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MASTER'S THESIS (PROJECT)

«Problems and perspectives of development of cryptocurrency market in kazakhstan»

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The purpose of this study is to study the individual properties of the cryptocurrency market. Guided by the concept of implied volatility, the authors studied the asymmetry property of the market reaction to news. Based on the concept of realized volatility, the hypothesis of volatility effect by economical and restriction news, through semantic analysis was provided on period of 2 years through Google news keywords analysis.

It was defined through regression analysis that low capitalized cryptocurrencies are not affected by economic news, as high capitalized cryptocurrencies. Both types of cryptocurrencies are mainly affected by restrictive legislations and rising gold prices.

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Introduction

The introduction of the current study conveys the reasons to study the topic of problems and perspectives of development of the cryptocurrency market in Kazakhstan, research in theoretical and empirical fields of study, objectives, and aims of investigation in the study and limitations as well as implications of the study.

1.1. Research problem

The beginning of the XXI century is characterized by the rapid development of digital technologies due to the processes of economic globalization and the revolution in the informational sphere. Economic globalization has a great impact on the transformation of all aspects of public life and is one of the sustainable processes contributing to the growth of interdependence of various countries and regions of our planet (Rauch, 2017). By now, the Internet has radically affected retail trade, which has already become virtual by 20% in many countries (Hileman, 2017). Several studies by Farell (2015), Skjellum (2016) and Chuen (2017) show that nowadays the world community is at the third stage of globalization – the digital transformation of society, primarily under the influence of a large increase in cross-border data. The digital transformation of society under the influence of the explosive growth of cross-border data and cross-border electronic commerce has led to the next stage of globalization, a characteristic feature of which is a new form of organization of economic relations - the digital economy (Yao Yue, 2021). Interestingly, a new

technology for storing and exchanging data - blockchain - appeared even before the global financial crisis of 2007-2008 (Sovbetov, 2018).

Due to the ubiquity and growth of electronic commerce, electronic money has gained particular popularity, which is facilitated by factors such as the convenience of paying for goods in online stores, high speed of transactions, the use of modern technologies to ensure security of transactions. Prosvirina (2018): in her theoretical study it's asserted that today's monetary policy of each country largely depends on understanding the importance of the role of cryptocurrencies in the modern economy due to different factors.

Studies designed to study the degree of stability of four cryptocurrencies (Bitcoin, LiteCoin, Ripple and Dash) and conducted using the Hearst method with an Amihud illiquidity coefficient revealed cyclical price dynamics, showed a low degree of market formation and a high degree of potential risks that have a long-term positive relationship with the financial stability of the cryptocurrency market (Guo, 2017). As a result of the research, the author found out that the cryptocurrency market has entered a new stage of development, which means a decrease in the possibility of obtaining excess income when investing in the most liquid cryptocurrencies in the future (Steinmetz, 2021).

Cryptocurrency is a decentralized convertible currency based on mathematical principles, which is protected by cryptographic methods, i.e. uses cryptography to create a distributed, decentralized, and secure information economy. To meet the challenges of the digital revolution, it is necessary to determine what factors influence the development of the cryptocurrency market as a potential new world currency. It is important that cryptocurrencies, as private money, are essentially a means for cross-border payments, where, competing with each other, a new global virtual currency will eventually stand out among them, which can become the main means of payment in international payments.

One of the main reasons why cryptocurrencies have become so popular in such a short time is that they are faster, cheaper, significantly more reliable than all modern national currencies, and are the most promising and progressive international payment instrument (Wu, 2019).

There are many studies devoted to the evaluation and analysis of cryptocurrencies on the market, but there are still questions regarding the prospects for their development. In particular, legal regulation and price development; the issue of domestic cryptocurrencies; opportunities and threats associated with the misuse of such payment systems (Ramos, 2021). Despite the considerable amount of research on the crypto market, a comprehensive analysis of the factors influencing the development of this market is still needed, since even soon, the cryptocurrency may become the leader of global financial relations. Previous research has focused on the currencies themselves, rather than on the relationships and dependencies between the cryptocurrency market and other factors (Chokor, 2021).

1.2. Problem Background

The global economy of the free and open market is going through a period of irreversible transformations. All this is characterized by the production of knowledge, the integration of technologies, and the development of information non-centric networks (Felten, 2019). On January 10, 2020, according to the EU's IFRS developments, the fifth anti-money laundering regulation had an impact on the cryptocurrency market platforms. Some of them closed, while the bitcoin exchange rate also declined. However, it is interesting that the average first deposit of users of trading platforms usually also decreases when the market "comes to life" and more small traders come who purchase cryptocurrency for the first time.

Since there are many studies on the benefits of cryptocurrencies, most central banks do not classify this type of asset as a currency or money. Due to its uncertainty and volatility, the cryptocurrency is not considered a unit of accounting and a store of value (Ankenbrand et.al, 2020). The problems of financial markets associated with excessive centralization make it necessary to transform the

existing system of international banking cooperation and logistics of financial flows. Blockchain technology has become an alternative solution. This is a distributed database, which is formed in the form of a continuously growing chain of blocks with transaction records (Felten, 2019). The most well-known and widespread example of a decentralized blockchain network is Bitcoin. The Bitcoin cryptocurrency has gained extraordinary popularity recently for several reasons. One of the most important factors was the distrust of market participants in the global financial system (Bonneau, 2017). Also the key differences between bitcoin and fiat money are decentralization; unaffected inflation; anonymity (to a certain extent); transparency; the inability to cancel transactions. Derivatives of cryptocurrencies usually differ from each other in the cryptographic algorithm (Felten, 2019).

In addition, there are 6099 different types of cryptocurrencies, each of which has its distinctive characteristics (see Appendix 1), and they all have many development paths, price development algorithms, exchange rate, privacy, and management policies.

The understanding of the factors affecting the main processes of cryptocurrency is limited. The reason for studying this topic is to identify the elements involved in the development of the market and cryptocurrencies that would help determine which factors cause problems and which factors lead to favorable prospects for cryptocurrencies. In addition, understanding the factors that will influence central banks' decisions about the importance of such a currency is also crucial.

1.3. Research Aim and Objectives

The study’s main objectives:

1. Provide a broad review of the literature: review of more than thirty articles and scientific documents that are useful for achieving the goals set in this study. Science Direct and Google Scholar are used as research tools during the initiative part of the current work.

The results of Science Direct on keywords ("problem", "cryptocurrency“ and ”market") showed 1619 documents, while keywords ("prospects”, "cryptocurrency” And "market") showed 1230 documents. The results show that the promising side of cryptocurrency development is poorly studied and justifies its high intensity of problematic research.

2. To analyze the prospects and problems of the development of cryptocurrencies in Kazakhstan;

3. To investigate the consequences of the spread of cryptocurrencies for the global financial system and money circulation;

4. To analyze the factors affecting the stability of the cryptocurrency market;

5. To define major factors (independent variables) that affect the development of the cryptocurrency market.

6. To use the obtained knowledge and concepts of regression modeling to the two-principle model on the cryptocurrency market of highly-market capitalized currencies and low market-capitalized currencies.

7. According to the data result, to propose solutions for Kazakhstan cryptocurrency market development and recommendation to Central Bank.

The thesis aims to reject or not to reject the hypothesis made in this thesis through statistical tools (MLR) the correlation of cryptocurrency market development and factors parameters which are selected during data mining and theory findings.

Numerous papers will be reviewed during the research and the keywords related to the thesis question, and the group's two-principle modeling (highly-market capitalized currencies and low market-capitalized currencies) will be built.

1.4. Research Questions/Hypotheses

The research question is to identify what are the problems and perspectives of the development of the cryptocurrency market and what factors affect their change. Taking all the things together, we can build and investigate two hypotheses:

Model I:

H0: 3 factors have no significant influence on the development of the market of highly market capitalized cryptocurrency.

H1: 3 factors have a significant influence on the development of the market of highly market capitalized cryptocurrency.

Model II:

H0: 3 factors have no significant influence on the development of the market of low market capitalized cryptocurrency.

H1: 3 factors have a significant influence on the development of the market of low market capitalized cryptocurrency.

It is necessary to recognize that the cryptocurrency of Bitcoin and Litecoin have different market capitalization structures, thus they can't be analyzed in one model.

After that, the equation model will be built and tested on significant effects on the outcome of the project. R-squared values, p-values, and Beta values will be explained. The result might look like Appendix 2. The results will be taken to create implications for Kazakhstan.

1.5. Limitations

Like many other similar projects conducted in different countries, this study has a limited time frame. On average, it takes about three months to collect data. In order not to go beyond the specified deadlines, the analysis is carried out not of the entire general set of big data, but only a

relatively small sample of it. And in order to obtain relevant and relevant research results, researchers, as a rule, use statistical analysis methods. This means that the lack of available time can have a significant impact on the results of any research in this area (Bouri, 2019).

Moreover, most of the research is focussed only on a strictly defined number of countries and their state corporations. Also, when preparing research plans, scientists rely on the fact that research will be conducted in these countries. Thus, it turns out that the bulk of the research results can be applied only to the list of countries that these studies were focused on. This is due to the cardinal differences in the economy and social structure, for example, of developed and developing countries (Alfieri, 2021).

In addition, it should be borne in mind that the results of research on cryptocurrencies that were conducted more than ten years ago may not just be irrelevant, but even erroneous. This is due to the fact that cryptocurrencies are one of the fastest growing areas, which means that information about them becomes obsolete much faster than information about other objects of the world economy can become obsolete (Caporale, 2018).

Also, significant difficulties are caused by the fact that a significant part of the information about cryptocurrency research and forecasts of potential growth and decline in the exchange rate is published in closed sources. Some studies, especially those conducted by the state, are confidential information, so there is no access to some resources during a general Internet search (Gil-Alana, 2018).

In addition, in the process of analyzing various studies, it turned out that on some sites brokers intentionally publish fake information about the forecasts of the cryptocurrency exchange rate to increase sales and revenue. Thus, such information is not considered relevant and should not be used in research (Vigne, 2020).

It is also worth noting that since cryptocurrency is one of the youngest objects in the economy of all countries, it is also one of the most unstable economic units (Philips, 2015). Only for a little

more than ten years of the existence of cryptocurrencies as a phenomenon, their exchange rate has already experienced several "explosions" and falls, which are completely unlike anything that has happened with the rates of other physical currencies. Also, some of the cases listed below in the text show that due to its instability, the cryptocurrency is extremely susceptible to the effects of the media, social media and influencers (Roubaud, 2019).

2. Literature Review

This section of the research demonstrates previous studies made on the topic of development of cryptocurrency and impact of different factors on it. It starts with the earliest research, explanations of the theoretical development of cryptocurrency and the transformation of the concept. It also observes some empirical studies connected with the impact of various factors on the cryptocurrency.

2.1. On the concept of cryptocurrency and early research

Cryptocurrency is a kind of digital currency, the creation and control of which are based on cryptographic methods. At the same time, any cryptocurrency does not have a single issuer or other body that would exercise control over it (Munro, 2020). The term "cryptocurrency" was fixed after the publication of an article about the Bitcoin system "Crypto currency" (Cryptographic currency), published in 2011 in Forbes magazine. At the same time, both the creator of bitcoin and many other authors used the term "electronic cash" (Greenberg, 2011).

Initially, the idea of creating an anonymous and independent currency appeared in the environment of cipher banks, an informal association of persons interested in cryptography and interested in maintaining absolute anonymity and independence from any external regulation (both from state bodies and from other persons). It is believed that David Chaum was a pioneer in this industry. In 1982, he published an innovative article in which he drew attention to the fact that, using information about payments for purchased goods or services provided (payment for hotels, fuel,

food, museums, cinemas, medicines, alcohol, etc.), a person with access to such data can fully control the life of the person he is interested in.

The volatility of cryptocurrency was analyzed by Trinh (2021), where an interesting case was shown. It occurred in 2014 and was associated with Elon Musk. He posted a tweet in which he spoke approvingly about bitcoin, which caused fluctuations in the bitcoin exchange rate for a long time after the tweet. And in 2015, the Dogcoin rate rose to one dollar for a while, again after Elon Musk's tweet about this cryptocurrency. After these situations, the question arose whether Musk's tweets are really able to influence the cryptocurrency exchange rate. In order to deal with this, you need to highlight the value structure of any resource. It consists of four stages - Accumulation, Mark-up, Distribution and Markdown. This normal cycle, through which any enterprise passes, is necessary for its development in the long term. Author concludes, that according to such cases it’s possible to claim that cryptocurrency is one of the most unstable economical unit.

In an article by Boehme (2015), after the collapse of the Japanese cryptocurrency exchange Mt.Gox in 2014, the authorities of different countries were divided into three ideological groups:

1. Countries that banned cryptocurrency trading (China, Bangladesh, Iceland, Lebanon, Vietnam, Thailand, Bolivia, Ecuador, Kyrgyzstan, Indonesia).

2. Countries that have allowed cryptocurrency trading, but through special intermediaries (exchanges and exchangers) and licensing procedures (USA, Canada, Great Britain, Australia, Estonia, Denmark, South Korea, Sweden, the Netherlands, Finland, Belarus).

3. The current status of cryptocurrencies and blockchain is not defined, while the state is interested in their legalization (Russia, Belgium, Colombia, Czech Republic, Germany, New Zealand, Israel, Ukraine, France, Croatia, Belgium, Poland, Hong Kong, Slovenia, Turkey, Singapore, Switzerland, Spain).

In addition, the study examined the profitability of bitcoin production, its weaknesses and long-term financial stability. In a study by Androulakis (2013), cryptocurrency volatility is largely

related to price constancy. In particular, the strong covariance of two cryptocurrencies, Bitcoin and Litecoin, significantly depends on market news, which confirms the conclusions about the interconnectedness of cryptocurrencies.

2.2. Research on the risks associated with cryptocurrencies

A number of surprises have shown different probabilities for the inefficiency of the cryptocurrency markets. As the so-called stylized facts of the inefficiency of cryptocurrency markets, various authors name asymmetry in the distribution of income and calculations on news, multifractality, and the presence of the phenomenon of long-term memory (Al-Yahyaee et al., 2018). In particular, the authors of (Jiang et al., 2018), using the sliding window method and a new efficiency index, find the effect of long-term, or long-term, memory (long-term memory) on the bitcoin market in December 2010 - November 2017. The presence of long-term dependencies in returns undermines the assumption of weak market efficiency (Fama, 1970), according to which current prices fully reflect all past information, so future returns cannot be predicted based on previous ones. The authors of the study (Al-Yahyaee et al., 2018) diagnosed the presence of multifractality and long-term memory in the cryptocurrency market using the MF-DFA method (multifractal fluctuation analysis). According to their findings, from 2010 to the end of 2017, bitcoin showed the greatest inefficiency of the four major cryptocurrencies. The inefficiency of cryptocurrency markets was also found in (Gurdgiev, O'Loughlin, 2020),

The cryptocurrency market was analyzed by Svetov (2020), using the Hurst method, where the strength of four cryptocurrencies (Bitcoin, LiteCoin, Ripple and Dash) was studied and the evolution of the crypto market over the past five years was investigated (Mikhailov, 2020). As a result of the research, the author found out that the cryptocurrency market has entered a new stage of development, which means a decrease in the possibility of obtaining abnormal profits when investing in the most liquid cryptocurrencies. This refers to the idea that the cryptocurrency market is becoming more stable and less affected by external factors.

Despite all these advantages of the emergence of cryptocurrencies, there are also a significant number of negative aspects associated with digital risks.

Firstly, the technological risk is associated with the fact that the advantages of digital technologies can be fully manifested only with the balanced development of organizations in the real sector of the economy. However, if segments of the economy undergo digitalization at different speeds, this can lead to a total imbalance in the entire economic system (Cross, 2020).

Secondly, the social risk is associated with the fact that the development of the digital economy inevitably leads to a significant transformation of the labor market, which is complex and occurs gradually as more and more traditional sectors are involved in the digital economy. This transformation is accompanied by a reduction in the number of jobs for people with low and medium qualifications, an increase in unemployment among older people due to the robotization of jobs, automation, and optimization of management processes. The problem is that such positions are usually occupied by representatives of the least competitive and most vulnerable segments of the population, therefore, when digitalizing the economy, the state should consider the possibility of implementing special measures to adapt such categories of citizens to the potential difficulties they may face. Highly qualified specialists will be in an even more unfavorable position because they will be involved until the last moment in the process of transition from traditional to the digital organization of production and will be thrown out on the labor market when the positions corresponding to their status will no longer be needed. Old professions will disappear, and during active working life, a person will have to change his profession several times. In this situation, an unwillingness to receive high qualifications may form, because in 5-7 years it will still be necessary to retrain, spending time and money. As a result, an atmosphere of social tension will form, which may lead to rejection of the very idea of introducing the digital economy (Fung, 2018).

Thirdly, political risks should be singled out as a separate item. According to experts, in the cross-border world of the digital economy based on blockchain technology with its decentralization and the absence of a regulator, the role of the state will have to be reconsidered. It should take the form

of a simple territorial entity with a certain number of people sorted according to their level of digital technology proficiency. This will lead to the abolition of the governing and controlling role of the state, the weakening of state regulation of the economy, the loss of the ability to exercise their functions and protect their sovereignty (Grassi, 2021).-new

Fourthly, the risks of violating the confidentiality of personal data are added to consumer concerns about the possibility of online fraud. There is a misconception that the digital environment minimizes the risk of fraudulent actions, but this is true only for low-tech types of fraud that are taking place now (Bekiros, 2018).

2.3. Empirical studies on the cryptocurrency market

The modern cryptocurrency market is directly related to the legislation of Kazakhstan. In the article by Daribayeva and Talasbek (2019), the National Bank of Kazakhstan does not consider cryptocurrency as the safest method of either asset value or currency value. It is necessary to recognize the needs and opportunities of Kazakhstan's monetary policy.

In an article by Akbulaev (2020), a mathematical model of the relationship between Bitcoin and Eutherium showed a strong dependence on political news and regulatory restrictions. It was also studied that the development of prices in the cryptocurrency market is largely due to macroeconomic, external factors, such as crisis shocks or changes in the prices of Brent crude oil or gold (Teker et.al, 2020).

Many studies consider Bitcoin as an asset, not a currency. Empirical studies show that economic factors, such as the consumer price index, DJIA, the US consumer price index, have a long-term negative impact on the price of bitcoin. This means that Bitcoin can be a hedging tool against the depreciation of the US dollar (Brukhansky and Spilnik, 2019, Buri et al., 2018).

In the study of Sovbetov (2020), examines the factors affecting the market competitiveness of Bitcoin, Ethereum, Litecoin and Monero, using the market beta version, trading volume and

volatility as parameters. In addition, several studies have been conducted on the crypto market and the stock market (Mishra, 2002; Wang et al., 2005; Diamandis, 2008; Tiwari et al., 2013; Baker, 2017).

Scientists who have researched semi-parametric risk assessment with cryptocurrencies have found that the SNP approach provides very accurate risk measures for cryptocurrencies, especially when conservative risk measures are required. This is a consequence of the wavy tails of the distribution, which cannot be performed using traditional parametric alternatives, and the flexibility in improving the data corresponds to a variable number of parameters. Positive transformations retain these properties, although, generally speaking, their use is not necessary as long as controlled optimization is implemented (Jimenez, 2019).

Inflation has a serious impact on the exchange rate, including cryptocurrencies. During previous periods of high inflation, investors tried to maintain their purchasing power by investing in assets such as gold, real estate and stocks. The recent addition of cryptocurrencies as an investment option has added a possible new alternative inflation hedge. According to a study by Conlon (2021), there is a brief positive relationship between forecasted inflation expectations and Bitcoin and Ethereum, coinciding with the initial stages of the COVID-19 crisis. Beyond this period, there is only very limited evidence that cryptocurrencies act as a hedge during periods of rising projected inflation expectations. These results suggest that cryptocurrencies do not hedge against an increase in projected inflation expectations, but instead can obtain price-related information from factors common to projected inflation expectations during the crisis. These findings add to the growing questions about the role of cryptocurrencies as a financial asset. Although the temporal connection between cryptocurrencies and projected inflation expectations is obvious, the lack of consistent hedging properties may be cause for alarm as investors try to find a store of value outside of traditional mechanisms. Such a desperate desire to preserve wealth in ultra-risky assets associated with crime will be of concern to both policy makers and regulators.

A separate broad topic for consideration is the so-called privacy coins. Goldfeder (2018) show how third-party web trackers can deanonymize users of bitcoin and other non-privacy-related coins. Due to financial transparency, institutions are hesitant to use cryptocurrencies that are not related to confidentiality as a means of exchange. The advent of privacy coins eliminates this problem by using features such as masternode technology, a ring signature and a hidden wallet address so that third parties cannot track transactions to the real parties involved. In his research on this topic, Sapkota (2021), suggested that traders who prefer confidentiality to full transparency are becoming another subgroup in digital financial markets. A common feature of cryptocurrencies is that the total supply of cryptocurrencies is often predetermined. As a result, pricing processes depend solely on demand, that is, on users. Given that the user base of privacy coins differs from the user base of non-privacy coins, it is highly expected that privacy coins form a cryptocurrency sub-market that is separate from the non-privacy coin market.

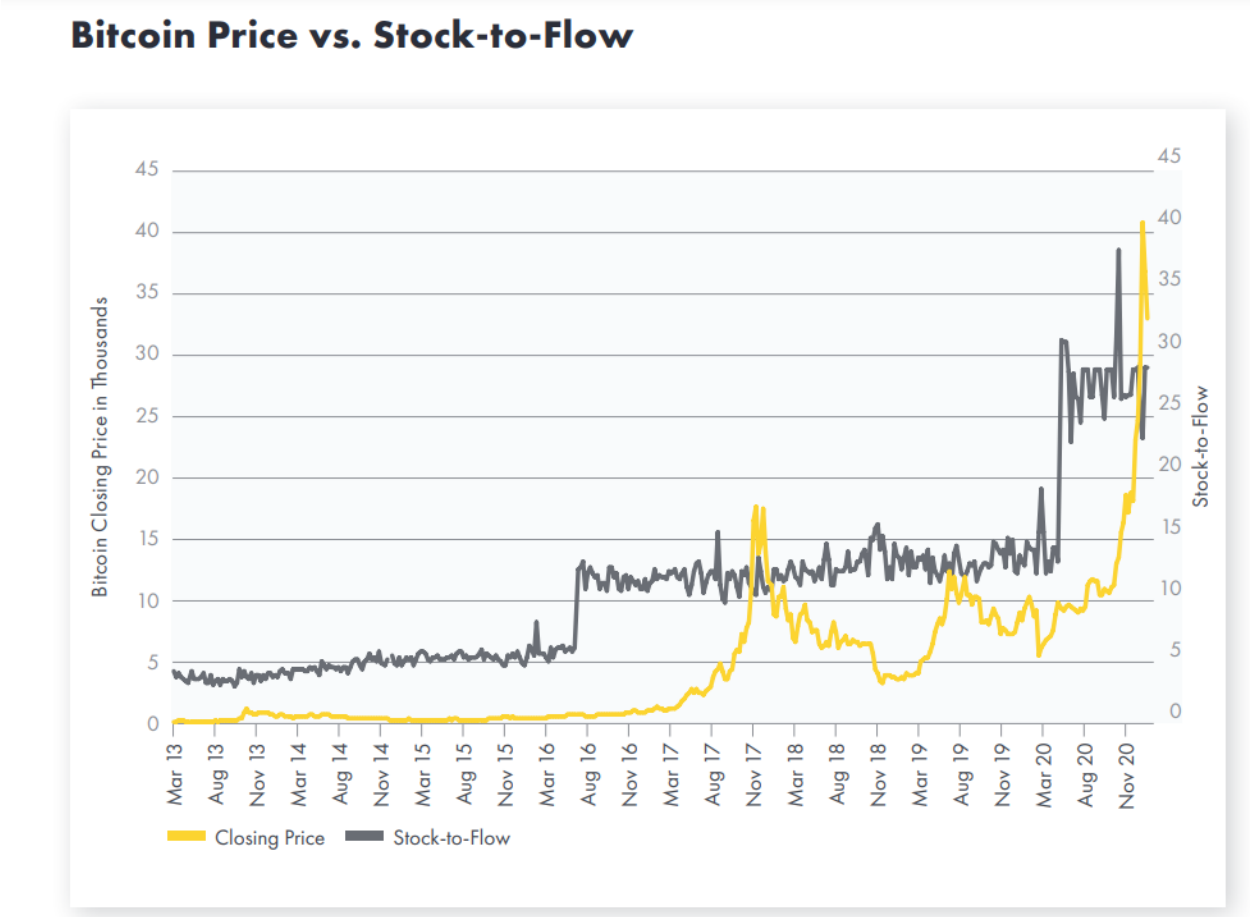

Figure 1. Bitcoin Price vs. Stock-to-Flow

Bitcoin is regularly compared to gold, due to its inherent scarcity. Modeling the value of Bitcoin akin to gold was first suggested by Twitter personality Plan B (2019), who used the stock-to-flow approach to analyze the value of Bitcoin. The top left panel of Figure 1 compares the price evolution of Bitcoin and its stock-to-flow ratio. The step-changes in the stock-to-flow ratio are driven by Bitcoin halving's. The theory suggests that the price of Bitcoin should increase as the stock-to-flow ratio increases, making Bitcoin scarcer. The data does indeed show evidence of this behavior and the stock-to-flow ratio appears to be a leading driver of the price of Bitcoin. After the price jumped in August 2016, the average price level started to increase in the following months. After the halving event in May 2020, the price level also rose in the following months. Since market liquidity was low in the first few years of Bitcoin, only the past two halvings provide meaningful information. Since the last halving occurred in 2020, the time-horizon was not sufficiently long and therefore will require further research to concretely prove the stock-to-flow model as the main driver of the Bitcoin price.

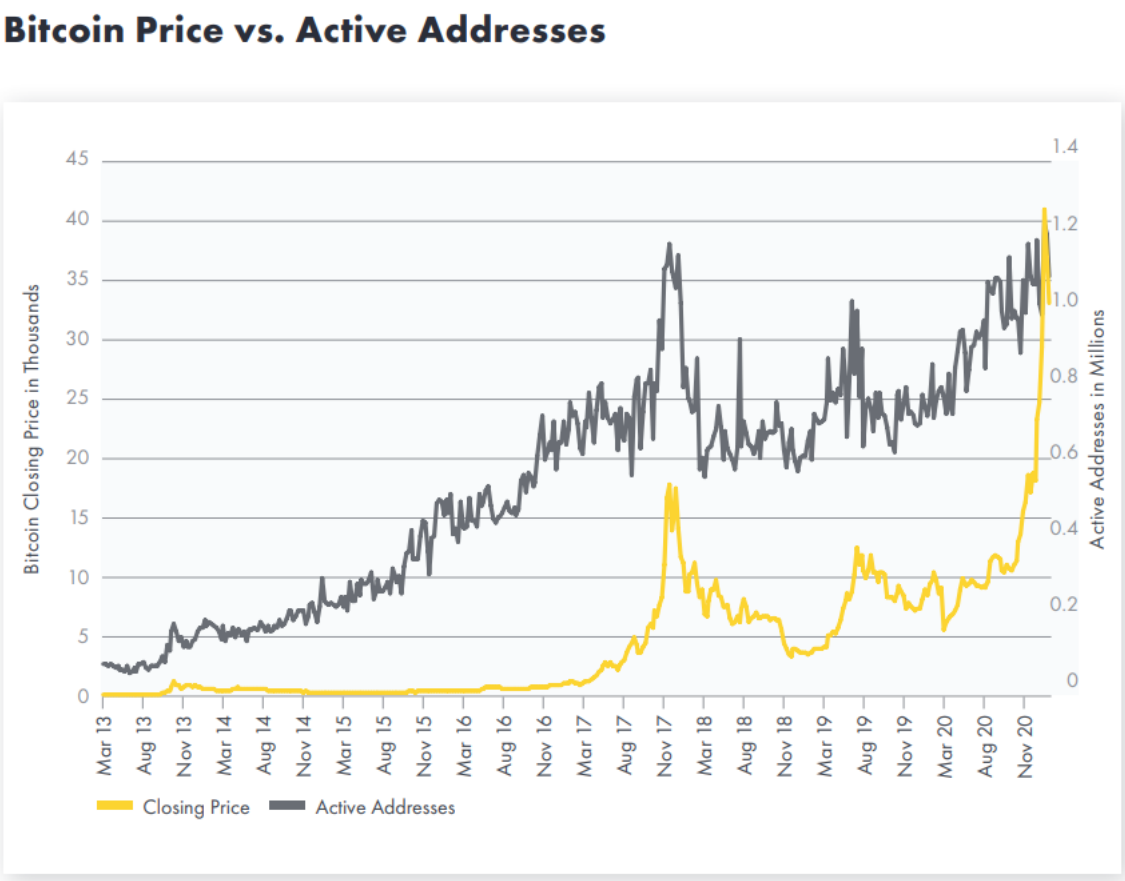

Figure 2. Active Adressess

The plot of active Bitcoin addresses against the Bitcoin price is shown in the top right panel of Figure 2. It shows a steady increase in active addresses over the years. The number of active addresses closely tracks the price until mid-2020, but it does not explain the recent spike in the Bitcoin price.

Payments: Bitcoin is included in this category because it was the first major cryptocurrency aiming to revolutionize the payments sector. As shown, the payment category includes other cryptocurrencies such as Monero, Stellar and Ripple. Bitcoin differs from these coins, as it is driven by the Stock-to-flow model. It would be expected that the other coins are particularly driven by the usage of the network, such as with XRP. The reasoning is that the more people/companies use the network, the higher its value is compared to other payment networks. Furthermore, financial attributes such as the transaction volume would be expected to impact price. The analysis showed that financial drivers do not appear to move in line with the prices of the coins. However, it was found that Bitcoin movements is a strong indicator of other price movements. In many cases, this should be expected, since Bitcoin Cash and Bitcoin SV are hard forks from Bitcoin. In the case of Litecoin and Monero, GitHub activity is strongly linked to price performance and, in some cases, social media volume was found to be a reasonablevalue driver. IOT: IOTA and Chainlink were categorized as IOT related coins. Both coins are dependent on a growing blockchain industry as well as general digitalisation. This is best proxied by the price of Bitcoin, so it would be expected to find Bitcoin is a value driver. The analysis showed that network usage, measured by the number of active addresses and network growth, is indeed a value driver of Chainlink. Due to data limitations, it was not possible to infer the same conclusion for IOTA, however it is a reasonable assumption that IOTA is driven by the same driver. Furthermore, the price of Bitcoin and Ether were found to be value drivers as well. Lending: Compound and Nexo were slotted to the Lending category. Since they are ERC20 tokens, it would be expected that the price of Ether is a value driver. The price of Ether is a proxy for the overall popularity of the Ethereum network, which

both of these coins are part of. The analysis showed that lending coins are indeed driven by Ether movements as well as Bitcoin, showing overall responsiveness to the market. Additionally, the MVRV ratio closely tracks the price. Whilst this is to be expected, it is not the norm across the coins investigated in this report. dApps: The dApps category includes a range of blockchains, the most prominent of which is Ethereum. The category includes other blockchains that allow the development of smart contracts and dApps, such as EOS and Cardano. It would be expected that these coins are driven by development activity, such as GitHub activity or developer activity. The reason is that the added value of these chains is their ability to host dApps. Increased development activities signal a chains' popularity and, theoretically, drive price. The analysis showed that the dApps category is heavily influenced by the price of Ether, since this is the main blockchain offering smart contracts and dApps (measured by market capitalisation). GitHub activity was also found to be a value driver, whereas developer activity appears to have less of an impact on the price.

Grobys (2021), also conducted research on this topic using cointegration analysis, which has at least three advantages; first, it provides an opportunity to test whether the market for privacy coins creates a cointegration equilibrium that is separate from the market for non-privacy coins. Secondly, given that there is an equilibrium of cointegration, the model allows you to simultaneously check the effectiveness of the market. Thirdly, and finally, the use of this model has the advantage that it does not require a specific formulation of the equilibrium price mechanism. Using the entire set of cryptocurrencies, consisting of twenty cryptocurrencies, to evaluate the model, it is possible to find evidence of four cointegration equilibria. Given liquidity, a fully defined VECM is evaluated by choosing the privacy and privacy coins with the highest and lowest market capitalization as the four left-hand side variables in the model. While both categories of cryptocurrencies are introduced in the equation modeling the privacy coin with the lowest market capitalization (PXI), that is, privacy coins and non-privacy coins, in the equation modeling DASH, which is the privacy coin with the highest market capitalization, only two non-privacy

coins included in the equation demonstrate statistical significance. During the execution of the likelihood ratio test, it is found that it is impossible to reject the hypothesis that the entire set of coins not related to confidentiality is jointly insignificant.

Lucey (2021,)in their article developed a new indicator of price and political uncertainty in the cryptocurrency markets. Using 726.9 million news articles from the Lexis Nexis database, they built a new cryptocurrency uncertainty index that reflects policy (UCRY Policy) and price uncertainty (UCRY price) around the major cryptocurrencies. Their article presents the historical decomposition of the UCRY index with the main events from 2014 to 2020, such as the COVID-19 crisis, cyber attacks on cryptocurrency exchanges and political elections. Compared to other similar indexes, it has narrow range boundaries, which suggests that although such uncertainty exists, it is not volatile. Nevertheless, it shows distinct movements around high-profile events in the cryptocurrency space. The results of the study show that this index can be useful for future studies of the uncertainty of cryptocurrencies, portfolio diversification and the effect of infection. In addition, it may have various practical and political implications for measuring the risk associated with cryptocurrency markets.

Also, in the article of Leirvik (2019), analyzed the relationship between liquidity volatility and the profitability of five large-cap cryptocurrencies. The results showed that there is a positive relationship between liquidity volatility and profitability in general. This means that investors view changes in liquidity over time as a risk that should be offset by higher returns. For Bitcoin, the largest cryptocurrency, this relationship changes over time, and it has been established that the relationship between liquidity volatility and profitability is the lowest, but positive among the studied currencies. This once again indicates that bitcoin investors consider liquidity to be less of a risk compared to other currencies, which may be due to the popularity of this particular currency.

The cryptocurrency (CC) markets are once again in the spotlight of market participants, as the market capitalization of the first decentralized digital currency, Bitcoin, exceeded the threshold of $1 trillion for the first time and the CC market has become too large to ignore even in the eyes of

institutional investors. However, previous episodes of CC price spikes were usually followed by excessive sales and volatility, i.e. a daily drop in CC prices of up to 40% (Chaim, 2018). Therefore, passive long-term investments even in highly diversified CC portfolios can lead to a significant decrease. In recent years, the amount of literature on CC profitability and trading strategies has increased significantly. In the early literature on CC prices, efficiency and predictability are investigated, and it appears that CC prices are either inefficient or weakly efficient (Tiwari, 2018). By focusing on momentum strategies in CC markets, Grobis (2019), and Tsuvanas (2020), show that they are profitable only in the short term. Based on this, CC portfolios were also considered within the framework of average variance Browneis (2019), with the main conclusion that CC portfolios with equal weight outperform portfolios optimized for average variance.

In an article by Palamalai (2021), the random walk hypothesis of the top ten cryptocurrencies was investigated using nonparametric and parametric approaches. Unlike existing studies, random walk was used for testing procedures, which fixes unknown structural gaps, volatility stability and asymmetric effects in the profitability of cryptocurrencies. From the point of view of GARCH-type models, the volatility of the leading cryptocurrencies demonstrates the characteristics of a significant change in time and clustering, that is, large fluctuations in profitability are usually followed by relatively large ones, while smaller fluctuations will be followed by smaller ones. Moreover, the asymmetric GARCH model is superior to the symmetric GARCH model, and the first one confirms a significant leverage effect, that is, bad news has a much greater impact on market volatility than good news for Bitcoin (BTC), Ripple (XRP), Litecoin (LTC), Monero (XMR), Dash (DASH) Ethereum Classic (ETC), NEM (XEM) and Producer (MKR). Conversely, positive shocks (good news) create more volatility than negative shocks (bad news) for Ethereum (ETH) and Stellar (XLM). By establishing asymmetric GARCH models, it is found that the yield from the leading cryptocurrencies demonstrates the effect of stability, thereby supporting the inefficiency of the market. Following Urquhart (2016) and Resta (2020), the entire sample set is divided into two subperiods to verify the validity of the results obtained over the entire sampling

period. The study used the unknown Quandt–Andrews breakpoint test to determine the subsample periods for the corresponding cryptocurrencies, and the analysis was carried out with respect to samples before the break date (the first period of the subsample) and after the break date (the second period of the subsample). Empirical data from nonparametric and parametric tests also testify against the random walk hypothesis, thereby confirming the inefficiency of the market.

This paper by Brauneis, Mestel, Riordan and Theissen (2021), compares the effectiveness of transaction-based liquidity metrics with benchmarks derived from high-frequency order book data. Data is used on the two most actively traded cryptocurrencies, bitcoin and Ethereum, as well as from three trading platforms. Four benchmarks are considered:

(a) quoted spread

(b) effective spread

(c) impact on the transaction price

(d) impact on the value of a round trip transaction

And the effectiveness of transaction-based measures is considered in three dimensions

(i) their ability to capture liquidity fluctuations in time series

(ii) their ability to fix the level of liquidity

(iii) their ability to fix interbank differences in liquidity

It turns out that no estimator works well in all dimensions. The estimates of Corwin and Schultz (2012) and Abdi and Ranaldo (2017) best reflect the change in the time series of liquidity. This is generally true for different quantiles of the distribution, in the first and second half of the sample period, as well as in subsamples with high and low returns, high and low volatility, and periods with high and low volume. The indicators that work best in cross-sectional analysis are Amihud's

illiquidity coefficient (2002) and Kyle and Obizhaeva's score (2016), because they work well at all data frequencies and for both currency pairs.

2.5. Research on the impact of the COVID-19 pandemic on the cryptocurrency market

The short history of Bitcoin and other leading cryptocurrencies does not give researchers the opportunity to study their market performance during major catastrophic events on a scale similar to the COVID-19 crisis outbreak. The latter represents an unprecedented catastrophic event in modern economic history. This froze the global economy and disrupted the financial markets, which led to a chaotic financial environment. The article Naeem, 2021, examines the impact of COVID-19 pandemic on the effectiveness of the four leading cryptocurrencies using the asymmetric MF-DFA method. According to empirical results, the profitability of cryptocurrency prices demonstrates, to some extent, the significant presence of long-term dependence, which intensified during COVID-19 pandemic, indicating inefficiency. Based on cryptocurrency after cryptocurrency, the results show that the COVID-19 pandemic outbreak has negatively impacted the performance of leading cryptocurrencies, with Bitcoin and Ethereum being the hardest hit. At the same time, these two largest cryptocurrencies recovered faster at the end of March 2020 after their sharp fall towards inefficiency. This study expands the limited understanding of the negative effects of COVID-19 pandemic on the efficiency of the cryptocurrency market. The results obtained show that during periods of global crisis in the field of healthcare, significant market inefficiency may occur. The findings are of concern to market participants who are always chasing abnormal profits in immature, unstable and unregulated cryptocurrency markets. The presence of multifractality indicates that the prices of cryptocurrencies do not reflect all the available information. Insufficient efficiency implies the use of trading opportunities and, consequently, the possibility of obtaining abnormal profits. In other words, evidence of asymmetric multifractality can be useful for portfolio management and hedging strategists. Such evidence can also shed light on the volatility of cryptocurrencies and the forecast of market collapse.

As part of a comparison of the performance of stable gold-plated coins and cryptocurrencies, it turned out that gold-backed cryptocurrencies were developed to increase the stability of the digital asset ecosystem and eliminate excessive volatility. But their behavior in terms of volatility during the Covid-19 pandemic, on the contrary, remained comparable to Bitcoin. In addition, cryptocurrencies backed by gold have not demonstrated a safe haven potential comparable to their main precious metal, gold (Jalan, 2021). Cryptocurrencies backed by gold are more sensitive to left-tail events in the gold market. The application of the quantile unit root test shows that stable gold-plated coins are closer to gold in their tail behavior than to bitcoin or tether.

Umar and Jarento (2021), investigated the relationship between dynamic profitability and volatility of two groups of currencies: the three most relevant cryptocurrencies (Bitcoin (BTC), Ethereum (ETH) and Ripple (XRP)) and fiat currencies euro, pound sterling and Chinese yuan. In addition, the main purpose of their research was to study the potential consequences of the first and second waves of the COVID-19 pandemic crisis for this system. To assess the indicators of dynamic profitability and the interconnectedness of volatility, the TVP-VAR approach was used in the study, which is an alternative methodology for the approach to the secondary effects index of Diebold and Yilmaz (2014).

First, the dynamic total return and the relationship of volatility change over time, and these estimates show two peaks: one at the beginning of the sample and one at the beginning of the first wave of the global outbreak of the pandemic. Secondly, it was possible to identify two clearly different behaviors between the dominant cryptocurrencies and fiat currencies analyzed in this study. Thus, cryptocurrencies (BTC, ETH and XRP) are net transmitters, and fiat currencies (euro, pound sterling and yuan) are net recipients not only in terms of profitability, but also volatility. The only exception is the euro, which, when analyzing the relationship of net dynamic volatility, demonstrates a clear profile of a net receiver at the beginning of the sample and a profile of a net transmitter throughout the first wave of the COVID-19 pandemic crisis. This result demonstrates the particular virulence of this wave of the SARS-CoV-2 coronavirus pandemic in Europe. Finally,

it is particularly noteworthy that the most significant differences between the net dynamics (profitability and volatility) of the interconnectedness of the two types of currencies (cryptocurrencies and fiat) are at the beginning of the sampling period, immediately before the outbreak of the SARS-CoV-2 pandemic crisis, although some small differences occur during the first and second waves of the pandemic, but to a lesser extent. A potential explanation for these results could be that the COVID-19 pandemic outbreak could cause investors to liquidate their positions, leading to massive demand for cash. Moreover, firms that did not have enough cash may have been looking for cash to continue their operations during the SARS-CoV-2 pandemic crisis. In this context, policy makers have proposed a number of incentive measures, such as tax packages, labor law adjustments and public sector support, for private businesses to reduce the potential effects of contagion between financial markets.

The impact of the coronavirus pandemic on cryptocurrencies was also investigated by Vidal-Tomas, 2021. He analyzed the evolution of the cryptocurrency network during the COVID-19 pandemic. The results of the study showed that the cryptocurrency network has not changed significantly due to the outbreak of COVID-19 pandemic on December 31, 2019 or the WHO's statement that the COVID-19 outbreak was a pandemic. However, the network topology changed on March 12, 2020, possibly due to the financial panic that spread to all markets as a result of insufficient measures taken by the ECB to reduce the impact of COVID-19 pandemic. Since then, the market has gradually recovered its original state. This result is important for scientists and investors, given that some of the existing conclusions in the literature, such as the presence of advantages in the field of cattle breeding, efficiency and diversification, may be related to specific phases of the market.

2.6 How various factors affect the cryptocurrency market

H1 - the impact of the oil price. According to research by Nua (2021), cryptocurrency volatility and oil market shocks do not have the same data frequency, however, OR, ORV and ORSV

(according to the one-dimensional Garch-Midas model (2013)) have a significant negative impact on the long-term volatility of the cryptocurrency. Also, OSS positively impacts the long-term volatility of cryptocurrencies, while the impact of OADS or OSDS is negative, as the effect of oil demand and OSS is negatively related (Kilian, 2009). Moreover, the empirical results of the research of Chancharat (2021) show that the lagged returns inversely affect their current returns in oil.

H2 - the impact of the gold price. In his research Butda (2021) claims that the empirical results, based on the return spillovers between Bitcoin and gold, indicate a unidirectional return spillover from Bitcoin to gold. Also Nakagawa (2021) says that the number of cryptocurrency wallet users is positively associated with the expected return on gold.

H3 - the impact of the political shocks. Meland (2018) researches factors that explain Bitcoin's price fluctuations. His main finding and contribution is that political incidents and statements ("shocks") are significant drivers of Bitcoin's price. Moreover, the volume of Bitcoin and Bitcoin's price has a significant, negative relationship. The interest of Bitcoin, measured by Google searches, has a positive, significant relationship with Bitcoin's price.

H4 - the impact of the economical shocks. Yiu (2021) claims that economic policy uncertainty, macroeconomic news, and the risk the the USA stock market could significantly affect cryptocurrency volatility. He also says that the uncertainty in the real economy is a crucial source of the cryptocurrency volatility.

H5 - the impact of the prohibition on the usage of cryptocurrencies in other countries. This topic is covered in a very limited amount of literature and research, however Chohan (2017) claims that the growth of cryptocurrencies has been met with a variety of regulatory and legislative responses across national jurisdictions, with some signalling approval of the general transactional and functional aspects of cryptocurrencies, while other responding with legislative prohibitions or restrictions. This diversity of legislative response signals on one hand the perplexity of authorities

as to the full possibilities of cryptocurrencies, and on the other hand a realization of the inadequate oversight and governance role those authorities would have in the disintermediated nature of cryptocurrency transactions.

H6 - the impact of the adoption of restrictive legislation. While papers on the potential risks and opportunities associated with cryptocurrencies are flourishing, empirically little is known about the spread, growth and use patterns of these innovations. There is information that the introduction of bitcoin is also partly due to the usefulness of cryptocurrencies for participating in illegal trade (Saiedi, 2020).

H7 - the impact of the general supply and demand. According to Noyan (2021), empirical analysis based on bitcoin transactions reveals the existence of a relatively flat downward-sloping demand curve and a much steeper upward-sloping supply curve. Regarding users, the inelastic nature of demand signals the utility of Bitcoin as a niche platform for transactions that are otherwise difficult to conduct. It was also found out that the use of bitcoins as a trading asset is associated with higher levels of tolerance to fees.

H8 - the impact of the number of political and economical news regarding the cryptocurrency market. Foglis (2021) says that cryptocurrency is considered as a part of conventional investment channel because there were found pass-through mechanisms between economy and digital markets. It implies that the investors who are likely to invest or trade in the cryptocurrency market should keep their eyes on the regular news, including economic growth, policy changes or any crises.

Methodology

In this chapter, the researcher explains the theory on various types of research design, as well as explaining what type of research investigation was chosen. The data collection procedures were identified, then following with an explanation of what sources were used to measure data. The analysis procedure was explained and instruments of data analysis defined and discussed.

Before explaining the design of the research, the aims and questions of this research will be reviewed.

The research question is to identify what are the problems and perspectives of the development of the cryptocurrency market and what factors affect their change. Taking all the things together, we can build and investigate two hypotheses:

Model I:

H0: 3 factors have no significant influence on the development of the market of highly market capitalized cryptocurrency.

H1: 3 factors have a significant influence on the development of the market of highly market capitalized cryptocurrency.

Model II:

H0: 3 factors have no significant influence on the development of the market of low market capitalized cryptocurrency.

H1: 3 factors have a significant influence on the development of the market of low market capitalized cryptocurrency.

3.1. Design of research

The methodology will consist of secondary data taken from scientific sources, articles, and books. The data was gathered from Google Scholar, Web of Science, and Scopus. These sources are taken for research instruments during the initiative part of the current work.

This paper will use statistical methods using the multiple regression model. To estimate the regression model and identify the relationship between the development of the cryptocurrency market and other variables the statistical analysis will be provided through ANOVA Excel. Data was gathered from multiple sources on from December 2000 to January 2020.

The strategy is the longitudinal study by using public web data and the model contains for identifying the relationship between the dependent variable (DS) and independent variable (3 factors). 3 factors include gold price, political shocks, economical shocks, prohibition on the usage of cryptocurrencies in other countries, adoption of restrictive legislation, general supply and demand, and the number of political and economical news regarding the crypto market in each year.

Each factor is described through a parameter or money amount in U.S. dollars or dummy variable, where 1 is for news/regulation occurred and 0 not occurred on specific week. The model represents several multiple linear regressions analyzed separately, after the assumption that the DS variable is responsive and factors are independent variables.

In multiple regression modeling the following formula is used:

$Y = \beta 0 + \beta 1x,$

where

yi=dependent variable

xi=expanatory variables

β0=y-intercept (constant term)

βp=slope coefficients for each explanatory variable

ϵ=the model's error term (also known as the residuals)

Correlation can be of two variants: positive and negative. It is assumed that there will be either a positive or negative correlation. After analyzing p-values and t-values, the statistical significance of factors will be defined. The hypothesis will be either rejected or rejected

3.2. Data collection

Intraday (high-frequency) data for Bitcoin prices covering the period from 1st December 2020 to 1st January 2021 was used to construct weekly measures of realized volatility, and its various covariates. The starting day of the sample period and the 60-minutes frequency of the data because results were also presented, for comparison purposes, for other major cryptocurrencies in addition to Bitcoin (see Section 1.2.) It should also be noted that a 60-minutes frequency renders it possible to circumvent liquidity issues (or the lack thereof), extreme high-frequency noise from no-activity periods observed mainly in very small-time windows, and zero prices. In this study it was defined that a trading day from Monday 16 to Sunday from 00:00 EST to 23:59 EST, which renders it possible to have a higher number of observations compared to an 8-hourly and 12-hourly bases. Intraday (high-frequency) data for EOS, Ethereum (ETH), Litecoin (LTC) and Ripple (XRP) prices covering the same period for the robustness analysis was used. Data for Bitcoin and other cryptocurrencies are from CryptoCompare.com (https://www.cryptoCompare.com), which provides data on a number of liquid Bitcoin markets and other major cryptocurrencies.

Results

4.1. Results for high capitalized cryptocurrencies

Regression				
R	0,87635			
R-squared	0,76798			
Adjusted R-squared	0,65393			
St.dev.	11,253			
	Coefficient	*St.dev*	*t-stat*	*P-value*
Y	342,5	134,384	1,83	0,0324
Gold price	103,66	66,3721	1,29	0,0410
E-P shocks	-99,642	7,53	1,51	0,0194
Restrictions	1,245	0,763	1,19	0,0420

Table 1. Regression statistics for factors affecting highly market capitalized cryptocurrency market

Correlation coefficient is statistical relationship of two or more random variables (or quantities that can be considered as such with some acceptable degree of accuracy) (Cohen, Cohen, West and Aiken, 2002). In this case, changes in the values of one or more of these quantities accompany a systematic change in the values of another or other quantities. R is equal 0,87 which means that there is a strong correlation. It shows that there is a strong relationship between variables in this model. P-values for coefficients are less than 0,05.

The validity of correlation, the t-test and F-test procedures will be reviewed:

From TINV function = 2,03, where n -2 = 100-2, α=0,05

$$t_{набл} = \frac{r \cdot \sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0{,}87 \cdot \sqrt{100-2}}{\sqrt{1-0{,}87^2}} = 17{,}46$$

As a conclusion, the actual t-test is greater than tabular at a probability of 95% and proves that observations are statistically significant.

Testing the significance of regression model, Fisher's F-test is employed:

$$F = \frac{0{,}87}{(1-0{,}87)/(100-2)} = 66{,}92$$

While the table value of F-test is 4,56, so the actual value F>than the tabular, which means that significance is confirmed.

The regression model is represented as:

Y = 342,5 + GP*103,66-99,64*EPS+1,245*RR

P-values for all 3 factors has shown its significance (<0,05) which reflects the acceptance of stated Hypothesis:

H1: 3 stated market drivers has an effect on high capitalized cryptocurrencies (Bitcoin, BTC)

4.2. Results for low capitalized cryptocurrencies

Regression	
R	0,8866
R-squared	0,78605
Adjusted R-squared	0,599
St.dev.	154,3

	Coefficient	*St.dev*	*t-stat*	*P-value*
Y	0,0044	14,84	1,54	0,006231
Gold price	-1943	133,5	1,93	0,0397

E-P shocks	1,34	15,33	1,62	0,647
Restrictions	0,0075	0,005	1,72	0,002976

Table 2. Regression statistics for factors affecting low market capitalized cryptocurrency market

II model coefficient of determination is 0,78 which shows that 78% of % of shareholders decision is explained by chosen factors and it is a high variance.

Correlation coefficient is statistical relationship of two or more random variables (or quantities that can be considered as such with some acceptable degree of accuracy) (Cohen, Cohen, West and Aiken, 2002). In this case, changes in the values of one or more of these quantities accompany a systematic change in the values of another or other quantities. R is equal 0,8866 which means that there is a strong correlation. It shows that there is a strong relationship between variables in this model.

The validity of correlation, the t-test and F-test procedures will be reviewed:

From TINV function = 2,03, where n -2 = 30-2, α=0,05

$$t_{набл} = \frac{r \cdot \sqrt{n-2}}{\sqrt{1-r^2}} = \frac{0{,}88 \cdot \sqrt{30-2}}{\sqrt{1-0{,}88^2}} = 9{,}907$$

As a conclusion, the actual Student's t-test is greater than tabular at a probability of 95% and proves that observations are statistically significant.

Testing the significance of regression model, Fisher's F-test is employed:

$$F = \frac{0{,}88}{(1-0{,}88)/(30-2)} = 189{,}65$$

While the table value of F-test is 4,56, so the actual value F>than the tabular, which means that significance is confirmed.

The regression model is represented as:

Y = 0,0044 - GP*1943 +0,0075*RR

P-values for factors GP and RR factors has shown its significance (<0,05) which reflects the acceptance of stated Hypothesis:

H1: 2 stated market drivers has an effect on low capitalized cryptocurrencies (Litecoin LTC, Ripple XRP)

4.3. Discussion of results

For stable cryptocurrency as BTC with large market capitalization it can be seen that EPS did affected on price volatility positively, which is in line with conclusion of Cio et al (2015) that countries should have decline EPS in order to improve price volatility of cryptocurrency. It can be applicable to Kazakhstan in the way that lower the EPS, then lower the volatility of cryptocurrencies. Then investors might use BTC as a hedging instrument as a more efficient instrument. In this study, researcher defined several factors of influence on cryptocurrency development, including:

- financial factors - the group includes financial information, such as prices, volumes of transactions, inflow or outflow of currency;
- development activity – the development activity of each blockchain protocol. The main factors used for this report were GitHub activity and overall developer activity;
- social media mentions – a category reflects the presence of each protocol on social networks such as Twitter, or mentions in search engines like Google; web usage – indicates how widely a particular protocol is used; network size and maturity – measures the size or maturity of a network.

For young and low capitalized cryptocurrencies, EPS did not showed statistical significance, however factor of RR increases price volatility on these currencies. More restrictions are imposed on these types of currencies, then more fluctuations on the market occurs.

Interestingly, that increasing Gold Price affected negatively on volatility, as these are substitute asset and can cause additional volatility.

BTC, LTC, XRPP are the main currencies, and it is necessary for Kazakhstan crypto miners to understand which drivers effect on additional volatility. As we can see, EPS and RR imposed additional volatility for the last 2 years, which government could control.

As a topic of future studies, additional governmental organization can develop cryptocurrency mining market with the usage of the above model.

4.4. Recommendations

The current study can give additional information for studying how cryptocurrency volatility is affected by external factors. The results can prove that price volatility can be significantly improved by larger amount of negative economic news, as well as economic and political. Moreover, low capitalized cryptocurrencies are not affected by economic news, but mostly affected by gold price volatility and regulatory restrictions. It can be stated that Bitcoin has more benefits than risks. It is used worldwide; yet, it is banned from the economies of certain countries. Attempts to regulate the price of bitcoin have all failed. Moreover, it was proved to be hard to predict bitcoin price in future periods using standard models for forecasting. A noticeable fact is that bitcoin price is very susceptible to its very popularity. Whenever bitcoin would get publicity in the media, its price would increase.

Conclusion

This study has investigated the effect of economic news, regulatory restrictions imposed in different countries and economical news through sentiment analysis using key words. To draw sharp conclusions about volatility, high-frequency data and estimated realized volatility was utilized and its jump component, i.e., price variation due to discontinuous price changes. In accordance with the previous literature, it was documented that the volatility of bitcoin is much higher than that of other financial assets.

The volatility of bitcoin is strongly influenced by news about bitcoin regulation. In particular, the volatility of bitcoin is significantly increased a day before an article about bitcoin regulation is published in a newspaper, the Financial Times. This result is consistent with Auer and Claessens (2018), who suggest that regulation is a significant price factor for cryptocurrencies. Our second key finding is that the hacking of cryptocurrency markets has a strong impact on bitcoin volatility and its jump component. In the latter case, the effect is particularly strong, especially for the right-tail of the jump volatility component. We extract investor sentiment from Google searches for bitcoin and other major cryptocurrencies separately for positive, neutral, or negative short phrases and words related to bitcoin use and regulation. We find that nonsupporting (negative) and neutral investor sentiment does not have a significant impact on bitcoin volatility, whereas supporting (positive) investor sentiment seems to have a positive effect and leads to an increase in the volatility and jump levels.

The value of a bitcoin is primarily determined by its stock-to-flow ratio, that is, the ratio of the total amount of BTC available to newly generated coins. According to the authors of the report, due to the scarcity inherent in the system, bitcoin should be valued on the model of gold: the production of bitcoins is difficult, and the maximum number of coins is limited from the very

beginning. And the halving dates, that is, the halving of bitcoin production, are considered growth impulses, since in this case the reward for the production of new coins is halved.

Unlike Bitcoin, the value of the second largest cryptocurrency, Ethereum, largely depends on the number of verified smart contracts. According to the Frankfurter Allgemeine Zeitung (FAZ, one of Germany's leading inter-regional newspapers), this is not about scarcity, but about building an open network that should run as many applications as possible. Interestingly, the prices of Ethereum competitors with their own blockchain, such as Polkadot, Neo or EOS, are based more on the ETH price than on their own network activity.

In contrast, Ethereum is primarily defined by the number of verified smart contracts on its blockchain. This conclusion is in line with expectations, since the unique selling point of Ethereum is not scarcity, but the creation of a global, open network. The number of dApps deployed also showed a similar correlation, but failed to capture the recent rise in Ethereum prices. The price of ERC20 tokens moved in the same way as the price of Ethereum itself.

Appendix

Appendix A

No	**Name**	**Market Cap, $ million**	**Unit Price, $**	**Change %**
1	Bitcoin	224,618	11,755	3,90
2	Ethereum	44,905	401	3,19
3	XRP	14,900	0,3	2,23
4	Tether	10,300	1	2,85
5	Bitcoin Cash	5,500	296	4,66

6	Litecoin	3,877	0,1	-0,88
7	Other	49,879	-	-

Source: Coindesk (2020). Bitcoin market capitalization (2020, December)

Appendix 2

Hypothesis	**Result**	**Outcome**
Hypotheses 1:	B=0,3 P<0,001	Support
Hypotheses 2:	B=0,45 P<0,001	Supported

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