

## Digital Currencies in Economies - Critical Analysis on the Future Role

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### Abstract

Current crises such as the global Corona crisis (Sars-COV-19) can mean that citizens are increasingly looking for secure forms of investment to cope with crises as well as digital payment options to avoid contact with pathogens for payment transactions. One possibility for this can be digital currencies. The origin of digital money lies in the digital, decentralized Bitcoin, which was initially issued in 2008. In addition to Bitcoin, there are over 5,600 other cryptocurrencies as of June 2021. However, the term digital currency is not synonymous with the term cryptocurrency. In addition to cryptocurrencies, stablecoins belong to the group of digital currencies. The digital currencies of the central banks are called Central Bank Digital Currencies or CBDCs. The objective of the given paper is to address the current discussion about the possibility of digital currencies to substitute cash as well as fiat money. In doing so, quantitative analyses are used to assess the Bitcoin, Facebook's Diem and the Swedish E-Krona in a critical manner. The paper states that digital currencies will be likely to play an important role in the future of finance. But the role Bitcoin, Diem and e-krona will play in the future depends on their advantages and disadvantages as well as the regulatory conditions and acceptance. The analysis shows that Bitcoin can be used for speculative investment purposes. The Diem and the CBDC e-krona, on the other hand, have the potential to become recognized means of payment in the future.

**Keywords:** Blockchain, Digital Currencies, Central Bank Digital Currency, Distributed-Ledger-Technology, Payment

## 1. Introduction

### 1.1. Problem Statement and Research Objective

Money in economies is constantly evolving. In the Roman age people paid in kind, i.e., goods of daily use. What followed was a time when precious metals such as gold were used to pay. Nowadays, so-called fiat money or paper money is established (Kellermann, 2013, p.6). In addition to paper money, innovative solutions such as digital forms of money can be observed increasingly. These could not only change the type of money, but also the entire payment system.

The origin of digital money lies in the digital, decentralized Bitcoin, which was initially issued in 2008 (Ali et al., 2014, p.262; Groß et al., 2020, p.712). In particular, cryptocurrencies such as Bitcoin dominate the reporting due to their high volatility (Dörner et al, 2021, p.1; Livni, 2021, p.1; Müller, 2021, p. 1; Szalay & Stafford, 2021, p.1). In addition to Bitcoin, there are over 5,600 other cryptocurrencies, as of June 2021 (Investing.com, 2021, w/o p.). This number has increased significantly: within the last five years, the number of cryptocurrencies has increased by more than 750% (GP Bullhound, 2018, p.30). However, the term digital currency is not synonymous with the term cryptocurrency. In addition to cryptocurrencies, stablecoins belong to the group of digital currencies. While Bitcoin has been on the market for over ten years, the origin of stablecoins is only a few years ago. For example, the best-known stablecoin Diem was only announced by Facebook in 2019 (Groß et al., 2020, p.712). Stablecoins, which are also known as stable-value cryptocurrencies, are characterized by a price mechanism that couples the currency, for example, to existing currencies, gold, or other assets. This hedge is intended to counteract price volatility (Groß et al, 2020, p.714). Compared to the developments in the private sector, i.e., cryptocurrencies and stablecoins, projects in the public sector have also emerged in recent years. The digital currencies of the central banks are called Central Bank Digital Currencies (CBDCs for short). According to the President of the European Central Bank (ECB for short) Christine Lagarde, cash payments are still dominant, but there is a trend towards digital payments. This was accelerated by the Corona crisis. The ECB is currently investigating whether a Digital Euro should be introduced (Lagarde, 2020, w/o p.). On the other hand, there are countries such as Sweden, which are already working on their own digital currency with e-krona (Lindeberg & Ummelas, 2021, p.1).

## 2. Theoretical Foundation of Money

### 2.1. Functions and Characteristics

According to the German Bundesbank, the concept of money is defined by its recognition as a means of payment. The quality (e.g. book money, banknotes, digital money) is insignificant. In contrast to this is the concept of currency. A currency is characterized by the fact that it is the official money issued by state institutions (Deutsche Bundesbank, 2019, w/o p.). For a good or a currency to be recognized as a means of payment in an economy, it must fulfil specific functions of money (Borchert, 2013, p.27; Thiele et al., 2017, p.3).

The first function of money is that it is recognized as a unit of account and thus forms the basis for economic transactions (Mankiw, 2017, p.98). In economic transactions, money is referred to as the so-called “numéraire”, that is, a general unit of reference or yardstick. The function of the computing unit enables prices to be expressed or debts to be recorded (Borchert, 2013, p.29; Mankiw, 2017, p.99).

Furthermore, money has the function of a store of value. Money earned today can be spent later or used to accumulate assets (Borchert, 2013, p.29). Due to inflation and deflation, the store of value function is an imperfect function. There is no guarantee that the value of money will last in the future (Mankiw, 2017, p.98). Should the domestic legal currency be exposed to stronger inflationary tendencies than, for example, foreign currencies, the foreign currency could be used in part. This can lead to a “functional split”, as the store of value function is taken over by another currency, metal, or the like. At the same time, the domestic currency will continue to be used as a medium of exchange (Borchert, 2013, p.29).

## 2.2. Introduction to Digital Currencies

Digital currencies and their underlying technologies are seen as the "next step in the evolution of money" (Maurer et al., 2013, p.273). When it comes to digital currencies, the terms electronic money (in short: e-money) and virtual money are often used arbitrarily interchangeable. Although they are closely related, the terms must be separated from one another. On the other hand, there is the physical money known today: fiat currencies. The term Fiat currency comes from the Latin and stands for "“it will”". In this context, fiat money is described as “money by order”. The fiat money used today is characterized by the fact that it is not tied to any material good but receives its value “by arrangement” from the central banks (Herger, 2016, p.67).

According to the German law on the supervision of payment services (Zahlungsdienstenaufsichtsgesetz; in short: ZAG) § 1 (2), electronic money is referred to as electronically stored monetary value that is issued to the issuer in return for payment of a sum of money and which is generally (of natural and legal persons) recognized. The stored value changes in its amount depending on the purchases and sales of the owner (European Central Bank, 2001, p.82). This means that e-money electronically represents a physical currency and, like fiat money, can be used as desired. In addition, e-money has a value-storing function and excessive fluctuations in value are not to be assumed (Welzel, 2013, p.217). E-money can be divided into two categories: software-based and hardware-based e-money. Software-based e-money means the storage of e-money in an online payment account. In contrast, there is hardware-based e-money, which is tied to a physical card (Europäische Kommission, 2018, p.2). Digital central bank currencies such as the e-krona or a potential e-euro are also e-money. However, it has not (yet) been defined whether these will be set up on a software or hardware basis (Häring, 2017, p.14).

The introduction of e-money has advantages for both issuers and users. Issuers assume an increase in efficiency and quality, a reduction in costs, an expansion of the product range and increased customer loyalty (Hartmann, 2000, p.68). In addition, the issuing e-money institutions have the option of accessing their users’ account information with their consent (limited to 90 days). In this way, the issuers can view data on lifestyle and purchasing habits, available financial framework, party affiliation, religion, etc. and use this data to gain a competitive advantage (Kühn, 2019, p.53). For the user, the greatest advantage is the simplified handling (Hartmann, 2000, p.68).

Virtual currencies are not to be understood as a further development of the traditional fiat money system with euros and US dollars. Virtual currencies are a completely new form of money that is not based on gold or previously existing currencies (Kasprowicz & Rieger, 2000, p.252). Thus, cryptocurrencies should not be seen as the next step in the evolution of money, but as a revolution (Maurer et al., 2013, p. 273). The concept of virtual currencies is

to be equated with the concept of cryptocurrencies. There are currently around 6,600 cryptocurrencies (Groß et al., 2020, p.712). According to market capitalization, the best-known cryptocurrency is by far Bitcoin, as of July 2021 (CoinMarketCap, 2021, w/o p.).

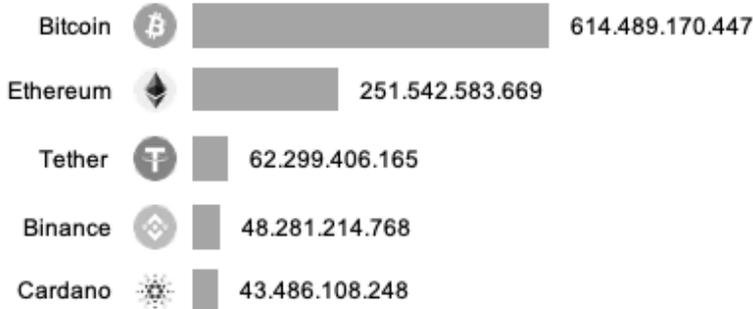


Figure 1: Market capitalization of the largest cryptocurrencies (in US-Dollar)  
Source: Own depiction. Data taken from CoinMarketCap, 2021

### 3. Research Design

#### 3.1. Current State of Academic Debate

Table 1 gives an overview of the main sources for analyzing the advantages and disadvantages of digital currencies. The author (author or the organization), the year of publication of the publication, the title as well as the objective and results of the publication are shown.

Table 1: Literature-Review

	Author, Year	Title	Objectives	Results
Bitcoin	Grigo & Hansen, 2019	Digitalwährungen stehen vor dem Durchbruch	The article discusses the future of Bitcoin and Libra (or Diem) as well as challenges for state monetary policy.	Digital currencies have various advantages and disadvantages. Nevertheless, they will prevail in the end.
	Hanl & Michaelis, 2017	Kryptowährungen – ein Problem für die Geldpolitik?	The analysis relates to the advantages of cryptocurrencies as well as to the conception and implementation of monetary policy.	Cryptocurrencies will be part of the future financial world. Until then, technical specifications need to be clarified and further research is necessary.
Diem	Groß, Herz, & Schiller, 2019	Libra — Concept and Policy Implications	The discussion paper explains the concept of Libra (or Diem), advantages and disadvantages (including market potential) and economic policy implications.	Libra (or Diem) could prevail, especially in developing countries, due to various advantages. Use in industrialized countries is still unclear; many points of the concept still need to be detailed.
	Libra Association	White Paper v2.0	The white paper explains the concept of the Libra (or	The Libra (or Diem) will be technically available

	Author, Year	Title	Objectives	Results
	Members, 2020		Diem) and reacts to points of criticism.	in two different forms. Regulatory risks have already been partially eliminated, but further details are necessary here as well.
e-krona	Groß, Klein, & Sandner, 2020	Central Bank Digital Currencies: Benefits, Risks, and the Role of Blockchain Technology	The paper analyzes the advantages and disadvantages of CBDCs.	The main advantages are increased efficiency, stability, and security. Disadvantages relate to the role of commercial banks and concerns about data protection law.
	Sveriges Riksbank, 2017	The Riksbank's e-krona project	The Swedish Central Bank explains why an e-krona project should be set up.	Numerous reasons, such as the decreasing use of cash, speak in favor of the introduction of the e-krona.

Source: Own research and depiction

In addition, the following literature analysis systematically shows which aspects have been dealt with in the various literature sources. Upper categories were created for comparison.

Table 2: Literature-Analysis

Categories			Grigo & Hansen	Hanl & Michae lis	Groß, Herz, & Schiller	Libra Association Members	Groß, Klein, & Sandner	Sveriges Riksbank
Type	Bitcoin		x	x	x		x	x
	Diem		x		x	x	x	
	CBDC		x	x	x	x	x	x
Benefits	Costs	Yes	x	x	x	x	x	x
		No						
	Speed	Yes	x	x	x	x	x	x
		No						
Access financial system	Yes			x	x			
	No	x	x			x	x	
Stable value	Yes	x	x	x	x		x	
	No					x		
Drawbacks	Data protection	Yes			x	x	x	x
		No	x	x				
	Volatility	Yes	x	x	x	x		x
		No					x	
Power consumption	Yes	x		x	x			
	No		x			x	x	
Illegal activity)	Yes	x				x		
	No		x	x	x	x	x	
Assignment not clear	Monetary policy	Yes	x	x	x	x	x	x
		No						
Role of commercial banks	Yes	x	x	x		x		
	No				x		x	

Categories		Grigo & Hansen	Hanl & Michae lis	Groß, Herz, & Schiller	Libra Association Members	Groß, Klein, & Sandner	Sveriges Riksbank
Acceptance / trust	Yes	x	x	x	x		x
	No					x	
Security	Yes	x	x	x	x		x
	No					x	
Anonymity	Yes	x	x			x	x
	No			x	x		
Technical background	Yes	x	x	x	x	x	x
	No						
Regulation	Yes	x	x	x	x		x
	No					x	

Source: Own research and depiction

The first upper category shows which digital currency types are addressed. The information is no longer limited to one digital currency type but expanded to all currency types mentioned in the respective sources. In addition to the Bitcoin and Diem categories, the CBDC category is chosen as a substitute for e-krona. This is justified by the fact that CBDCs are more often mentioned in publications than e-krona and the advantages and disadvantages of CBDCs can be transferred to e-krona. The next major category concerns the listed advantages followed by the disadvantages. Not all advantages and disadvantages that are explained in the course are covered here. The selection of the sub-categories of advantages and disadvantages is limited to the essential points. The last category "assignment not clear" addresses points that are not clear advantages or disadvantages. Nevertheless, they are of central importance. An example of this is the monetary policy sub-category.

### 3.2. Quantitative Research - Empirical Findings

After the advantages and disadvantages of the individual digital currencies have been determined, three quantitative analyzes are carried out below. The aim of the first analysis is to check to what extent Bitcoin, Diem and e-krona are suitable as alternative investment vehicles for portfolio diversification. The second analysis aims to compare the volatility of different types of investment. The third analysis should show whether the course of the share price shows a positive or negative trend overall.

The data used for the analysis are shown in Table 3. The daily closing price was selected for the analysis. In addition, the analysis was limited to the days of the week Monday to Friday, as only the Bitcoin is traded on the weekend. The last five years were chosen as the period (07/22/2016 to 07/22/2021). There is no data yet for the digital currencies Diem and e-krona, as they are still in a test phase. Correspondingly, the correlation with Bitcoin, Morgan Stanley Capital International (short: MSCI) World, Euro, Standard & Poor's (short: SP) 500, German government bonds, Great Britain Pound (short: GBP), Japanese Yen (short: JPY), Gold, oil, German stock index (short: DAX) and National Association of Securities Dealers Automated Quotations (short: NASDAQ) is tested.

Table 3: Data Sources

Investment option	Refinitiv Short	Refinitiv Long
Bitcoin	BTC=	BITCOIN/US DOLLAR FX SPOT RATE
MSCI World	IWDA.L	iShares Core MSCI World UCITS ETF USD (Acc)
Euro	EUR=	EURO/US DOLLAR FX SPOT RATE
SP500	.SP500	S&P 500 INDEX
Dt. Staatsanleihe	RXRGEX.DE	iShares eb.rexx(R) Government Germany (DE)
GBP	GBP=	UK POUND STERLING/US DOLLAR FX SPOT RATE
JPY	JPY=	US DOLLAR/JAPANESE YEN FX SPOT RATE
Gold	GCc1	COMEX Gold Composite Commodity Future Continuation 1
Öl	CLc1	NYMEX Light Sweet Crude Oil (WTI) Electronic Energy Future Continuation 1
DAX	GDAXI	DEUTSCHE BOERSE DAX INDEX
NASDAQ	.NDX	NASDAQ 100 INDEX
Diem*	n.a.	n.a.
e-krona*	n.a.	n.a.

\*Since Diem and e-krona are still in the test phase, they are not included.

Source: Own depiction. Data taken from Refinitiv, 2021.

The first analysis should check to what extent Bitcoin, Diem and e-krona are suitable as alternative investment vehicles for portfolio diversification. The formula used is the Pearson Correlation Coefficient. The results of the correlation analysis are shown in the following output (Figure 2).

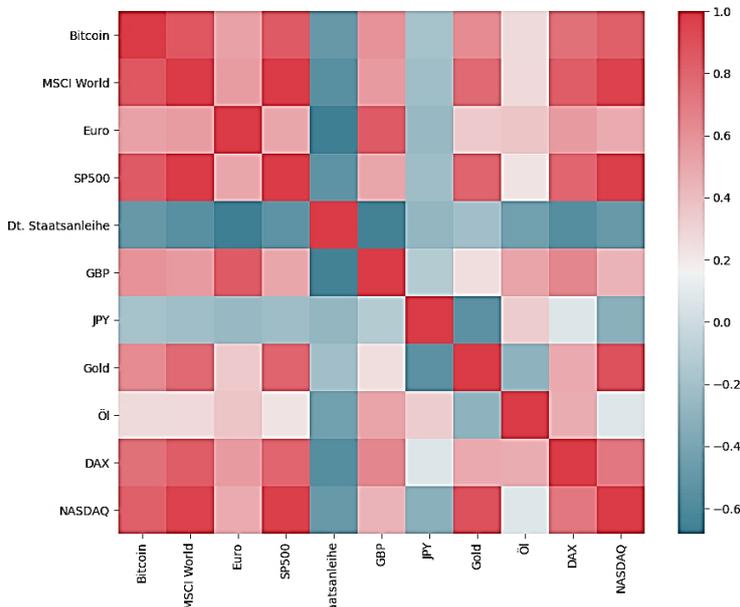


Figure 2: Correlation analysis including March and April 2020

Source: Own depiction. Data taken from Refinitiv, 2021; Calculation with Jupyter Notebook, 2021.

The correlation analysis shows that the Bitcoin is strongly correlated with the price of the MSCI World, SP500, and NASDAQ. A lighter correlation can be seen with the Euro, GBP, gold and the DAX. Bitcoin has a negative correlation with German government bonds. No or very little correlation can be seen with JPY and oil.

Since the Bitcoin correlates with various forms of investment in the analysis, it must be checked whether this is due to the Corona crisis. Figure 3 shows that a slump was recorded in some price developments in March and April 2020. The interruptions during the course, which can be seen in the diagram, are due to public holidays on which no trading took place.

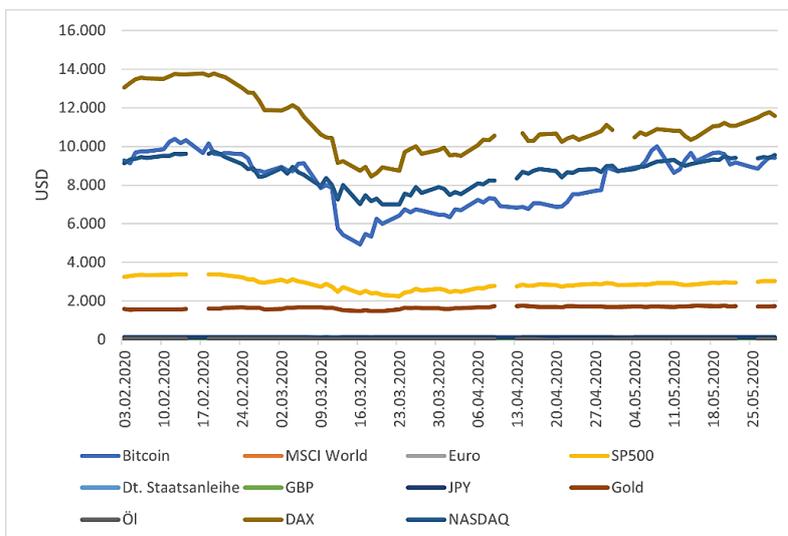


Figure 3: Price slump due to the corona crisis

Source: Own depiction. Data taken from Refinitiv, 2021.

Figure 3 graphically shows that some of the price developments saw a slump in March and April 2020, presumably due to the Corona crisis. The DAX, NASDAQ, Bitcoin and SP500 are affected. Other values such as gold did not develop noticeably during this time. The correlation analysis is therefore carried out again without the out-of-sample (OOS for short) data.

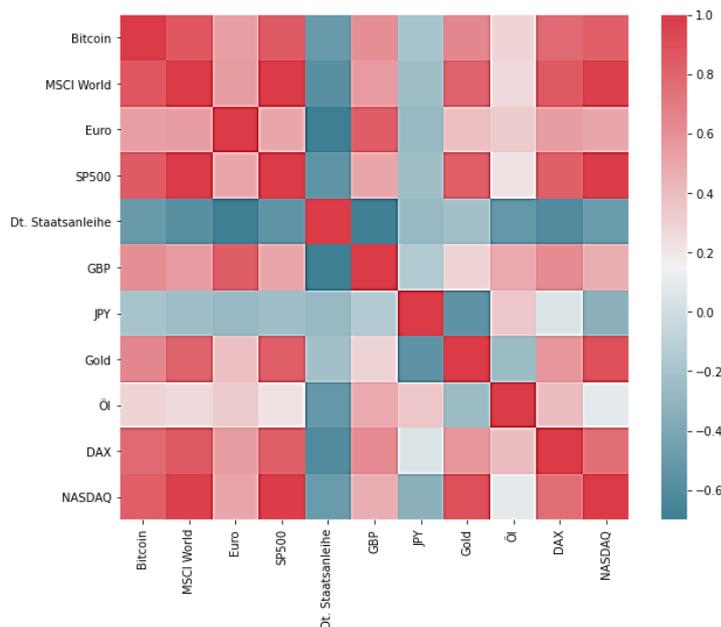


Figure 4: Correlation analysis exclusive of March and April 2020

Source: Own depiction. Data taken from Refinitiv, 2021; Calculation with Jupyter Notebook, 2021.

OOS data is filtered to smooth out outliers in long-term samples. They are also often used for predictions. For this correlation analysis, it makes sense to carry out this without the OOS data, since the prices generally collapsed in March and April and thus the results of the correlation may have been falsified. The period in the following analysis is therefore again the past five years (07/22/2016 to 07/22/2021) excluding the months of March and April 2020. If correlations have occurred due to the Corona crisis, they are smoothed in this calculation.

The correlation analysis carried out gives similar analysis results as before: A strong correlation with the MSCI World, SP500 and NASDAQ; medium strong correlation with Euro, GBP, gold, and DAX; negative correlation with German government bonds and finally a very low correlation with JPY and oil. The results show that a portfolio diversification through the Bitcoin offers itself in relation to German government bonds, since the price of these is opposite to that of the Bitcoin. Furthermore, a portfolio consisting of JPY and oil can be expanded by Bitcoin, as there is no correlation to these types of investments.

In the second analysis, the various investment options are to be examined for their volatility. Previously, it was already described in this work that Bitcoin shows high volatility. This should be checked with the following analysis. The same data is used as in the first analysis. First, a comparison of the volatilities is shown graphically.

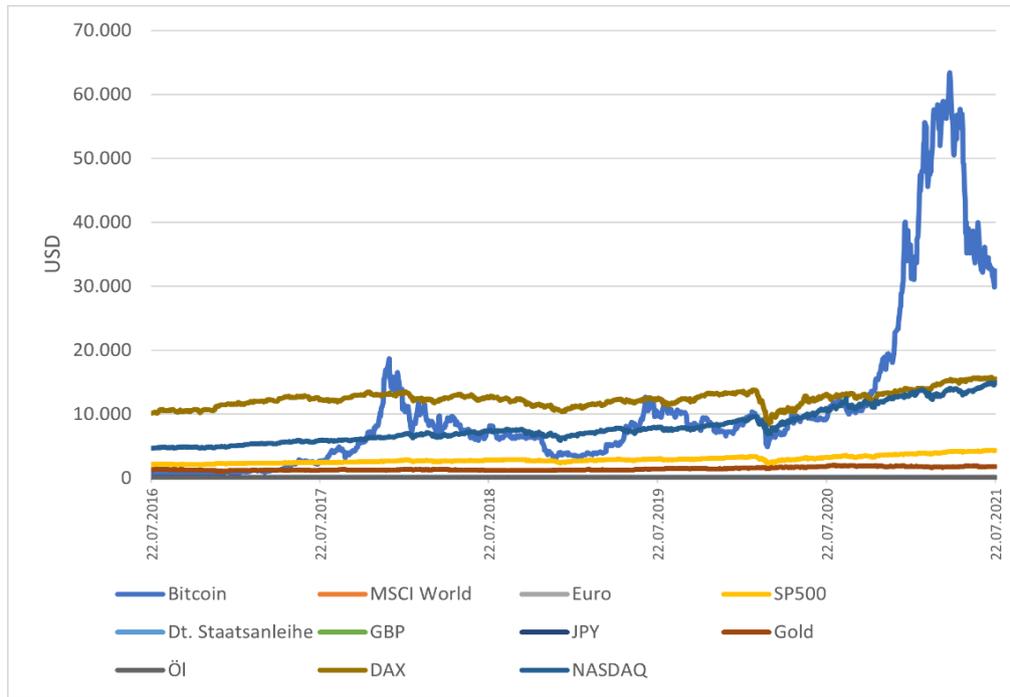


Figure 5: Volatility of various types of investments - graphic analysis  
Source: Own depiction. Data taken from Refinitiv, 2021.

The graph shows that Bitcoin is much more volatile than the other investment options. To verify this, the volatility is checked below using the standard deviation. The analysis was carried out once including and once excluding the OOS months March and April 2020. The results of the analysis are shown in Table 4.

Table 4: Volatility of various types of investments - mathematical analysis

Investment option	Standard deviation including March and April 2020	Standard deviation excluding March and April 2020
Bitcoin	13.024.400.344	13.227.908.664
MSCI World	10.034.990	10.124.719
Euro	0.048354	0.048197
SP500	541.794.419	548.474.872
German government bond	1.587.559	1.602.099
GBP	0.052864	0.051860
JPY	3.274.958	3.305.279
Gold	244.407.620	245.537.610
Oil	11.434.768	9.821.888
DAX	1.247.507.394	1.184.902.985
NASDAQ	2.694.870.481	2.739.704.040

Source: Own depiction. Data taken from Refinitiv, 2021; Calculation with Jupyter Notebook, 2021.

The analysis of the standard deviation shows that Bitcoin has by far the largest standard deviation and thus the highest volatility. This can also be seen in the analysis excluding the months of March and April 2020. The recommendations for action derived from this result are explained in the next chapter.

The third analysis will analyze the trend of the Bitcoin course. To analyze the trend, a trend line, and the simple moving average (SMA for short) are shown graphically on the one hand. The data already described, including March and April 2020, are used as the data basis. Figure 6 shows the trend line of the Bitcoin price.

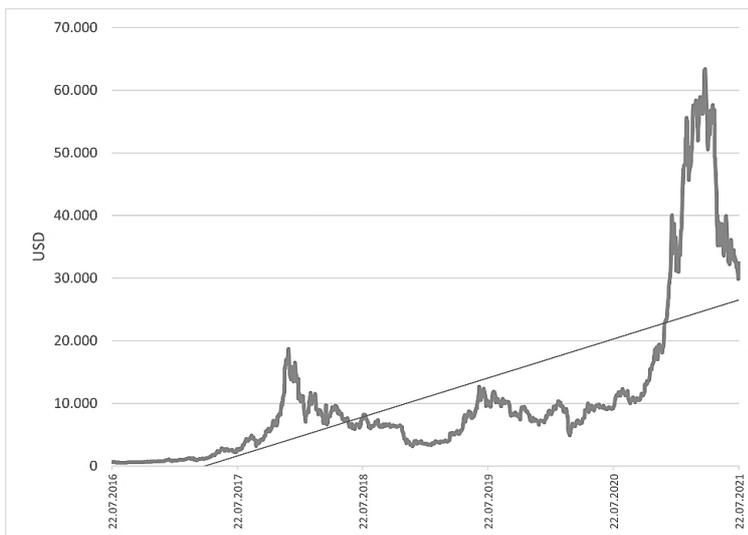


Figure 6: Volatility of various types of investments - graphic analysis  
Source: Own depiction. Data taken from Refinitiv, 2021.

In the previous figure a trend line with a positive slope can be seen. This shows that, despite its volatility, Bitcoin has increased in value overall. The SMA enables price developments to be analyzed with smoothed fluctuations.

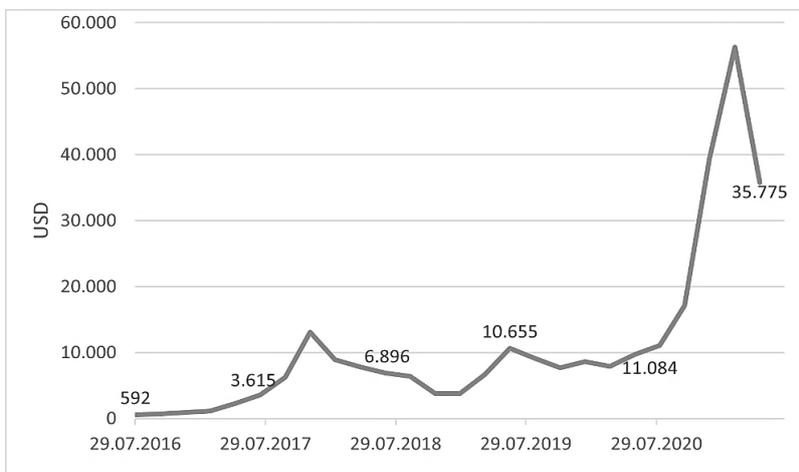


Figure 7: SMA Bitcoin  
Source: Own depiction. Data taken from Refinitiv, 2021.

The SMA with a 50-day interval in Figure 7 also shows significant volatility in the Bitcoin price. Nevertheless, a positive development can also be observed here over the past five years. The analysis of the Trendline and the SMA has shown that Bitcoin has risen tendentially over the course of the year.

### **3.3. Critical Appreciation and Recommendations**

Before recommendations for action are given and the research question is answered, the results are critically assessed. It should be noted that the analysis results are findings that are linked to current circumstances. Due to their technological nature, digital currencies are exposed to dynamic processes so that the results may change in the future (Hagl & Michaelis, 2017, p.363).

Also, regarding the not yet realized currencies e-krona and Diem, it must be pointed out that important technical and organizational details have not yet been finally defined (Groß et al., 2019, p.631). Thus, the assumptions made regarding the influence on monetary policy, for example, have so far only been guesses. How the Diem and e-krona will affect monetary policy and other areas remains to be seen. It is also a research limitation that the quantitative analysis could only be carried out for the Bitcoin. Diem and e-krona have not yet been introduced and therefore no market data is available. It should also be noted that the Corona crisis, despite the OOS calculations without the months of March and April 2020, has an impact on the results and the results are to be viewed critically from this point of view.

Despite the criticism, it can be assumed that Bitcoin, Diem and e-krona will play a relevant role in the future financial world. It cannot be assumed that the three different forms of digital currencies will cover the same fields of application in the future. What the fields of application could look like is determined below based on recommendations for action for each of the three digital currencies.

Due to the high volatility and other risks described above, the Bitcoin will probably not be able to establish itself as a means of payment in the short to medium-term future and thus not be able to replace cash. The use of Bitcoin as a means of portfolio diversification also turned out to be limited in the correlation analysis. Nevertheless, Bitcoin has various advantages. As the first digital currency, it is considered a pioneer and technical role model for the subsequent digital currencies and has a good reputation within the crypto community. The general public's interest in Bitcoin is high, which is evident from various reports. When looking at the course of the Bitcoin price, not only the volatility, but also a positive trend that becomes apparent. Thus, it can be said that Bitcoin is suitable for investors who are willing to take a high risk for potential high returns. Due to the positive trend, a long-term investment seems valid. In any case, it is a speculative investment, which is why only a small proportion of the assets should be invested.

The Diem, on the other hand, covers other fields of application. It is potentially conceivable that the Diem will be used as a means of payment, a unit of account and as a store of value. Currently, the concept does not necessarily envisage the Diem as a store of value, it should tend to be used for payment purposes. Whether it can assert itself as a means of payment and a unit of account depends largely on its acceptance. Should the Diem be accepted worldwide, it could cover these fields of application. Currently, the Diem is still heavily criticized. The Diem Association has resolved not to issue the Diem until all questions have been clarified and the risks and criticisms have been covered. If the Diem Association succeeds in this, the question of acceptance by the Diem Association itself remains. Trust in Fiat currencies is

based not least on the established central banks. Although Facebook is not a partner of the Diem Association, the company remains inextricably linked to the Diem in the minds of many. It is still unclear whether the name change from Libra to Diem could help here. In general, interest in Diem has tended to decline over time. The Diem Association probably still has a long way to go to be able to introduce the Diem with the desired success and thus a replacement of cash by the Diem is not foreseeable soon.

Finally, the e-krona is assessed as an example for a CBDC. With e-krona, Sweden has set up a project that is unique in Europe due to the pre-conditions. The Swedes only use cash to a small extent, which means that it is likely that the e-krona will be widely accepted. The acceptance and the resulting trust are the most important point on the way to a successful digital currency. If the Swedish Riksbank succeeds in finally resolving the regulatory issues that are still open, there is probably not much in the way of e-krona and it can be assumed that it will prevail as a means of payment. Since the e-krona is equated with the Krone, it will probably also be able to establish itself as a unit of account. Whether the Swedes have enough trust to keep their assets in e-krona remains to be seen, but according to the previous analysis, it seems not unlikely. Thus, the e-krona can presumably correspond to the three central money functions and possibly also replace the cash. However, since regulatory issues still must be clarified, such a development will not take place soon.

#### **4. Conclusion and Outlook**

This work has shown that digital currencies will be a part of the financial world of the future. The role Bitcoin, Diem and e-krona will play in the future depends on their advantages and disadvantages as well as the regulatory conditions and acceptance. The analysis has shown that Bitcoin can be used mainly for speculative investment purposes. The Diem and the CBDC e-krona, on the other hand, have the potential to become recognized means of payment in the future. The chances for e-krona are to be assessed more positively due to the prerequisites. The Swedish Riksbank is an established organisation, and the Swedish population is a digital-savvy buyer. In contrast, the Diem has met with a lot of criticism in the past and it remains to be seen whether it will be ready for the market and how its acceptance will then be. Thus, the research question of whether digital currencies will replace cash soon has been refuted. This was justified by arguments such as the high volatility of Bitcoin, lack of acceptance of the Diem and questions still to be clarified about the specific design of the e-krona.

Various research is possible to further grasp the subject area. About digital means of payment in general, it could be analyzed to what extent the corona crisis or other crises such as environmental disasters affect the use of digital means of payment and the need for secure investment options. Another possible research activity could relate to the role of banks in tomorrow's financial world, especially considering a scenario in which transactions are exclusively peer-to-peer ("P2P"). In addition to this extreme scenario, an analysis of the possible coexistence of digital and traditional currencies would also be interesting to evaluate how monetary policy and the economy would change. Possible regulatory arrangements could also be researched at this point. If the Diem and the e-krona are ready for the market, an analysis of the market figures in comparison to Bitcoin and traditional currencies and forms of investment would be valuable and could represent a link to previous research in further research. The analysis could be based on quantitative research and fully test the correlation and volatility. Regarding e-krona as probably one of the first CBDCs to be issued, an analysis

of the first mover advantages and a later comparison with other CBDCs is possible. So far, the Krona has played a rather subordinate role in the global economy - could this change because of the e-krona and could it replace the US dollar as the key currency?

## Bibliography

- Ali, R., Barrdear, J., Clews, R., & Southgate, J. (2014). Innovations in Payment Technologies and the Emergence of Digital Currencies. *Bank of England Quarterly Bulletin 2014 Q3*.
- Borchert, M. (2013). *Geld und Kredit: Einführung in die Geldtheorie und Geldpolitik* (8. Auflage). München: Oldenbourg Wissenschaftsverlag.
- CoinMarketCap. (2021). Today's Cryptocurrency Prices by Market Cap. Abgerufen von <https://coinmarketcap.com/1/> [Zugriff 2021-07-08]
- Deutsche Bundesbank. (2019). Was ist Geld? Abgerufen von <https://www.bundesbank.de/de/service/schule-und-bildung/erklaerfilme/was-ist-geld--800972> [Zugriff 2021-07-30]
- Dörner, A., Mallien, J., Müller, M., Neuhaus, A., & Rezmer, A. (2021). Erst Bitcoin-Einbruch, dann Dogecoin-Boom: Wie Elon Musk die Krypto-Kurse bewegt. *Handelsblatt*.
- Europäische Kommission. (2018). *Bericht der Kommission an das europäische Parlament und den Rat über die Umsetzung und die Auswirkungen der Richtlinie 2009/110/EG und insbesondere über die Anwendung der aufsichtsrechtlichen Anforderungen an E-Geld Institute*.
- Europäische Zentralbank. (2001). Elektronisches Geld als Zahlungsmittel. *E-Commerce und E-Payment*, 83–101.
- eurostat. (o. J.). Glossary: In-sample vs. out-of-sample forecasts. Abgerufen von [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:In-sample\\_vs.\\_out-of-sample\\_forecasts](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:In-sample_vs._out-of-sample_forecasts) [Zugriff 2021-07-30]
- GP. Bullhound. (2018). *Token Frenzy*.
- Grigo, J., & Hansen, P. (2019). Digitalwährungen stehen vor dem Durchbruch. *ifo Schnelldienst*, 72(17), 6–8.
- Groß, J., Herz, B., & Schiller, J. (2019). Libra — Concept and Policy Implications. *Wirtschaftsdienst*, 99(9), 625–631.
- Groß, J., Herz, B., & Schiller, J. (2020). Bitcoin, Libra und digitale Zentralbankwährungen — ein Geldsystem der Zukunft? *Wirtschaftsdienst*, 100(9), 712–717.
- Groß, J., Klein, M., & Sandner, P. (2020). Central Bank Digital Currencies: Benefits, Risks and the Role of Blockchain Technology. *Wirtschaftsdienst*, 100(7), 545–549.
- Groß, J., & Seeser, S. (2020). *Wie funktioniert Bitcoin?*
- Hanl, A., & Michaelis, J. (2017). Kryptowährungen - ein Problem für die Geldpolitik? *Wirtschaftsdienst*, 97(5), 363.
- Häring, N. (2017). E-Geld statt Cash. *Handelsblatt*, Nr. 209, 14.
- Hartmann, M. E. (2000). E-Geld als Zahlungsmittelinnovation: Mosaiksplitter oder Meilenstein? *Elektronisches Geld und Geldpolitik*, 67–134.
- Herger, N. (2016). *Wie funktionieren Zentralbanken? : Geld- und Währungs-politik verstehen*. Wiesbaden: Springer Gabler.
- investing.com. (2021). All Cryptocurrencies. Abgerufen von <https://www.investing.com/crypto/currencies> [Zugriff 2021-07-30]
- Kasprowicz, D., & Rieger, S. (2020). *Handbuch Virtualität*. Wiesbaden: Springer VS.
- Kellermann, P. (2013). Kurze Geschichte des Geldes (Gold und Geld). In *Soziologie des*

- Geldes : Grundlegende und zeithistorische Einsichten* (S. 3–6). Wiesbaden: Springer Fachmedien Wiesbaden.
- Kühn, I. (2019). Der direkte Weg. *Der Handel*, (7–8), 52–53.
- Lagarde, C. (2020). *Payments in a digital world*.
- Lauren, S., & Harlili, S. D. (2014). Stock trend prediction using simple moving average supported by news classification. *2014 International Conference of Advanced Informatics: Concept, Theory and Application (ICAICTA)*, 135–139.
- Libra Association Members. (2020). *White Paper v2.0*.
- Lindeberg, R., & Ummelas, O. (2021). Swedish Central Bank Reveals First Study of Digital Currency. *Bloomberg*.
- Livni, E. (2021). Cryptocurrency prices stabilize after another wild weekend. *The New York Times*.
- Mankiw, N. G. (2017). *Makroökonomik*. Stuttgart: Schäffer Poeschel.
- Maurer, B., Nelms, T., & Swartz, L. (2013). “When perhaps the real problem is money itself!?”: the practical materiality of Bitcoin. *Social Semiotics*, 23(2), 261–277.
- Müller, M. (2021). Elon Musk verhilft Kryptowährung Dogecoin zu Kurs-gewinnen. *Handelsblatt*.
- Peren, F. W. (2020). *Formelsammlung Wirtschaftsstatistik: Wissen kompakt für Studierende und Praktiker*.
- Praekhaow, P. (2010). Determination of trading points using the moving average methods. *International Conference for a Substation Greater Mekong Sub-Region, GMSTEC*.
- Sveriges Riksbank. (2017). *The Riksbank’s e-krona project*. (Report 1).
- Szalay, E., & Stafford, P. (2021). Bitcoin flash crash amplified by leverage and ‘systemic issues’. *Financial Times*.
- Thiele, C.-L., Diehl, M., Mayer, T., Elsner, D., Pecksen, G., Brühl, V., & Michaelis, J. (2017). Kryptowährung Bitcoin: Währungswettbewerb oder Spekulationsobjekt: Welche Konsequenzen sind für das aktuelle Geldsystem zu erwarten? *ifo Schnelldienst*, (22), 3–20.
- Welzel, P. (2013). Elektronisches Geld: Herausforderung für die Wirtschafts-politik? *Transatlantik: Transfer von Politik, Wirtschaft und Kultur*, 215.