Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Trade and Finance

Bachelor Thesis

Comparative Analysis of Cryptocurrencies – Case Study of Bitcoin, Solana and Ethereum

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CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

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Comparative Analysis of Cryptocurrencies – Case Study of Bitcoin, Solana and Ethereum

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Objectives of thesis

The main objective of the author lies in understanding if cryptocurrencies are worth considering as investment options. Consequently, the author comes up with a series of suggestions for potential investors seeking opportunities to increase their capital by investing into specific coins that make up the crypto market.

Thus, the author analyzes volatility of those stocks, quantifies contribution of three chosen coins – Solana, Bitcoin and Ethereum to the entire crypto market capitalization and evaluates which coin is the most important driving force of the market capitalization of cryptocurrency. The very final point is to understand if there is any seasonal pattern in the cryptocurrency market and to come up with the conclusion about best months to invest in cryptocurrency.

Methodology

In order to reach his objectives, the author focuses primarily on quantitative or empirical research. The time period selected for the analysis covers 4 years (from 2019 to 2022) and the analysis is represented by: seasonality analysis, linear regression analysis, trend estimation, correlation analysis and volatility analysis in the form of computation of coefficient of variation for three coins – Solana, Bitcoin and Ethereum.

The proposed extent of the thesis

30 – 40 pages

Keywords

Bitcoin, Solana, Ethereum, cryptocurrency, market capitalization, speculation, seasonality, volatility

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Prague on 12. 03. 2023

Declaration

I declare that I have worked on my bachelor thesis titled "Comparative Analysis of Cryptocurrencies – Case Study of Bitcoin, Solana and Ethereum " by myself and I have used only the sources mentioned at the end of the thesis. As the author of the bachelor thesis, I declare that the thesis does not break any copyrights.

In Prague on 15.03.2023 _____

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Comparative Analysis of Cryptocurrencies – Case Study of Bitcoin, Solana and Ethereum

Abstract

The main objective of the author lies in understanding if cryptocurrencies are worth considering as investment options. Consequently, the author comes up with a series of suggestions for potential investors seeking opportunities to increase their capital by investing into specific coins that make up the crypto market. Thus, the author analyzes volatility of those stocks, quantifies contribution of three chosen coins – Solana, Bitcoin and Ethereum to the entire crypto market capitalization and evaluates which coin is the most important driving force of the market capitalization of cryptocurrency. Also, the author characterizes the seasonality of the cryptocurrency market.

In order to reach his objectives, the author focuses primarily on quantitative or empirical research. The time period selected for the analysis covers 4 years (from 2019 to 2022) and the analysis is represented by: seasonality analysis, linear regression analysis, trend estimation, correlation analysis and volatility analysis in the form of computation of coefficient of variation for three coins – Solana, Bitcoin and Ethereum.

Consequently, the author comes with the following conclusions: volatilities of the three chosen cryptocurrencies are 87% for Solana, 147% for Ethereum and 193% for Bitcoin; the best month to invest in cryptocurrencies is April with 26% more market capitalization in this month; the worst month to invest in cryptocurrencies is July with an almost 22% drop in market capitalization. It is not worth investing in cryptocurrencies if an investor has a strategy oriented on a long-term horizon. Bitcoin is the key driving force behind the market capitalization of cryptocurrency market.

Keywords: Bitcoin, Solana, Ethereum, cryptocurrency, market capitalization, speculation, seasonality, volatility

Srovnávací analýza kryptoměn-Případová studie Bitcoinů, Solany a Etherea

Abstrakt

Hlavním cílem autora je pochopit, zda kryptoměny stojí za zvážení jako investiční možnosti. V důsledku toho autor přichází s řadou návrhů pro potenciální investory, kteří hledají příležitosti ke zvýšení svého kapitálu investováním do konkrétních mincí, které tvoří kryptotrh. Autor tedy analyzuje volatilitu těchto akcií, kvantifikuje příspěvek tří vybraných mincí-Solana, Bitcoin a Ethereum k celé kryptografické tržní kapitalizaci a vyhodnocuje, která mince je nejdůležitější hnací silou tržní kapitalizace kryptoměny. Autor také charakterizuje sezónnost trhu s kryptoměnami.

Za účelem dosažení svých cílů se autor zaměřuje především na kvantitativní nebo empirický výzkum. Časové období vybrané pro analýzu zahrnuje 4 roky (od roku 2019 do roku 2022) a analýzu představují: analýza sezónnosti, lineární regresní analýza, odhad trendů, korelační analýza a analýza volatility ve formě výpočtu variačního koeficientu pro tři mince – Solana, Bitcoin a Ethereum.

V důsledku toho autor přichází s následujícími závěry: volatilita tří vybraných kryptoměn je 87% pro Solanu, 147% pro Ethereum a 193% pro Bitcoin; nejlepší měsíc pro investování do kryptoměn je duben s 26% vyšší tržní kapitalizací v tomto měsíci; nejhorší měsíc pro investování do kryptoměn je červenec s téměř 22% poklesem tržní kapitalizace. Do kryptoměn se nevyplatí investovat, pokud má investor strategii orientovanou na dlouhodobý horizont. Bitcoin je klíčovou hnací silou tržní kapitalizace trhu s kryptoměnami

Klíčová slova: Bitcoin, Solana, Ethereum, kryptoměna, tržní kapitalizace, spekulace, sezónnost, volatilita

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List of abbreviations

ETC…Ethereum

BTC…Bitcoin

SOL…Solana

USD…United States Dollar

1 Introduction

The author, like almost anyone else living in the modern dynamic world, constantly seeks new opportunities to dispose his earnings and invest them into something that will ensure his own financial prosperity. However, the modern world did not only offer everyone boundless opportunities to earn money, but it also created a serious amount of headache that is related to the selection of investment option.

Thus, it is possible to distinguish securities – bonds, stocks, etc; commodities – future contracts and options, etc. However, there is one particular element of the modern world that is becoming more and more popular among people from the same generation as the author – cryptocurrencies.

Henceforth, the author decided to take a profound insight into the way how those coins and crypto assets function and define for himself and also for potential readers of this very study if it is worth considering cryptocurrency as a good investment opportunity in 2022-2023.

2 Objectives and Methodology

2.1 Objectives

The main objective of the author lies in understanding if cryptocurrencies are worth considering as investment options. Consequently, the author comes up with a series of suggestions for potential investors seeking opportunities to increase their capital by investing into specific coins that make up the crypto market.

Thus, the author analyzes volatility of those stocks, quantifies contribution of three chosen coins – Solana, Bitcoin and Ethereum to the entire crypto market capitalization and evaluates which coin is the most important driving force of the market capitalization of cryptocurrency. The very final point is to understand if there is any seasonal pattern in the cryptocurrency market and to come up with the conclusion about best months to invest in cryptocurrency.

2.2 Methodology

In order to reach his objectives, the author focuses primarily on quantitative or empirical research. The time period selected for the analysis covers 4 years (from 2019 to 2022) and the analysis is represented by: seasonality analysis, linear regression analysis, trend estimation, correlation analysis and volatility analysis in the form of computation of coefficient of variation for three coins – Solana, Bitcoin and Ethereum.

The author considers the most fundamental techniques used in statistics due to the fact that the author seeks to maximize the objectivity in his research, and he seeks at the same time to rely solely on empirical data rather than on opinions and beliefs. All kinds of analyses used are supported by relevant framework and specific formulas for each case, which have been in use by infinitely many prominent researchers and academists.

Furthermore, it is wise to specify that the author uses secondary data, which is obtained mostly from major crypto exchange platforms and independent databases reflecting on the fluctuations of prices of crypto assets.

3 Literature Review

3.1 Cryptocurrencies

3.1.1 History

In order to properly address the question of cryptocurrencies and potential investment into this kind of security, it is downright essential to take an insight into the history of the phenomenon. In addition to that, this can be easily done especially given the fact that cryptocurrencies are a relatively young phenomenon whose birth dates back to the 10s of the 21st century.

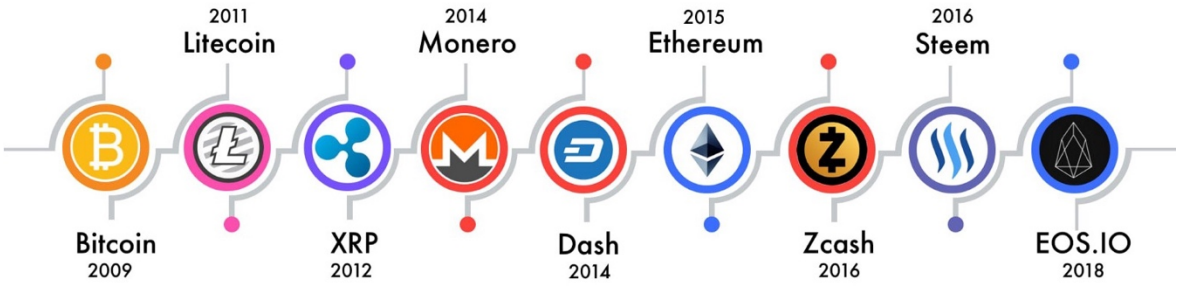
Yet, when talking about cryptocurrencies and their history, it is still wise to say that initial steps towards the creation of digital currencies were made in the 80s of the 20th centuries, when the first-ever electronic money was created under the name ecash by an American cryptographer. However, it is still wise to say that cryptocurrencies in the form that we all see today were created in 2009, when a person who claims to have a name of Satoshi Nakamoto developed the first-ever cryptocurrency under the name of Bitcoin, which was soon to become incredibly successful and acclaimed all over the world by numerous investors (Chohan, 2022).

Figure 1, bitcoin logo

Source: Vecteezy, 2023

After the original start of Bitcoin and Bitcoin trading, other cryptocurrencies were about to enter the market with Litecoin being established in 2011 and Peercoin being created in 2012, following by countless other coins that all will bear the name of altcoins, standing for alternative coins and the word alternative practically refers to them being alternatives to bitcoin (Brunton, 2020).

Figure 2, historical timeline of cryptocurrencies



Source: Redman, 2020

Over the course of the previous decade, the phenomenon of cryptocurrencies started to attract attention of centralized governments around the year 2014, when central banks all over the world started to investigate the phenomenon and issued a series of recommendations related to the treatment of a new security. The discourse indeed changed in just a matter of years, when the market capitalization of the crypto market started to skyrocket and more and more people started to deposit their savings into crypto assets, thus switching from traditional securities such as bonds, stocks and futures to the digital currency. Following this, numerous governments all over the world addressed the issue of cryptocurrencies by simply banning their use, trading and mining, i.e., generation or extraction using hardware (Deepika, 2017).

What is rather interesting is the fact that crypto market itself went through the series of incredible surges in the total capitalization and reached its peak in November 2021 until slumping to astonishingly low figures in the beginning of 2022 and the market capitalization remained on the same level throughout the whole year. Despite the fact that prediction about potential future of digital currencies and crypto assets is almost impossible and it will bear the nature of a mere hypothesis, the history of crypto assets suggests that the idea turned out to be rather advantageous and successful, especially given the fact that coins that cannot

anyhow take tangible form proved themselves to be in high demand and incredibly popular among ordinary people (Uhlig, 2022).

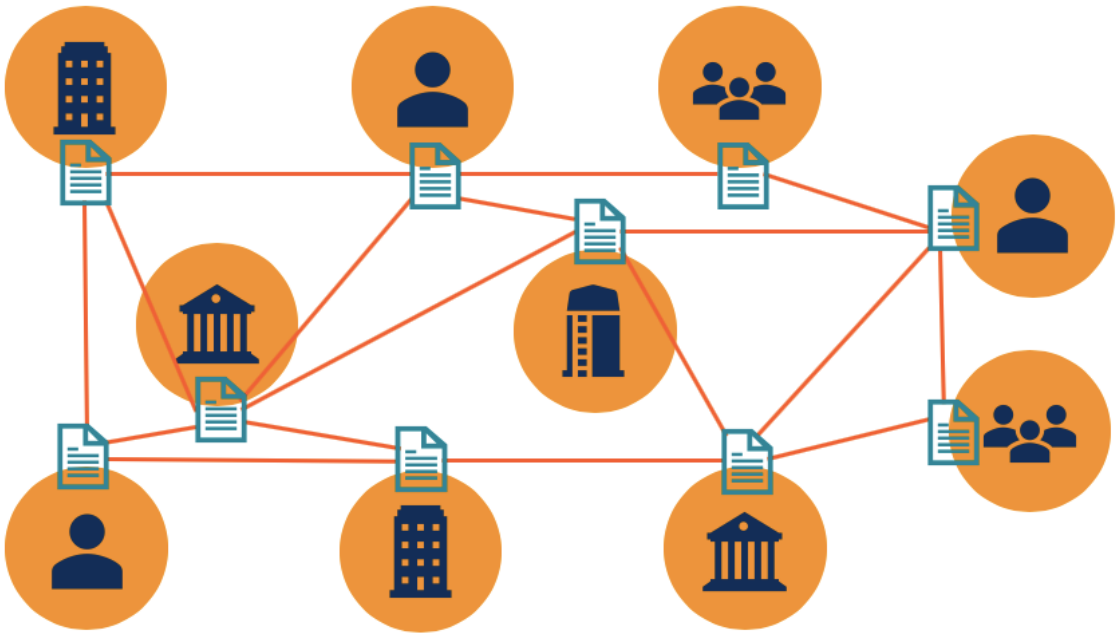
Figure 3, crypto market capitalization

Source: Williams, 2022

3.1.2 Concept

In fact, when talking about the concept or the essence of cryptocurrencies, it is wise to say that there are many different applications and descriptions related to the mechanism of cryptocurrencies. Yet, it is inevitable not to mention the blockchain technology, which is directly responsible for those digital currencies. Blockchain technology is based on a distributed ledger technology, or simply put DLT, which is represented by a series of records called blocks, which all are linked between each other using cryptography. This very technology allows to contain a specific algorithm related to the previous block connected to the chain, a timestamp and transaction data. Hence, all transactions made by cryptocurrencies can be traced back to its origin using this technology. However, the application of blockchain technology does not necessarily mean that cryptocurrencies are the only domain where this technology is exercised. As many authors and scientists stress it, one of the best advantages offered by cryptocurrency is the opportunity to exercise various contracts and transactions related to other fields. Those contracts are called smart contracts, and this is something that is often regarded as the technology of the future, which is still in the process of evolving (Zheng, 2018).

Figure 4, distributed ledget technology scheme



Source: Crypto Valley Journal, 2020

Yet, the main focus of the following thesis is to focus on cryptocurrencies as a security and the concept of cryptocurrency is something that makes them attractive to investors and ordinary people. Compared to ordinary securities, e.g., stocks, cryptocurrencies are not regulated by any authorities, and they are decentralized, while the overwhelming majority of securities actively traded by the general public are centralized, i.e., they are subject to numerous conditions and requirements that have to be met in order for a given commodity or security to be traded publicly or even regarded to as a tradable commodity or security. Contrary to those regulated securities and tradable commodities, cryptocurrencies generally have no regulation exercised from the inside, but as it was mentioned earlier, numerous governments around the world constantly try to change the current situation by imposing additional regulations – some countries do it quite successfully and cryptocurrency flow there is somewhat constrained or regulated by those regulations while attempts of other countries are simply categorized as fruitless (Yadav, 2020).

3.1.3 Modern Application

Interestingly enough, cryptocurrency is used practically anywhere in the year 2022, and the scope of fields where this innovation is being used keeps on increasing even in spite of the major upheaval that occurred at the end of 2021 and then at the end of 2022, when a massive cryptocurrency exchange platform called FTX, who were almost exclusively specializing in cryptocurrency, fell and caused a major panic on the cryptocurrency market. As of the year 2022, the principal use of cryptocurrency is as a tradeable security, which is actively exchanged on international crypto exchange platforms such as Binance, Coinbase, and Kraken (Kim, 2021).

In addition to being a tradable security, cryptocurrencies are also regarded to be a currency; hence, a P2P network and an immediate transfer mechanism may be used in order to facilitate a variety of transactions with the aid of cryptocurrencies. As of the year 2022, a wide variety of stores and even some of the most well-known corporations in the world accept payments that are made using cryptocurrency. However, the nature of their attitude towards digital currencies is still questionable, and logical questions have arisen as to whether those businesses are simply attempting to gain popularity and increase their presence in the world, thus catching up with the tide of popularity of cryptocurrencies, or whether they are actually interested in the technology (Hairudin, 2022).

Aside from the very obvious applications of cryptocurrencies, there is one particular one that is worth mentioning in a separate paragraph. This is the application of cryptocurrencies as a natural currency, which occurred quite recently in the country of El Salvador, where their relatively forward-thinking president approved the introduction of bitcoin as an official currency to be used alongside the American dollar beginning in the year 2001. In September 2021, the government of the country decided to begin using bitcoin as its primary form of currency. At the same time, the president of the country converted a portion of the country's gold and cash reserves into bitcoin. This decision turned out to be rather unfortunate, particularly in light of recent events and the declining market value of bitcoin and other crypto assets. This chain of unfavorable occurrences will always result in difficulties with the country's liquidity, and it will essentially bring the nation to the brink of

economic solvency, placing it in a position where it will almost certainly be required to announce that it will default on its debts (Analytica, 2021).

Figure 5, bitcoin payment sign in El Salvador

Source: BBC, 2022

Of course, this negative experience of El Salvador does not inevitably mean that digital currencies are deemed to be a real flop, but it just proves the point that macroeconomic environment might not be ready to embrace the introduction of new decentralized currencies because they are significantly volatile compared to ordinary assets, such as gold and international reserve currencies.

3.2 Altcoins and Bitcoin

3.2.1 Bitcoin

The phenomena of bitcoin in relation to the crypto market is unquestionably one of a kind due to the fact that any changes in the value of bitcoin are anticipated to induce changes in practically all alternative currencies, although of varying intensities but continuing in the same general direction. The behavior of the market after significant fluctuations in the price of bitcoin proves the point that the cryptocurrency market is subject to at least some laws and patterns that can be traced and analyzed. As a result, Bitcoin is something that is believed to be highly correlated with the rest of the cryptocurrencies. However, this fundamental

dependence of alternative coins on the very first cryptocurrency can be explained by the fact that bitcoin accounts for almost 50–70% of the total market capitalization of all cryptocurrencies. Because of this, bitcoin is indeed the whale on which the entire market is relying. Moreover, because bitcoin was the very first cryptocurrency, it has a fundamental advantage over other cryptocurrencies. Bitcoin, in addition to creating diverse changes in altcoins, acts as a tool that shows whether or not a certain cryptocurrency is likely to see a significant increase in its price. This can be done by comparing the price of bitcoin to the price of another cryptocurrency. The market capitalization of Bitcoin is something that is not likely to be surpassed by any other cryptocurrency in the near future, so when thinking and projecting possible changes in a given alternative coin, analysts always take into consideration the market capitalization of Bitcoin, and they set this value as a boundary that cannot be exceeded by a given altcoin at the time without bitcoin experiencing a growth at the same time. This is because the market capitalization of Bitcoin is something that is not likely to be surpassed by any other cryptocurrency in the near future (Schilling, 2019).

Figure 6, bitcoin market capitalization

Source: Statista, 2022

Unsurprisingly, the pattern of the market capitalization of bitcoin almost perfectly replicates the chart shown previously depicting the development of the market capitalization of all crypto assets. After all, it all boils down to bitcoin's performance when judging changes in the market capitalization of cryptocurrencies.

3.2.2 Altcoins

Altcoins, also known as alternative coins, are a variety of cryptocurrencies that can be bought and sold openly on cryptocurrency exchanges. Although altcoins roughly represent the entire market in terms of their quantity, this is most certainly not the case in terms of their capitalization, as they only account for an approximate percentage that ranges anywhere from 30 to 50 percent at various stages of the market. Notably, altcoins are typically connected to a specific company or startup that is working on a particular project. As a result, those coins are frequently used as a source of funding for those projects, and the prices of those coins typically serve as an indicator of whether or not a given project is really successful in its performance.

XRP, Dogecoin, Cardano, Litecoin, and Ethereum are some of the most prominent examples of alternative cryptocurrencies as of the beginning of the year 2023. The last one is generally thought of as the engine that drives all alternative currencies since the technology that ETH provides is often the foundation on which alternative coins are built. Ethereum is often thought to be an alternative to bitcoin, which currency confirms with its consistent performance during the course of its 7-year existence. This is despite the fact that Ethereum is recognized as a driving force behind the market of altcoins (Chen, 2019).

However, it is vital to point out that the market capitalization of altcoins and their position used to be considerably stronger than they are at the end of 2022 and the beginning of 2023. This is something that has to be mentioned. The crash of one of the market's leading cryptocurrencies at the time, Luna, whose price dropped from around 120 dollars to figures well below 1 dollar before the currency was eventually withdrawn from almost all exchanges, helps to explain the current bear market. The price of Luna dropped from around 120 dollars to figures well below 1 dollar.

There are still other alternatives to bitcoins as well as conventional reserve currencies; these alternatives are known as stablecoins. In addition to very hazardous and volatile assets such as altcoins, there are still other choices to choose from. Stablecoins are coins that serve as alternatives to currently existing centralized currencies issued by the central banks of the world's top countries. Stablecoins are often used by individuals for the purposes of conserving money, conducting transactions, and also purchasing cryptocurrencies. Tether, USD token, Binance USD, and a number of other instances are significant examples. Historically, the volume of those coins repeats the volume of the original currency that those stablecoins copy, so providing a foundation for the method through which prices emerge (Chohan, 2019).

Figure 7, logos of altcoins alongside bitcoin

Source: MacFarlane, 2022

3.3 Technical Analysis

3.3.1 Volatility Analysis

When considering such volatile assets as cryptocurrencies, a pertinent volatility analysis is an integral part of any case study because it will inevitably allow a given decision-maker to quantity the amount of risk that is related to a given asset. Of course, when talking about cryptocurrencies, there is no way that a risk-averse person would venture into the world

where the whole market can just slump in a matter of minutes as it happened multiple times throughout the history of cryptocurrencies (Liu, 2019).

Thanks to corporate finance and financial analysis, there are multiple risk assessment techniques that might prove themselves to be highly useful in the context of tradeable securities and other assets, but they are not really applicable in the case of cryptocurrencies. Hence, according to multiple authors and analysists, one of the best ways to draw a conclusion about the extent to which a given cryptocurrency is risky or not would be calculating its standard deviation and after doing so, it is vital to express the deviation in percentual terms by calculating the coefficient of variation, whose calculation process follows the following formula:

$$Coefficient\ of\ Variation\ = \frac{Standard\ Deviation}{Mean} * 100 \quad (1)$$

According to financial analysts and researchers, the boundary of 20% for the coefficient of variation is considered to be crucial, as it separates investment opportunities into 2 categories – risky assets (with the coefficient of variation above or equal to 20% and safe ones (with the coefficient of variation less than 20%).

3.3.2 Seasonality Analysis

Seasonality analysis has long ago proven itself to be a highly useful tool needed in the analysis of time series, where this analysis allows analyst to quantify the seasonal factor and find periodicity of a given phenomenon evolving through time. Seasonality analysis can be exercised through 2 different approaches: the first one is the calculation of seasonal factor and the second one is the calculation of seasonal index. Practically, both of them indicate more or less the same thing, but seasonality factor is based on explaining the percentual value of the dependent variable relatively to a given time period being quarter, month, day of the week, etc., while seasonality index offers a quantified version of the seasonality factor.

Seasonality index is calculated as follows:

$$Seasonal\ Index\ = \frac{Seasonal\ Average}{Grand\ Average} * 100 \quad (2)$$

Seasonality analysis is quite often used in the analysis of macroeconomic variables, but it can be rather useful in the analysis of cryptocurrencies as there are numerous rumors and assumptions generated by investors and market analysts that cryptocurrencies perform better in given month than in other ones (Kaiser, 2019).

3.3.3 Regression Analysis

Finally, the last but not the least, linear regression or regression analysis is a fundamental tool that allows analysts and researchers to quantity the effect of selected regressors on a dependent variable. Compared to trend analysis, regression analysis offers analyst a wider perspective where he or she is able to assess the significance of individual factors relatively to the selected earlier variable.

Regression analysis is a linear analysis meaning that the parameters that are about to be estimated are linear ones and the estimation is based on the OLS method standing for the ordinary least squares calculated according to the following formula:

$$Estimated\ Parameters\ =\ (X^T X)^{-1} X^T Y \tag{3}$$

X stands for the matrix of exogeneous variables and Y stands for the vector of endogenous variable.

Apart from the assumption of linearity of parameters, there are also other fundamental assumptions that always have to be followed when creating a linear regression model or to be more specific, an econometric one, which is often used in finance and economics. These assumptions are:

1) Normality of residuals.
2) Absence of autocorrelation.
3) Absence of heteroscedasticity.
4) Absence of multicollinerity.

Whenever those assumptions are being following in addition to the assumption of linear parameters, the model is deemed to be BLUE, standing for the best linear unbiased estimator (Wooldridge, 2010).

4 Practical Part

4.1 Volatility Analysis

The very first part of the analysis is related to the volatility analysis where the author will find the percentage of volatility (coefficient of variation) and subsequently compare the volatilities of each coin, thus estimating the degree of risk. In addition to that, the author also takes into consideration the chain index in order to understand if the volatility in the chosen stocks was caused by a positive tendency of rise in the price of coins or by a negative, i.e., a decrease in the price of coins.

The very first coin whose volatility and chain index will be analyzed is Solana. The following table indicates the input used for the analysis.

Table 1, Solana volatility

Solana		
Date	Price, USD	Chain Base Index
01.04.2020	0.74	-
01.05.2020	0.59	-20%
01.06.2020	0.85	44%
01.07.2020	1.69	99%
01.08.2020	4.44	163%
01.09.2020	2.95	-34%
01.10.2020	1.44	-51%
01.11.2020	1.91	33%
01.12.2020	1.54	-19%
01.01.2021	4.23	175%
01.02.2021	13.31	215%
01.03.2021	19.18	44%
01.04.2021	42.58	122%
01.05.2021	28.56	-33%
01.06.2021	33.92	19%
01.07.2021	32.25	-5%
01.08.2021	109.65	240%
01.09.2021	135.28	23%
01.10.2021	193.34	43%
01.11.2021	204.35	6%
01.12.2021	172.51	-16%
01.01.2022	93.4	-46%
01.02.2022	85.57	-8%
01.03.2022	120.7	41%
01.04.2022	94.09	-22%
01.05.2022	47.19	-50%
01.06.2022	33.92	-28%
01.07.2022	43.8	29%
01.08.2022	31.46	-28%
01.09.2022	33.94	8%
01.10.2022	33.25	-2%

Standard Deviation
59.92306213

Variability
87%
Average increment
31%

Source: CoinMarketCap, 2022

After conducting the series of calculations, it becomes obvious that the variability of Solana coin over the time period from 01.04.2020 until 01.10.2022 is equal to 59.92 USD or 87%, which is quite high. Nevertheless, this high volatility is primarily caused by the fact that the coin was gradually increasing in price with an average increment of 31% for the chosen period of time. Then, the author continues with the volatility analysis for Bitcoin.

Table 2, bitcoin volatility

Bitcoin		
Date	Price, USD	Chain Base Index
01.04.2020	8658.5537	
01.05.2020	9461.0586	9%
01.06.2020	9137.9932	-3%
01.07.2020	11323.467	24%
01.08.2020	11680.82	3%
01.09.2020	10784.491	-8%
01.10.2020	13780.995	28%
01.11.2020	19625.836	42%
01.12.2020	29001.721	48%
01.01.2021	33114.359	14%
01.02.2021	45137.77	36%
01.03.2021	58918.832	31%
01.04.2021	57750.176	-2%
01.05.2021	37332.855	-35%
01.06.2021	35040.836	-6%
01.07.2021	41626.195	19%
01.08.2021	47166.688	13%
01.09.2021	43790.895	-7%
01.10.2021	61318.957	40%
01.11.2021	57005.426	-7%
01.12.2021	46306.445	-19%
01.01.2022	38483.125	-17%
01.02.2022	43193.234	12%
01.03.2022	45538.676	5%
01.04.2022	37714.875	-17%
01.05.2022	31792.311	-16%
01.06.2022	19784.727	-38%
01.07.2022	23336.896	18%
01.08.2022	20049.764	-14%
01.09.2022	19431.789	-3%
01.10.2022	19345.572	0%

Standard Deviation
16510.67196

Variability
193%
Average increment
5%

Source: CoinMarketCap, 2022

When it comes to bitcoin and the risk that is related to this investment option, it is concluded that the variability of Bitcoin is equal to 16510 USD with 193%. Undoubtedly, this is a very high volatility index and in addition to the average chain index of just 5%, it is quite evident that it is not the best option in terms of risk and return.

Table 3, Ethereum volatility

Ethereum		
Date	Price, USD	Chain Base Index
01.04.2020	207.60205	
01.05.2020	230.97571	11%
01.06.2020	226.315	-2%
01.07.2020	345.55466	53%
01.08.2020	435.07974	26%
01.09.2020	359.93787	-17%
01.10.2020	386.59033	7%
01.11.2020	614.84253	59%
01.12.2020	737.80341	20%
01.01.2021	1314.9862	78%
01.02.2021	1416.049	8%
01.03.2021	1918.3621	35%
01.04.2021	2773.207	45%
01.05.2021	2714.9453	-2%
01.06.2021	2274.5476	-16%
01.07.2021	2536.21	12%
01.08.2021	3433.7327	35%
01.09.2021	3001.679	-13%
01.10.2021	4288.0742	43%
01.11.2021	4631.479	8%
01.12.2021	3682.6328	-20%
01.01.2022	2688.2788	-27%
01.02.2022	2919.2012	9%
01.03.2022	3281.6428	12%
01.04.2022	2730.1868	-17%
01.05.2022	1942.328	-29%
01.06.2022	1067.2988	-45%
01.07.2022	1681.5173	58%
01.08.2022	1553.6849	-8%
01.09.2022	1327.9786	-15%
01.10.2022	1344.9985	1%

Standard Deviation
1276.297913

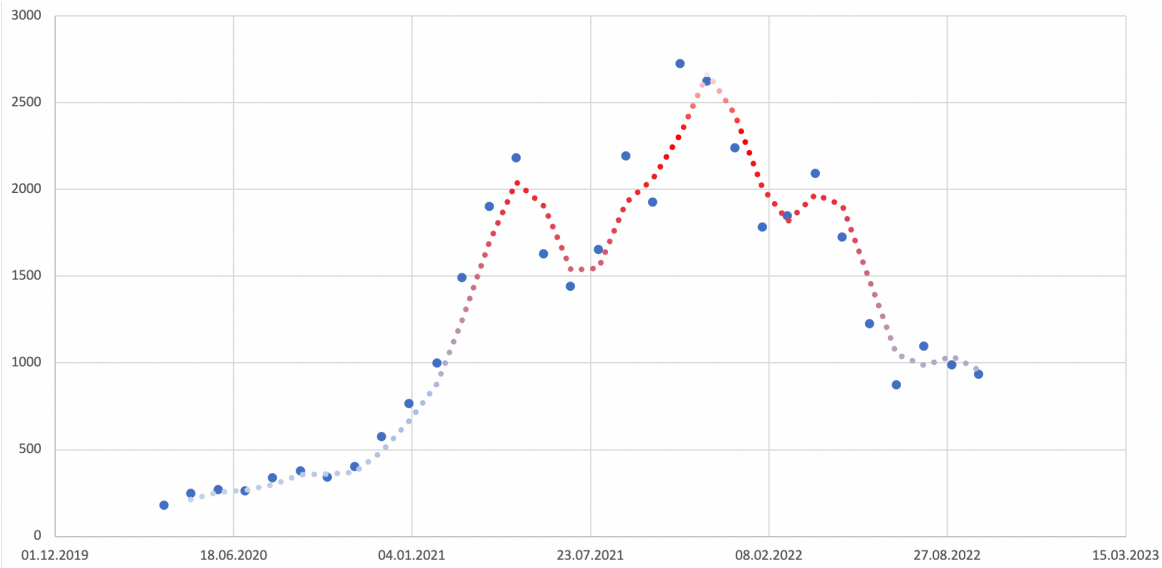
Variability
147%
Average increment
10%

Source: CoinMarketCap, 2022

Finally, Ethereum has a standard deviation of 1276 USD with a variability of 147% and an average increment of 10%. This is slightly better compared to Bitcoin, but still remains a risky investment opportunity as the variability is significantly high.

4.2 Market Capitalization Analysis

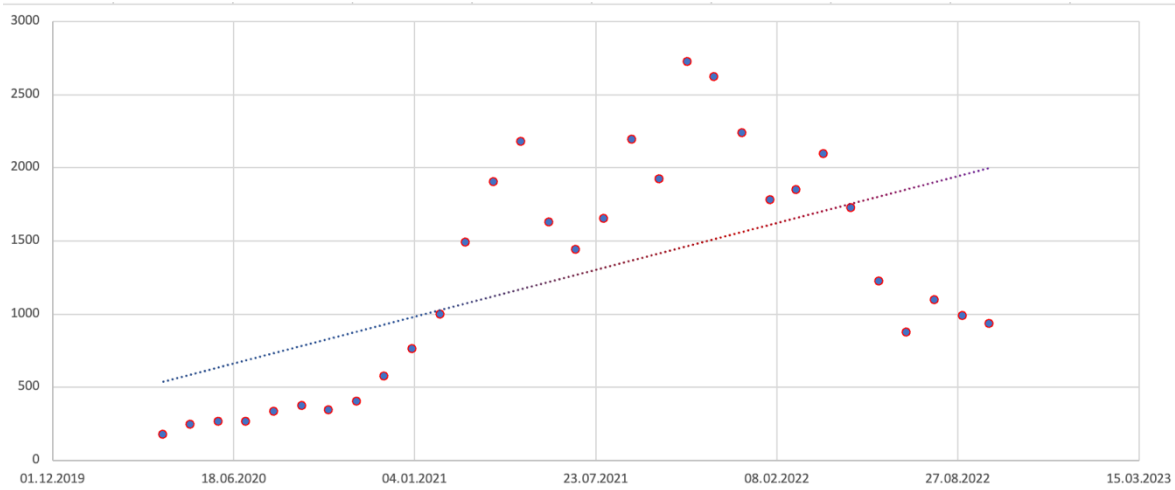
Figure 8, market capitalization over time



Source: own processing based on data from CoinMarketCap

Based on the moving average representing the development of market capitalization over the time period covering 3 years – from 2019 until 2022, it is visible that there might be some kind of seasonality in the following time series due to the fact that the pattern somehow resembles cyclical tendencies. Consequently, the author creates a trend that will depict the development of crypto market capitalization over time:

Figure 9, trend estimation



Source: own processing based on CoinMarketCap

Following the trend estimation done in Microsoft Excel, it is possible to estimate the following model using SPSS statistics:

Figure 10, trend parameters

	Model Summary					Parameter Estimates	
Equation	R Square	F	df1	df2	Sig.	Constant	b1
Linear	.328	14.156	1	29	<.001	488.374	48.739

Source: own processing

$y = 488.374 + 48.739t + Si + \varepsilon$, where:

T = time vector

Si = seasonality component

ε = error term.

The quality of the estimated trend is equal to 0.32, which basically means that just 32% of the variation is explained. This is a poor result but quite expected due to the highly volatile nature of the crypto market.

The average increment per month is equal to 48.739 billion US dollars meaning that this is an upward pointed trend, and the market capitalization increases over time. In the next

chapter, the author will estimate the seasonality component and make a prognosis for November 2022.

4.3 Seasonality Analysis

In this part, the author performs a seasonality analysis to understand in which month the market capitalization of cryptocurrency is more profitable and prosperous. For this purpose, the author performs a seasonality analysis whose steps were discussed in the literature review. In order to come up with relevant conclusions, the author takes a dataset with 37 observations reflecting the development of cryptocurrency market capitalization from 01.10.2019 until 01.10.2022 in order to find seasonality indices for each month of the year.

Table 4, market capitalization time series

Date	Market Cap, billion USD
01.10.2019	221
01.11.2019	245
01.12.2019	205
01.01.2020	191
01.02.2020	257
01.03.2020	243
01.04.2020	179
01.05.2020	246
01.06.2020	267
01.07.2020	263
01.08.2020	336
01.09.2020	376
01.10.2020	342
01.11.2020	403
01.12.2020	575
01.01.2021	764
01.02.2021	1000
01.03.2021	1491
01.04.2021	1902
01.05.2021	2180
01.06.2021	1628
01.07.2021	1441
01.08.2021	1653
01.09.2021	2193
01.10.2021	1925
01.11.2021	2724
01.12.2021	2622
01.01.2022	2239
01.02.2022	1781
01.03.2022	1848
01.04.2022	2093
01.05.2022	1726
01.06.2022	1226
01.07.2022	874
01.08.2022	1096
01.09.2022	986
01.10.2022	935

Source: CoinMarketCap, 2022

Consequently, the author finds the average for the whole period chosen – 1099 billion US is the average market capitalization of the crypto market. Consequently, the author conducts the calculations according to the relevant formula and gets the following seasonality indices per each month:

Table 5, seasonality index calculation

January	0.96844986
February	0.92114924
March	1.08609499
April	1.26559478
May	1.25892418
June	0.9463156
July	0.78167306
August	0.93540007
September	1.07790835
October	0.75438424
November	1.02242108
December	1.03151736

Source: own processing

Thus, it can be concluded that:

- Market capitalization in January is 3.2% lower.
- Market capitalization in February is 7.9% lower.
- Market capitalization in March is 8 % higher.
- Market capitalization in April is 26% higher.
- Market capitalization in May is 25.8% higher.
- Market capitalization in June is 5.4% lower.
- Market capitalization in July is 21.9% lower.
- Market capitalization in August is 6.5% lower.
- Market capitalization in September is 7% higher.
- Market capitalization in October is 24.6% lower.
- Market capitalization in November is 2% higher.
- Market capitalization in December is 3% higher.

The most profitable month for investments in terms of market capitalization gains in April with 26% more capitalization on average.

Consequently, it is possible to make a prediction for November 2022:

$y = 488.374 + 48.739 * 38 + 46.8\ (seasonality\ increment) =$
$2387.2651\ billion\ US$

This is highly unlikely but at the same time, it serves as an interesting piece of statistics indicating the potential market capitalization if the current recession would have not happened due to the Ukrainian Conflict.

4.4 Linear Regression Analysis

In the final part of his analysis, the author focuses on estimating a linear regression model that will have the following economic model:

$f\ (y) = (x1, x2, x3)$, where:

Y = crypto market capitalization in billion USD.
X1 = price of Ethereum in USD per 1 coin.
X2 = price of Bitcoin in USD per 1 coin.
X3 = price of Solana in USD per 1 coin.

Consequently, the econometric model will have the following characteristics:

$yt = ß0 + ß1X1t + ß2X2t + ß3X3t + \varepsilon$, where

ß0 = error term.
ß1,2,3 are parameters of independent variables.
ε = error term.
t = time vector representing 1 month.

The original dataset consists of 37 observations each representing variables' values every month on the first day of the month starting from 01.10.2019 until 01.10.2022.

Dataset was collected using secondary data published on CoinMarketCap, a huge

Table 6, dataset for estimation

Market Cap, billion USD	Ethereum Price, USD	Bitcoin price, USD	Solana Price, USD	Date
221	183.97	9199	0	01.10.2019
245	152.54	7569	0	01.11.2019
205	129.61	7193	0	01.12.2019
191	180.16	9350	0	01.01.2020
257	219.85	8599	0	01.02.2020
243	133.59	6438	0	01.03.2020
179	207.602051	8658.553711	0.69	01.04.2020
246	230.975708	9461.058594	0.57	01.05.2020
267	226.315002	9137.993164	0.85	01.06.2020
263	345.554657	11323.4668	1.54	01.07.2020
336	435.079742	11680.82031	4.44	01.08.2020
376	359.937866	10784.49121	2.95	01.09.2020
342	386.590332	13780.99512	1.44	01.10.2020
403	614.842529	19625.83594	1.91	01.11.2020
575	737.803406	29001.7207	1.54	01.12.2020
764	1314.986206	33114.35938	4.23	01.01.2021
1000	1416.04895	45137.76953	13.31	01.02.2021
1491	1918.362061	58918.83203	19.18	01.03.2021
1902	2773.207031	57750.17578	42.58	01.04.2021
2180	2714.945313	37332.85547	28.56	01.05.2021
1628	2274.547607	35040.83594	33.92	01.06.2021
1441	2536.209961	41626.19531	32.25	01.07.2021
1653	3433.732666	47166.6875	109.65	01.08.2021
2193	3001.678955	43790.89453	135.28	01.09.2021
1925	4288.074219	61318.95703	193.34	01.10.2021
2724	4631.479004	57005.42578	204.35	01.11.2021
2622	3682.632813	46306.44531	172.51	01.12.2021
2239	2688.278809	38483.125	93.4	01.01.2022
1781	2919.201172	43193.23438	85.57	01.02.2022
1848	3281.642822	45538.67578	120.7	01.03.2022
2093	2730.186768	37714.875	94.09	01.04.2022
1726	1942.328003	31792.31055	47.19	01.05.2022
1226	1067.298828	19784.72656	33.92	01.06.2022
874	1681.517334	23336.89648	43.8	01.07.2022
1096	1553.684937	20049.76367	31.46	01.08.2022
986	1327.978638	19431.78906	33.94	01.09.2022
935	1344.998535	19345.57227	33.25	01.10.2022

database with information about cryptocurrency.

Source: CoinMarketCap, 2022

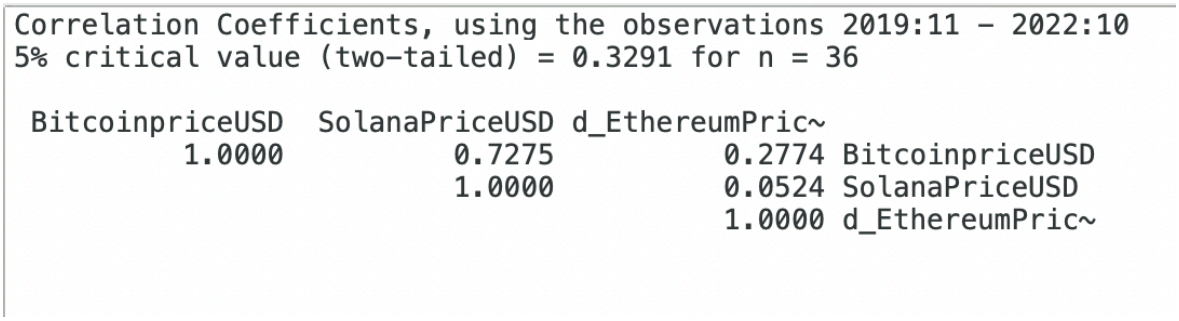
The author has the following list of assumptions:

- There is no multicollinearity (|r| of independent variables < 0.8).
- Error is normally distributed.

- Residuals are independent (no heteroscedasticity)
- No autocorrelation.
- The signs of all variables will be positive as they will positively contribute to the development of market capitalization.

The author transforms the variable (x1) into the variable of successive differences in order to prematurely eliminate potential multicollinearity. The multicollinearity check is done through the use of a correlation matrix in Gretl:

Figure 11, correlation matrix



```
Correlation Coefficients, using the observations 2019:11 - 2022:10
5% critical value (two-tailed) = 0.3291 for n = 36

 BitcoinpriceUSD  SolanaPriceUSD d_EthereumPric~
          1.0000          0.7275          0.2774 BitcoinpriceUSD
                          1.0000          0.0524 SolanaPriceUSD
                                          1.0000 d_EthereumPric~
```

Source: own calculations

No multicollinearity and the first assumption is satisfied.

The author proceeds to the OLS estimation:

Figure 12, OLS output

```
Model 2: OLS, using observations 2019:11-2022:10 (T = 36)
Dependent variable: MarketCapbillionUSD

                     coefficient  std. error    t-ratio   p-value
  ------------------------------------------------------------------
  const                0.523376    75.5905       0.006924  0.9945
  d_EthereumPriceU~   -0.547203     0.0782566   -6.992     6.35e-08 ***
  BitcoinpriceUSD      0.0327271    0.00324281  10.09      1.81e-11 ***
  SolanaPriceUSD       4.62307      0.931777     4.962     2.22e-05 ***

Mean dependent var   1123.750   S.D. dependent var   803.9207
Sum squared resid     1483264   S.E. of regression   215.2952
R-squared            0.934427   Adjusted R-squared   0.928280
F(3, 32)             152.0023   P-value(F)           5.23e-19
Log-likelihood      -242.3541   Akaike criterion     492.7081
Schwarz criterion    499.0422   Hannan-Quinn         494.9189
rho                  0.329291   Durbin-Watson        1.335466
```

Source: own calculations

$$yt = 0.5233 - 0.54X1t + 0.03X2t + 4.62X3t + \varepsilon$$

Henceforth:

1. When the change in ETH increases by 1 USD per coin compared to the previous month, the market capitalization of cryptocurrency goes down by 0.54 billion USD.
2. When the price of one BTC increases by 1 USD per coin, the market capitalization of cryptocurrency goes up by 0.03 billion USD.
3. When the price of one SOL increases by 1 USD per coin, the market capitalization of cryptocurrency goes up by 4.62 billion USD.

Based on R square of 0.93 and the adjusted R square of 0.92, it can be concluded that 92% of the variation in y1 is explained. This is a solid result, but more variables can be added.

Now, the author checks the assumptions about the econometric properties of the model – an absence of heteroscedasticity, autocorrelation and presence of normality of residuals based on the output from Gretl:

Figure 13, testing output

```
White's test for heteroskedasticity -
  Null hypothesis: heteroskedasticity not present
  Test statistic: LM = 8.6013
  with p-value = P(Chi-square(9) > 8.6013) = 0.474861

LM test for autocorrelation up to order 12 -
  Null hypothesis: no autocorrelation
  Test statistic: LMF = 1.45705
  with p-value = P(F(12, 20) > 1.45705) = 0.220642

Test for normality of residual -
  Null hypothesis: error is normally distributed
  Test statistic: Chi-square(2) = 19.2112
  with p-value = 6.73518e-05
```

Source: own calculations

Tests for each assumption:

Table 7, tests

Ho: no heteroscedasticity Ha: there is heteroscedasticity	Ho: no autocorrelation Ha: there is an autocorrelation	Ho: error is normally distributed Ha: error is not normally distributed
P = 0.47 0.47 > 0.05 (Ho is not rejected)	P = 0.22 0.22 > 0.05 (Ho is not rejected)	P = 0.001 0.001< 0.05 => Ho is rejected

Source: own calculations

Just one assumption is not satisfied – error is not normally distributed.

Now, the author proceeds to test of the significance of the model, the F test:

Table 8, F-test

Ho: ß1 = ß2 = ß3 = 0 (the model is not significant) Ha: At least one parameter ≠ 0 (the model is significant)
P = 0.001 0.001<0.05 => Ho is rejected.

Source: own calculations

Then, the significance of individual parameters is tested:

Table 9, T-tests

Ho: ß1 = 0 (change in ETH is not significant) Ha: ß1 ≠ 0 (change in ETH is significant)	Ho: ß2 = 0 (BTC is not significant) Ha: ß2 ≠ 0 (BTC is significant)	Ho: ß3 = 0 (SOL is not significant) Ha: ß3 ≠ 0 (SOL is significant)
P = 0.001 0.001<0.05 => Ho is rejected.	P = 0.001 0.001<0.05 => Ho is rejected.	P = 0.001 0.001<0.05 => Ho is rejected.

Source: own calculations

Following the analysis, it is possible to say that a minor problem was the normality, but upon expanding the original dataset to cover more months, this issue can be eliminated. In addition to that, the author calculates elasticities for September 2022 per each variable:

Table 10, elasticities for September 2022

	Sep.22
Change in ETH	-0.0119701
BTC price	0.69359521
SOL price	0.17113076

Source: own calculations

- When ETH changes by 1% compared to the previous month, the market capitalization of crypto changes by 0.01%
- When BTC changes by 1% compared to the previous month, the market capitalization of crypto changes by 0.69%
- When SOL changes by 1% compared to the previous month, the market capitalization of crypto changes by 0.17%

BTC has the highest effect on cryptocurrency market capitalization.

4.5 Correlation Analysis

Finally, the author will analyze the correlation between the prices of the three coins chosen – Bitcoin, Ethereum and Solana to understand if altcoins are really correlated that much with the bitcoin price.

Table 11, correlation analysis

	Eth	Bitcoin price, USD	Solana Price, USD
Eth	1		
Bitcoin price, USD	0.902818703	1	
Solana Price, USD	0.906096748	0.727460786	1

Source: own calculations

It can be concluded that the correlation between the 3 elements is incredibly high with values above 0.7. However, the most important insight is the correlation between bitcoin and

other altcoins. Thus, bitcoin and eth have a correlation of 0.9 and Solana has a correlation of 0.72 with bitcoin.

5 Results and Discussion

5.1 Risks

To begin the discussion section, it is worth starting by assessing the degree of risk of cryptocurrency. As the author was able to conclude it from his analysis, the volatility index reflecting risk for Bitcoin is 193%, for Ethereum, it is 147% and finally, for Solana it is just 87%. Of course, when comparing those values with the volatilities of securities such as stocks, which are considered to be quite volatile, it becomes evident that the level of volatility of cryptocurrency exceeds even the riskiest financial securities traded on the market and in some cases, it does exceed them 2 or 3 times, according to one author (Apergis, 2022). In addition to that, when taking into consideration the boundary of 30% distinguished by various researchers as acceptable volatility, it is pretty clear that cryptocurrency is not something that should be regarded as a safe investment opportunity. In that regard, the author coincides with other authors criticizing cryptocurrencies for their incredibly high volatility (Catania, 2022).

On the contrary, another point that might partially justify the choice of cryptocurrency as an investment option is the fact that almost every time higher risk means a higher return and more money generated from the investment. Of course, it is not possible to make money in a short-term horizon when going for safe investment options such as bonds. However, when it comes to investors seeking a quick potential return in just a matter of a couple of months and when it comes to cryptocurrency, a couple of days in some cases, it seems quite sensible to consider cryptocurrency as an investing option. What is more, it became evident that the volatility of each coin is primarily explained by the fact that the price per each coin selected was increasing over the time period chosen as the average chain index was positive.

Finally, another interesting point to mention lies in the author's assumption that cryptocurrency indeed is just pure speculation or simply a bubble that is not anyhow underpinned by any real asset, so the price is highly volatile. Clearly, the author partially shares his assumption with a bunch of author authors considering the cryptocurrency market as a whole as a pure bubble that is about to burst, but there is something more to the way how he actually thinks. Undoubtedly, cryptocurrency should have some value as the

blockchain algorithm proves itself to be more and more useful and important, as well as other projects from cryptocurrency. Yet, the fact that the real popularity and attractiveness of a given cryptocurrency is highly positively correlated with the mentions of this cryptocurrency or news related, serves as an explanation for such high volatility and consequently, it serves as a partial justification for the assumption that cryptocurrency is just a mere speculation. After all, it is downright essential to understand one thing – speculation itself is not bad at all, but putting all money into coins whose price is driven either up or down as a consequence of new speculation in media is not just risky but simply lacks a logical foundation.

All in all, cryptocurrencies are deemed to be not only risky but extremely volatile and rather unstable, as their price keeps fluctuating enormously.

5.2 Tendencies

Then, when it comes to the current tendencies of the crypto market, it is wise to say that two main pieces of analysis will help the author to formulate his conclusions – regression analysis and seasonality analysis. First, there is partial evidence for the fact that the crypto market is somewhat seasonal with given months traditionally more profitable and bullish than others. Thus, it is concluded that the most prosperous month is April with 26% more market capitalization on average in that month and the most bearish month is. October with almost 25% less market capitalization on average. All in all, there might be a relatively similar pattern to stock markets, as there is evidence that stock markets perform better in November, December and April. Following the analysis, it is also concluded that the crypto market performs better during those months as the seasonality factor is higher (Shanaev, 2022).

When it comes to the most bearish months, in stock markets they are usually August and September and, in that regard, there is a slight difference as September is slightly bullish in the crypto market, while August is indeed one of the worst months. All in all, this partially proves the fact that the crypto market is somewhat similar to stock markets as the performance is better in some months and worse in others.

Then, it is vital to talk about the main driving forces behind the crypto market capitalization. Based on the regression analysis where the quantitative effect on market capitalization was evaluated, the author concludes that out of three coins chosen for the analysis, bitcoin is the one that influences the change in the market capitalization the most, accounting for almost 0.69% of all change in the crypto capitalization is caused by just 1% change in the price of bitcoin. Of course, the elasticity is slightly less than what the author assumed, but it is still sufficient to say that the market capitalization of the entire crypto market depends mostly on the way how bitcoin behaves itself.

Another interesting point that the author has concluded is that the correlation between all three is significantly high and this serves as a piece of evidence to underpin numerous findings of other authors about the fact that the cryptocurrency market is quite unique –the price of altcoins is strongly associated with the price of bitcoin and there can be no significant increment in the market capitalization of a given altcoin that might even theoretically give chances to overpass the market capitalization of bitcoin. This assumption of academists and financial analysts is underpinned by the author's finding about a high degree of correlation between the 3 coins chosen for the analysis (Taskinsoy, 2020).

5.3 Recommendations

All in all, when it comes to providing a precise list of recommendations or an action plan in relation to investment in cryptocurrencies, it is essential to understand that every single person on Earth has a different motivation for investing, as well as different strategies and plans. When it comes to people who are willing to take a risk and they are not disposing of their very last savings, cryptocurrency can be considered a serious investment due to the fact that there is almost no other security or asset on Earth that can be bought with such a high probability that the return will happen in just a matter of days. Undoubtedly, the probability that there will be a high return in just a matter of days is almost the same as the probability that the price of a given crypto asset will slump enormously. What is even more, the fact that just a couple of months ago, a prominent cryptocurrency known under the name of Luna, which was in the list of top ten cryptocurrencies with the largest market capitalization dropped in price from 50 USD per 1 coin to just 0.20 or even less is another evidence that suggests that investing in crypto is a good idea for potential investors who are not afraid to lose their money.

However, for those that are looking for a safer bet and an investment that might provide a solid return in the long-term horizon, cryptocurrencies are not suitable due to their extremely high volatility and the overall nature of cryptocurrency – a speculative one. After all, any news or saying done by a prominent figure from the financial or political world can significantly damage the positions of a given cryptocurrency thus putting ordinary investors who will just fall victim to some party's interests. An interesting phenomenon that partially proves the author's logic is the changes in the price of one coin called the DOGE coin caused by numerous publications posted by one prominent businessman Elon Musk on his personal account on Twitter, as other authors also point that out (Huynh, 2022).

6 Conclusion

All in all, the author comes up with the following series of conclusions:

1) It is not worth investing in cryptocurrencies if an investor plans for a long-term horizon due to the speculative character of the market and enormously high volatility. For those seeking an option to dispose of a given amount of their money which they are not afraid to lose, cryptocurrencies might offer a great opportunity to quickly enrich themselves.
2) Volatilities of the three chosen cryptocurrencies are 87% for Solana, 147% for Ethereum and 193% for Bitcoin.
3) The best month to invest in cryptocurrencies is April with 26% more market capitalization in this month.
4) The worst month to invest in cryptocurrencies is July with an almost 22% drop in market capitalization.
5) Bitcoin has the highest impact on the change in the market capitalization and thus whenever the price of 1 bitcoin changes by 1%, it inevitably leads to a 0.69% change in the market capitalization. However, the effect of the rise of bitcoin is much more positive since almost all altcoins are positively correlated with bitcoin and it will have an indirect positive effect on them.

Cryptocurrencies have proved themselves to be highly volatile yet quite unique, especially when comparing them to traditional investment options, such as stocks and bonds.

The author recommends expanding the framework of the following study by including more alternative coins in the analysis and covering a larger time frame.

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