

Crypto portfolio versus FAANG investment portfolio

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Abstract <p>Permanent technological progress leads to the constant creation of financial innovations, one of which is cryptocurrency. This is a new instrument of the world market, which has been actively traded only in recent years. In this regard, a number of questions arise, including the possibility and feasibility of forming an investment portfolio of cryptocurrencies using classical methods of portfolio management.</p> <p>The aim of the research is to identify correlation between main cryptocurrencies in the crypto portfolio and highlight the main differences between standard stock portfolio and crypto one. Historical data from Yahoo Finance was mainly used for the analysis in the period from 2017 to 2021.</p> <p>A quantitative approach was chosen for the research in order to calculate and compare portfolios' risk and return. Several metrics were used in order to get reliable results, such as Correlation analysis, Variance Covariance matrix, CAPM and Beta. Calculations were supported by secondary data from recent academic researched and articles from trading journals. Collected data helped to build assumptions behind results and answer the research questions about interrelation of the cryptocurrencies and its similarities with traditional portfolio.</p> <p>The empirical findings unexpectedly revealed low correlation between five main cryptocurrencies and its influence on the portfolio return. It also displayed how risky and unstable crypto portfolio could be compared to the FAANG portfolio, that consisted of very consistent companies 'stocks. It gave understanding of unsystematic risks in the portfolios and how it can be beneficial for different types of investors. The research also showed the interconnection of the cryptocurrencies and S&P500.</p>		
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Miscellaneous (Confidential information) Confidential information must be marked clearly stating which appendixes are confidential and what the confidentiality is based on and how long the period of secrecy is. For example: Appendixes 1, 4 and 7 are confidential and they have been removed from the public thesis. Grounds for secrecy: Act on the Openness of Government Activities 621/1999, Section 24, 17: business or professional secret. Period of secrecy is five years, and it ends 18.5.2022.		

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1 Introduction

Globalization, growth of money markets, digitalization and the development of IT technologies have entailed the emergence in our society of a huge number of additional institutions, financial instruments and new forms of interaction between people. One such institution in the modern world is electronic money. Coins and banknotes are gradually being replaced by plastic payment cards, and several modes of payment systems are available on internet, originally created only for electronic payments, such as PayPal, WebMoney & Yandex money. At present, digital currencies are not issued by national central banks. But progress does not standstill, and now it is clear that the growth of the Cryptocurrency - new means of payment of the XXI century.

Cryptocurrency is a new factor in global liquidity and Bitcoin is an electronic payment system that uses the unit of the same name (digital currency) to record transactions and the data transfer protocol of the same name. Other cryptocurrencies do exist, and their total current number currently exceeds 1.2 thousand. However, only a few are widely used for real financial calculations, and only a few dozen of these is in demand on exchange and over-the-counter markets around the world. Digital currencies are based on blockchain technology and are characterized as a very promising financial instrument for both payments and financial speculation.

Even though cryptocurrency and Bitcoin is a new tech wave, it does not mean that CFOs, investors or entrepreneurs should be afraid of implementing it into their businesses and financial schemes. It holds many advantages that can bring compound and recurring success and elevate the business to a new level. For example, one of the advantages is commission. The commission for transactions in the bitcoin network and the speed of their execution does not depend on the distance over which the transfer needs to be made. If, when using the services of companies, such as Western Union and Rabobank, sending funds can take several days- Bitcoin transactions can complete this task on average in one hour. In this case, the commission will be incommensurate with the amount sent. For example, in February of this year, the Bittrex exchange sent 49,922 BTC (\$ 460 million at the exchange rate at that time) in

one transaction with a commission of \$ 0.60, and in January, there was an operation in the amount of 124,946 BTC (about \$ 1 billion), for which they had to pay \$ 83. At the same time, BTC is considered an outdated cryptocurrency in terms of technology, and to solve its shortcomings, there are a lot of altcoins that will perform such tasks much faster and more efficiently. Take for argument's sake, the XRP token which was developed by Ripple to solve banking problems. Blockchain project products, such as xRapid & allows large sums of money to be transferred instantly and for an extremely modest fee over any distance.

Another very factor worth mentioning is inflation. Jerome Powell discussed & debated the deflationary nature of bitcoin in 2020, when central banks of major countries like US, Great Britain, Hong Kong etc. applied extraordinary measures to support economic health. (Степанова, 2020) Since the beginning of the year, the total balance of the United States, Europe and Japan has grown by \$5 trillion. (Comply Advantage, 2020) At the same time, the emission of cryptocurrency cannot be increased; it always will be 21 million coins.

In turn, this means that, unlike the US dollar, which is issued on an unlimited scale, bitcoin is not influenced by inflation. On the contrary, over time, the supply of cryptocurrency in the market will decrease, which means that even if demand persists, its price will rise. The coin is programmed to rise in price, making it look much more valuable than fiat money.

Unlike the benefits of cryptocurrencies, there are still a lot of uncertainties about its legalization. Today bitcoin is banned in Morocco, Ecuador, Kyrgyzstan, Bangladesh, Nepal. In more than 65 countries of the world, it is legalized. Moreover, more than in 40 countries, the status of bitcoin is regulated with the help of relevant regulations, and in other countries it is still remains unclear, although the regulatory and institutional framework is rapidly evolving. Already today, according to (Eugene Kim, 2021), more than 0.5% of all electricity produced in the world is spent on mining. ICO (initial coin offering) has already strongly affected the real economy. ICO is a mechanism allowing start-ups and the general public to attract traditional or digital money for the implementation of their projects. The technology is exactly the same as on the usual

the stock market, but with one exception: there are no established rules of the game yet, no effective regulation.

Therefore, one of the main premises of this thesis is to track the influence on traditional stock market and investing methodologies. Furthermore, various literature and research are classifying cryptocurrency's correct asset class: some researchers compare cryptocurrencies to stocks (Symitsi & Chalvatzis, 2019), bonds (Corbet et al., 2018), gold (Klein et al., 2018), or other precious metals (Mensi et al., 2019). Although scholars have not defined cryptocurrency and despite its popularity as an exchange medium, it seems mostly useful as an investment asset.

1.1 Motivation for research

One of the main reasons for the author to conduct research in the topic of cryptocurrency was to uncover misunderstandings and answer questions about new digital asset which appears on the market and grew dramatically during the last decade. Revolutionary creation of blockchain caused a change is almost every industry involved in digital processes. It could not leave behind the e-money concept, which created cryptocurrencies and the first and the most famous one – Bitcoin. Bitcoin technology is very young and thus it is very unstable on the arena. In 2021 Bitcoin rate reached \$64000 and then dropped back to \$20000; the volatility of unknown currency brings a lot of questions and attention from all generations. Especially investors and traders are interested on changes on stock markets and how their businesses can benefit from it. In this thesis the main intention is to provide readers with basic information about cryptocurrencies and its influence on stock market, whether it can bring new opportunities or it is unstable asset which is not ready to be included to the global arena.

1.2 Research method and questions

The main purpose of the research is to identify the effect of cryptocurrency stock markets on traditional investing portfolios and volatility of the cryptos in the

portfolios itself. It is known that one of the main portfolio rules is “Do not put all eggs in one basket” and spread the capital across different assets. However, there is no assurance that it can be valid for crypto investment due to the high correlations between the currencies, what makes the whole stock “one basket”. Therefore, the main problem can be defined as follows:

Lack of cryptocurrencies’ independence in the market for portfolio diversification.

In order to understand the nature of cryptocurrency investment, the author will analyze factors influencing financial portfolio development and its possible use for crypto investing. Thus, one of the main objectives is to show relations between stock markets and crypto-stock markets in order to highlight differences in portfolio compilation. According to the above objectives, the main questions are created:

- What is the nature and extent of correlations between different cryptocurrencies?
- What is the difference in risks and returns between crypto and traditional portfolios? How can investors benefit?
- What is the level of unsystematic risk in cryptocurrency portfolio? How dangerous it can be?

2 Literature Review

2.1 Investment Portfolio

A portfolio is a grouping of financial assets such as stocks, bonds, commodities, currencies and cash equivalents, as well as their fund counterparts, including mutual, exchange-traded and closed funds. A portfolio can also consist of non-publicly tradable securities, like real estate, art, and private investments (Hiriyappa 2008, 2.).

Portfolios are held directly by investors or managed by financial professionals and money managers. Investors should construct an investment portfolio in accordance

with their risk tolerance and investing objectives. Investors can also have multiple portfolios for various purposes. It all depends on one's objectives as an investor. (Ken Faulkenberry, 2015)

To build a suitable portfolio for a client, investment advisers should first seek to understand the client's investment goals, resources, circumstances, and constraints. In order to make investment portfolio profitable, financial professionals apply different strategies that based on several main factors that are vital for decision making:

- interest rates
- economics growth,
- confidence/ expectations,
- technological development, and
- availability of sources from banks (Pettinger 2017).

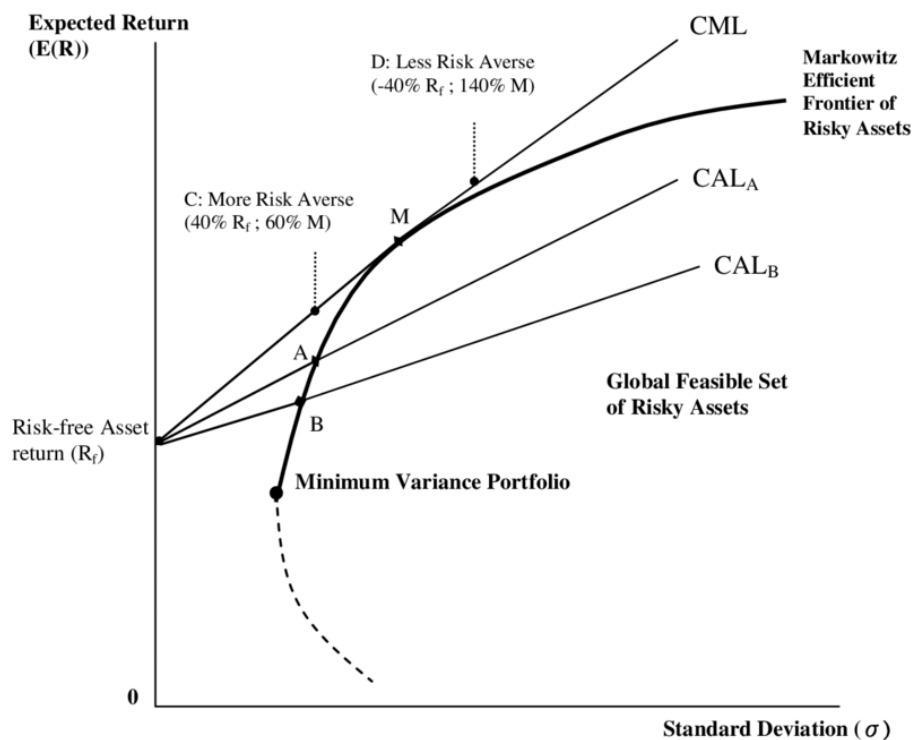
2.1.1 Modern Portfolio Theory

Modern portfolio theory was presented first time in the article written by Harry Markowitz in 1952. Harry Markowitz claims that major asset categories tend to move differently: market conditions that could result in a gain from one class of assets may result in a loss in another class. The main hypothesis is that if one asset class moves down, losses can be offset by the return of other asset classes.

In his theoretical studies, G. Markowitz suggested that the value the yield of securities is a random variable distributed according to the normal the optimal law, which is estimated as the expected return ($E(r)$); thus, as the scale of the expected income from a number of possible incomes in practice use the most probable value, which, in the case of a normal distribution, coincides with expected value. The risk, according to this theory, is a measure of the definiteness of this random variable, which is calculated as a standard deviation of the possible values of its profitability (σ). The investor needs to consider this indicator of dispersion: the greater the spread of the values of possible income - more danger there is that expected income will not be received. Besides, when determining the risk of a specific portfolio, investors must take into account the correlation of stock prices. As a correlation, Markowitz suggests

using the C covariance between changes in the prices of individual securities. It can be considered as a limiting case when an infinite number of securities included in a portfolio - the variance will asymptotically approach the mean value of the covariance C (Fig. 1).

Figure 1 Representation of minimum portfolio variance according to MPT

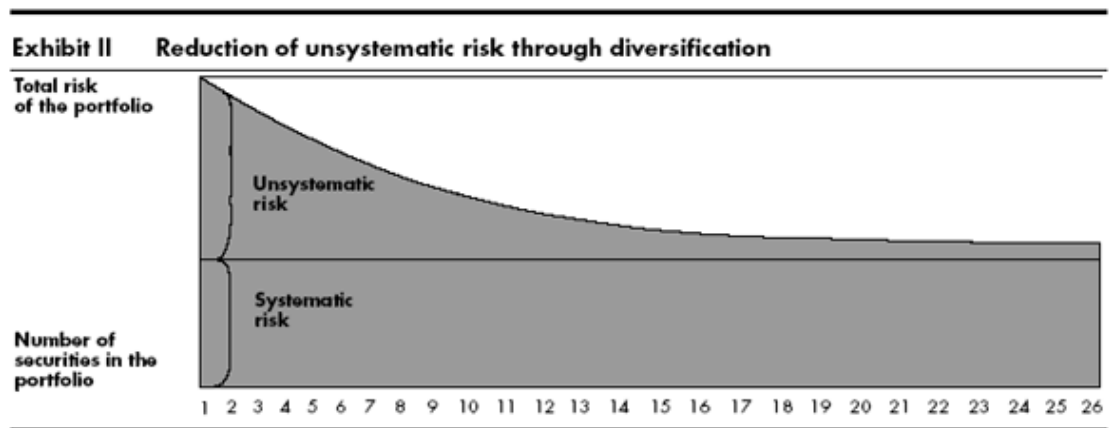


2.1.2 Risk and CAPM

G. Markowitz developed an important position for the modern theory of portfolio management. It consists in the following: the total portfolio risk can be decomposed into two parts. The first part is a systematic risk that cannot be excluded, all securities are equally exposed to it. The second component is the unsystematic risk that is inherent in a particular security, and it can be avoided by managing a portfolio of securities. In this case, the sum of the invested funds for all assets must be equal to the total volume of investments. However, there is the problem of determining the relative shares in the portfolio of stocks and bonds that are most beneficial to the owner.

In this regard, the author of the model limits the solution to the fact that out of the entire set of “admissible” portfolios, those that satisfy the constraints are the riskiest ones, which are characterized with the same income by a greater risk compared to others or by a lower income with the same level of risk. According to G. Markowitz's theory, investors strive to form a portfolio of securities in such a way as to maximize the profit they receive for themselves with the limiting losses of the expected return and the level of risk. Therefore, investors obvious desire to predict and calculate risks as close as possible.

Figure 2 Reduction of unsystematic risk through deversification



An unsystematic risk arises from any event the business is not prepared for, and which disrupts the normal functioning of the business. Unsystematic risk is associated with business, financial, operational or strategic risks. Main examples of those can be liquidity issues, worker strikes or management inefficiency. It is clearly visible in the graph that an unsystematic risk is more in case you do not have a diversified portfolio. But, as you start investing in more than one stocks, your unsystematic risk goes down and approaches zero

In 1960s W. Sharpe first time presented capital asset pricing model and introduced the concept of β (beta) to measure the systematic risk of an asset. Sharpe's contribution to portfolio theory is summarized in the following principles:

- Investors prefer a high expected return on investment and a low standard deviation; portfolios of common stock that provide the highest expected return at a given standard deviation are called effective portfolios.
- In order to know the limiting influence of a stock on the portfolio risk, it is necessary to take into account not the risk of the stock itself, but its contribution to the portfolio risk. This contribution depends on the sensitivity of the stock to changes in the value of the market portfolio.
- The sensitivity of the stock to changes in the value of the market portfolio is indicated by the "beta" indicator; therefore, beta also measures the stock's marginal contribution to the risk of a market portfolio. To assess how the inclusion of a new security in a well-diversified portfolio will affect its risk, it is not so important to know the total risk of this security σ overall. It is enough to know the market risk and determine how sensitive it is. (Watson & Heads, 2016)

This sensitivity is measured by the β - coefficient. β shows the level of volatility of an asset (for example, a security) in relation to the market portfolio (average asset). Statistically β of shares j can be defined as follows:

$$\beta = \frac{\sigma_{jm}}{\sigma_m^2}$$

σ is the covariance between the return on share j and the market return determined by the dynamics of the market index (the stock market index on which the given share is quoted).

Stocks with a beta of more than 1.00 usually rise and fall at a higher percentage than the market, if they have a high systematic risk and are very sensitive to changes in the market. Conversely, a stock with a beta of less than 1.00 has low systematic risk and is less sensitive to market movements.

The formula for assessing the future profitability of an asset (stock) according to the CAPM model has the following form:

$$R_s = R_f + \beta_s(R_m - R_f)$$

R_s = the stock's expected return (and the company's cost of equity capital).

R_f = the risk-free rate.

R_m = the expected return on the stock market.

β_s = the stock's beta.

In Fisher Black and the Revolutionary Idea of Finance, Mehrling (2007) considers the CAPM as the "revolutionary idea" that runs through financial theory. He describes the first important step in the development of modern financial theory as the Efficient Market Hypothesis, followed by the second step, the CAPM. Model shows that investors can expect to attain a risk-free rate together with premium and multiplied it by their exposure to the market. Final equation would be defined in Chapter 3.

2.2 Cryptocurrency and Technology of blockchain

High volatility in the cryptocurrency market can lead to risks such as bubbles and significant downturns, which may attract speculative investors (Baek and Elbeck, 2015). On the other hand, uses rational bubble models to give strong evidence on Bitcoin and Ethereum bubbles, taking into account both heavy tails and the chance of a total decline in asset values.

2.2.1 Blockchain Mechanism

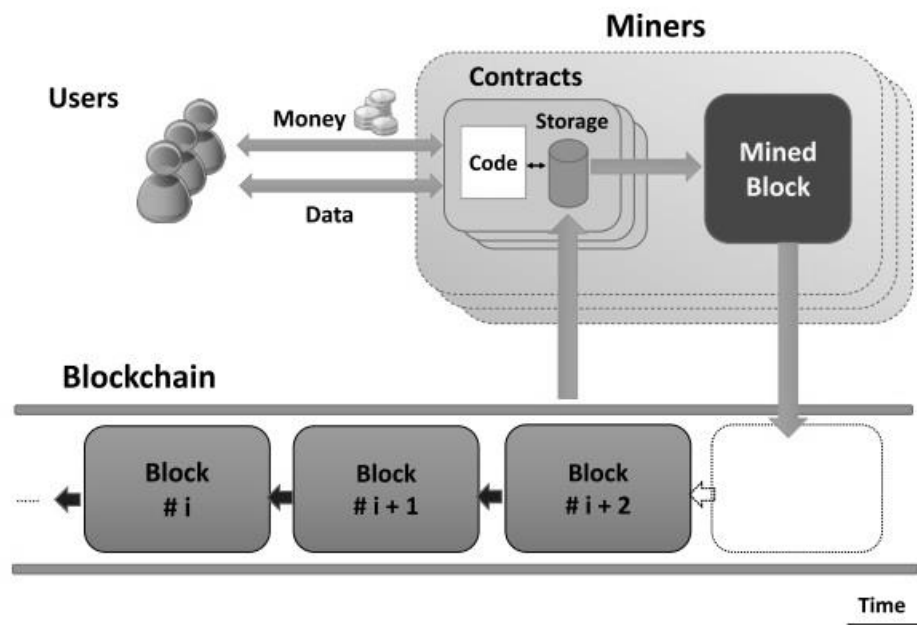
The technology of distributed ledger systems or more known as blockchain is on the radar of interest to the governments of developed and developing countries, and this technology is also vigorously discussed in scientific circles. The development of a cryptocurrency (bitcoin) by a programmer Satoshi Nakamoto in 2009 marked the beginning of the development of blockchain technology. In other words - "blockchain" (blockchain) is a distributed database, in which data storages are not connected to a common server (Kotow, 2019). This database stores an ever-growing list of records called blocks. Each block contains a timestamp and a link to the previous block. The technology allows you to record and store information on the network, which is at the same time decentralized (data is stored on several servers) and distributed (these nodes are interconnected and interact with each other). Such networks can be both private and public. In a public blockchain, any anonymous user may join the network, view the blockchain's content, make new transactions, and verify the blocks' accuracy. Bitcoin, NXT, and Ethereum are examples of public blockchains. Only users with authorization can join a private blockchain network, write, or transfer transactions to the blockchain. Prior to entering the network, a firm or a group of companies is normally in charge of granting such permissions to users. Everledger, Ripple, and Eris are examples of private blockchains. (Maher Alharby, 2017)

Blockchain technology is considered as part of the fourth industrial revolution (Nosirov Z. A., 2021). This is due to its main qualities such as reliability, immutability and transparency. These characteristics give rise to many potentials uses for this technology. Financial sector was influenced the most by appearing so many cryptocurrencies based on distributed ledger system. Moreover, there are also the successful results of the introduction of blockchain into the education system of some European countries. In addition to that, BT is actively used in electronic voting systems and in the technology of the Internet of Things.

Blockchain simplifies the process of compromising on authenticity and credibility by using smart contracts. A smart contract is executable code that runs on the blockchain to facilitate, execute, and enforce the terms of an agreement, it allows to avoid

middleman in transactions. The main purpose of a smart contract is to automatically execute the terms of an agreement once the specified conditions are met. Therefore, smart contracts promise low transaction fees compared to traditional systems that require a trusted third party to enforce and execute the terms of an agreement. The idea of smart contracts came from Szabo in 1994 but became well known only with the appearance of blockchain technology. A smart contract can be thought of as a system that releases digital assets to all or some of the parties involved as soon as arbitrary and predefined rules are met. For example, Maria sends X money units to Shabnamjit when he receives Y money units from Pia.

Figure 3 Smart contract system



2.2.2 Bitcoin

Bitcoin was the first cryptocurrency that was created and based on blockchain technology. Bitcoin began a document that went to press on October 31, 2008, signed by an unknown person working under the name Satoshi Nakamoto. It is still untold who is the true creator, if it is a group of people or still one person - remains unknown, despite multiple journalistic investigations. In this research author has already mentioned main characteristics of the cryptocurrency – decentralization and anonymous. However, there are also downsides of Bitcoin which does not allow cryptocurrency

fully to enter the market. Firstly, it is the trust in Bitcoin. The ecosystem of this cryptocurrency depends on key players without which normal network operation is impossible. These are wallet providers, mining pools, cryptocurrency traders, payment operators. Separately those player van make decisions that will be beneficial only for them and their profit, which creates financial criminal schemes that cannot be tracked and protected by law. Secondly, bitcoin and other currencies are only digital and can be accepted only in the places provided with the Internet. Third reason is the difficult to mine it. Bitcoin mining is based on a solution to a complex cryptographic code, for which there is no better approach than brute force¹. Mining is not done by single coins but by blocks or "packs". Initially, the size of the earned block was 50 BTC, but then it decreased by half after every 210 thousand blocks mined. At the moment, the system already includes more than 250 thousand mined blocks, therefore, one block costs about 25 BTC. Due to the periodic decrease in the block reward, the total amount of BTC will never exceed 21M, ~ 55% of all BTC has already been mined.

Some economists, including A. Greenspan, former Chairman of the Board of Governors US Federal Reserve, N. Welink, former president of the Central Bank Netherlands, Nobel laureate R. Schiller, are of the opinion that virtual currency is a short-term hobby or a financial bubble that is about to burst. Other experts, including E. Volovik considers what virtual currency represents a threat to the financial system, and on the Bitcoin currency the main approaches to building more serious virtual currencies, which will be less volatile, more protected and are promising for use in calculations. Cryptocurrency proponents believe that these payment systems are a necessary alternative to fiat money. However, representatives of all parties have no doubt that cryptocurrencies that allow anonymous transactions between people can exist in a digital space that is inaccessible to any individual state. People are striving to have an alternative currency as a means of accumulation, guarantees of wages and access to goods and services because of losing trust to the national currencies.

¹ In cryptography, a **brute-force** attack consists of an attacker submitting many passwords or passphrases with the hope of eventually guessing correctly. The attacker systematically checks all possible passwords and passphrases until the correct one is found.

The reason for the high demand for bitcoin is the limited emission of 21 million units. 16 million of those rotate in circulation, the rest will be released by 2050. In other words, demand is many times greater than supply, which creates a certain level of deficit, making this cryptocurrency highly liquid, and investments in it profitable. In the entire history of its existence, there have been only a few cases when the course of cryptocurrencies fell drastically with no particular reason behind it. New bitcoin cash, which entered the market on August 1, 2017, showed even better results than the parent - its value tripled already on the second day of trading.

Since January 2017, about 90% of transactions are daily associated with the conversion of cryptocurrencies into each other and into national currencies of the countries, and only a little more than 5% of transactions account for payments, purchase and sale of goods, works, services. In other words, bitcoin is a purely speculative asset. The hypertrophied growth of the bitcoin rate sharply increases the risks of critical volatility in financial markets. Famous broker Mike Maloney, founder of precious metals investment fund GoldSilver.com, urged investors to use Bitcoin as a must-have investment in their portfolios in the event of financial market volatility and unexpected economic downturns. He stated: "Gold is becoming less and less reliable as a hedge against market volatility. Bitcoin is in the lead. I am sure that buying cryptocurrencies today is the most effective way to protect yourself from the shaking of the global financial system. " Investors around the world have begun to transfer part of their "gold reserves" to cryptocurrency. Thanks to decentralization, the bitcoin rate is not enough depending on external events: it is already in practice demonstrated that he is one of the safest assets and is able to protect even a solid investment.

2.2.3 Ethereum

Ethereum is 2nd most popular blockchain technology with Market Capitalization more than 545B. (Finance.Yahoo.com, 2021) It was developed by Russian programmer Vitaly Buterin. For the first time, he expressed the idea of creating Ethereum in the Bitcoin Magazine at the end of 2013, in the same year the presentation of the currency was successfully held. After that, active fundraising began at specialized sites for start-up founders in San Francisco.

Ethereum blockchain technology is used for generating smart contracts. A smart contract is a computer algorithm that controls the process of exchanging funds in blockchain technology for both parties. The advantage of this algorithm is that the process also follows the main characteristic of crypto currency – decentralization, thus it makes sure that the conditions are met correctly without involvement of human check. Therefore, data falsification and other types of fraud are difficult and practically impossible.

2.2.4 Tether

Tether (USDT) is the third largest cryptocurrency in terms of capitalization and the first in terms of trading volume in the world, the rate of which is always stable thanks to its peg to the US dollar. According to the company, the pegging of the rate is supported by a reserve: for every 1 USDT issued, there is 1 USD held in a bank deposit. Tether also has the cryptocurrency equivalent of the Euro (EURT) and Chinese Yuan (CNYT). (EXMO, 2020)

Now there are 709 million USDT coins in circulation, with a total capitalization of 72.5 billion US dollars (Finance.Yahoo.com, 2021). The company is issuing new coins in stages for several hundred million tokens.

According to the company, "platform currencies are 100% backed by reserves." This means that everyone can convert all their USDT into USD and everyone has enough fiat money. However, Tether is secured by 74%, a significant part of which are securities and loans issued to related companies. However, Bitcoin or Ether has no reserves at all, therefore USDT is more reliable than BTC or ETH.

2.2.5 Binance Coin

Binance Coin (BNB) is a cryptocurrency built on the ERC20 standard from Ethereum and issued by the famous cryptocurrency exchange Binance. With the help of BNB coins, exchange users can pay transaction fees and receive additional discounts for

this. In the first year - 50%, in the second - 25%, in the third - 12.5%, in the fourth - 6.75%.

According to statistics published in April 2021, the platform performs more than 1.4 million transactions per second, being one of the leaders in this indicator among all cryptocurrencies. Moreover, from early April to mid-May 2021, Binance Coin showed impressive growth and doubled its value. Its current market capitalization is 108B. (Finance.Yahoo.com, 2021)

2.2.6 Dogecoin

Unlike Bitcoin, the creator of Dogecoin is famous - his name is Jackson Palmer. He came up with his own cryptocurrency in 2013. The reason was the first boom around bitcoin and the formation of the first "crypto investors" as everyone around was discussing the new product. Palmer decided to joke and created his own cryptocurrency to show everyone around that investing a lot of money in this unstable decentralized money is absurd.

Dogecoin is a fork from Luckycoin and Luckycoin is a fork of Litecoin. Therefore, it is often simplified and written that Dogecoin is based on Litecoin. The name and image of the currency is also a joke: the cryptocurrency is named after the meme doge - a Shiba Inu dog.

Unlike Bitcoin, Dogecoin was mainly created for a good cause: charity. A foundation of the same name was launched, various initiatives around the world were supported. Dogecoin is also convenient in use for transferring money between stocks due to its speed and low cost.

In December 2020, the Dogecoin rate was \$ 0.00025 per coin, and a month later - already \$ 0.0023, it was an increase of 10 times in a month. Over time, growth has slowed down, and the cryptocurrency has become as volatile as the others: either rapid growth, or a long decline. Currently it is one of the most successful cryptocurrencies and its market cap is 36.8B.

3 Methodology

This chapter explains the data collection process, its sources and research strategy. In his book Kothari said that research methodology is a way to systematically solve the research problem. Thus, it is significant to understand techniques and methods to develop tests and assumptions to evaluate a particular problem. (Kothari, 2004)

3.1 Research Approach

Neuman admitted in his book that research can be conducted differently, it can be experimental versus nonexperimental, it can be case study with focus groups or qualitative versus quantitative research. (Neuman, 2006) To answer main research questions in current paper, author have chosen to proceed with quantitative method, which allows to focus only on data analysis concerning this particular method. There are several advantages to conduct quantitative research as first of all it can be time saving due to less organizational and administrative work. Secondly data results can be more careful due to rigorous data collection and its public legitimate source. However, Dudwick, Kuehnast, Jones and Woolcock mention possible weaknesses in quantitative approach too. Quantitative research requires a large-scale of data collection which sometimes can be impossible to retrieve and analyze properly. Besides, it is missing meaningful characteristics that can impact the results such as human perceptions and beliefs. (Dudwick, 2006)

Yin believes that research strategy should be determined by the study situation. Each research technique takes a unique approach to collecting and analyzing empirical

data, and as a result, each strategy has its own advantages and disadvantages. Although each research method has its own characteristics, there are some areas where they overlap, adding to the complexity of the strategy selection process. Yin admits that strategy choice should be based on a type of raised question and degree of focus on available data. A table below portrays the overlapping section between traditional research methods: positivism for quantitative research and realism as for qualitative research.

Table 1 Adapted key features of positivism and realism (Dilanthi Amaratunga, 2002)

Theme	Positivism	Realism
Basic beliefs	<p>The worlds are external and objective</p> <p>Observer is independent</p> <p>Science is value-free</p>	<p>World is socially constructed and subjective</p> <p>Observer is part of what is observed</p> <p>Science is driven by human interests</p>

Researcher should	<p>Focus on facts</p> <p>Look for causality and fundamental laws</p> <p>Reduce phenomena to simplest elements</p> <p>Formulate hypotheses and test them</p>	<p>Focus on meanings</p> <p>Try to understand what is happening</p> <p>Look at the totality of each situation</p> <p>Develop ideas through induction from data</p>
Preferred method in the research	<p>Operationalizing concepts so that they can be measured</p> <p>Taking large samples</p>	<p>Using multiple methods to establish different views of the phenomena</p> <p>Small sample investigated in depth or over time</p>

Quantitative studies tend to measure "how much" or "how often" and look for "distinguishing traits, elemental properties, and empirical bounds". (Nau, 1991) Quantitative research excels in determining variables, such as a quantitative assumption about construction process capabilities, which states that "processes can be reduced to a collection of variables that are somehow similar across construction projects, persons engaged, and conditions." A quantitative method may be justified if this measurement is one of the research's main goals. (Dilanthi Amaratunga, 2002)

Within the research community, there is a strong belief that quantitative and qualitative research are best conceived of as complimentary and should thus be mixed in all kinds of research. (Das, 1983) The use of many approaches to explore the same issue is known as triangulation. With the increased focus on "triangulation" in research, this emphasis has emerged (Yin, 1994).

The notion of traditional quantitative method - positivism is used in this work because it is the most appropriate strategy for analysing crypto reality and summarizing results that may be used in similar contexts over time. Raw data assessment, data input and transmission, data processing, conveying findings, data interpretation, and completing data analysis are all part of a quantitative data analysis plan (Pacitti, 1998). In this paper the main focus is to find and analyse data correlation over time to prove authors assumptions about cryptocurrency dependencies.

3.2 Methods of data collection

Secondary data collection is used for the quantitative research. Mostly raw data collection from stock exchange markets has been included in the analysis. Despite, raw data, other sources as cryptocurrencies' technology information and summaries of documentary secondary data as journals, videos and films about crypto and blockchain technology. (Saunders et al. 2007, 258.)

Core financial data has been taken from the Investopedia.com, which includes historical data from July 2017 due to appearance of some cryptocurrencies on the market from that time. Data is collected to compare and analyze several types of investment portfolios: crypto and traditional ones. Sources are certified and contemplated as official platforms for investors. Thus, we can consider the data reliable and trustworthy. The study relied solely on numerical data, allowing the researcher to avoid qualifying anything.

Cryptocurrency trading does not stop for weekend of holidays therefore dates of historical data was matched between stock dates trading and cryptocurrency date to make data more precise.

3.3 Methods of Data Analysis

Data analysis was conducted based on calculation of two different types of portfolios – crypto portfolio and stock portfolio. Crypto portfolio is consisted of five main

cryptocurrencies on the market with the largest market capitalization nowadays: Bitcoin, Ethereum, Tether, Binance Coin and Dogecoin. Background information about those coins were mentioned in Chapter 2.2. Currencies' value is based on different technology and algorithmic calculations; thus, it can be determined as a diversified portfolio with the main share of Bitcoin.

Traditional stock portfolio includes shares of five main fast-growing companies for the last 5 years, it is also known as FAANG companies. Five of the most rapidly expanding equities in history are Facebook (FB), Amazon (AMZN), Apple (AAPL), Netflix (NFLX), and Alphabet (GOOGL), previously Google. The FAANGs possess a considerable margin of safety because of their enormous market capitalizations. On September 4, 2020, the market capitalizations of three FAANG companies, Apple, Alphabet, and Amazon, surpassed \$1 trillion. People invest in FAANGs on the belief that their money will be protected and will thrive. (Moore, 2021)

FANG Stock Beat the Market: 5-Year Price Growth vs. S&P 500:

- Facebook +28%
- Amazon +302%
- Apple +296%
- Netflix +305%
- Google (Alphabet) +83%

It is one of the lowest risk portfolio types and the representation of new digital era which have shown the boom for the past five years together with the breakthrough of cryptocurrency. Therefore, the comparison of these two types of portfolios would be a representation of new trends and how fast investors should react to new developed technologies.

To identify clearly the volatility through the historical data of each stock, author calculates standard deviation for the chosen historical data by using the following formula:

$$\text{Standard Deviation} = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$$

where:

x_i - Value of the i point in the data set

\bar{x} - The mean value of the data set

n - The number of data points in the data set

In order to compare risk versus return of crypto portfolio, author applies CAPM model to crypto portfolio in order to understand the correlation between investment assets and systematic risk in this kind of portfolio, whether it is overall possible or not. The clear picture will be also shown by differentiation of the risk into systematic and unsystematic risk of the portfolios and comparisons between each other.

The formula for calculating the expected return of an asset given its risk is as follows:

$$ER_i = R_f + \beta_i(ER_m - R_f)$$

where:

ER_i - expected return of investment

R_f - risk-free rate

β_i - beta of the investment

$(ER_m - R_f)$ - market risk premium

These calculations help to visualize the volatility of cryptocurrency and propose assumptions of its cause, whether it is dependent on crypto characteristics or novelty on the market itself.

Another conducted analysis is based Variance-Covariance matrix. The standard deviation of a stock portfolio is calculated using the covariance matrix, which is then utilized by portfolio managers to measure the risk associated with that portfolio. Variance-Covariance matrix is used when portfolio has more than two assets.

In order to perform the analysis, it requires to establish portfolios with varied weights representing different capital allocations to each company, compute the standard deviation of each portfolio, and then compare the risk.

The variance–covariance matrix (or simply the covariance matrix) of a random vector X is given by:

1.

$$\text{Cov}(X \sim) = E h (X \sim - EX \sim)(X \sim - EX \sim) T i .$$

2.

$$\text{Cov}(X \sim) = E[X \sim X \sim T] - EX \sim (EX \sim) T$$

3.

Figure 4 Detailed Variance-Covariance Matrix equation

$$\text{corr}(\mathbf{X}) = \begin{bmatrix} 1 & \frac{E[(X_1 - \mu_1)(X_2 - \mu_2)]}{\sigma(X_1)\sigma(X_2)} & \dots & \frac{E[(X_1 - \mu_1)(X_n - \mu_n)]}{\sigma(X_1)\sigma(X_n)} \\ \frac{E[(X_2 - \mu_2)(X_1 - \mu_1)]}{\sigma(X_2)\sigma(X_1)} & 1 & \dots & \frac{E[(X_2 - \mu_2)(X_n - \mu_n)]}{\sigma(X_2)\sigma(X_n)} \\ \vdots & \vdots & \ddots & \vdots \\ \frac{E[(X_n - \mu_n)(X_1 - \mu_1)]}{\sigma(X_n)\sigma(X_1)} & \frac{E[(X_n - \mu_n)(X_2 - \mu_2)]}{\sigma(X_n)\sigma(X_2)} & \dots & 1 \end{bmatrix}.$$

Variance-Covariance matrix shows the correlation between any two stocks. Its useful tool that presents the dependencies cryptocurrencies from the main blockchain currency Bitcoin. Our ultimate aim is to understand how one stock's behavior is related to that of another's.

Once the covariance of all the stocks in the portfolio is known, the standard deviation of the full portfolio can be identified. In order to do this, it needs to be decided on the weights or percentage capital allocation for each stock.

The weight sum must be equal to 1 or 100%.

Figure 5 The matrix 'W' for a portfolio containing 'n' stocks

$$W = \begin{bmatrix} W_1 \\ W_2 \\ W_3 \\ W_4 \\ W_5 \\ \vdots \\ W_n \end{bmatrix}$$

The portfolio's expected returns are given by:

$$\text{Expected portfolio return} = \mathbf{M} * \mathbf{W}$$

The portfolio's variance is given by

$$\text{Expected portfolio variance} = W^T * (\text{Covariance Matrix}) * W$$

3.4 Validity and reliability

The validity, according to Krishnaswamy, Sivakumar, and Marhitajan (2009), is the amount to which the test measures what it was designed to assess. Another definition by Simon and Burstein (1981) states that:

“ Reliability is essentially repeatability – a measurement procedure is highly reliable, if it comes up with the same result in the same circumstances time after time, even employed by different people.”

The purpose of reliability in a study is to reduce mistakes and biases. The goal is to assure that if another investigator followed exactly the same processes, they would come up with the identical results and conclusions. (Dilanthi Amaratunga, 2002)

The author practiced different analyses and calculations in order to make the research precise and reliable for the following explorations in the current topic. Furthermore, previous studies in similar disciplines were considered in order to explain the research's external validity and avoid ambiguous documentation of the variables.

4 Research Results

In this chapter the author presents the main findings of the analysis of created portfolios. First part of the results shows the correlations between the cryptocurrencies themselves in order to give a clear answer for one of the main research questions. Second part displays comparison between portfolio calculations. Author reviews main portfolio metrics as Portfolio Return versus Expected Return, Volatility of the portfolios, Systematic and Unsystematic risks.

4.1 Correlation analysis

Correlation coefficient is widely used among investors and traders. Correlation on the return become useful for those who constantly looking for optimization of the portfolio. As it is mentioned in chapter 3 it is done according to Modern Portfolio theory – maximize the return with the lowest level of risk. (Stefanov, n.d.) Scale for the coefficient is vary from -1.0 to +1.0, where 1.0 between two assets means perfect correlation and it can be expected the same per centage of the return. -1.0 shows the perfectly negative correlation – if one asset is up for 100% the other one is perfectly opposite. Zero correlation indicates no connection between them. Using correlation matrix, portfolio managers try to diversify their assets with both positively and negatively correlated in order to lower their risks.

According to correlation analysis presented in Table 2 for the FAANG portfolio, the coefficient for all the assets set at >0.62 and portfolio does not contain any negative correlations. All the positive correlations in the portfolio can be dangerous for the investors during the uncertain time however due to careful consideration of assets' risks the hazard would be mitigated. The FAANG Portfolio considers to be the most stable choice for the investors, and it can be noticed by looking at its low volatility and high returns for the past years, presented in Table 3.

Table 2 Correlation analysis for the FAANG Portfolio

	<i>AMZN</i>	<i>FB</i>	<i>GOOGL</i>	<i>NFLX</i>	<i>MSFT</i>
<i>AMZN</i>	1				
<i>FB</i>	0,61761291	1			
<i>GOOGL</i>	0,667807703	0,68632922	1		
<i>NFLX</i>	0,630707344	0,494734578	0,531104823	1	
<i>MSFT</i>	0,717694146	0,636167878	0,789695517	0,564651305	1

Standard deviation for GOOGL, MSFT and AMZN is the lowest in the range of 28-30% which shows very low volatility in the prices and stable returns of the companies for the past years. FB and NFLX has higher but still standard results from 35% to 39% with one of the highest returns from NFLX – 42,4%.

Table 3 Risk and Return of the FAANG Portfolio

	<i>AMZN</i>	<i>FB</i>	<i>GOOGL</i>	<i>NFLX</i>	<i>MSFT</i>
<i>AVG. RETURN</i>	0,118%	0,070%	0,106%	0,140%	0,143%
<i>ANNUALISED AVG. RETURN</i>	34,600%	19,180%	30,605%	42,399%	43,432%
<i>VARIANCE</i>	0,037%	0,049%	0,032%	0,062%	0,033%
<i>STANDART DEV.</i>	1,929%	2,207%	1,784%	2,497%	1,819%
<i>ANNUALIZED STANDART DEV.</i>	30,625%	35,036%	28,316%	39,641%	28,878%

Looking at the correlation analysis of the cryptocurrencies it is obviously seen the differences from the FAANG portfolio. The highest correlation lays between Bitcoin and Ethereum which is predictable due to Ethereum algorithms that is directly based on bitcoin transactions. Its correlation coefficient is 0,75. Tether (USDT) and Binance coin (BNB) has a correlation closer to zero – 0,03 and 0,04 respectively. At the same time Dogecoin has also a positive correlation with bitcoin with a coefficient 0,23. It is also noticeable that there are negative closer also to zero correlation for Tether (USDT) with Binance coin (BNB) and Dogecoin (DOGE) -0,015 and -0,002. It can explain by differentiation in their technology base and uniqueness of the algorithms that prevents dependency from main cryptos as Bitcoin and Ethereum.

Table 4 Correlation analysis of the Crypto Portfolio

	<i>BTC</i>	<i>ETH</i>	<i>USDT</i>	<i>BNB</i>	<i>DOGE</i>
<i>BTC</i>	1				
<i>ETH</i>	0,748917	1			
<i>USDT</i>	0,034303	0,033410	1		
<i>BNB</i>	0,046129	0,013614	-0,014802	1	
<i>DOGE</i>	0,232133	0,233689	-0,001659	0,002544	1

According to Investopedia, it is beneficial to have portfolio with opposite correlation coefficient of the assets in order to diversify your portfolio and minimize the risk. However, risk of the cryptocurrency portfolios can reach the top of any investors expectations and reach extreme percentages that could be comparative only with the gambling risk percentages. (See Table 5)

Table 5 Risk and Return of the Crypto Portfolio

	<i>BTC</i>	<i>ETH</i>	<i>USDT</i>	<i>BNB</i>	<i>DOGE</i>
<i>AVG. RETURN</i>	0,2926%	0,2505%	-0,0009%	-0,2783%	0,4394%
<i>ANNUALIZED AVG. RETURN</i>	108,821%	87,866%	-0,223%	-50,461%	201,909%
<i>VARIANCE</i>	0,265%	0,442%	0,002%	100,771%	4,193%
<i>STANDART DEV.</i>	5,148%	6,645%	0,398%	100,385%	20,477%
<i>ANNUALIZED ST. DEVIATION</i>	98,34%	126,96%	7,60%	1917,84%	391,21%

It is appeared clearly how volatile the cryptocurrency is and especially during the years taken for the research when these new currencies and technologies were appearing on the market on 2017 -2021. Binance coin (BNB) reaches almost 2000% of the risk with the negative return of 50%. Meanwhile, Bitcoin (BTC) also shows the volatility of around 99%, however its return shows promising and positive results – 109%. Tether indicates the lowest risk among all the shown cryptocurrencies – 7.6%, however it is high in the market of so called “cheap” cryptocurrencies, as its price reaches max of \$1. (Tether, 2021) It is the safest way to start and test investments methods.

Statistical comparison of these two investment portfolios will be represented more detailed in the next chapter.

4.2 Portfolios’ metrics comparison

In this chapter author discuss the calculations results of two portfolios and make assumptions of its reasons. Final results of the equations represented in the Table 6 and Table 7, which are the main referral point.

Starting from the return of the portfolios, it is seen that annualized actual return for the FAANG portfolio’s assets is in the range for from 19% till 43%, which shows positive return for the whole portfolio and very stable volatility mention in the previous chapter. It means that return on portfolio equals to 34% and doubles the expected return. It happened mainly due to Amazon, Netflix and Microsoft returns for the past

4 years that grew more than double. There can be multiple assumption for the reasons of it, however it is obvious that for the past 2 years COVID-19 and world quarantine boosted the digitalization processes and the usage of online platforms and streaming services. Covid stocks were developed as a result of the pandemic. These enterprises were mostly unaffected by how the virus wreaked havoc on other industries, such as traveling. (Deagon, 2021)

Crypto portfolio returns differs significantly from the standard portfolio; the range of the actual return of the assets vary from -50% of Binance coin to 202% return from Doge coin. To avoid losses, it is good to have both of them in one portfolio in order to compensate each other's risk and still get a high profit – diversification rule of every investor 'portfolio. Bitcoin, Ethereum and Doge coin have very high returns of over 100% which gives very successful portfolio return of 87% for the past four years and it is higher than the FAANG portfolio for 1.5 times.

Even though Crypto returns look much more appealing for investors and traders, it is important to understand the cost of such results and mainly how much luck in these profits.

Standard deviation calculation of the portfolios shows how consistent is the prices over time. Results of these calculation for the Crypto portfolios represent an incredible number such as Binance coin volatility is over 1500% with Beta more than 2. It twice more volatile than S&P500. Overall volatility of all crypto assets is very high however the betas of Bitcoin and Tether are unusually close to 0. In the standard portfolio it would be explained as zero correlation from the market but in the Crypto portfolio it is interpreted as zero systematic risk and cannot be considered as zero risk at all. In the FAANG portfolio the volatility is pretty standard and vary slightly from each other although its betas are higher than 1. It is common for technological companies to have beta greater than 1 due to their annual growth and trends. Overall, the results of both Crypto and FAANG portfolio are possible and can be chosen only based on the investors, their strategies and risk tolerance.

Speaking about risk and risk tolerance. It is essential to look at the difference of systematic and unsystematic risks in these portfolios. In the FAANG portfolio systematic risk (21%) is twice higher than unsystematic risk (11%) and it highlights the stability and predictability of the portfolio. Such results would obviously suit low risk takers and promise stable growth for future investing too. Unlikely to Crypto portfolio where unsystematic risks hit 243% against 8% of the systematic risk. It also proves the unstable price behavior of cryptocurrencies that also was noticeable by their high percentages of standard deviation. Such a handsome unsystematic risk would rather be in the radar of Risk takers investors, who accepts greater loss and tolerates uncertainty.

Table 6 Overview of the Crypto portfolio risk and return calculations

Crypto Portfolio						
	BTC	ETH	USDT	BNB	DOGE	S&P 500
Average Returns	0,29%	0,25%	0,00%	-0,28%	0,44%	0,06%
Annualised Avg. Returns	1,08821086	0,87866065	-0,00246090	-0,50461202	2,01909326	0,15898600
Standard Deviation	5,15%	6,65%	0,40%	100,43%	20,49%	1,29%
Annualised St. Deviation	81,75%	105,54%	6,32%	1594,29%	325,21%	20,44%
Beta	0,042121021	1,228681679	-0,000855829	2,078103699	0,711800738	
Systematic Risk	0,8610%	25,1156%	-0,0175%	42,4787%	14,5500%	
Unsystematic Risk	80,8908%	80,4238%	6,3401%	1551,8086%	310,6576%	
Risk Free Rate	0,0144					
Exp. Return CAPM	2,049%	19,205%	1,428%	31,486%	11,732%	
Weight	0,6	0,1	0,1	0,1	0,1	
Actual Portfolio Return	89,20%					
Expected Portfolio Return	7,61%					
Portfolio Systematic Risk	8,729%					
Portfolio Unsystematic Risk	243,458%					

Table 7 Overview of the Crypto portfolio risk and return calculations

The FAANG Stock Portfolio						
	AMZN	FB	GOOGL	NFLX	MSFT	S&P 500
Average Returns	0,12%	0,07%	0,11%	0,14%	0,14%	0,06%
Annualized Average Returns	34,60%	19,18%	30,61%	42,40%	43,43%	0,158986
Standard Deviation	1,930%	2,208%	1,785%	2,498%	1,820%	1,29%
Annualized St Dev	30,64%	35,05%	28,33%	39,66%	28,89%	20,44%
Beta	0,925114	1,091175	1,078645	0,959306	1,189926	
Systematic Risk	18,91%	22,30%	22,05%	19,61%	24,32%	
Unsystematic Risk	11,73%	12,75%	6,28%	20,05%	4,57%	
Risk Free Rate	0,0144					
Exp. Return CAPM	14,816%	17,217%	17,036%	15,310%	18,645%	
Weight	0,2	0,2	0,2	0,2	0,2	
Actual Portfolio Return	34,04%					
Expected Portfolio Return	16,60%					
Portfolio Systematic Risk	21,44%					
Portfolio Unsystematic Risk	11,07%					
Portfolio Beta	1,048833					

5 Conclusion

5.1 Discussion about main findings

Individual investor profiles and preferences dictate the relative weightings in all portfolios, which strive to have a mix of volatilities. As more investors grow familiar with the basic facts underpinning the value case for bitcoin and other crypto assets, and as volatility becomes more tolerable, this trait is expected to become less of a barrier and more of a quality to be cherished.

Answering thesis research questions:

What is the nature and extent of correlations between different cryptocurrencies?

In the current built crypto portfolio, it was surprisingly low correlation between cryptocurrencies and cryptocurrencies from the Bitcoin, even though most of the cryptos algorithms is built on the blockchain technology and would be considered as a high influence on the prices. However, it was obvious to see high correlation of Bitcoin and Ethereum as the main cryptos in the portfolio and the oldest ones in the market. Ethereum is directly depends on the Bitcoin deviations. Its correlation of 0.75 makes ether a high beta version of bitcoin. When bitcoin prices rise, ether prices tend to rise more and likewise with the price fall. Yashu Gola recently said in his article:

“While the portfolio could see exceptional performance one month with the two cryptos making gains in tandem, you could also see huge drawdowns in a bad month as the cryptos move lower together.”

Therefore, high correlation between the cryptocurrencies only in crypto portfolio can only increase the risk.

What is the difference in risks and returns between crypto and traditional portfolios?

In both portfolios there are positive returns. Nevertheless, in Crypto portfolio it is higher by 1.5 times. However, the unsystematic risk in the FAANG portfolio is 24 times lower. Therefore, the portfolios' natures are completely different but both of them have a place to be. Bitcoin's significant volatility should not be used as an excuse to avoid it. Contrary to popular belief, it strengthens the asset group's position in asset diversification. It also mostly depends on the type of investors and its risk tolerance. The most common investors portfolio's types are aggressive, moderate and conservative. According to the results of the research it would be right to say that the FAANG portfolio is the safest and low risk type as conservative one, whereas Crypto one is aggressive. All portfolios aim to have a mix of volatilities, with the relative weightings determined by individual investor profiles and preferences. As more investors get familiar with the basic facts underpinning the value case for bitcoin and other crypto assets, and as volatility becomes more tolerable, this trait is expected to become less of a barrier and more of a quality to be embraced. (Acheson, 2020)

What is the level of unsystematic risk in cryptocurrency portfolio? How dangerous it can be?

In the current crypto portfolio risk hits incredibly high percentage of volatility and risk. Moreover, the research showed that all this risk is unsystematic and cannot be predicted properly. Given the decentralized nature of blockchain, political instability, interest rates, and the soundness of the financial system are unlikely to have a direct influence on the business. Furthermore, nations have continued to argue how to tax the asset class. As a result, systemic risks for traditional assets differ from those for crypto. However, if crypto becomes more widely used, many of the concerns that exist in regular markets will become more evident. According to the findings, risky cryptocurrencies and their extreme volatility could be more suitable for diversification of

more safe portfolios to mitigate the risk but at the same time bring twice as much profit than traditional stocks.

5.2 Practical implications, limitations and recommendations

There are several limitations concerning this research. The most important one is the nature of the data taken for the analysis. Data was taken from the trustful source, however due to the 24-hours trading of the cryptocurrencies, the weekends and holidays daily prices has to be taken manually and match with the working days of usual market, in this case S&P500. Besides, the frame of the data had to be reduced from 5 years to 4 as several cryptos are too young and appeared only in 2017.

Secondly, cryptocurrency appeared in 2009 and was traded for the first time in 2010. The technology behind it was unknown and did not catch the eye of the world at first but in 2012 the breakthrough happened, and first serious literature appeared. However, books and research are still young and did not prove its reliability yet. Therefore, literature review contains mostly financial theory as literature about cryptocurrency itself can be too controversial and dubious.

Finally, chosen metrics for the analysis represent basic picture of investing in cryptocurrency and suitable for the beginners to understand the differences of the investing into the new digital assets. Therefore, author recommends further research of the topic in the field of crypto portfolios and its future influence on portfolios diversification and market overall.

6 References

- (2021). Retrieved from Finance.Yahoo.com: <https://finance.yahoo.com/>
- Acheson, N. (2020, September). *Crypto Long & Short: What Investors Get Wrong About Volatility (and Not Just for Crypto)*. Retrieved from CoinDesk: <https://www.coindesk.com/markets/2020/09/06/crypto-long-short-what-investors-get-wrong-about-volatility-and-not-just-for-crypto/>
- Arslanian, H. &. (2019). The Rise of Bitcoin. In Cham: Palgrave Macmillan. pp. 95-111. Retrieved from The Future of Finance.
- Asness C. S., M. T. (2013). Value and momentum everywhere. *The Journal of Finance*, 929–985.
- BANTON, C. (2021, April). *Calculating Covariance for Stocks*. Retrieved November 2, 2021, from <https://www.investopedia.com/articles/financial-theory/11/calculating-covariance.asp>
- Baumgarten, M. (2010). *Paradigm wars – Validity and reliability in qualitative research*.
- Białkowski, J. (2020, June). Cryptocurrencies in institutional investors' portfolios: Evidence from industry stop-loss rules. *Economics Letters*. Retrieved from Economics .
- Choy, L. T. (2014). The Strengths and Weaknesses of Research Methodology: Comparison and Complimentary between Qualitative and Quantitative Approaches. *IOSR Journal Of Humanities And Social Science*.
- Comply Advantage. (2020, February 9). *Cryptocurrency Regulations Around The World*. Retrieved from Comply Advantage :

<https://complyadvantage.com/insights/cryptocurrency-regulations-around-world/>

Cong, L. W. (2017). Blockchain disruption and smart contracts, SSRN. *Elec. Journal*.

Corbet S., L. B. (2017). Datestamping the bitoin and ethereum bubbles. *Finance Research Letter*.

CryptoCompare Cryptocompare coin list . (n.d.). Retrieved October 28, 2021, from <https://www.cryptocompare.com/>

D. Kancs, P. C. (2015). The digital agenda of virtual currencies. Can bitcoin become a global currency? *Publications Office of the European Union, JRC Technical report*.

Das, T. H. (1983). QUALITATIVE RESEARCH IN ORGANIZATIONAL BEHAVIOUR. *Journal of Management Studies*, 301-314.

Deagon, B. (2021, June). *Unrivaled Digital Shift Fanning The Flames For Hot Covid Stocks*. Retrieved from Investors.com:
<https://www.investors.com/news/technology/tech-stocks-hit-it-big-as-covid-sparked-digital-shift-continues-with-no-end-in-sight/>

Dilanthi Amaratunga, D. B. (2002). Quantitative and qualitative research in the built environment: application of "mixed" research approach",. pp. 17-33.

Dudwick, N. K. (2006). *Analyzing Social Capital in Context: A Guide to Using Qualitative Methods and Data*. Washington.

Eugene Kim. (2021). Bitcoin mining consumes 0.5% of all electricity used globally and 7 times Google's total usage, new report says. *Insider*, 1.

- EXMO. (2020, September). *Обзор Tether: описание, преимущества, недостатки и перспективы*. Retrieved from EXMO.me:
<https://info.exmo.me/ru/kriptovalyuty/tether-usdt/>
- EY. (2019). *The valuation of crypto-assets*. Retrieved October 29, 2021, from
https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/emeia-financial-services/ey-the-valuation-of-crypto-assets.pdf
- Fama E., F. K. (1992). The cross-section of expected stock returns. *The Journal of Finance*, pp. 427-465.
- Frankenfield, J. (n.d.). *Investopedia. Definition of the Bitcoin*. Retrieved October 27, 2021, from <https://www.investopedia.com/terms/b/bitcoin.asp>
- Fry J., C. E.-T. (2016). Negative bubbles and shocks in cryptocurrency markets. *International Review of Financial Analysis*, pp. 342-352.
- Grant, M. J. (2014). Is bitcoin money?: Implications for bitcoin derivatives regulation and security interest treatment of bitcoins under article 9 of the uniform. *New York University (NYU), School of Law*.
- Huijbregts, M. (n.d.). *An Asset Pricing Model for Cryptocurrencies*. Rotterdam: ERASMUS UNIVERSITY ROTTERDAM.
- Jones, I. (1997). *Mixing qualitative and quantitative methods on sports fan research, The Qualitative Report*. Retrieved November 2, 2021, from www.nova.edu/ssss/QR/QR3-4/nau.html
- Kothari, C. R. (2004). *Research Methodology*. New Delhi: New Age International (P) Ltd.
- Maher Alharby, A. v. (2017, August). *Blockchain Based Smart Contracts : A Systematic Mapping Study*. Retrieved from ResearchGate:

https://www.researchgate.net/publication/319603816_Blockchain_Based_Smart_Contracts_A_Systematic_Mapping_Study

Moore, B. D. (2021). FAANG Stocks Definition, Analysis & Which One to Buy in 2021? *Liberated Stock Treader*.

Neuman, W. L. (2006). *Social Research Methods: Qualitative and Quantitative Approaches*. USA: 6th Edition, Pearson International Edition.

Nosirov Z. A., F. V. (2021). Analysis of Blockchain Technology: Architectural Basics, Application. *Systems of Control, Communication and Security*, 37-75.

S. Nakamoto. (2008). Bitcoin: A peer-to-peer electronic cash system,. *White Paper*.

Spilka, D. (2021). *Why Are Bitcoin Prices So Volatile?* Retrieved October 28, 2021, from <https://www.kiplinger.com/investing/cryptocurrency/603280/why-are-bitcoin-prices-so-volatile>

Stefanov, V. (n.d.). *How to use the correlation coefficient to build a diverse portfolio*. Retrieved from TRADEPRO Academy: <https://tradeproacademy.com/how-to-use-the-correlation-coefficient-to-build-a-diverse-portfolio/>

Tatyana Nikolaevna Sokolova, G. Y. (2018). *ANALYSIS OF PRICE CHANGE CORRELATION IN THE MARKET OF CRYPTOCURRENCIES*. Retrieved October 28, 2021, from <https://cyberleninka.ru/article/n/analiz-vzaimo>

Tether. (2021, November 16). Retrieved from CoinMarketCap: <https://coinmarketcap.com/ru/currencies/tether/>

Watson, D. H. (2010). *Corporate finance: principles and practices*. 4th edittion. In D. H. Watson. Harlow: Person Education Limited.

Степанова, Л. (2020, September). *HashTelegraph*. Retrieved from Биткоин и

криптовалюты не являются защитой от инфляции:

<https://hashtelegraph.com/bitkoin-i-kriptoaljutjy-ne-javlajutsja-zashhitj-ot-infljacji/>