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„Cryptocurrencies - a new asset class? “

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Foreword

“It is actually very difficult to explain Bitcoin.[...] In 2011, I heard about Bitcoin for the first time and my reaction was exactly the same as the reaction of anybody else who heard about Bitcoin the first time [...] and that reaction was ‘ha, nerd money’.” (Antonopoulos, 2016)

It is exactly this complexity that fascinates a whole movement of people. Even though Bitcoin’s 2008 white paper is a quite simple, eight pages document introducing an alternative electronic payment system, its concept of decentralization spread across borders and industries, making supporters feel an imminent revolution and opponents see it as dangerous and criminal. Thus, behind this new online payment method lies great idealism and potential - maybe a revolution, as well as immense challenges and obstacles - maybe even dangers.

Concurring with Bitcoin’s inception it was thrilling and shocking to observe the extent that the global financial crises took on, with governments rescuing banks and companies, and people losing their homes. These crises questioned a system which has not been questioned for decades and was taken for solid.

This work combines both of these, for current generations incisive events, giving a central theme about how and why cryptocurrencies play a role in financial markets and whether they are finding their place as a financial asset class. As using the blockchain technology started not even 10 years ago, compared to established asset classes the data history is much shorter. Also, finding actual scientific work in that field is not easy and because of the rapid developments in cryptocurrencies empirical work seems outdated quickly. Still, it shows serious indications for further work to be done. Most discussion happens in fora, newspapers and on social media, making it hard to distinguish intuition-based opinions from evidence-based information. Nevertheless, it forms an essential part of growing interest in cryptocurrencies, driving adaption of the concept.

I hope after reading this work gives a structured overview about cryptocurrencies in the world of financial assets without missing excursions in the wide range of topics the blockchain technology is moving in. I thank Mr. Univ.-Prof. Thomas Gehrig for overseeing this contemporary question.

Isabella Hoffmann

Vienna, August 30, 2018

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List of Abbreviations

BTC = Bitcoin

CRIX = CRyptocurrency IndeX

ES = Expected Shortfall

ETF= Exchange Traded Found

ETH = Ether (name of the coin belonging to the blockchain foundation Ethereum)

GLD = SPDR Gold Shares

ICO = Initial Coin Offering

IPO = Initial Public Offering

IRS = Internal Revenue Service

PCA = Principle Component Analysis

REIT = Real Estate Investment Trust

SPDR = Standard & Poor's Depository Receipt

VaR= Value-at-Risk

VNQ = Vanguard Real Estate ETF

XRP = Ripple (name of the coin belonging to the company and blockchain project Ripple)

1. Introduction

The blockchain technology and its cryptocurrencies are currently highly present in the media. Extreme and emotional opinions on both sides lead to long expert and philosophic discussions, also reflected in the high volatility of cryptocurrencies. Whereas some people believe it is just a hype and bubble that will burst soon, leaving nothing but disappointed investors, others are sure about seeing a technology that will revolutionize companies and the whole financial system. Due to the technological complexity, it is not an easy task to make a judgement about the newly applied concept of decentralization and the widely-spread influence cryptocurrencies could have.

This work aims to illuminate the future cryptocurrencies may have in the financial sector, considering the numerous different opinions about using the blockchain technology. The first and still the most popular cryptocurrency – Bitcoin - was developed to build an electronic payment system, making international online payments faster, cheaper, more secure and available for everyone (Nakamoto, 2008). All the controversial discussions and the technology essentially gaining ground in finance and the fact that the cryptocurrency market capitalization cracked the \$200 billion mark in 2017¹, lead to the therefore legitimate main question of this work: Cryptocurrencies - a new asset class?

Taking a closer look at the question opens the relevance of two great topics, namely the function of financial assets in the financial system and the functionality and aims of cryptocurrencies, which is a very broad field. Hence, chapter 2 gives an overview of these sectors, building the ground for linking financial assets with digital coins and tokens. A detailed description of the features that asset classes need to fulfill, based on Robert J. Greer (1997), will enable to analyze cryptocurrencies according to exactly those requirements later in this work. As over the years more and more digital coins² evolved, the cryptocurrency environment reached a remarkable size with projects in various industries. Subsection 2.2 for this purpose deepens into the cryptocurrency world and introduces coins which were important for the environments development. This is reasonable for a clear understanding about the place the technology can take in the future of financial markets.

¹ See <https://coinmarketcap.com/charts/> [last access: 09/17/2018]

² For convenience reasons the terms „digital coin“, „virtual coin“ or simply „coin“ will be used as a synonym for cryptocurrency further in this thesis.

Following up this overview chapter 3 applies the pattern of asset classes on Bitcoin as a representative for cryptocurrencies and finds it to match those criteria. In order to make such a statement the features of cryptocurrencies need to be compared to established asset classes, like stocks, bonds or commodities. Still, there are strong opponents on the other hand, which are given a voice in subsection 3.3, naming various reasons why digital coins are dangerous and have no space or future in financial markets. The arguments point out different problems of the technology, ranging from the immense energy usage for mining and maintaining the system, over criminal and terrorist activities to extreme volatility and market manipulation (e.g. (Engle, 2016; Brill & Keen, 2014)).

Chapter 4 complements previous analyses by presenting the current place cryptocurrencies have in society. As governments and institutions publicly talk about how and whether to regulate digital coins, they already credit the area of digital coins a certain importance. But the topic of regulation concerning cryptocurrencies is also a complex one, because existing laws and jurisdiction do not properly fit and, as mentioned before, e.g. Bitcoin is related to criminal activity and tax evasion (Engle, 2016). Over all, numerous governments deal with virtual coins, not least because of their international presence and the technology knowing no borders. Additionally, subsection 4.2 gives reason on why cryptocurrencies could become that popular in the first place and shows indicators on them mattering in the future.

The answer to the leading question, whether cryptocurrencies are a new asset class is executed in chapter 5. It considers previous analysis of returns, risks and correlations, as well as the mentioned macroeconomic factors. This chapter also gives perspectives on which industries and areas will have a future with the blockchain technology and cryptocurrencies and what this future could look like.

2. Financial assets and cryptocurrencies: an overview

This chapter will briefly point to the definitions of relevant terms, mainly *cryptocurrencies* and *asset class*. To answer the lead question, whether cryptocurrencies are a new financial asset class, the purpose of financial markets and their assets needs to be clear. For completeness and to expose the central theme, section 2.1 will give a short insight into this space. Later in this work, it will be important to mention the valuation of the traditional asset classes, Bitcoin and cryptocurrencies in general. Because their environment, as well as their valuation, is still very novel and complex, a common framework must be built to analyze cryptocurrencies with respect to properties of financial asset classes. For this purpose the most crucial features of the blockchain technology, its advantages and disadvantages, as well as basic points of the cryptocurrencies will be named in subsection 2.2. On this basis, the main part will discuss, if cryptocurrencies have the features to be a new asset class, contributing to the duties of financial markets. This excursus is also reasonable, because the question will not only be answered based on risk and return profiles and liquidity of the possible class, but also based on broader reasons why cryptocurrencies can be a serious investment topic and part of the future.

2.1 Functions of financial markets

Markets function to allocate resources by giving its participants the opportunity to trade and thus collect data about supply and demand, finding equilibria and prices. The main functions of financial markets are intertemporal transfers of funds, hedging risk and information production. Governments, banks, pension funds and the capital markets give users the opportunity to smooth their consumption by e.g. saving or investing their money now to later consume more or the other way around by taking loans for present consumption. For hedging risk in this area, insurances or funds take their part in the market through allocating resources in different asset classes and thus diversifying portfolios. All this participation and action produces information about the assets and trading partners, which is important to reduce risk and discover prices. Financial intermediaries play a major role here (Allen & Gale, 2000). The following narrow overview shows how traditional asset classes contribute to this role of financial markets. It is then essential to examine whether cryptocurrencies support these duties and form a new asset class.

To provide the above mentioned points to investors, securities and assets can be purchased and sold on financial markets. An asset class contains securities which show similar characteristics, forming a group. Assets in one class have an alike market behavior and are also treated equally by regulators. Conclusively, they are also defined by law, which will be discussed in detail in chapter 3.3 as an argument against cryptocurrencies being a new asset class. These common characteristics imply that classes have different risk and return features, varying cash-flow streams and diverse degrees of risk. Their similarities within one class and distinctions from the other classes attract different investor groups, so that an asset class also represents distinct investors' preferences regarding in-/tangibility of the assets, cash-flow structures and risk profiles. On the other hand, an investment portfolio consisting of different classes helps to reduce overall portfolio risk through diversification. Generally, there are three main asset classes, namely equities or stocks, bonds or fixed-income securities and cash equivalent, marketable assets. Some definitions also include real estate, commodities and artworks, but analysts' opinions on this differ (Greer, 1997; Farlex Financial Dictionary, 2012).

Robert J. Greer (1997) categorizes the three groups of capital assets into either being a) a permanent source of value, b) consumable or transformable assets and c) store of value assets, which are neither consumable nor generating cash-flow. He gives further features asset classes need to fulfill. They should provide enough liquidity and therefore give market participants the opportunity to invest, which he calls "investability". For the categorization of financial assets, their politico-economic profiles need to be distinguishable, including the value basis, their governance and their use cases. This differing environment should lead to independent fluctuation of each asset class and low correlation of returns. The results are variable risk-reward profiles. That is how assets find their corresponding class.

Traditional asset classes such as equities and bonds can be easily classified as belonging to one the asset categories mentioned above. Later in this work, it will be investigated, whether Bitcoin has similarities to these existing classes or can fulfill the requirements for opening a new asset class jointly with other cryptocurrencies.

2.2 The environment of cryptocurrencies

The previous chapters already mentioned Bitcoin and cryptocurrencies being a very controversial and highly discussed, as well as disputed, topic. To distant oneself from loud and extreme opinions this section will have a look on general features of cryptocurrencies. Due to the open-source code of Bitcoin, most cryptocurrencies are based on the same idea, differing in parameters and use cases. That is why the main concept can legitimately be represented through the pioneer Bitcoin, introduced by Satoshi Nakamoto in October 2008. The release of its white paper was followed by launching Bitcoin and providing its open-source software in January 2009 (Sagona-Stophel, 2015).

Satoshi Nakamoto (2008) recognized that electronic payment was exclusively possible with financial institutions involved and that this sector was not evolving in the progressively digital environment. For most transactions, especially in Europe and the United States, this system works well, but bears the cost of mediation which is increasing transaction costs and limiting the minimal transaction size. The third trusted parties by default must be distrustful against their customers and collect information which would not be needed otherwise, making the system more expensive. They keep track of double-spending and make sure the person initiating a payment has enough means. Cash payment and meeting in person avoid payment uncertainties, but that is not possible in digital commerce.

Bitcoin provides a solution for the named uncertainties without having to rely on trust and financial institutions. With Bitcoin, the first decentralized cryptocurrency was born, i.e. transactions are taking place peer-to-peer, directly between the users without an intermediary involved. It creates a system with coins made from digital signature, providing a strong ownership control, whereas the problem of double-spending is solved by the network using proof-of-work for recording and verifying the transactions. A so-called private key is securing the wallets and the person owning this key, owns the Bitcoins on it. Trying to cheat in this system is quite expensive because attackers need to hold more power than the rest of the network which is highly distributed. Therefore, the “cheating” block will usually not be accepted and the computing power the attacker used is gone and not rewarded. There is also no incentive to cheat as rewards are paid out in Bitcoin, to keep miners³ interested in maintaining its value. Changing the system is only possible with consensus,

³ Miners are community members, providing computational power (CPU time and electricity) to issue new Bitcoins and approving transactions. (see Nakamoto, 2008)

the majority of the community has to agree (Nakamoto, 2008). Thus, trust in intermediaries and third trusted parties is replaced. On the blockchain everything is publicly recorded, highly reducing chances for corruption. As a result, costs of frictions and conclusively costs of transactions sink, which is also associated with the digital environment. This is great for low income countries because it gives them a possibility to transfer value cheaply and without a bank account (Shrier, et al., 2016). Blockchains are using the distributed or public ledger technology. Such a ledger is a comparable to a decentralized bank-book, which keeps record and confirms transactions. Not being dependent on a central institution accelerates the processing of transactions and the transparency allows all the participants to see the transaction histories. This enables a complete register about the origin and all following stages of e.g. a physical product and can therefore be used in private companies, especially in supply chain management, without the background of liquidity and trading related figures (Geiling, 2016).

The name Bitcoin is confusing because it is no physical coin and does not fit into the economic definition of a centralized, government issued currency. Which part of law and regulation can be applied on cryptocurrencies as they are no currencies by definition? Maybe a less distracting name like blockchain assets would fit better, especially for regulators. Also, their usefulness as means of exchange and additionally store of value complicates a clear definition. Figure 1 shows the total cryptocurrency market capitalization for the last two years peaking at \$828.5 billion, which is larger than the equity markets of e.g. Brazil and Russia⁴ (Coinmarketcap, 2018; Fundstrat Global Advisors, 2018). This may indicate these assets to create a new, maybe alternative investment class. To make this statement further analysis is needed and documented in the next chapter of this thesis.

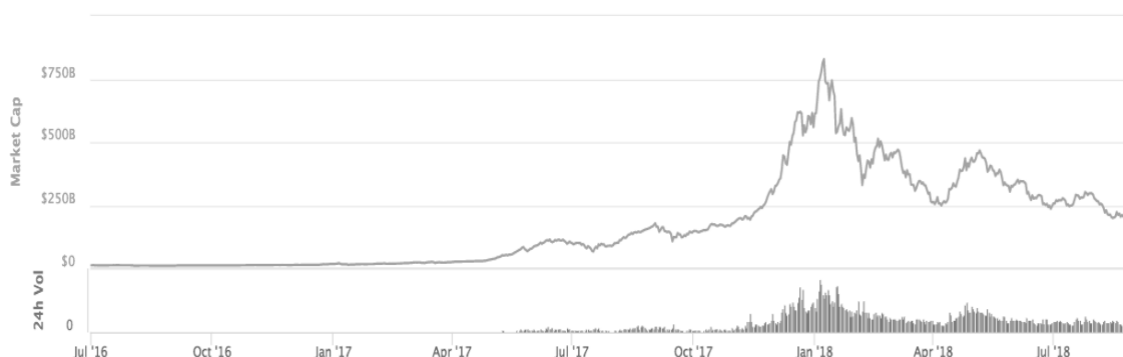


Figure 1 Total cryptocurrency market capitalization curve and average daily trading volume as histogram from July 2016-August 2018 in US Dollar vs. time (source: www.coinmarketcap.com)

⁴ See <https://coinmarketcap.com/charts/> [last access: 08/27/2018]

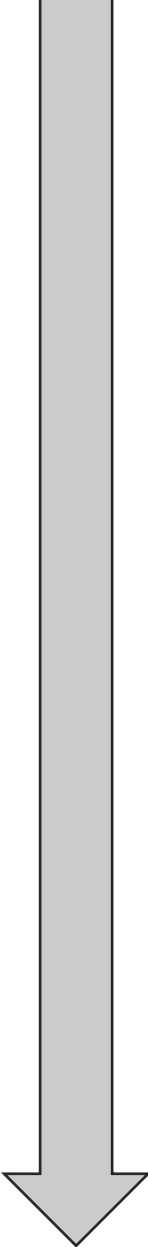
Of course, as the concept of cryptocurrencies and decentralization in this context is still new, there is naturally a flipside. The greatest controversy arises with the anonymity provided by the absence of the requirement to prove your personal identity. When using a financial intermediary, e.g. a bank, all transactions are transparent to this third trusted party. Banking confidentiality exists but can be abolished in case of suspicious, maybe illegal activity. This is important because of the economic dead weight loss resulting from such actions. Hence, a Bitcoin transaction opens the doors for illegal and criminal activities, which is not desirable for society (Pichler, 2018; Engle, 2016).

Especially with Bitcoin, through the non-reversibility of transactions, customers might never see the goods or services they purchased and no third trusted party is taking responsibility for that. Nowadays there are already cryptocurrency projects solving this issue. The larger problem is that Bitcoin and other digital coins are not widely accepted as payment method, so their use as a currency is very restricted. Right now, it is impossible to replace the fiat system because of the high price fluctuations and regulatory uncertainty (Onies, et al., 2011).

All these arguments, pro and contra, are changing and evolving with the rapid development of alternative cryptocurrencies, so-called altcoins, and the growing public attention. Even though the role digital assets will play in the economy and global financial systems is still greatly disputed, they are already a valid economic issue worth researching and observing (Kurka, 2017). While the previous section served the short introduction of Bitcoin and basic points of its technology, now the focus will be put on blockchain based projects building an essential part of the crypto environment, its valuation and infrastructure.

Elendner et al. (2016) claim that the development from a technological proof-of-concept to a serious asset took place in less than 10 years, which were full of the evolution of digital assets based on the blockchain technology. Most of the alternative digital blockchain projects try to improve Bitcoin as a means of exchange and value storage or solve completely different and relevant use cases. Through the open-source nature of Bitcoin and the whole environment derivative works are easy to set up. “Bitcoin creates an environment that is ripe for innovation, because it’s not just a currency; it’s a technology, a network, and a currency.” (Antonopoulos, 2016, p. 6)

Currently⁵ 1890 coins are listed on <http://www.coinmarketcap.com>, which is twice as much as in August 2016 with 767 active coins. The following illustration summarizes the chronological evolution of altcoins, naming representatives for each feature, whereas the selection of coins stated follows Elendner et al. (2016). The purpose of this is a better understanding of the cryptocurrencies area and to present the possible trends of development and use cases in the future, which is not unimportant for their appearance in financial markets.

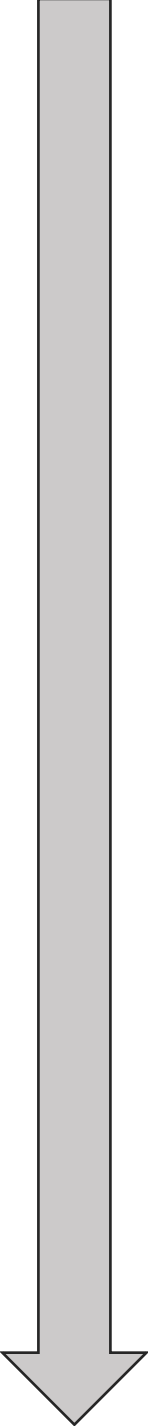


One of the first cryptocurrencies launched after Bitcoin was Namecoin, not only transferring value in terms of coins, but providing a decentralized Domain Name Service and identity storage. Their biggest achievement is the “.bit” websites, which in contrast to all other Domain Name Services are not controlled by a government or corporation and cannot be censored. It also enables the storage of value data being beneficial for identity management (Elendner, et al., 2016; Namecoin, 2018).

Ripple was established largely independent from the development of Bitcoin through a different source-code, which is uncommon in the cryptocurrency space. It is one of the first coins and still in use, offering an infrastructure for banks and payment providers to make cross-border payments fast and efficient. The distinct use case becomes clear, as Ripple is not only digital cash, it represents a company, the technology (payment protocol), and the cryptocurrency Ripple (XRP) (Elendner, et al., 2016; Schwartz, et al., 2014).

To solve the problem of high electricity use for mining cryptocurrencies, especially Bitcoin, Peercoin was the first to implement the proof-of-stake mechanism. With this implementation, coins are not earned through mining and an attacker would not need to outperform the rest of the network with 51% of computational power, but to buy a significant amount of coins to own 51% of them. Again, there should be no incentive to destroy the system after being involved to that extent. This mechanism is not very popular in the cryptocurrency environment as it concentrates power where money is and so the development of proof-of work altcoins is still advancing (Elendner, et al., 2016; King & Nadal, 2012).

⁵ As of August 2018



A very interesting trend with coins being related to countries or regions evolved. Iceland was the first nation, developing and launching Auroracoin, which was given to the citizens of Iceland when entering their resident ID on Auroracoin's official website. Through a hype in March 2014 it even became the 2nd largest cryptocurrency by market capitalization. This success triggered the development of country associated coins, with Venezuela's Petro being the most popular concept. Although it is not used properly and causes legal problems, it combines the idea of being a government-backed and asset-backed cryptocurrency, because of being linked to the country's oil and gas reserves. It was created as a supplement for the hyperinflated Venezuelan Bolivar Fuerte (Elendner, et al., 2016; Chohan, 2018)

Anonymity, in terms of not needing an identity for transacting, is provided with Bitcoin's pseudonymous character, but because of all transactions being publicly on the blockchain successful law enforcement against illegal purposes is possible. Coins like Monero do not disclose any identity or transaction details, thus it is even more anonymous and according to its market capitalization quite popular (Elendner, et al., 2016; Monero, 2014).

One of the greatest innovation with using the blockchain technology is the development of smart contracts. Ethereum is the best representative for such coins, operating as a platform and thereby enabling crypto assets to evolve. These assets or tokens do not have an own blockchain, but use the one of the main currency – in this case Ether (ETH). Hence, creating a crypto asset does not require much technological knowledge and is a good possibility to implement economic use cases. By providing the platform, blockchain projects benefit from the existing infrastructure, the open source code and the new possibilities for getting funds (Elendner, et al., 2016; Ethereum Foundation, 2015).

In summary, when looking at even just a few cryptocurrencies the wide range of possible derivatives using Bitcoin and the blockchain technology becomes obvious. The previous illustration does not only show the chronological development of active and successful coins, but also their different directions. Coins that copy Bitcoin code and only change some parameters were not even mentioned, but still examples like Litecoin do a great job in improving transaction speed

and security of the system. In an increasingly digital environment, digital cash, decentralization and digitalization of processes dealing with trust seem to gain interest of established institutions like large corporations, banks and governments. The very small number of cryptocurrencies named do not reflect the immense complexity and variety of coins with different applications and use cases. Of course, their innovation potential, cost efficiency and real need is sometimes disputable as well as their current and future role in financial markets. While this chapter aimed to clarify the terms important for the central theme of this work and to give an overview of the relevant aspects of financial markets, traditional assets and cryptocurrencies, the following pages are entirely dedicated to the analysis of the leading question, whether cryptocurrencies form a new asset class.

3. Cryptocurrencies as a potential asset class

As the features needed to define a financial asset class are clarified, the following pages are dedicated to the analysis on whether cryptocurrencies do fulfill them. To do so, subsection 3.1 introduces relevant numbers for being an asset class through summary statistics. It looks at different time periods to show the development of cryptocurrencies and to further compare them to traditional assets. This comparison is extended to possible correlations between digital coins and representatives of existing classes in order to see whether cryptocurrencies are distinct enough to form a class of their own. Even though the results are remarkable and indicate a good way for virtual coins to become accepted as a financial instrument, there are strong voices against these indicators. To answer the leading question, such counter arguments are of great relevance and are therefore discussed in subsection 3.3.

3.1 Statistical properties of cryptocurrencies

The first section will have a look at the 10 largest cryptocurrencies' summary statistics, large in terms of market capitalization. The results will be compared to the ones of traditional asset classes, so that possible benefits and problems can be identified. As prices and returns in the cryptocurrency space change very quickly, a chronological comparison of the summary statistics will be made with the purpose to see the evolution of e.g. volatility.

Table 1 exhibits descriptive statistics on the simple daily returns in percent with data from March 30, 2014 until July 24, 2016, whereas Table 2 covers the period from August 31, 2015 until November 30, 2017. The selected digital currencies are different in both time periods, even though they are chosen according to their high market capitalization. This difference represents the fast-moving environment and that the market is still developing a lot. The aims and use cases of the coins chosen in the statistics do not have to be presented, as the purpose in this chapter is to look at the numbers of cryptocurrencies as an umbrella term.

What becomes obvious from looking at the raw datasets is that most simple daily percentage returns are negative but the positive ones have higher absolute values. That explains the mostly positive means and negative medians. In other words, the coins lose in value more often than they gain, but the gains are disproportionally higher. Bitcoin is the only cryptocurrency in the set containing more

positive values than negative ones, which can be interpreted as a special role of the coin in the cryptocurrency market back in 2016. This assumption cannot be made that clearly for 2017, as here also Dash, Litecoin, Monero and NEM do not exhibit negative median values which means they do not lose value more often than they gain it and might be interpreted as the market share and special role of Bitcoin diminishing in that year due to other cryptocurrencies gaining popularity (Brauneis & Mestel, 2018; Elendner, et al., 2016).

Table 1 Summary Statistics⁶ using simple daily returns in percent from 03-30-2014 until 07-24-2016 (source: Elendner, et al., 2016, p. 17)

	BTC	ETH	XRP	LTC	DASH	MAID	DOGE	XEM	XMR	BTS
maximum	22,31	55,24	86,02	41,82	114,24	72,91	61,65	69,50	123,93	64,31
upper decile q90	3,37	11,88	4,92	4,12	7,85	9,02	5,15	10,09	9,03	6,65
upper quantile q75	1,32	4,95	1,73	1,29	2,76	4,07	1,74	3,88	3,42	2,40
median	0,09	-0,07	-0,22	-0,18	-0,20	-0,07	-0,39	-0,13	-0,09	-0,61
mean	0,09	1,07	0,10	-0,01	0,66	0,54	0,08	1,10	0,38	0,18
lower quantile q25	-1,21	-3,39	-1,97	-1,60	-2,82	-3,55	2,35	-3,41	-3,56	-3,34
lower decile q10	-3,07	-7,29	-4,73	-4,41	-6,39	-7,66	-4,90	-8,00	-7,63	-6,58
minimum	-22,26	-48,33	-34,22	-42,14	-40,8	-31,2	-28,62	-24,87	-29,43	-23,74
%age negative	47,85	50,57	53,24	52,98	52,72	51,19	56,9	51,98	50,51	55,71
volatility	3,34	9,28	6,03	5,34	9,07	8,44	6,100	10,04	8,77	0,70
skewness	-0,564	-0,612	1,152	-0,805	1,268	0,500	1,062	1,332	1,164	1,774
N	848	351	848	848	848	817	848	479	794	733

Both tables indicate no normal Gaussian distribution in the cryptocurrency market. The first period data in Table 1 shows negative and positive skewness and state that coins with lower market capitalization (such as MONA or XLM) have heavier tails (see Table 2).

Considering the Cryptocurrency-Index (CRIX)⁷ as a representative for the market, its skewness of -0.680⁸ for the time period beginning on March 30, 2014 until July 24, 2017 is negative and could be seen as an indicator for a time of decline. Still, all the positive skewness values and the skewness measures from the second dataset lead to the assumption of a good investment opportunity with a fast increase and slow decrease in cryptocurrency returns. The extremely high kurtosis of 11.990⁹

⁶ projects belonging to the coins in the table: BTC = Bitcoin, ETH=Ether, XRP=Ripple, LTC=Litecoin, DASH=Dash, MAID=MaidSafeCoin, DOGE=Dogecoin, XEM=NEM, XMR=Monero, BTS=Bitshares

⁷ The CRIX is an index provided by the Humboldt University Berlin, the Singapore Management University and CoinGecko to represent the cryptocurrency market. It contains the most appropriate coins for creating a benchmark, like a stock market index. For the detailed computation go to <http://crix.hu-berlin.de> (Elendner, et al., 2016, p.11)

⁸ See (Elendner, et al., 2016, p.17)

⁹ See (Elendner, et al., 2016, p.17)

supports the rejection of normal distribution and represents the new, still developing market (Chuen, et al., 2017).

Table 2 Summary Statistics¹⁰ using simple daily returns in percent from 08-31-2015 until 11-30-2017 with Standard Deviation (sd), Skewness (skew) and Kurtosis (kurt) (source: Brauneis & Mestel, 2018, p. 59)

	mean	median	min	max	sd	skew	kurt
BTC	0,53	0,32	-18,74	23,94	3,55	0,13	8,96
ETH	0,95	-0,08	-27,06	35,36	7,14	0,87	6,77
XRP	0,72	-0,35	-46,00	179,37	9,12	10,03	185,72
DASH	0,88	0,01	-21,59	54,92	6,22	2,03	15,50
LTC	0,57	0,00	-32,64	66,59	5,68	2,85	31,80
XMR	1,00	0,00	-25,41	79,43	7,84	2,66	21,91
XEM	0,36	0,00	-29,75	78,58	9,64	2,31	15,56
XLM	0,82	-0,36	-30,67	106,07	10,08	4,56	41,82
BTS	0,79	-0,07	-32,41	68,2	8,75	2,40	17,19
MONA	0,85	-0,22	-23,28	134,48	9,47	5,81	66,04

Elendner et al. (2016) examine means and standard deviations in rolling windows of 180 trading days and find great fluctuation of risk and return features in the cryptocurrency market. This instability becomes even more obvious as coins react differently to higher volatility, having higher or lower means. The distinct standard deviation values result from contrarian reasons, sometimes from higher positive and sometimes from higher negative returns. There is no consistent pattern and therefore considerable insecurity. The ongoing strong and quick changes in cryptocurrency market capitalization and coin prices underline that even simple statistical features are still insecure over time, exhibiting the idiosyncratic risk within this market.

When now comparing the data to traditional asset classes the first crucial fact is the wide range of returns appearing in cryptocurrencies. Also, in terms of average daily returns cryptocurrencies outpace the ones of established asset classes. Chuen et al. (2017) state the very high annual return of 0.3% of the CRIX, which is more than twice as much as the 0.12% annual return for stocks. These relatively high annualized returns are connected to a larger return volatility. The CRIX has a comparatively large standard deviation of 0.0326 (S&P500: 0.000065) and a daily maximum drawdown of -22.64% (S&P500: -4.02%). Elendner et al. (2016) look at commonly used risk

¹⁰ projects belonging to the coins in the table: BTC = Bitcoin, ETH=Ether, XRP=Ripple, DASH=Dash, LTC=Litecoin, XMR=Monero, XEM=NEM, XLM=Stellar, BTS=Bitshares, MONA=MonaCoin

measures like value at risk (VaR) and expected shortfall (ES)¹¹. Not surprisingly these measures are a lot higher compared to assets like stocks, bonds or commodities, stating that cryptocurrencies are no stable investment and associated with high risk. Ether, the second largest coin according to market capitalization exhibits an expected loss over the worst days of 30.57%, a number never seen in established asset classes. Further in this work a more detailed view will dissect the risk and return relationship, i.e. whether enough compensation for the given high volatility is given compared to traditional asset classes.

Investability

As the previous chapter introduced Robert J. Greer's (1997) characteristics for defining an asset class, first the "investability" of cryptocurrencies will be presented and compared to established financial assets. The base for this comparison and presentation of the required features is a research paper from Burniske and White (2017), where they use daily trading volumes as a measure for liquidity with Bitcoin being the representative of cryptocurrencies. In 2016, the daily trading volume was increasing over time and averaging over \$1.5 billion¹². Looking at 2017, an increase in trading volume can be observed, with an average of around \$2.4 billion per day. From the beginning of 2018 until end of August 2018, daily trading volume averages at \$6.8 billion¹³, which is a more than fourfold increase compared to 2016, indicating more trading activity and deeper liquidity (Coinmarketcap, 2018)¹⁴. As time passes by and cryptocurrencies emerge, possible currency pairs traded on exchanges and order types grow, which gives more opportunities to more traders. In addition, the fact that regulators' interest is increasing and therefore macroeconomic uncertainty is diminishing, more investors want to fasten on Bitcoin and cryptocurrencies.

According to Burniske and White's (2017) data, Bitcoin has a remarkably higher average daily trading volume than the SPDR Gold Shares ETF (GLD) and the Vanguard REIT ETF (VNQ) for

¹¹ The VaR and ES measures follow Franke, et al. (2015) and Artzner, et al. (1999) and are accepted by the Basel Committee on Banking Supervision (BCBS, 2014)

¹² Burniske and White (2017) use data from Bitcoinity and CoinDesk BPI

¹³ Numbers for 2017 and 2018 are based on own calculations of the daily trading volume average of the corresponding year

¹⁴ For availability reasons the data of 2017 and 2018 for own calculations is sourced from CoinMarketCap (<https://coinmarketcap.com/currencies/bitcoin/historical-data/?start=20130428&end=20180828>) and can differ from the one Burniske and White (2017) used, because exchanges self-report their trading volume and the named websites contain activity of partly differing exchanges.

real estate in the last quarter of 2016, although Bitcoin only stored \$15 billion, compared to gold with \$34 billion and the VNQ even with \$58 billion of value. It is disputable whether this comparison is significant and what it is stating. Real estate is not a notably liquid asset class by nature, as trading buildings and properties is not physically easy, neither is it in terms of matching buyers and sellers. Bitcoin, on the other hand, is tradable fast and simple on online exchanges, which makes it easier to be liquid (Foucault, et al., 2013). The comparison with gold possibly makes more sense as Bitcoin due to its use for value storage, its scarcity through fixed supply and hedging capabilities is often named the virtual gold (Haubo Dyhrberg, 2016). It is possible, but uncommon and again physically impractical to use gold as a means of exchange, because of which Bitcoin might be more attractive for retail in terms of daily trading volume.

Trading and short-term investing are only one part of “investability”, meaning that long-term holders are also important and make a remarkable fraction of investors. In Figure 2, Burniske and White (2017) show the increasing percentage of Bitcoins traded relative to Bitcoins held from 2012 to 2016.

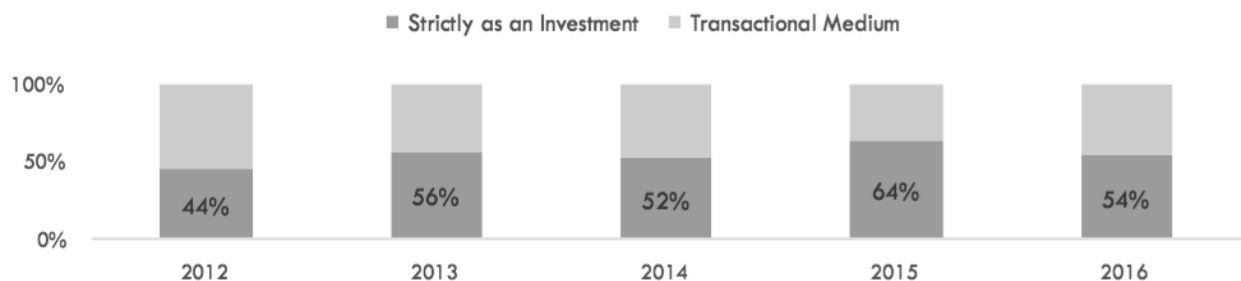


Figure 2 Bitcoin held vs. Bitcoin traded (source: data from ARK Investment Management LLC & Coinbase, graph from (Burniske & White, 2017, p. 8))

With the exception of the year 2012, the percentage of Bitcoins as a strict investment in terms of long-term value storage is higher than Bitcoins used for transactions or short-term trading. In total, the shares are moving around 50%. As the Bitcoin market exhibits both long-term holders and short-term investors and they are provided with fair liquidity, the feature of “investability” is fulfilled by the potential asset class of cryptocurrencies.

Politico-economic profile

According to Robert J. Greer (1997), for a classification as an asset class, cryptocurrencies need to have a clear distinct politico-economic profile, where unique value bases, the way they are governed and corresponding use cases are crucial. This is the foundation for distinguishable and, in best case, independent market behavior because the unique environments lead to distinct market forces and drivers.

The underlying basis of value is not comparable with the valuation of traditional asset classes, but still there are vague similarities. First, no tangible assets are backing the value of cryptocurrencies, which is also the case for e.g. shares of service companies and government bonds. Unlike the latter holding coins does not by default lead to cash flows, but some can be leased in return for interest or holders get compensated for enabling transactions through holding the coin. The relevant point in the valuation of cryptocurrencies lies in the network-effect and the right to participate in this network via voting. Hence, the price is extremely dependent on the demand of the coin and the size of the network being interested in it, as the amount supplied is fixed and predetermined. This fixed supply forms a large difference to the valuation of fiat currencies (Chuen, et al., 2017). Additionally, there is no legal entity or institution being held accountable for problems, which is similar to the value of gold, as it is also determined without a legal structure. Burniske and White (2017) justify the unique basis of value to be the right on a limited underlying asset represented by the digital coin, verified through the public blockchain, in other words, independently from any central institution. The concept of investing in absolute digital assets neither backed by tangibility nor by governments or large companies may not seem convincing, yet it matches an era of digitalization and distrust in legal entities. Conclusively, the valuation of cryptocurrencies right now implies the future potential for the technology which is still developing and progressing in terms of infrastructure, leading to higher acceptance and demand with increasing prices. The growing interest of regulators and clarification of laws handling crypto coins support this confidence.

As the above described factors for cryptocurrencies' basis of value is new and different from established asset classes like equities, bonds or commodities, the next step is to evaluate a distinguishable way of governance. This feature can be proven quickly, because concerning governance, cryptocurrencies exhibit an anomaly of what is known so far. Their supply is

determined mathematically by an open source code. This code can only be edited with the community agreeing on a change. In the case of Bitcoin, the code is generating 21 million decentralized coins until 2140, making it deflationary in contrast to inflationary fiat currencies such as the US dollar or Euro. There are no monetary policies for e.g. regulating exchange rates and money supply and no third party is involved in issuing or controlling the Bitcoin supply. Although different cryptocurrencies of course have varying time spans for a certain number of coins to be generated, most of them are decentralized, do not fall under regulations and are thus theoretically secured against supply shocks because there is no influence of monetary policies, no inflation due to a fixed programmed supply and no power concentration because coins are not issued or controlled by one single bank or government. So far, there is no other asset with such a predictable and transparent supply curve, as shown in Figure 3 (Burniske & White, 2017).

Decentralized, unregulated assets with coins sourced by code and only editable through network consensus legitimately have a distinct way of governance compared to already established asset classes.

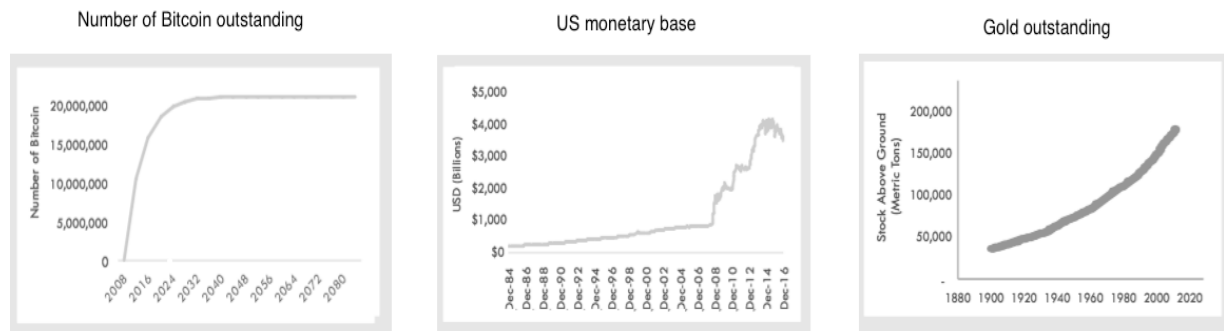


Figure 3 Supply comparison of Bitcoin outstanding, the US monetary base and gold outstanding in tons. (source: data from Bitcoin Wiki, Federal Reserve Bank of St. Louis and Number Sleuth, graph from (Burniske & White, 2017, p. 11))

The last characteristic to check for the distinct politico-economic profile are the use cases of cryptocurrencies. Until now, Bitcoin for example is comparable to fiat currencies in the sense that some goods can be bought and sold against it. On the other hand, investors are also using it to store value, like it is possible to do via gold. These two cases do not cover the large potential of platforms, automatically executing contracts on the blockchain through crypto coins and smart contracts,

explicitly mentioned in chapter 2.2. According to Robert J. Greer's (1997) classification of use cases, cryptocurrencies can be used as capital assets providing a possible value increase or gain of rewards by e.g. leasing of coins, as well as being transformable/consumable through their role in smart contracts and additionally serving as value storage. It is observable that both, transaction value and trading volume of Bitcoin, are increasing. The growth in transactional volume supports its role as a means of exchange for goods and services, showing more and more sellers and service providers accepting Bitcoin as a payment instrument. Still, trading volume is increasing even faster than the transactional applications, therefore using Bitcoin as an investment medium is getting more popular. Burniske and White (2017) call this a healthy process of increasing liquidity and decreasing volatility, which subsequently will foster transactional value. Additionally, this value is likely to increase because more use cases for cryptocurrency transactions are developing. The blockchain technology and its currencies bring innovative possibilities for trading and transferring assets like stocks or bonds, and decentralized venture financing and voting rights. As this section clearly exhibits a clear separation from traditional asset classes concerning their politico-economic profiles, the following part of this work concentrates on return correlation and whether cryptocurrencies bring the required price independence.

3.2 Correlations between cryptocurrencies and traditional asset classes

This section takes a look at the correlation between cryptocurrencies and existing asset classes. It needs to be checked whether cryptocurrencies belong to an existing asset class in terms of their price behavior on the market. The previous section showed a distinct politico-economic profile compared to the traditional investment categories, but still it is important to see autonomous action concerning prices and the correlation of returns. To do so, Bitcoin and later the CRIX will serve as representatives for the group of cryptocurrencies. After checking for correlation with other classes, a comparison of different coin returns will bring the analysis to new dimensions.

Burniske and White (2017) find, that in all six years of their observed period, 2011 until the end of 2016 Bitcoin has distinct price movements compared to the representatives of the traditional asset classes.¹⁵ It is also the only asset having a consistently low correlation: its market behavior is

¹⁵ Representative for (1) equities= S&P500; (2) bonds= The Bloomberg Barclays US Aggregate Bond Index; (3) gold=SPDR gold shares ETF; (4) real estate= The MSCI US Real Estate Investment Trust Index; (5) oil= The Crude Oil Futures; (6) emerging market currencies= The MSCI Global Currency Index

independent. Kurka (2017) confirms this very low connection and further analyzes spillovers¹⁶ from one asset class to the others. Especially after the last financial crisis, interconnectedness among assets and shock transmission is a great topic. Therefore, it is important to also understand volatility spillovers where a possible influence of cryptocurrencies should not be ignored.

Table 3 exhibits the correlation between Bitcoin and the representatives of the most common asset classes, allowing a comparison and rejection of the possibility of cryptocurrencies belonging to an existing investment class.

Because of Bitcoin being used as means of exchange and as storage of value, its returns could be assumed to correlate with emerging market currencies. This intuition is contradicted by the consistently low correlation between Bitcoin and the emerging market currencies over all five years which ranges from -0.05¹⁷ to maximum 0.27. Conclusively, both assets behave differently to certain market forces and Bitcoin does not belong to the class of emerging fiat currencies.

Table 3 Correlation Table¹⁸ showing one year rolling correlations of the traditional asset classes and Bitcoin from 2011 until 2016. The numbers in the table are generated by extracting the maximum absolute correlation for the observed five years period of each pair and afterwards adding the respective sign. This table is a collection of these maximum values and does not represent the pairwise correlation of each year. (source: data from Bloomberg & CoinDesk BPI, table: Burniske & White, 2017, p. 16)

	S&P500	US Bonds	Bitcoin	Gold	US Real Estate	Oil	Emerging Market Currencies
S&P500	/	-0,67	0,35	0,48	0,87	0,73	0,83
US Bonds	-0,67	/	0,28	0,53	0,59	-0,52	0,57
Bitcoin	0,35	0,28	/	-0,51	-0,39	-0,37	0,27
Gold	0,48	0,53	-0,51	/	0,45	0,52	0,62
US Real Estate	0,87	0,59	-0,39	0,45	/	0,63	0,74
Oil	0,73	-0,53	-0,37	0,52	0,63	/	0,63
Emerging Market Currencies	0,83	0,57	0,27	0,62	0,74	0,63	/

Looking at the one year average correlation of Bitcoin of -0.03^{19,20} to the other asset classes states a heavy price independence and exclusion of cryptocurrencies of these investment groups. Even though the Internal Revenue Service (IRS)²¹ classifies cryptocurrencies as a property, the

¹⁶ The spillover methodology follows Diebold & Yilmaz (2012) using realized measures of volatility. For details about all the measures and calculations used see (Kurka, 2017, p. 2ff.)

¹⁷ See Burniske & White (2017), p. 17

¹⁸ Explanation: *low correlation*, *medium correlation*, **high correlation**

¹⁹ See Burniske & White (2017), p.18

²⁰ See Appendix

Figure 10, p. 57

²¹ The IRS is the United States' tax collection agency.

correlation is only slightly negative. The same holds for the relationship with oil, contradicting the Commodity Futures Trading Commission's ranking for Bitcoin as commodity (Burniske & White, 2017).

Previously in this thesis the analogy of Bitcoin serving as virtual gold was mentioned. The returns of gold, as well as Bitcoin for now, do only very little depend on the economy and both share a similar investor group, being skeptical against fiat currencies and regulations. The correlation with gold is the only moderate and also the highest one, when comparing Bitcoin with the other assets. It begins being moderate and negative in 2015 and there reaches a coefficient of -0.5.^{22,23} This can be explained through significant losses of 40% in the value of the here compared gold shares ETF, resulting in outflows from gold to Bitcoin as an alternative investment vehicle and substitute for the commodity (Burniske & White, 2017).

When having a look at spillovers from specific asset classes to others, concerning Bitcoin the only remarkable relationship is negative volatility spillovers to gold, but not vice versa. In other words, financial turmoil on the Bitcoin market leads to an increase in the gold price (Kurka, 2017). Figure 4 shows the Bitcoin price evolution on the left and the spillovers to gold on the right.

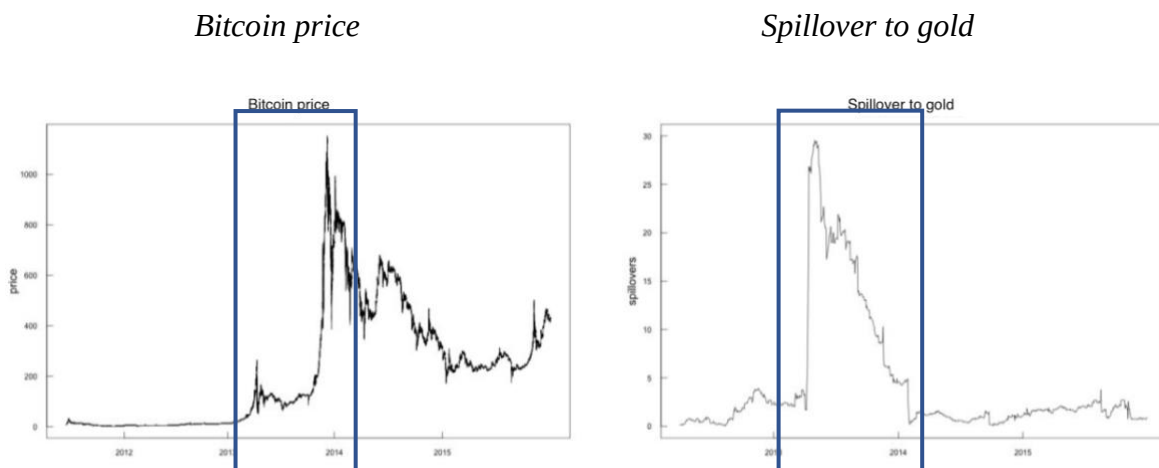


Figure 4 Bitcoin price evolution (left) and spillovers from Bitcoin to gold (right). The boxes shows the overlap from 2013 until mid of 2014 and the spillover from Bitcoin to gold. (source: Kurka. 2017, p.7)

²² See Burniske & White (2017), p.17

²³ See Appendix,
Figure 11, p. 57

Until 2013 the role of Bitcoin on the financial market was inconsiderable, which is why volatility e.g. in 2011 did not have any significance for the gold price. In April 2013, a large drop in the Bitcoin price caused by exchanges not having the capacity to execute all incoming orders immediately, led to outflows from Bitcoin investments to gold. The regaining of trust in Bitcoin until the beginning of 2014 resulted in a price decrease of gold, as investors put their money back. Thus, in this case gold received negative spillovers from Bitcoin (see Figure 4).

Still, this one incidence is only an indicator for cryptocurrencies possibly interacting with financial markets and influencing them (Kurka, 2017). But the low correlations and no other significant spillovers make it impossible to state the clear role of Bitcoin in financial markets and investment possibilities right now. The so far observed price independence and negligible shock transmission to other markets put Bitcoin in another perspective, namely portfolio diversification. Elendner et al. (2016) expand the analysis of comparing Bitcoin with traditional asset classes by observing the behavior of 327 cryptocurrencies in relationship to each other and the established financial markets.

With their findings, they confirm the results of the previously presented work and demonstrate the same price independency and low correlation holding true for other cryptocurrencies (see Table 4). The coefficients are all around zero.

Table 4 Correlation of cryptocurrencies and traditional assets (source: Elendner, et al., 2016, p. 22)

	BTC	ETH	XRP	LTC	DASH	MAID	DOGE	XEM	XMR	BTS
USD/EUR	-0.05	-0.04	0.04	-0.06	-0.01	-0.03	-0.06	-0.01	-0.05	-0.03
JPY/USD	0.02	-0.04	-0.03	-0.04	0.09	0.02	0.05	-0.05	0.02	0.06
USD/GBP	-0.06	-0.09	0.04	-0.09	-0.01	-0.01	-0.02	-0.17	-0.04	-0.03
Gold	0.05	0.04	0.04	0.05	-0.01	0.07	0.01	0.09	0.02	-0.01
SP500	0.00	-0.05	0.05	-0.05	0.02	0.00	0.01	-0.05	0.03	0.04
XWD	0.01	-0.03	0.02	-0.07	0.03	0.03	0.01	-0.07	0.05	0.07
EEM	0.00	-0.09	0.04	-0.09	0.00	-0.01	0.02	-0.04	0.02	0.04
REIT	0.03	-0.09	0.04	0.05	0.00	-0.03	0.01	0.05	-0.01	-0.05
DTB3	0.02	0.09	0.00	0.02	0.03	0.04	0.04	0.07	0.03	0.05
DGS10	-0.02	-0.08	0.00	-0.02	0.01	-0.03	-0.01	-0.01	-0.02	-0.01

To analyze the diversification opportunity of Bitcoin and later a possible asset class of cryptocurrencies the focus now lies on the risk and reward profiles of the different investment categories. Based on the moderate correlation with gold and the observed spillovers, it can already

be said, that Bitcoin serves as a diversifier and sometimes even hedge for commodities (Bouri, et al., 2017). Kurka (2017) even proposes an application of Bitcoin as risk sharer for more asset classes. Burniske and White (2017) also suggest Bitcoin to be a portfolio diversifier, but on the other hand emphasize the large volatility of Bitcoin. Considering volatility with daily percentage price changes as the common risk measure, all six observed years exhibit extremely high volatility ranging up to 50% per day. Still, it is decreasing over time and the month of April 2016, where gold was less stable than Bitcoin needs to be stressed out for its potential to be a serious asset class. As time goes by, clarity in regulation and government as well as more stable and established exchanges are conducive to the long-term stabilization. Compared to traditional asset classes like equities, bonds, real estate and commodities Bitcoin is the most volatile asset. For 2015 and 2016, there is only a slight difference compared to oil.²⁴ From an investor's perspective, risk in terms of volatility and rewards, here equivalent to absolute returns, colludes to form decisions. In this context, Bitcoin for its short lifetime exhibits great returns and outperforms any other asset class, but is the most volatile one. For the observed period Burniske and White (2017) find Bitcoin to have a quite stable growth since January 2015 until the end of 2016. Macroeconomic circumstances, especially the devaluation of the Chinese Yuan and the hyperinflation in Venezuela, and for some investors unimaginable incidents like the Brexit and election of Donald Trump, caused distrust and the search for an alternative investment like Bitcoin, resulting in a price increase through higher demand. An investment of \$10,000 in 2011 would have led to a \$2.3 million five years later in 2016, which is equivalent to a 23,000% increase of the portfolio's value. This is accompanied with a 70% loss after the peak in November 2013, taking two and a half years to recover. In that sentence, the great reward potential and the opposite side of high risk and losses are summarized. No other asset can state such numbers, neither in absolute returns, nor in volatility. An important criterion for investing is the compensation for risk. For risk-averse investors higher risk needs to be rewarded appropriately. To obtain this, risk adjusted returns are commonly measured through the Sharpe Ratio, given by returns above the risk-free rate in relationship to the volatility.

From Figure 5 it becomes obvious, that the higher Sharpe Ratio of Bitcoin is superior with exception of the last three years period, where it only outperforms gold, oil and emerging market currencies. Although Bitcoin is so volatile, according to the Sharpe Ratio measure investors get

²⁴ See Appendix, Figure 12, p. 58

compensated best, compared to traditional “safer” asset classes. Nevertheless, taking such possibly great losses is not everyone’s preference, still the low correlation to other markets and the good compensation make it a candidate for portfolio diversification (Burniske & White, 2017).

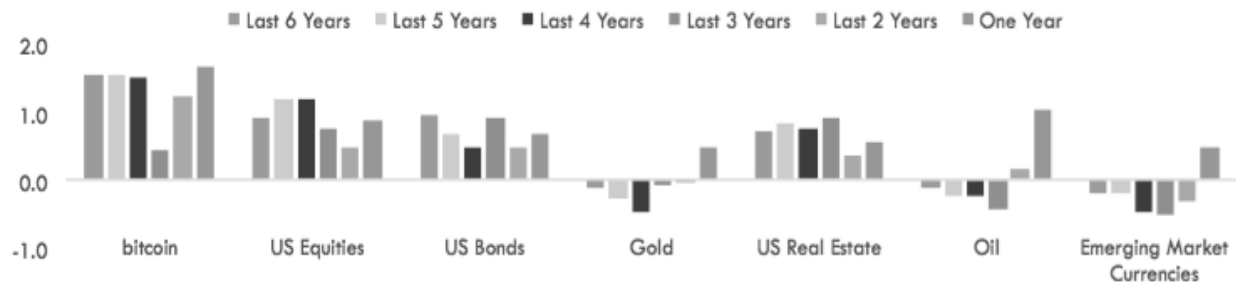


Figure 5 Sharpe Ratios with the last six years until last year (from 2011 until 2016) from left to right (source: data from Bloomberg & CoinDesk BPI, graph from Burniske & White, 2017, p. 23)

A comparatively high Sharpe Ratio is also found for the cryptocurrency index CRIX by Chuen et al. (2017). The ratio is even higher than the one for Bitcoin and the drawdown is lower. This can be an indicator for a diversification potential within the group of cryptocurrencies, which then would form a real class of assets. Elendner et al. (2016) already claim the world of cryptocurrencies no longer to be an alternative investment, but a whole class of alternative investments within a dynamic environment because of the different objectives behind each coin and the relative ease to create them. The market is quite competitive, as new coins replace similar ones if they provide better solutions, and as the network of supporters and investors depends on the performance and progress of the team behind each project. There is no protection or regulation yet, which also increases investors’ risk. It is remarkable that cryptocurrencies with lower market capitalization are gaining on interest over time. Those small market capitalization coins have higher returns, hence the crypto assets share the size effect with stocks. Return differences also occur through the varying technical features, which is also similar to stocks having different underlying businesses and industries. With Bitcoin being the first purely digital currency issued, it holds a high fraction of the market and returns.

Figure 6 shows the immense dominance of Bitcoin in the cryptocurrency market for the period until mid 2016, observed by Elendner et al. (2016), but after the first quarter of 2017 its share drops remarkably and today is still around 50%.

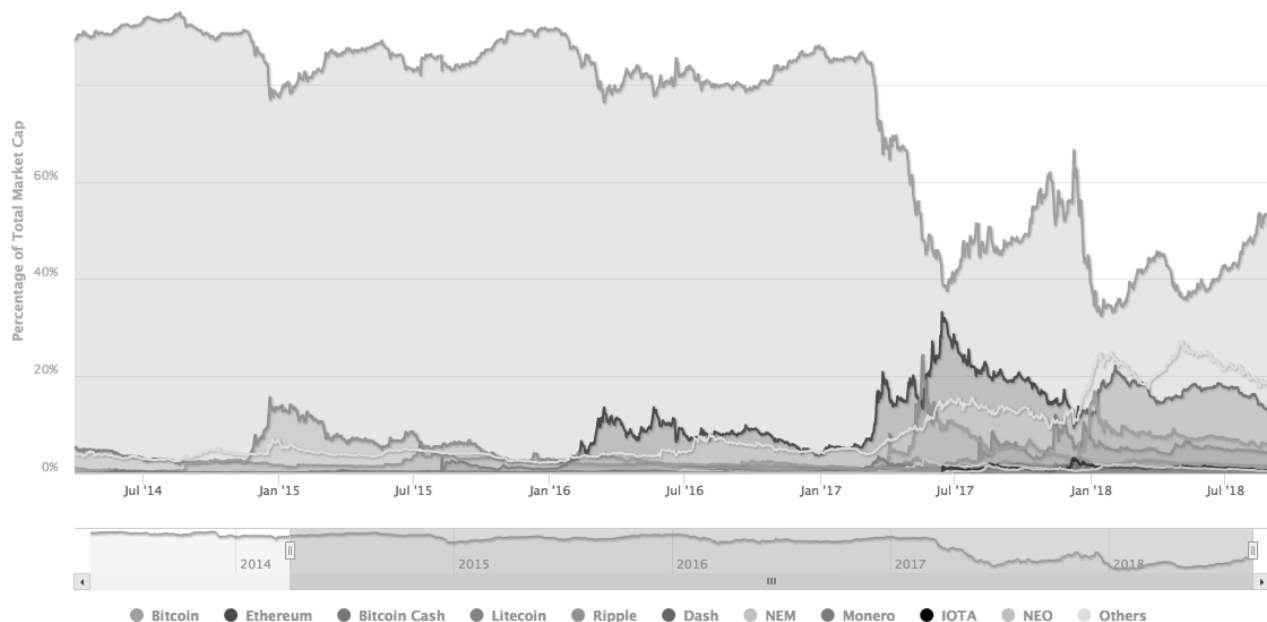


Figure 6 Bitcoin dominance in total market capitalization (source: CoinMarketCap (2018))²⁵

For many investors, Bitcoin still serves as an entry point into coin investing and its media presence outperforms all other cryptocurrencies. Furthermore, many exchanges do not accept fiat currencies other than the US dollar, so it is mandatory to first buy Bitcoin to then buy other coins. Nevertheless, they gain popularity resulting in the decrease of Bitcoin dominance.

Elendner et al. (2016) show that overall correlation between the currencies is very low,²⁶ which is surprising. In fact, most of them share their code basis and the same investor type. Additionally, a principal component analysis (PCA)²⁷ for the returns of the top ten valued cryptocurrencies needs seven factors to represent 90% of the return variations. Adding explaining factors leads to only a slow decrease in additional information. Surprisingly, the top two coins are explained by different

²⁵ See <https://coinmarketcap.com/charts/#dominance-percentage>

²⁶ See Appendix, Table 5, p. 58

²⁷ The PCA finds factors explaining return variations. If different information drives movements of different observed datasets, they are probably lowly correlated. For more details on the PCA method see i.a. Abdi & Williams (2010)

factors, which indicates low internal correlation and distinct movements of cryptocurrencies. This low cross-sectional connection of returns is supported by various working papers and articles. Multiple authors ran diverse tests to check this correlation for being unconditional and persistent (see e.g. Corbert, et al., 2017 or Chuen, et al., 2017). Therefore, Elendner et al. (2016) analyze pairwise correlation for days with negative and positive CRIX returns independently. Even though return correlation for negative days is higher than for positive ones, the results still show only little cryptocurrency-intern relationships.²⁸ The numerous coins conclusively are no close substitutes and diversification within a crypto portfolio, like the CRIX suggests, makes sense. According to the risk measures VaR and ES, investing in the index bears the lowest risk compared to the top ten cryptocurrencies.²⁹ In fact, there is a risk sharing effect in diversifying investments in coins. The last combination to look at in terms of correlation is between different cryptocurrencies and the established asset classes, the results of which were already presented above in Table 4. Although for some assets, like fiat currencies and digital coins, a different result is expected, correlation again is very low and close to zero. Lee (2018) confirms this and even states falling correlation over time until January 2018. Conclusively, the previous findings about Bitcoin also hold for other cryptocurrencies and offer a great option for diversifying (Fundstrat Global Advisors, 2018).

The last step is to evaluate the effect of adding Bitcoin and other digital assets to a traditional portfolio. As the cryptocurrency environment changes very quickly, prices are not stable and volatility is high, results can differ a lot when looking at e.g. different time periods. Additionally, due to the early stage of the technology, digital assets and their data only provide the possibility for short-term analysis. Until now, researchers agree on the low cross-sectional correlation and negligible relationships to established asset classes. Brière et al. (2013) investigate the inclusion of Bitcoin into a well-diversified portfolio and find that only a small percentage of integrated Bitcoins can bring significant benefits in terms of the risk-reward ratio. Using the mean-variance approach with a data range from 23 July 2010 until 27 December 2013, the efficient frontier with Bitcoin included shifts upwards drastically, as seen in Figure 7.

²⁸ See Appendix, Table 6, p. 59

²⁹ These risk measures are currently accepted by the Basel Committee on Banking Supervision (BCBS, 2014)

Furthermore, adding Bitcoin to a portfolio with only 3% is accompanied by an increase of Sharpe Ratio and the annual average mean by 1.44 and 8.75% respectively. This proportion hits a 6% volatility level of the portfolio but increases the level of extreme risk.

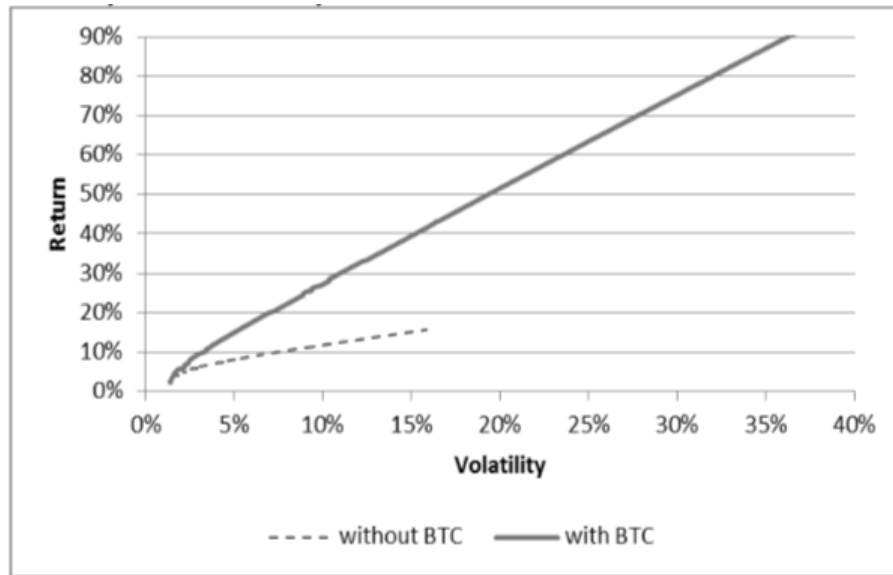


Figure 7 Mean-variance efficiency frontier shift (source: Brière, et al., 2015, p. 12)

Eisl et al. (2015) criticize this approach, as using the mean-variance approach requires a normal distribution or potential losses are not presented properly because of high tail risk. The value at risk (VaR) is included in the regulations through the Basel Committee on Banking Supervision, but also suffers insufficiencies like instability and difficulties in estimation without normal distribution. Hence, Eisl et al. (2015) use the conditional value at risk (Rockafellar & Uryasev, 2000). By analyzing data from 01 July 2011 to 30 April 2015, the time horizon compared to Brière et al. (2013) is longer and more recent. Still, in terms of correlation to traditional asset classes the results are similar, as well as the conclusion that adding Bitcoin to a well-diversified portfolio improves overall performance. Both, expected returns and risk are increasing with including only a small weight of Bitcoin, namely between ca. 1.5% and 7.5%³⁰ depending on the portfolio optimization framework, with returns rising more than risk. Because of the low correlation of cryptocurrencies besides Bitcoin to other assets, Elendner et al. (2016) suggest extending the findings concerning portfolio diversification with Bitcoin to other coins, especially because an

³⁰ See Eisl et al. (2015), p. 12

investment into the CRIX exhibits lower risk than investing in only a single coin, still being lowly correlated to financial assets in a standard portfolio. Of course, this contribution to portfolio allocation brings extremely high returns and risk, in contrast to numbers of traditional asset classes. Lee (2018) presents in this context the differences of portfolio performance for a three-year time horizon looking at annualized returns, volatility, the Sharpe Ratio and maximum drawdown. The basis is a “typical” portfolio (1) containing 60% weight in stocks and 40% in bonds.

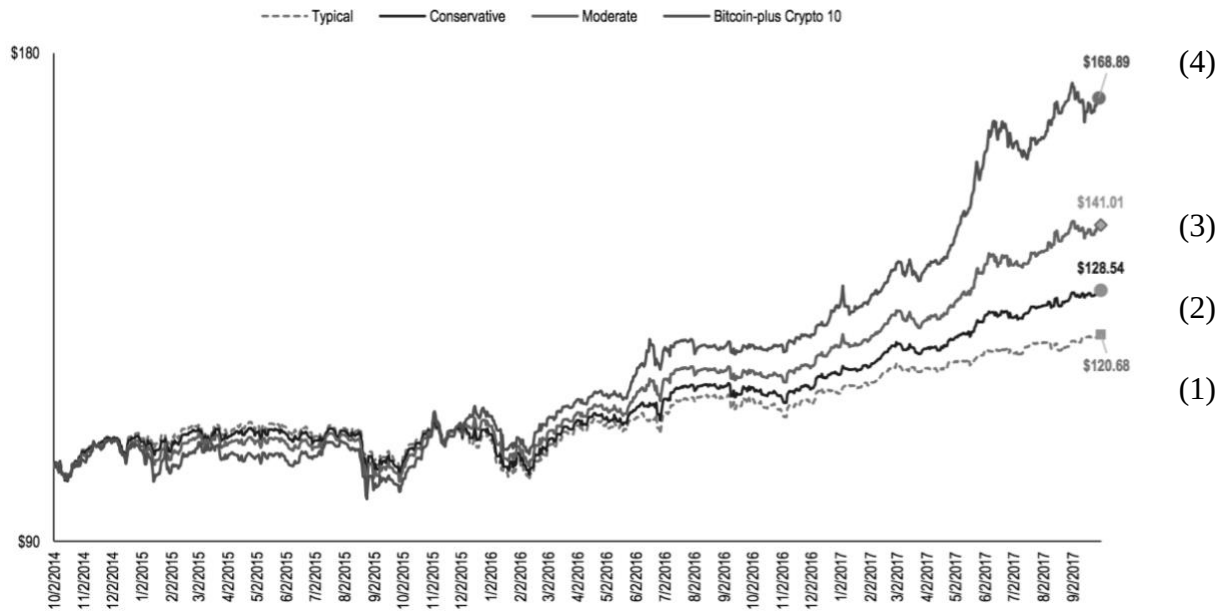


Figure 8 Comparison of portfolio performance with and without cryptocurrencies (source: Fundstrat Global Advisors, 2018, p. 46)

Figure 8 shows the development of the different portfolios. Allocating the weights to 55% stocks, 40% bonds and 5% Bitcoin leads to a 6% increase in returns, accompanied by only 0.48% increase in volatility. This leads to more than a double Sharpe Ratio (from 59% to 128%). Consistent with previously mentioned studies, a small proportion of 2% (5%) Bitcoin already improves the performance significantly. It is remarkable that line (4) in Figure 8, representing an allocation of adding Bitcoin and the ten most liquid cryptocurrencies, brings the largest benefit. Compared to the typical portfolio (1) it adds 12.75% to the returns, 2.16% volatility and therefore triples the Sharpe Ratio.³¹ The conclusion to make here is that adding a diversified cryptocurrency portfolio to an already diversified combination of traditional assets exhibits significant benefits to investors.

³¹ See Appendix, Table 7, p. 59

This would underline the development of a new asset class, which can be diversified internally and results in great diversification possibilities for general financial investment portfolios.

Chuen et al. (2017) confirm the findings concerning the upwards shift of the market efficiency frontier when including the cryptocurrency index into a mainstream portfolio consisting of traditional assets. That means, with cryptocurrencies any given level of risk is compensated with a higher return. They argue that mean-variance investors are more interested in statistical utility. Running mean-variance spanning tests, they state that no cryptocurrency analyzed can improve the tangency portfolio and therefore investors' utility. Due to the large tails exhibited by all the coins and the cryptocurrency index, as already mentioned before, an investment goes along with high risk and possibly substantial losses.

To conclude this subsection, Bitcoin and other cryptocurrencies with their unique technical and statistical properties are candidates for a new asset class (Burniske & White, 2017). The remarkably low internal correlation and the low correlation to existing asset classes, as well as their independent market behavior put them into the perspective of great diversification potential and even a haven for commodities (Elendner, et al., 2016; Kurka, 2017). It was shown that a small incorporation of digital coins into a traditional portfolio can have great impact on portfolio performance, nearly double returns and improve the Sharpe Ratio (Lee, 2018). One main take-away is that the effect of higher returns for a given risk only holds for the global minimum-variance portfolio and the market efficiency frontier, but not for the tangency portfolio. Thus, the enthusiasm of cryptocurrencies being the Holy Grail of portfolio diversification should be handled with caution (Chuen, et al., 2017). In addition, the early stage, short-term nature of the data and the ambiguities in regulation and purposes that cryptocurrency payments could be used for, need to be considered (Eisl, et al., 2015).

3.3 The counterparty arguments

The previous section favors the statement of cryptocurrencies being a new asset class and a great diversification tool. Especially in the last three years Bitcoin received a lot of media attention and became publicly explosive and controversial. Opinions therefore differ strongly and it is important to show the arguments and skeptical views against the use and existence of cryptocurrencies. This

subsection names the most plausible points to encourage a discussion and suggestions for further handling of this topic. Chapter 2.1 already hinted that regulators, institutions, companies and governments are divided about how and whether to use or even accept cryptocurrencies. A few paragraphs will give an impression about public opinions concerning the digital currency world and introduce the aspects discussed in the papers presented here. Beforehand, it needs to be mentioned that some arguments are generally in favor, as well as against cryptocurrencies, depending on the perspective and justification.

One of the arguments chasing Bitcoin and digital coins from the very beginning are attractive features for criminals and terrorists. Through decentralization and the possibility to, at least partly, convert and transact money anonymously gives room for criminal elements (Murphy, 2017). There are numerous articles and working papers, as well as examples, deepening this aspect. Engle (2016) claims Bitcoin to make murder and illegal arm sales more efficient, not daily general transactions. He sees a large potential for terrorist support, which is not in interest of society and potential crime victims, and therefore dangers outweigh the benefits. Brill and Keen (2014) also share this judgement of pros like safety, global funding, innovative potential and a reduction of transaction costs, underbidding cons like the risk of criminal activity and threats to national security. They argue that only criminals have the need for anonymous payment without disclosing an identity, as other people do not have to hide anything. From their point of view, the difficulty for governments to track cryptocurrency transactions, combined with the fast execution of payments and the relative ease of usage are aspects attractive for terrorists. Adding the global reach without any restriction of transactions with politically hostile countries, make it immoral to see digital coins as an investment or asset class. Factors like the rapid and unpredictable price fluctuations, vulnerability to hackers and the worldwide rising interest of law enforcement to track transactions would be arguments against usage of Bitcoin by criminals, but according to Brill and Keen (2014) they are inferior. They underline the necessity for governments and authorities to regulate the use and trade of cryptocurrencies and not to ignore this phenomenon. Pichler (2018) in this regard states that blockchain based coins bring along high social costs and stresses the necessity of third trusted parties to conserve security. Additionally, banking confidentiality is sufficiently good for legal business relations and transactions. Everything other than that is needed for criminal activity, drug dealing, money laundering and tax evasion. In terms of acting ethically, the huge consumption of energy to mine Bitcoins and other coins based on the proof-of-work mechanism, is a significant

argument against supporting cryptocurrencies. The consequences for climate and environment are immense and a solution is needed (Murphy, 2017).

Digital coins according to Engle (2016) violate the states' currency monopoly to issue "money" and conclusively are illegal to be classified or used as currencies. Brill and Keen (2014) criticize the actual use of cryptocurrencies in terms of being currencies used to buy goods and services. They state it is not possible to get a cup of coffee or anything similar, which means e.g. Bitcoin does not even serve its original purpose as an instrument of payment. It is neither a means of exchange nor a legitimate value storage in terms of a central bank because it is not backed. The use for transactions is anyway limited because of not being accepted by most companies and because of the large and quick changes in price (Murphy, 2017). If someone took a loan in Bitcoin years ago, this person as well as the lender would now have a problem concerning the pay back. Stability in currency prices therefore is a crucial factor for economic relationships, making digital coins useless in terms of digital money as they are neither stable nor scalable. Thus, Bitcoin fails in its original purpose and is no currency in an economic sense, which due to lack of regulation and control limits its ability or suitability as an asset class in any context (Pichler, 2018).

Onies et al. (2011) in this context add the risk of never getting the products bought online, because of no third trusted party being involved. There is no claim to make to anyone for insisting on delivery or fulfillment. Most newspapers and websites in relationship to the risk of holding or trading cryptocurrencies claim the relatively high probability of getting hacked and having the digital money stolen. Murphy (2017) states that coins whose prices are increasing, which is generally desirable for investors, are more lucrative for attackers and history already shows some large exchanges losing significant amounts of funds. The biggest Bitcoin theft caused by a hack of one of the first Bitcoin exchanges Mt. Gox, happened in 2014, when at least 750,000 Bitcoins back then worth around \$400-\$ 500 million were stole,. As reported in 2013, 80% of all Bitcoin trading was going through Mt. Gox, thus many investors were left with immense losses (Trautman, 2014). There are numerous examples for hacked exchanges, including quite popular ones like Bitstamp and Bitfinex³², bringing insecurity and volatility in the whole market. Blanco (2018) adds that phone operating systems, like mobile applications, managing your coins' storage and trading, are no solution because they can also get spoilt and the digital wallets emptied by attackers who steal

³² See examples on <https://rados.io/list-of-documented-exchange-hacks/> [last access: 09/23/2018]

the money. Engle (2016) summarizes this aspect with computational vulnerability to denial-of-service cybercrime and computer viruses, making cryptocurrencies an insecure investment.. Moreover, if you forget the password of an account, there is no option to regain or reset it in any way and again, all value on that wallet is irreversibly lost. The person owning the private key, which is very long and needs to be saved somewhere, owns the currency. Losing or deleting this key results in lost coins which do no longer belong to anyone. Based on estimations by Chainanalysis³³ (Roberts & Rapp, 2017) to date around 4 million Bitcoins (17%-23%) are lost forever. This risk of getting lost irreversibly is applicable to other cryptocurrencies and therefore relevant for the whole class.

A great concern directing private investors and supporters is the immense volatility and valuation difficulty. The technology is still new and most of the business concepts and use cases behind a crypto coin are unproven. It is inevitable to hear about a hype and a bubble associated with Bitcoin and cryptocurrencies. Such hypes and bubbles are created through psychological biases and they will burst as reality catches up and speculation goes down (Groshoff, 2014). Imperfect information, irrational behavior based on emotions and biases lead to imperfect decisions and hence to mispricing. According to Engle (2016) cryptocurrencies are only speculation and bad investments. Enthusiasm about alleged great potential, as well as precursors getting rich quickly, bring private investors to false beliefs and investments, which should be outlawed for this reason. Savings and the market itself are threatened by investors' confidence in hypothetical products. Previously, this work mentioned the complicated valuation of cryptocurrencies, because it is very much dependent on the number of people in a network using and wanting a digital coin. If there is no demand and no network supporting it, the value will go down. Vice versa that means, that if there is a large group of people supporting the idea and background of a coin, it probably has a high price for a certain period of time even though there is possibly no use and product behind it.

Through the controversy, media attention and stories about getting rich quickly, people started following the crowd without researching what they are investing in, overlooking the complexity of their new investments. In this early innovation phase knowledge about the technology and the coins' background is inevitable for any responsible investment. Otherwise, investors are not aware of the risks accompanying a new technology with no authority involved, which results in

³³ Chainanalysis Inc. is a US company studying blockchains to create more trust by tracking down criminal activity happening through cryptocurrencies. (Chainanalysis Inc., 2018)

cryptocurrencies being classified as dangerous scam. Because it is difficult to distinguish serious projects from fraudulent ones, research and proactivity are very important. Thus, investing and speculating money not affordable to lose or even borrowed money is irresponsible (Chen, 2018). A Statista Group study from July 2018 states that 80% of the ICOs in 2017 were identified as scams, raising money for a project which is never aimed for completion, and leaving with the money collected. The phony project Centra, promoted by celebrities, received funding worth \$ 32 million and after the founders got arrested, the coin lost in value immensely (Dowlatabadi, 2018; Valore Initiative, 2018). Cohan (2017) names this a problem of new investors being uninformed as well as “unsavvy” (Cohan, 2017). They neither have sophisticated knowledge of the technology, nor of all the ongoing market asymmetries and imperfections mentioned in this chapter. This awareness is largely required in the cryptocurrency area to reduce the risk of panic in times of unexpected price changes.

There are some reasons why critics talk about manipulation and market failure concerning cryptocurrencies. In this context, Murphy (2017) names the aspect that especially Bitcoins are concentrated in a few wallets, and that most miners are operating in China. In case of an upcoming network vote, power is also accumulated in these few hands. Furthermore, the market could be manipulated through deals within this power. Theoretically this can be the case with every cryptocurrency issued, because founders can keep a significant amount of coins for themselves before offering it to the public. According to Kharif (2017) 40% of all Bitcoins are in the hands of around 1000 people, called “whales” (Cohan, 2017) having the power to influence the price immensely and liquidate the Bitcoin markets. The value is not backed by any tangible asset and does not generate cash flows. Conclusively, it de facto has no basis for valuation but can only be traded. The price is solely chased through psychology, expectations and the network’s interest (Cohan, 2017). Engle (2016) mentions Ponzi schemes and so called pump and dumps³⁴, which indicate clear market manipulation leading to bad investments and a suboptimal allocation of funds into fraudulent projects. As even unregulated exchanges exist, money can get stolen through unannounced shutdowns, unexecuted orders or hacks, all resulting in investors’ losses. Popper (2018) adds that price manipulation is happening on such unregulated exchanges through traders who post trade orders they never want to complete and thereby signal false information to other

³⁴ A pump and dump happens when a group of people buys coins at a very low price, drives it up through promoting it and then sells all their coins resulting in panic selling, dumping the price again. (Grydon, 2014)

market participants. Shortly, trading infrastructure is insecure and inefficient, making fraud and stealing common. Hence, the cryptocurrency market is free in the sense of not being regulated and interfered with, but does not allocate resources efficiently. This is not what society and financial markets aim for. According to the nonprofit Anti-Phishing Working Group (APWG)³⁵ \$1.2 billion have been stolen since the beginning of 2017 through cyber criminals taking advantage of the growing popularity of cryptocurrencies. This can also be seen as market manipulation and adds on to the price not representing the value of a coin (Chavez-Dreyfuss, 2018; Henning, 2018).

With the blockchain technology a new way of starting projects and funding them was created, namely through Initial Coin Offerings (ICOs), possibly a crypto environment equivalent for Initial Public Offerings (IPOs) on the stock market. ICOs are open to everyone, are not examined by an authority and do not first go through institutional approvals to then get available to investors. In contrast, IPOs are monitored and investigated before being available to the public. In order to secure investors, specifications such as a minimum earnings level, audits explaining a company's financial situation and prospects need to be disclosed. The high standards fulfill due diligence by opening this information. ICOs, however, have no validation and even though they publish white papers providing their idea and business model, there is no legal entity overseeing the information. This makes ICOs riskier than IPOs, but they can provide a chance for any kind of person to invest and drive innovation. Furthermore, in the case of IPOs institutions get an advantage because they are the first to know about such offerings and their potential (Blanco, 2018). Although investing in ICOs can be, therefore, regarded as more fair to the public, it is based on unverifiable information which demands personal judgement about reliability of the underlying business model and the team's potential and estimation of whether a supporting network can be created. Basically, it is investing in nothing more than an idea. Due to this almost impossible judgement whether a project is good or bad, countries like China already banned ICOs. Others still think about ways to regulate them, giving an additional risk factor about a project's future for investors (Popper, 2018).

Most of the arguments above lead to the conclusion of cryptocurrencies being far too risky, especially because of missing applicable regulation and laws. This absence of regulation combined with no existing asset insurance strengthen the possibility of hysteria and panic on the cryptocurrency markets, since there is no entity to deal with dramatic losses to investors arising

³⁵ The APWG is a union of institutions and companies having to deal with phishing attacks and cyber security. (Anti-Phishing Working Group, Inc., 2018)

from all the above mentioned market imperfections (Cohan, 2017). To give a summary about the concerns associated with digital coins and an introduction for the next chapter which deals with regulation, the difficulty to classify them by law is stated. In that sense, cryptocurrencies based on United States law neither clearly fall under the definition of a security nor of a currency. The different types of governance and financing the projects make it difficult to put the whole cryptocurrency environment into one class by law. Also, their aims matter, such as being only a means of exchange, rather a company selling services or even just being a provider of a platform or software to use. Some coins give voting rights and promise future payments and are that way structured like stocks. Others do not and only serve as value storage. Hence, different cryptocurrencies need to be treated differently concerning regulation and tax. In fact, some coins are securities, masked as currency and chapter 4 goes into detail in terms of regulating suggestions (Jabotinsky, 2018). This regulatory complication brings additional risk to the market, because future steps are unknown and unclear.

In Europe, regulation and taxation of cryptocurrencies are also complicated because of the different domestic laws and the virtual coins being independent of national borders. In a way, this already indicates that it makes sense to work together across borders to avoid loopholes concerning the issuing of cryptocurrencies and their taxation.

This chapter showed the great potential of a new and valid asset class serving as a diversifier and innovation driver by lack of correlation with other markets and it having freedom in funding new projects. On the other hand, fatal market failure due to information asymmetries and manipulation call for a legal framework, as the market does not allocate efficiently by itself.

4. Cryptocurrencies and Society

The previous chapter contrasts indicators in favor of cryptocurrencies being a new asset class with the obstacles of being one. It is reasonable to conclude that the whole sphere will undergo changes concerning regulation, use cases and the technology itself. However, it will also bring changes in the way companies get funded and reduce costs, as well as in the international financial investment area (Kurka, 2017). Regulators are facing a new and growing challenge, as the interest in cryptocurrencies increases. For this purpose chapter 0 exhibits different approaches for governments on how to deal with the issuing of cryptocurrencies, their classification for tax payers and the negative externalities of anonymity.

As the whole concept is merely based on a community and network using and supporting digital coins without being backed by any physical assets or bringing cash flow, maybe other factors than only making a solid investment matter for the high interest in cryptocurrencies. Here, chapter 4.2 will depict different elements on why cryptocurrencies became so popular and probably came to stay. It particularly focusses on the timing of inventing Bitcoin in 2008/09, on trends for the future concerning the further digitalization of businesses and on the profile of the generation that promotes cryptocurrencies (Nakamoto, 2008). A reflection of these points is crucial for making statements about the prospects of digital coins and the development of the future investment universe.

4.1 Regulation of cryptocurrencies

Obviously, opinions about cryptocurrencies differ widely and so do suggestions for regulation and categorization of digital coins. On these grounds, the focus of this chapter is on highlighting existing legal frameworks where cryptocurrencies possibly fit in. Regulation in this area leads to an antagonism for governments and financial institutions, because applying policies and laws to cryptocurrencies means acceptance, although numerous regulators are generally against it. Banning and accordingly not accepting the usage of such coins, on the other hand, leads to underground activity (Brill & Keen, 2014). The aspect of cryptocurrencies being no (national) central bank money is clear, but they still create an alternative to using currencies in a central bank sense and in some cases at least complement national money. Hence, they are not categorized as a currency, but used as such, despite violating a state's currency monopoly (Engle, 2016). Murphy (2017) suggests

central banks to better, at least partly, adopt and adapt the blockchain technology. Financial instability results in an increase of cryptocurrency use, which is why it is more popular in Latin American and African countries that are facing e.g. high inflation and having only little access to bank accounts (Jabotinsky, 2018). The Financial Action Task Force claims digital coins as

“A digital representation of value that can be digitally traded and functions as: (1) a medium of exchange; and/or (2) a unit of account; and/or (3) a store of value, but does not have legal tender status (i.e., when tendered to a creditor, is a valid and legal offer of payment) in any jurisdiction.” (Financial Action Task Force, 2014, p. 4)

This definition fits for Bitcoin and its equivalents, having the aim to be an instrument of payment, but it by far does not cover the numerous coins with different purposes. BaFin in Germany defines it similarly as a digital representation of value, not a digital currency, which is not created by a central bank or institution (BaFin, 2016).

Ethereum as a platform for cryptocurrency projects, executing smart contracts³⁶ for them, does not fulfill the above requirements, but its coins Ether could be considered a security. Furthermore, the blockchain technology and cryptocurrencies are used for projects with environmental and social backgrounds, as well as for traditional business cases. A simple classification of treating digital coins like a currency or rather security is, conclusively, not accurate and a whole new framework, analyzing the use case and business model of every coin, is needed (Jabotinsky, 2018).

As the number of cryptocurrencies representing a business model with a reward system, founder team and commercial solutions is growing, the idea of handling them like securities, e.g. stocks, bonds or futures becomes reasonable. The following paragraph presents the legal definitions of securities and commodities and then explains why and why not certain digital coins fall into this category according to the United States' law.

- A security is “any note, stock, treasury stock, security future, security based swap, bond...[or] investment contract” (15 U.S.C. § 77b(a)(1) (2012), p.100)
- A commercial paper is a promise to pay a certain amount of money by a certain date.

³⁶ Smart contracts are blockchain applications working without any middle man, only following their underlying code (Ethereum Foundation, 2015).

- A stock brings a right to vote or any other claim as e.g. for dividend payments.
- A future is a promise to pay a certain sum when a certain contingency happening.
- A bond is a promise to pay a principle with a certain interest.
- An investment contract needs to fulfil the four aspects of (1) being an investment of money (2) in a common enterprise (3) expected to generate profits, (4) caused by the effort of others. (SEC v. Howey Co., 328 U.S. 299-301 (1946))
- A commodity is a tangible item, which is no security.

(Engle, 2016)

As said before, Bitcoin does clearly not fit to be a stock, bond, future or commercial paper. It is also no investment contract, because there is no enterprise behind it and the price is not changing due to the effort of others. It is also no commodity, because it is intangible. In Germany, Bitcoin is a financial instrument rather than a currency and so are other coins like Ether (Spancken, et al., 2016; Engle, 2016). Buying Ether is an investment of money in a common non-profit organization and investors expect profits through the effort of this organization and following price changes. The definition of an investment contract hence, depending on interpretation, could fit. In June 2018, the SEC decided to not consider Ether a security, because of the lack of third party effort being responsible for the project's success (Hinman, 2018). Ethereum and numerous blockchain projects launched an ICO, which because of the similarities to an IPO makes them possibly look like stocks (Jabotinsky, 2018). Previously in this work, the risks of ICOs being an unregulated opportunity to finance blockchain projects, were presented. The possible consequences for the market and investors were shown, justifying the need for clarification and regulation. The value of every coin issued is among other things dependent on its level of security. Until now, a blockchain project usually publicizes a white paper, describing their propositions and aims. These white papers are neither mandatory nor overseen by any legal entity or financial intermediary. Thus, investors have no prior judgement about the feasibility, rentability or seriousness of the project and additionally cannot insist on regulatory intervention if their investment turns out to be a scam or brings a total loss (Blanco, 2018).

Jabotinsky (2018) in this context mentions the fact that a different way of funding projects does not change the fundamental purpose of this financing and pleads for a mandatory disclosure and

regulation analogous to IPOs on the stock markets. Marian (2015) asks what information should be disclosed to not destroy the innovation opportunities and cost improvements. An efficient market allocates given information quickly and finds the right price reflecting the value of the underlying product. Without disclosure and the possibility to enforce contractual promises, the market fails in allocating efficiently and does not solve the problems of asymmetric information, moral hazard and adverse selection. Conclusively, mispricing occurs and uninformed traders cannot join the market fairly because they are missing insider information, hence the market does not provide an optimal solution. As the value and price of a cryptocurrency strongly depends on its security level, a disclosure of information about the whole ecosystem and the founding team as well as goals and reasons of the project is mandatory. A very important point which needs to be public is the exact breakdown of what the money is used for. Moreover, investors' rights need to be clearly stated. Also worth disclosing, are the way the coin is creating value and its governance structure, as they can differ from traditional stock companies, accompanied by the underlying blockchain structure, e.g. whether it is public, private or the code open sourced. This information disclosure helps investors form their opinion after intermediaries evaluate it and find the right price (Jabotinsky, 2018). Early investors and supporters of Bitcoin and cryptocurrencies joined the system among other reasons because of the space being unregulated and not controlled by any institution. Bringing in intermediaries who evaluate the concepts behind coins is therefore not desired. Marian (2015) underlines that intermediaries in a suboptimally functioning market are needed and created by these markets and not governments. In the case of digital coins and tokens, new intermediaries are demanded, who adapt the relevant features of the traditional ones. They should not increase criminal behavior connected to anonymity and not decrease the current standard of financial anonymity, as well as the innovation potential through decentralization (Marian, 2015).

Regulation is mostly decelerating innovation and is causing additional costs. The information that financial intermediaries produce cannot exclude certain people from accessing it. To avoid the free rider problem, right now the party disclosing information to be evaluated is paying the intermediaries, bringing them into interest conflicts. According to Jabotinsky (2018) financial intermediaries should be prohibited to invest in the projects they evaluate, both traditional and virtual ones, as this otherwise leads to linkages and interconnectedness through institutions holding similar assets and portfolios, which increases systemic risk. In order to prevent important

institutions to be exposed to the great price fluctuations of cryptocurrencies, regulators preventively should be forbidden to get involved financially.

The purpose of every single coin or token financed by an ICO determines which information should be disclosed and how they can be categorized legally. Projects with dividend payments, changes in value and voting rights (e.g. the decentralized autonomous organization (DAO)) can be handled like stocks, whereas platforms such as Ethereum align better with investment contracts, while digital coins like Bitcoin find most parallels with currencies. While selected previous work on cryptocurrency regulation suggests banning ICOs, like China does, or even to completely ban all virtual currencies in order to save national security from terrorist and criminal activity, others see the potential of blockchain technology and the need for regulating them as financial instruments (Engle, 2016; Brill & Keen, 2014). What most of those works have in common is underscoring the demand of anti-fraud measures. While among others Engle (2016) does so based on criminal opportunities, Jabotinsky (2018) explains that regulative screening is protecting investors, minimizing fraud and is conclusively building crucial confidence in the technology's potential.

Brill and Keen (2014) point out the internationality of cryptocurrencies and that countries need to deal with it to prevent criminal activities. They suggest to form an alliance which would work together transparently in an international community, sharing suspicious coin transactions. To do so, there is a need for uniform transparency standards and laws for beneficial ownership, as well as international cooperation in applying digital coins. The cryptocurrency community's aim of being independent from governments should be taken seriously and, hence, autonomous self-regulating organizations monitoring cryptocurrency transactions should be created. That way, consumerism can be enforced through both the community and national authorities agreeing on rules within national jurisdiction. Such a collaboration would lead to a balance between the economic and innovative potential of cryptocurrencies and the risk of getting abused by criminals, without harming the community's idea of having no governmental intervention. Additionally, communication between anti-money laundering guarantors and those working against terrorist financing needs to be improved to work more efficiently, as both need similar data and often search for the same persons. This should happen based on the idea that it is easier to prove an economic crime like tax evasion, followed by an analysis on why the money was laundered and hidden.

The biggest challenge for regulators concerning cryptocurrencies lies in finding the balance between obtaining the maximal gains out of the blockchain potential and minimizing the risks for criminal acts like tax evasion, drug dealing or terrorist financing. An aspect worth mentioning here is consumer protection because digital coins can be created for funding without passing legal requirements for disclosure and there being no law enforcement. Here, the issue of internationality complicates the idea of simply banning such coins, because it is hard to forbid or rather control whether they are still bought by citizens of the banning country online, as not all governments ban the issuance (Brill & Keen, 2014; Jabotinsky, 2018; Marian, 2015).

4.2 Why cryptocurrencies (will) matter

The previous section showed the difficulty of regulation due to no properly fitting existing laws and most of cryptocurrencies being decentralized and spread across borders, with e.g. Bitcoin not having an enterprise or head office anywhere. Still, the attempt of regulating cryptocurrencies and, that way, making them part of the whole financial and economic system, shows high interest of governments, institution and societies. Growing interest is underlined by the fact that the United States' largest cryptocurrency exchange Coinbase currently has around 20 million³⁷ users, i.e. almost as many users as Fidelity Investments with 27 million³⁸. In this context the immense growth of Coinbase in 2017 with 50,000 new users every day is remarkable (Mathis, 2018). This section aims to present reasons why virtual coins like Bitcoin could become popular and why they also will matter in future.

Looking at the very roots of Bitcoin and thus every other coin based on the blockchain technology, namely Satoshi Nakamoto's white paper, one finds the basic intention: "A peer-to-peer electronic cash system"³⁹ (Nakamoto, 2008). Chapter 2.2 already specified the short comings of financial intermediations in online commerce and payment. Bitcoin provides cryptographic proof instead of relying on trust. Antonopoulos (2016) points out transport and payment as the issues of modern retail operating globally through the internet. Here, the internet already solved the problem of transportation by recreating products virtually and Bitcoin would bring the solution for payments. As credit cards were introduced in the 1950s, they do not suit the needs of a digital internet era. In

³⁷ As of September 2018, see <https://www.coinbase.com/about>

³⁸ As of September 2018, see <https://www.fidelity.com/about-fidelity/fidelity-by-numbers/overview>

this context, Yermack (2013) states that the cost for retail shopping using Bitcoin is lower than using other payment methods, e.g. credit cards. The increasing number of online retailers and technology supporters accepting Bitcoin for routine transactions features a real need and use case for cryptocurrencies, which in the long run should increase their demand. Hence, relating virtual coins to digitalization and the internet age, a long-term perspective in growing usage and value should not be excluded.

Antonopoulos (2017) points out the use cases for low-value offline transactions, like buying a cup of coffee. He underlines fiat money like the Dollar or Euro being perfect for this, but that one should not forget circumstances in Asia or Latin America, where there are hyperinflation, corrupt governments and around two billion people without access to international finance capabilities. Additionally, fees for sending money to poorer destination countries are higher, which can be alleviated with cryptocurrencies as two billion of the unbanked population are using the internet (Antonopoulos, 2016, p. 3).

Figure 9³⁹ shows the percentage of adults having bank accounts, where only the high-income OECD countries and East Asia & Pacific show numbers significantly higher than 50% (Hodgson,).

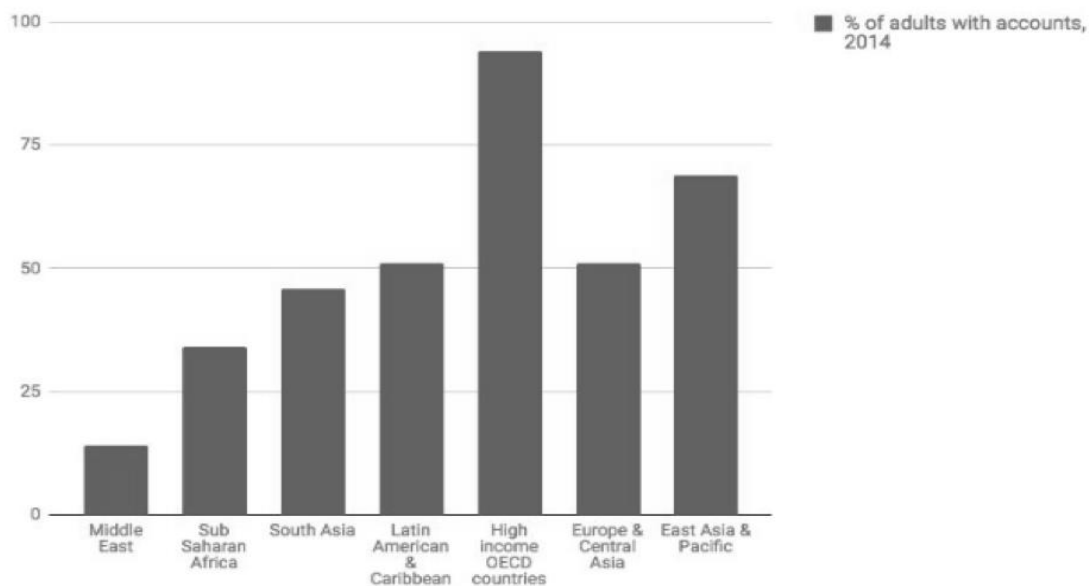


Figure 9 Percentage of adults having bank accounts in percent in 2014 (source: Data from World Bank, graph from Business Insider UK)

³⁹ Graph at: <https://www.businessinsider.de/the-worlds-unbanked-population-in-6-charts-2017-8/#the-vast-majority-94-of-adults-in-oecd-high-income-countries-said-they-had-a-bank-account-in-2014-while-only-54-of-those->

These unreachable people are strengthening the future potential of digital wallets and coins, which could help support the population outside the Western world through global fundraising possibilities like microcredits or lender communities. Again, this may not seem necessary in developed countries, but opens innovation potential with new markets and could bring about major improvements for e.g. a farmer or social activist in Colombia or Kenya.

Besides technology enthusiasts, online merchants and unbanked citizens, cryptocurrencies are interesting for young people born between the 80s and early 2000s, the so-called millennials. A Fundstrat⁴⁰ study from 2017 shows millennials being the largest population group in the United States ever. They form 27% of the United States' population and thus have a great effect on the assets they invest in. The study further analyzes the investment behavior of each generation since the Greatest Generation starting from 1910. Every generation has different asset preferences based on their possibilities and economic developments. To emphasize the power millennials' investments will probably have, they demonstrate what happens when members of a certain generation come into their prime income and investment years between 35 to 60 years of age. In 1971, individuals could buy gold for the first time and its price peaked when the Silent Generation reached the peak of their prime income years in 1982. The following generation of the Baby Boomers (born between 1946 till 1964) exceeded the previous generations in terms of the size of the cohort. Their entry into their prime income years in 1982 and the following peak in 1999 matches the equity market boom, also peaking in 1999. The average millennial's age today is 26.5 years, i.e. they will peak their prime income years in 2036. Yet, the first ones already entered in 2016, coinciding with large growth in the cryptocurrency market. Based on the fact that this generation grew and grows up with digital companies like Facebook, Airbnb and Uber, they easily adapt to the usage of decentralized Applications (dApps) instead of Apps and, conclusively, cryptocurrencies. With them being the largest generation seen in history, investing only 10% of their prime income (100 billion dollars) in the cryptocurrency market is forecast to lead to an immense increase in market capitalization and price appreciation of around 2.5 trillion per year (Lee, 2018; Fundstrat, 2018).⁴¹ The Appendix provides a graph illustrating the study.⁴²

⁴⁰ Fundstrat Global Advisor is a research company analysis financial assets and trends. (see: <https://www.fundstrat.com/firm/about/>)

⁴¹ See the presentation here: <https://www.youtube.com/watch?v=GGberGnxiJk>

⁴² See Appendix,
Figure 13, p. 60

Another aspect making cryptocurrencies attractive and supporting is the abundant distrust in banks and the financial system. A Facebook study of 2016 revealed that 92% of millennials do not trust traditional banking (Facebook IQ, 2016). In addition, only around 20% of its citizens have trust in the United States' government. This trust level is even lower in most Asian and Latin American countries, but peoples of France, Spain, Italy and Greece also have low trust in their national governments (Fundstrat, 2018). In this context, Yermack (2013) mentions libertarians favoring the usage of cryptocurrencies due to their open and broad beliefs: they publicly state their distrust in the world financial system. Bitcoin as a representative of cryptocurrencies is independent from government control and cannot be manipulated by any other central authority. The value of fiat money is based on the agreement of using it and on the confidence of everyone that not too much of it is printed. As many citizens do not trust their governments, their trust in the financial system is also fading. The timing of introducing Bitcoin at the bottom of the global financial crisis in 2008/09 therefore creates fuel and ground for the spread of cryptocurrencies. Vigna and Casey (2016) call this crisis a disaster based on what people were used to believe and think. They say it is "a crisis of confidence" (Vigna & Casey, 2015) where governments needed to bail out companies and save a financial system previously assumed to be solid, from collapsing. Cryptocurrencies hence were provided as an alternative to the system which started to look fragile and triggered the crisis. According to Vigna and Casey (2016) they are becoming a cultural movement, as people wear virtual coin logos and create art and songs about it, which nobody did with e.g. PayPal.

As a new technology, the blockchain and its application through Bitcoin could prove the concept is working and has use cases in less than 10 years. In 2013, it slowly reached mainstream media and many people who were not being supporters of the concept previously turned into enthusiasts. The strong community, fast price appreciations and interest of governments and big companies like Dell and Microsoft researching and partly using blockchains, also attracted Wall Street. The New York Stock Exchange invested in Coinbase, indicating that profit oriented organizations start showing confidence in the concept. Accordingly, people with money and not only passion participate in the cryptocurrency market (Vigna & Casey, 2015). The estimated profit margins of Coinbase lie around 60%, whereas the Intercontinental Exchange manages to make 35%. Thus, cryptocurrency exchanges may provide comparatively higher profits (Fundstrat Global Advisors, 2018; Lee, 2018).

Besides, in 2013, registering Bitcoin ETFs was not successful, but was followed by many more attempts (Yermack, 2013). In a report by the Bank of America Merrill Lynch, it claims the potential of a \$1.6 billion market for cryptocurrency ETFs. Still, there is no approval yet, despite the Bitcoin ETFs receiving support by an increasing number of people with influence (Chaparro, 2017). Additionally, the introduction of Bitcoin futures on the Chicago Stock Exchange in December 2017 expresses traditional investors' acceptance and interest in the cryptocurrency market. According to Holtermann (2018), in the long term these futures can stabilize the Bitcoin course, as they are dealt on regulated exchanges. However, right now he holds them responsible for the 2018 crash, higher volatility and risk in the market, because big investors went short upon the opening of the futures markets. Nevertheless, introducing futures marks the arrival of cryptocurrencies in the classic financial market.

Certainly, the blockchain technology and cryptocurrencies still have a long way to go, as technology always is an iterative process. The great potential as well as the demand for any number of use cases and industries is there, as well as money flowing into research and development. Especially the concepts of the internet of things and optimizations in the supply chain management see their future with the blockchain (Lee & Pilkington, 2017). The timing of distrust in the banking system combined with the internet era and digitalization built both, a solid ground and future perspectives for cryptocurrencies. Of course, dealing with the financial system and currencies is a protracted field, where people and institutions indeed need time to adapt, no matter if the change is from precious metals to paper money or from paper money to digital money (Antonopoulos, 2016).

5. Conclusion

Financial markets among others enable the trade of financial assets and, thus, produce useful information, give the possibility for hedging risks and transfer funds intertemporally (Allen & Gale, 2000). Interested parties are e.g. governments, pension funds, banks, speculators and, of course, investors. Financial assets have different characteristics concerning their liquidity, governance or basis of value, as well as their risk and reward profiles. In other words, they differ in structure, influencing factors and returns, which makes it possible to categorize the assets in classes (Greer, 1997). As the leading question this thesis wanted to evaluate whether the emerging digital cryptocurrencies are a new financial asset class.

An overview of the environment and rapid development of applications and projects using the blockchain technology showed sufficient relevance of the topic and the need for scientific work and analysis, underlined by the amount of money already being traded on cryptocurrency markets.

Presenting numbers concerning market capitalization, daily trading volumes and long-term coin holders on the example of Bitcoin, led to the conclusion of cryptocurrencies being liquid enough to fulfill Greer's (1997) requirement of providing enough liquidity to investors. That liquidity combined with a unique value basis, governance and applications deliver a first indicator for being a possible asset class (Burniske & White, 2017). The comparison with traditional asset classes, like equities, bonds and commodities results in digital coins not fitting in any of those established categories. A very interesting and major finding is that cryptocurrencies are highly uncorrelated both between each other and to other existing asset classes (Burniske & White, 2017; Elendner, et al., 2016; Kurka, 2017). Deductively, investing in a set of cryptocurrencies reduces risk and adding this set to a traditional portfolio, again, has a risk sharing effect. That fact makes cryptocurrencies very interesting for investors due to diversification aspects.

So far, cryptocurrencies do fulfill the requirement for being an asset class and deliver additional benefits to a portfolio, but factors like regulation and accessibility play an important role, too. For governments, it is still not clear how to deal with digital coins, because they are decentralized and some of them, like Bitcoin, do not even have a company or foundation which could be taken responsible for errors or fraudulent behavior. The allegation of being used by criminals for e.g. terrorist financing makes it hard to accept such a technology as an asset class from an ethical point

of view (Engle, 2016). Probably the most important aspect to mention in the context of financial markets is the occurrence of price manipulation.

If a market does fail in its function to allocate resources efficiently, which is exactly what happens through market manipulation, it needs supporting regulation. As the cryptocurrency market is not embraced by existing laws for neither currencies nor securities, it might be reasonable to cooperate internationally by e.g. exchanging useful data and sharing resources (Brill & Keen, 2014; Jabotinsky, 2018). The line between regulations being supportive of development and slowing down or even breaking innovation potential is airy, creating a real challenge for regulators. What needs to be mentioned here, is that any kind of regulation is against the intended decentralized nature of cryptocurrencies.

Nevertheless, the fast rise and emergence of the virtual coin and token environment, based on the pioneer Bitcoin appearing not even 10 years ago, is impressive, especially when considering the fact that Bitcoin never had a fundraising or marketing. It shows a convinced, steadily growing community, a proof of the concept, as well as reasonable use cases in different industries. The timing of introducing the blockchain technology in the age of digitalization, e-commerce and a period of distrust and insecurity in the financial system might have facilitated the concept becoming popular.

To summarize the conclusion and answer the leading question:

“[...]as new technologies emerge, so do new ways of investing.” (Gomez Quintana, 2017, p. 22)

While researching and writing this work I noticed that most of the scientific papers talking about cryptocurrencies and financial markets off the reel, already use the term asset class in a confident and solid way. Even though digital coins are not traded on traditional exchanges together with traditional asset classes, the market capitalization and trading volume is remarkable. In terms of investing I see great potential in digital currencies, because of the possibility to only invest little money and still see appreciable returns. Additionally, the new generation of investors has grown up with digitalization and fast changes, so they feel quite comfortable investing in cryptocurrencies. Amongst others, backed up by the fact that Wall Street and large companies are interested in cryptocurrencies and research that field, I also see them as a new asset class. What I have to criticize about especially the young investors is impatience and the pursuit of quick and high returns as well

as trying to convince the whole world of the blockchain technology revolutionizing the financial system and whole government structures. Internet based companies back then in the late 1990s had to endure a hard time and also conservative opponents did not believe in a transformation of (e-)commerce. More than half of the internet companies did not survive the dotcom bubble. Still, years later social media (e.g. facebook), e-commerce and virtual intermediaries like AirBnb and Uber are everywhere and their stocks traded largely on traditional exchanges (Morris & Pervaiz, 2008). Equivalently, cryptocurrencies and the blockchain technology need to evolve, endure hard times and maybe bursting bubbles to become a commonly used concept on financial markets.

I see the immense volatility on the cryptocurrency market as a healthy process of getting adapted and finding the balance. Of course, it is scaring traditional investors due to high risk. In the context of investing in virtual coins, the advice of only investing what one can afford to lose, appeared numerously. In my opinion this advice has no special value in the cryptocurrency market, because it should be taken seriously in any kind of investment. Still, there is work to do and more time and experience need to pass to let the technology evolve in a steady iterative process. Trying to classify virtual coins with existing laws does not make sense in my opinion, because of the wide range of use cases, methods and objectives. Setting up an overseeing committee and providing information analyzed by a team of experts to the public would be a great enrichment. In that way, investors have a source of information they can rely on, but still make their own decisions in terms of taking risks or not. Evaluating but not controlling the projects would allow free play to innovations and at the same time the possibility to stay updated and intervene upon suspicion of fraud or criminal activity. Because of not being an expert in law, I leave that statement to better judgement and will follow further work in that area.

Conclusively, cryptocurrencies already have their foot in the door of financial asset classes and markets, which is an important ground for their future. Whether they had that intention or not, is disputable. They are of great interest, to young and adventurous investors as well as to traditional ones because of their portfolio diversification potential. I also think that volatility will decrease with more investors participating in the market, but so will, in the long term, the uncorrelatedness and risk sharing effect, due to interconnectedness and investors choosing the market portfolio. But until that happens, cryptocurrencies will already be an established asset class. For further work I suggest to study the perspectives of virtual coins as means of payments or international currency and new ways of insuring and hedging risk via decentralized prediction markets.

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7. Abstract

Controversial opinions and evaluations of the blockchain technology and its cryptocurrencies are currently highly discussed in the media. The complexity of the concept and the wide range of topics attending it, make it hard to judge the potentials and risks.

As newspapers like the New York Times and the Financial Times report about cryptocurrencies regularly and market capitalization as well as trading volumes reached a remarkable number, the leading question whether cryptocurrencies are a new asset class is legitimate.

To answer the question, this work collects prior studies describing the risk and reward profiles of virtual coins, comparing and setting them in relation with traditional asset classes. According to these factors, cryptocurrencies can be seen as a new asset class. To make the picture complete, this work also highlights counter arguments, such as the serious problem of market manipulation and the lack of regulation.

These issues still need to be clarified in the near future, but the blockchain technology and cryptocurrencies will play an essential role in financial markets.

Zusammenfassung

Widersprüchliche Meinungen und Beurteilungen der Blockchain Technologie und ihrer Kryptowährungen werden momentan medial stark diskutiert. Die Komplexität des Konzepts und die weite Bandbreite an Themen die es begleiten, erschweren ein Urteil über sein Potential und seine Risiken.

Da bereits Zeitungen, wie die New York Times oder die Financial Times regelmäßig über Kryptowährungen berichten und sowohl die Marktkapitalisierung als auch das Handelsvolumen eine erwähnenswerte Größe erreicht haben, ist die Leitfrage, ob Kryptowährungen eine neue Anlageklasse bilden, gerechtfertigt.

Um diese Frage zu beantworten, sammelt diese Arbeit vorangegangene Studien, die Eigenschaften beschreiben, die Risiko und Rendite betreffen, und Kryptowährungen mit bereits etablierten Anlageklassen vergleichen und in Beziehung setzen. Gemäß dieser Analyse, können digitale

Währungen durchaus als Anlageklasse betrachtet werden. Um das Bild zu vervollständigen, beleuchtet diese Arbeit auch Gegenargumente, wie das ernstzunehmende Problem von Marktmanipulation und fehlender Regulierung.

Diese Belange müssen in naher Zukunft noch besser geklärt werden, doch die Blockchain Technologie und Kryptowährungen werden eine wesentliche Rolle in Finanzmärkten spielen.

8. Appendix

Here the one year rolling correlation between Bitcoin and traditional asset classes can be seen, with the line representing the low average of -0.03.

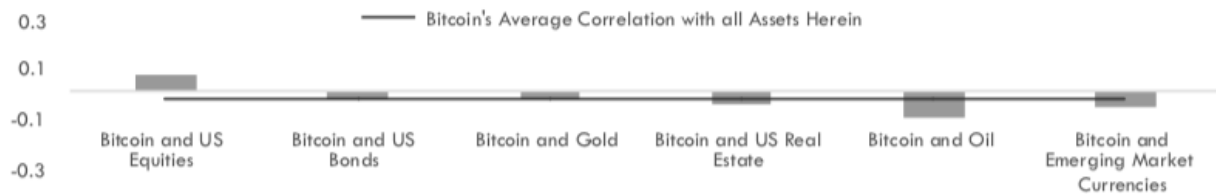


Figure 10 One year rolling correlation between Bitcoin and traditional asset classes from 2011 until 2016. The line represents the average of -0.03. (source: data from Bloomberg & CoinDesk BPI, graph from Burniske & White (2017), p.18)

This graph shows the one year rolling correlation between Bitcoin and Gold. The previously mentioned -0.5 in September 2015 can be seen clearly.

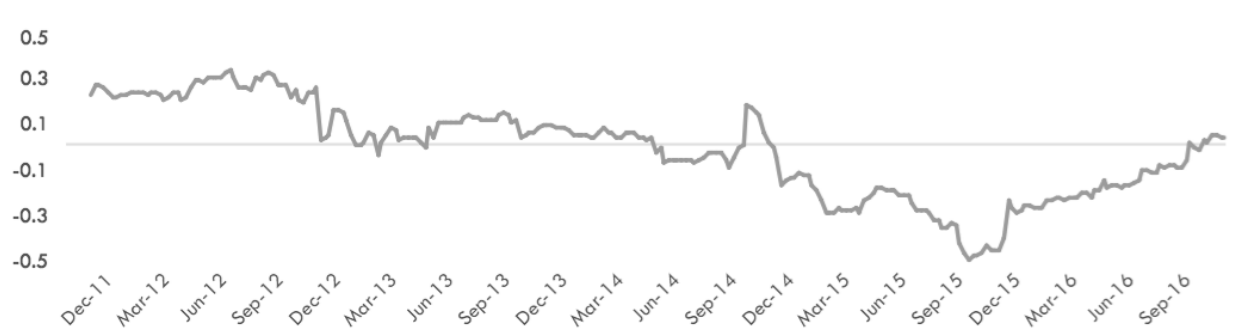


Figure 11 Correlation between Bitcoin and Gold (source: data from Bloomberg & CoinDesk BPI, graph: Burniske & White, 2017, p. 16)

This is an illustration of weekly volatility of Bitcoin and representatives of traditional asset classes. It observes periods starting from the last six years until the last year (from left to right). Previously, this work talks about weekly volatility beginning with the last two years of Bitcoin and Oil being quite close.

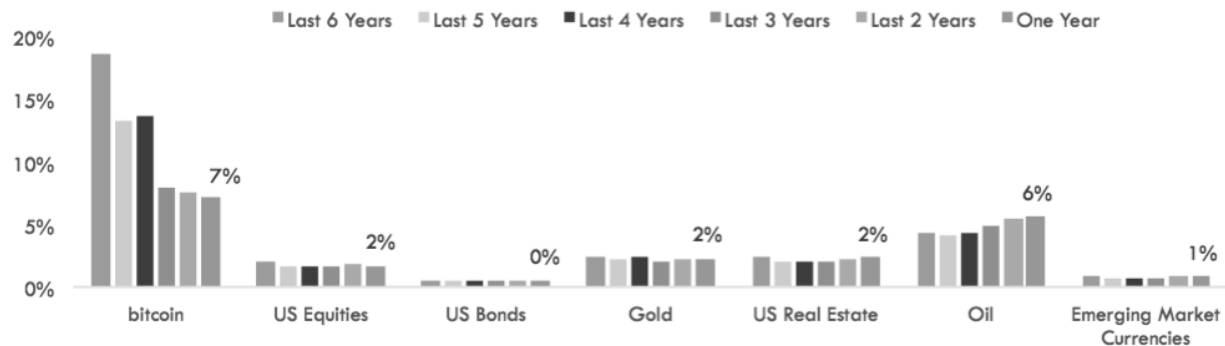


Figure 12 Weekly volatility of Bitcoin and traditional asset classes (source: data from Bloomberg & CoinDesk BPI, table: Burniske & White, 2017, p. 20)

This table shows the correlations between the analyzed cryptocurrencies, where the part of the table above the empty diagonal exhibits correlation coefficients and the lower part the corresponding p-values.

Table 5 Correlations between cryptocurrencies (source: Elendner, et al. (2016), p. 21)

	BTC	ETH	XRP	LTC	DASH	MAID	DOGE	XEM	XMR	BTS
BTC		0.08	0.17	0.58	0.33	0.24	0.43	0.32	0.31	0.27
ETH	0.13		0.03	0.05	0.10	0.29	0.05	-0.01	0.12	0.19
XRP	0.00	0.61		0.12	0.07	0.19	0.13	0.10	-0.02	0.16
LTC	0.00	0.33	0.00		0.20	0.08	0.43	0.23	0.21	0.20
DASH	0.00	0.06	0.03	0.00		0.11	0.17	0.11	0.15	0.11
MAID	0.00	0.00	0.00	0.02	0.00		0.12	0.02	0.14	0.14
DOGE	0.00	0.37	0.00	0.00	0.00	0.00		0.20	0.15	0.28
XEM	0.00	0.82	0.03	0.00	0.02	0.73	0.00		0.04	0.12
XMR	0.00	0.02	0.65	0.00	0.00	0.00	0.00	0.38		0.22
BTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	

Results on whether the low correlation between cryptocurrencies is not conditioned on negative or positive returns are in the table below.

Table 6 Pairwise correlation for days with negative and positive CRIX returns (source: Elendner, et al. (2016), p. 21)

	BTC	ETH	XRP	LTC	DASH	MAID	DOGE	XEM	XMR	BTS
BTC		0.02	0.07	0.31	0.25	0.11	0.30	0.25	0.25	0.11
ETH	-0.08		-0.03	0.03	0.05	0.22	0.02	-0.03	0.17	0.19
XRP	0.16	0.02		0.05	0.07	0.11	0.14	0.09	-0.01	0.16
LTC	0.69	-0.11	0.08		0.12	-0.05	0.23	0.15	0.08	0.13
DASH	0.36	0.09	0.08	0.32		0.05	0.17	0.08	0.17	0.05
MAID	0.28	0.35	0.12	0.13	0.20		0.08	-0.06	0.12	0.11
DOGE	0.40	-0.01	0.05	0.39	0.20	0.09		0.15	0.04	0.23
XEM	0.32	-0.07	0.03	0.27	0.04	0.11	0.16		-0.09	0.08
XMR	0.41	-0.01	0.10	0.29	0.15	0.18	0.18	0.14		0.16
BTS	0.30	0.17	0.10	0.16	0.07	0.10	0.25	0.14	0.22	

The table below shows a detailed allocation, belonging to Figure 8 with the corresponding performance metrics.

Table 7 Portfolio allocation with and without cryptocurrencies(source: Fundstrat Global Advisors, 2018, p. 46)

	Ratio	3-yr Portfolio Performance Metrics			
	Stocks / Bonds / Bitcoin / Crypto 10	Return CAGR	Annualized Volatility	Sharpe Ratio	Maximum Drawdown
Typical	60% / 40% / 0% / 0%	6.47%	7.38%	59%	(7.9%)
Conservative	58% / 40% / 2% / 0%	8.73%	7.32%	91%	(7.2%)
Moderate	55% / 40% / 5% / 0%	12.14%	7.86%	128%	(7.4%)
Bitcoin-plus Crypto 10	50% / 40% / 5% / 5%	19.22%	9.54%	180%	(8.0%)

This graph presents how many people trust their own national governments to do the right thing for their country.

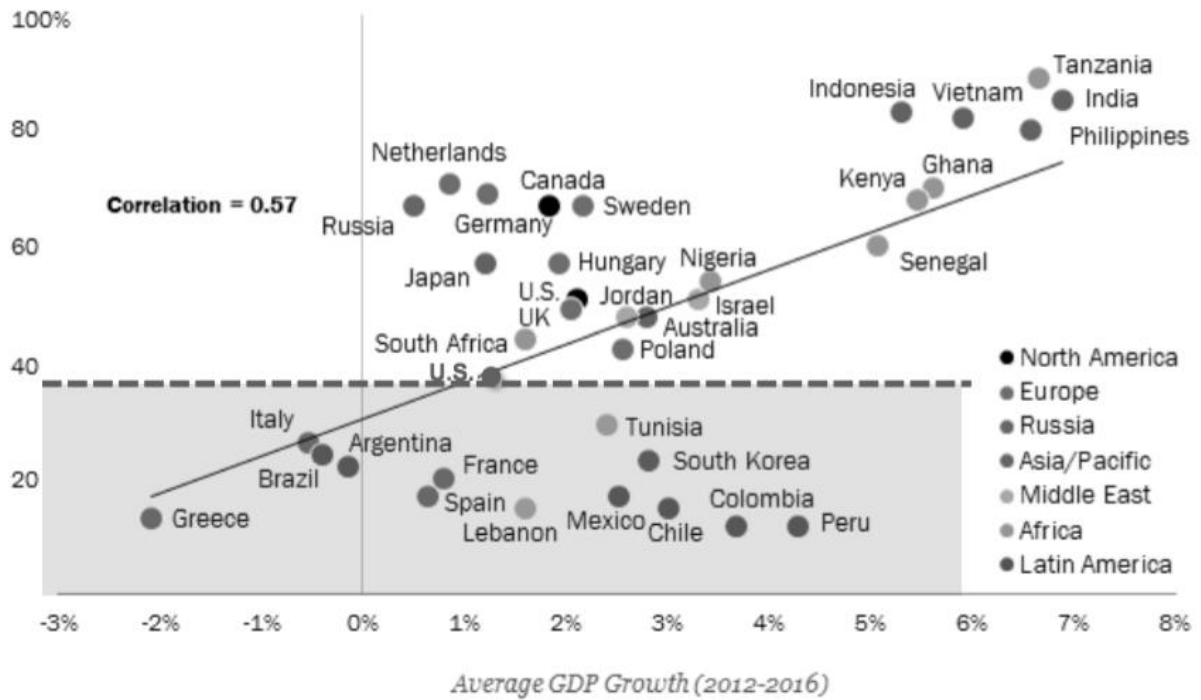


Figure 13 Trust in the national government (source: (Fundstrat Global Advisors (2018), p. 5)