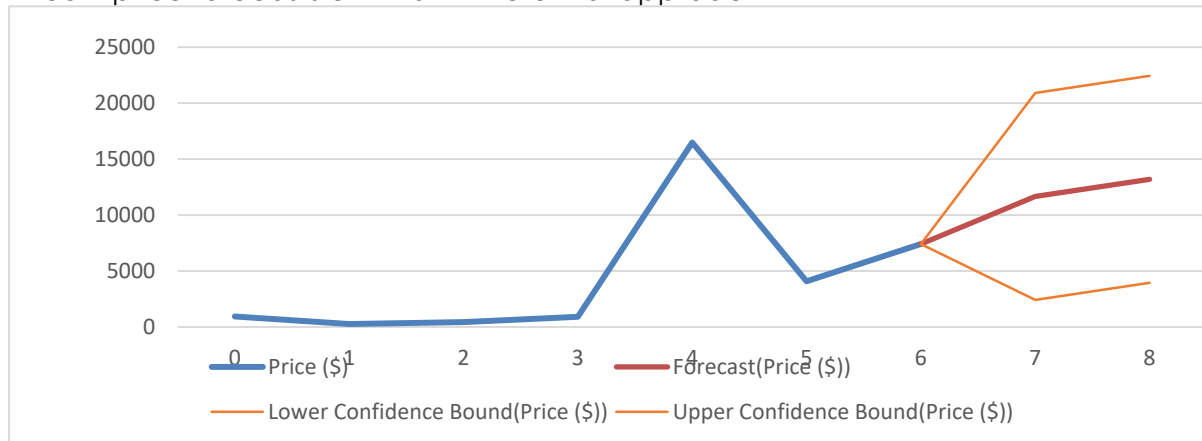
Figure 1 presents the Bitcoin price forecasts until 2022-Inferential approach.

The average rate of change calculated using the geometric mean showed an increase in the price of Bitcoin by 51.34% per year. Accordingly, the Bitcoin price forecast for 2021 is \$ 11216.21, for 2022 \$ 16974.51 and 2023 \$ 25689.05598.

Data analysis shows that among all cryptocurrencies currently traded, Bitcoin is the most influential, supported by the fact that as of July 9, 2019, the market capitalization of Bitcoin was 64% of the total market capitalization (\$ 352,505,516,548). Given the above, based on the estimated parameters, a trend model was calculated for the price of Bitcoin in the period from 2014 to 2020. Bitcoin price forecasts using the linear trend method show a further upward trend in the next short term. The projected price of Bitcoin for 2021 by this method is \$ 10515.8. The forecast for 2022 is \$ 12055.3 and for 2023 \$ 13594.8.

The inferential approach shows with a 95% confidence interval for 2021 the Bitcoin price movement between Lower Confidences Bound \$ 2413.10, Upper Confidence Bound \$ 20907.66. For 2022, the forecast is \$ 13,191.63421. In the year 2022 with a 95% confidence interval the Bitcoin price forecast ranges between \$ 3,944.31 and \$ 22,438.96.

Figure 1  
Bitcoin price forecasts until 2022-Inferential approach

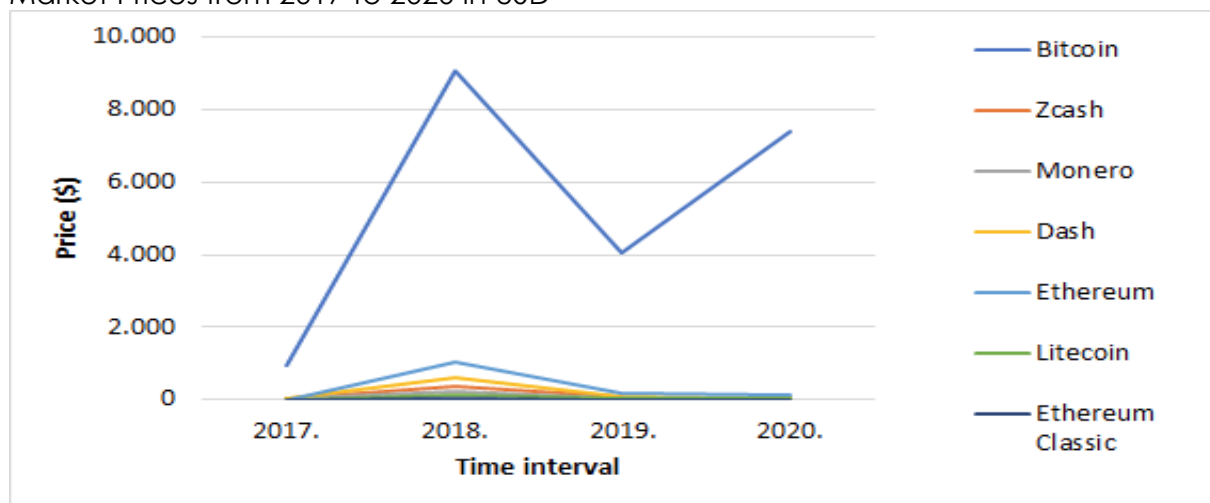


Source: Author's illustration according to CoinMarketCap (2020)

Figure 2 presents the market prices from 2017 to 2020 in USD. Observing changes in Bitcoin prices shows a nonlinear tendency, so the use of an exponential trend is more suitable for forecasting purposes. Applying the exponential trend in the Bitcoin market value model, the average price growth is 172.9% per year and the calculated R-square value of 0.5917 indicates that this model has high reliability. From all the above, it can be concluded that for the purpose of forecasting Bitcoin price movements, the application of the exponential trend provides the highest level of reliability.

Bitcoin price forecasts using the exponential trend method show a further upward trend in the coming short term. The projected price of Bitcoin for 2021 by this method is \$ 15,543.25. For 2022, the forecast is \$ 26,875.81, and for 2023 \$ 46,470.92.

Figure 2  
Market Prices from 2017 to 2020 in USD

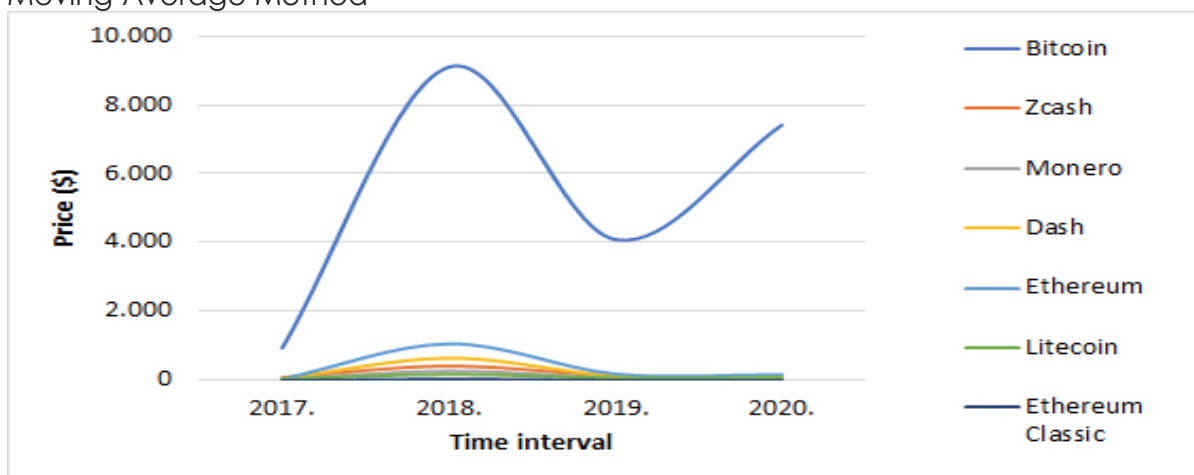


Source: Author's illustration according to CoinMarketCap (2020)

Using a linear trend in the model for the purpose of forecasting several years in advance, the obtained values have a high level of unreliability, which indicates the inadequacy of this model and is visible if we look at the image showing the forecast for the period. In order to obtain usable business and economic data, a different approach to time series processing is more appropriate by looking at the basic components of the time series from a different perspective, which prefers not to assess them as default but more susceptible to constant change. By accepting the possibility that the basic components may change over time, we get rid of the attachment to the application of fixed trends and seasonal patterns. Newbold, P. et al. (2010).

Applying the moving average method enables time series smoothing. By calculating the moving averages, the irregular component is levelled, which provides the possibility of gaining insight into the pattern of movement over time. The intention to use the moving average method is to reduce the effect of a large irregular component at any given time on a time series by putting it into the calculation of the average with its closest values. Using SPSS statistics, version 23, a calculation of moving averages is obtained, which can be seen in Figure 3.

Figure 3  
Moving Average Method



Source: Author's illustration according to CoinMarketCap (2020)

Table 3  
Forecasting Bitcoin Prices from 2021. to 2023. Year (Quoted in USD)

Forecasting Method	Bitcoin Prices 2021.	Bitcoin Prices 2022.	Bitcoin Prices 2023.
Exchange Rate	11216.21	16974.51	25689.06
Linear Trend	10515.80	12055.30	13594.80
Exponential Trend	15543.25	26875.81	46470.92

Source: Authors' work according to CoinMarketCap (N/A)

Table 3 presents the forecast of the Bitcoin prices from 2021 to 2023. The latest data show that halving, i.e. the reduction in the number of Bitcoins generated by "mining" has so far not resulted in a more pronounced jump in the value of that digital currency. Therefore, analysts point out that investors will have to be patient this time for more tangible returns.



## Conclusion

Crypto economy is changing our perception of traditional money. They try to replace all the shortcomings that paper money had, and highlight all its positive aspects, in a way that the positive characteristics of money are implemented in electronic money. Cryptocurrencies are often in the spotlight as an extremely risky investment; however, investing in cryptocurrencies can also be a very profitable business opportunity. Before investing, you need to make a good analysis and constantly monitor and understand the latest market trends. According to market capitalization and popularity, Bitcoin still dominates among cryptocurrencies, but other cryptocurrencies compete with it (Ethereum, Ripple, Litecoin). No cryptocurrency will provide us with a 100% return. Cryptocurrencies are perhaps the riskiest tool on which you can put your hard-earned money.

To support the business decision-making process of crypto investments, we offered the answer to one of the most frequent questions of forecasting cryptocurrencies; quantitative and intuitive techniques. In purpose to support the business decision-making process of investing in the cryptocurrency market, some forecasting models are presented.

Certain forecasting models were presented to support the business decision-making process while investing in the cryptocurrency market.

The results showed that according to all selected methods, Bitcoin price forecasting has a tendency of continuous growth in the period until 2023. The lowest value of the predicted price of Bitcoin is shown by the linear trend method, whose reliability of the forecast is not respectable. The average rate of change shows a balanced increase in the price of Bitcoin, which is understandable given the calculation methodology. The largest increase in the projected price of Bitcoin is shown by the exponential trend method whose reliability of the forecast is solid (\$ 15,543.25 for 2021, \$ 46,470.92 by 2023).

The results of Bitcoin prices show extremely high price variability and this variability is not largely related to price movements in other standard financial markets. This extremely large variability is smoothed by the moving average method because the underlying irregular component is removed from the array in order to reveal structural components more clearly. Based on this research, it is possible to confirm that Bitcoin is the most influential cryptocurrency on the market today. Based on the results of the research, it is possible to conclude that the world cryptocurrency market is improving day by day, using a small correction twice a year. Although the growth of market capitalization is undeniable, there are still many questions to be answered.

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