Entrepreneurship and Management 2018
University of Social Sciences Publishing House | ISSN 2543-8190

Volume XIX | Issue 1 | Part 1 | pp. **229–243**

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The Comparison of the Crypto- and Fiat Currencies' Exchange Rate Volatility in The Years 2015–2017

Abstract: The article describes the issues related to exchange rate volatility of crypto- and fiat currencies. The first part presents the issue of exchange rate volatility as well as methods of its evaluation and criteria of the conducted research. In the next part the author presented the essence of currencies and the main currency i.e. fiat money in the global economy in terms of the volume of transactions on the FOREX market. Then the main idea of crypto currency was presented – together with its advantages as well as disadvantages and main currencies in the economic cycle in terms of their market capitalization. Next, the results of research on exchange rate volatility in the time horizons were presented: 1-day, 1-week, 1-month and 1-year. The exchange rate fluctuations of EUR, JPY, GBP and BTC, ETH, XRP cryptocurrencies against the US dollar were analyzed. The article was concluded with a summary, which shows that cryptocurrencies are characterized by significantly greater exchange rate volatility against the so-called traditional currencies.
Key words: fiat curriencies, cryptocurriences, exchange rate volatility

Introduction

In 1999 M. Friedman said: "The one thing that's missing, but that will soon be developed, is a reliable e-cash, a method whereby on the internet you can transfer funds from A to B, without A knowing B or B knowing A" [Friedman 1999]. In 2009, which is just a few years later, Bitcoin was created and is described as the first cryptocurrency creating the opportunities mentioned by Friedman. Since then, a dynamic growth in popularity was noted. Market value and importance of cryptocurrencies, currently of circulation in excess of 1,550, and their total capitalization on December 31, 2017 amounted to USD 573 billion [coinmarketcap.com].

The function of cryptocurrencies is based on blockchain technology, which is a distributed network and was firstly introduced with Bitcoin to solve the double-spending problem. As a result of the bitcoins append validated, mutually agreed-upon transactions started to be provided [Christidis, Devetsiokiotis 2016, pp. 2292–2303].

Supporters of cryptocurrency claim that they will replace the currently used fiat money, which the world's leading currencies are considered to be. This idea is justified by the advantages of this technological solution. However, cryptocurrencies also seem to note several defects that might have a significant impact on reducing their use as a means of payment. One of the most important is the high volatility of their rates in relation to traditional currencies. The research goal of this article is to compare and assess the volatility of main crypto- and fiat curriencies in 2015–2017. The hypothesis was defined as follows: Cryptocurrencies show significantly higher exchange rate volatility than fiat currencies. The research methods used are literature analysis as well as assessment and comparison of the level of exchange rate indicator for particular currencies obtained on the basis of historical exchange rates in 2015–2017.

Exchange rate volatility and the method of its evaluation as well as the criteria of the conducted study

Volatility refers to the amount of uncertainty, risk and fluctuations that occur on the market and, as the most important to the quantity and scale of price changes in a given period on the financial markets. It is measured as the quotient of the variability of a given trait – the standard deviation and the average value of this trait. Most often expressed in percentage.

In terms of evaluating the exchange rate volatility, a situation is assumed provided that the value of the indicator below 5% means a low level of volatility. The level of 5-10% means the average volatility, while the values above 10% testify to the real volatility of a particular currency [Michalczyk 2014, p. 353].

The present study assessed exchange rate variability on a period of 1-day, 1-week, 1-month and 1-year based on daily close prices. The exchange rate fluctuations of EUR, JPY, GBP and the cryptocurrencies BTC, ETH, XRP against the US dollar, considered as the most important currency in the global financial system, were analysed in the following paper. The study period included 3 years: from January 1, 2015 to December 31, 2017 (with the exception of the Ethereum currency, which was established in August 2015). This period was chosen for the reason of a dynamic increase in the popularity of cryptocurrencies during this time. The obtained results are presented in diagrams. In order to show the scale of differences in volatility, in relation to the graphs depicting the

variability of cryptocurrencies, the author decided to include charts representing volatility for fiat currencies on the same scale, although it reduced their readability.

Fiat currency – the essence and main currencies

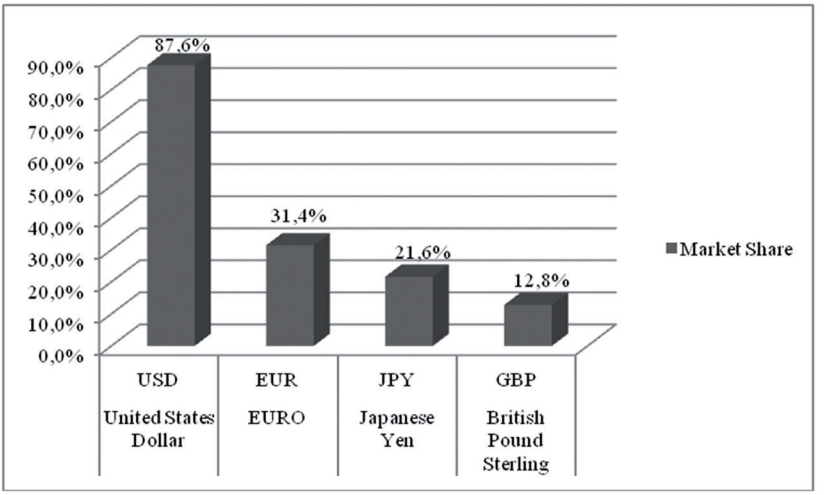
Fiat money is a currency without support based on material goods (such as ore), the value of which usually comes from a legally-designated monopoly in using it in a particular area as a legal tender and generated on demand by state institutions, mainly through tax collection. The value of fiat money is based on trust in the issuer.

In modern economic systems, fiat money is issued by central banks as part of their monetary policy. The main instrument regulating the amount of money in circulation based on the interest rate granted by central banks, established from time to time. The purpose of such changes is usually based on the statutes of these banks to maintain the economic situation and stability of the economy [https://www.nbportal.pl].

Throughout history, paper money and banknotes had traditionally been described as a promise to the sides of the transaction. After the post-World War II Bretton Woods system, the U.S. dollar has been served as an international reserve currency, on the value of $35 for an ounce. In August 1971, Richard M. Nixon (United States President) provided an announcement that he would "suspend temporarily the dollar into gold" or other reserve assets. In fact, however it was the actual end of the Bretton Woods system and the last vestiges of the gold standard. Within two following years, a major currencies bridge "floated", rising and falling in value [www.britannica.com].

Currently, fiat currencies are considered as so-called traditional. The largest in terms of turnover on the exchange market (FOREX) are represented by United States Dollar (USD), EURO (EUR), Japanese Yen (JPY) and British Pound Sterling (GBP). For the base currency – a point of reference – was USD. The remaining three currencies were examined for the volatility of their exchange rates. Chart 1 presents the share of particular currencies in the Forex market. The US dollar is the leader – as much as 87.6% of the volume of all transactions related to currency pairs, was in USD.

Chart 1. Most Traded Currencies in 2017



Source: own elaboration based on: https://thedailyfx.com/.

Cryptocurrencies: advantages, disadvantages and main cryptocurrencies

Cryptocurrencies are defined in law and have legal defintion as "convertible digital currencies" (according to the US Financial Crimes Enforcement Network directive issued in 2013) or as a "digital equivalent of cash" (according to the European legislation EC/2009/110 on electronic money). Such description applies to the cryptocurrencies that are directly convertible to official currencies based on digital marketplaces and exchange sites. [Papadopoulos 2015, ss. 153–171].

The vast majority of cryptocurriences as a payment system does not need any centralized authority to confirm or deny specific transactions. Individuals and entities which do not trust one another or any single central authority can finalize the transaction on the permission relying on a consensus mechanism to ensure the ledger's accuracy. This avoids the necessity for users to possess their own database that they periodically reconcile against those of their counterparties. Instead, all transactions are recorded on a single database. Every user have a copy of the database, thus there is no possibility of failure as exists with traditional relational databases. Once they are included to the blockchain transactions cannot be done again, providing the ledger an immutable record of all previous transactions [Lewis, McPartland, Ranjan 2017, ss. 6–7]. Moreover, e-commerce involving cross-border transactions benefits from cryptocurriences are not related to any specific countries. Virtual currencies also enable entities with no access to traditional

payment mechanism (credit cards or banking services) to participate in e-commerce. In fact, it is even feasible to transfer a payment without revealing one's personality, similarly like in case of physical money [Jagg, Bach 2015, ss. 139–151].

The most immediate effect virtual currencies like Bitcoin could exert on e-commerce is related to their property of payment irreversibility. Transactions in virtual currencies cannot be undone, but only refunded by the receiving party. Moreover virtual currencies are capable of providing such advantages form traditional trading to e-commerce and to find the solution to the problem of payment reversibility of card payments faced by online merchants. Payment irreversibility of virtual currencies transfers risk from merchants to the final consumers, since they may not receive the purchased goods. Nevertheless, the extent of this risk is lessened by a reputation incentive for online merchants (and involved posts) to correctly dispatch and deliver, respectively. In fact, in comparision to consumers, merchants possess a much stronger reason to maintain a reputation of trust [Jagg, Bach 2015, ss. 139–151].

Another type of risk is the highly volatile exchange rate of cryptocurriencies in comparison to traditional currencies. In order to recognize cryptocurrencies as full-fledged money, they should provide the opportunity to be used as so called means of payment. However, the high volatility of their exchange rate causes it difficult to be used as official, legal means of payment. As a result the following question should be pointed - do cryptocurrency have much greater volatility than fiat currencies? The comparison is presented in the third part of this study.

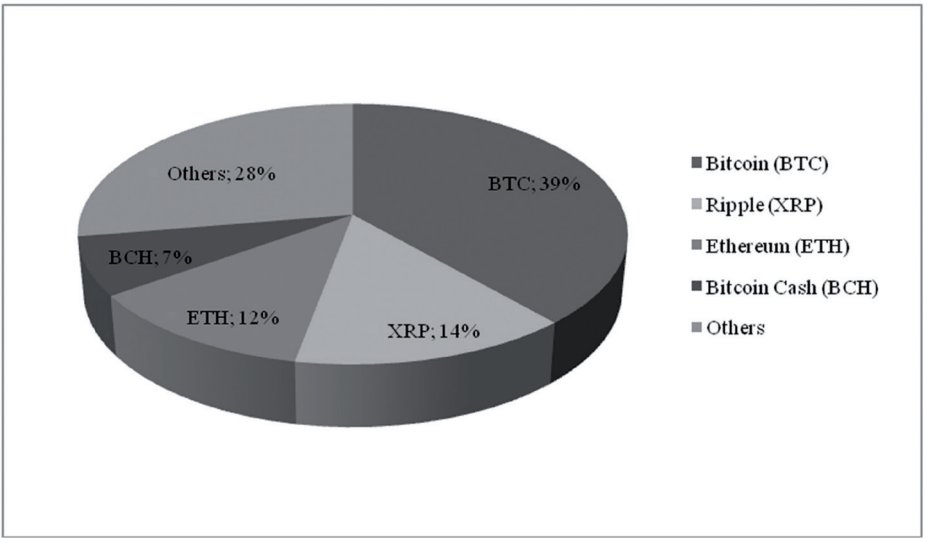
Three cryptocurrencies with the largest market capitalization as at December 31, 2017 were selected for comparison. Their capitalization in USD as well as the market share are presented in Table 1 and Chart 2.

Table 1. Share of individual cryptocurrencies in the market by capitalization as at 31/12/2017

No	Cryptocurrency	Code	Market Capitalization (USD)	Market Share
1	Bitcoin (BTC)	BTC	220 903 949 498	39%
2	Ripple (XRP)	XRP	82 199 880 481	14%
3	Ethereum (ETH)	ETH	69 767 510 695	12%
4	Bitcoin Cash (BCH)	BCH	41 526 715 510	7%
5	Others	-	158 475 124 904	28%
	Market	-	572 873 181 088	100%

Source: own elaboration based on data from coinmarketcap.com.

Chart 2. Share of individual cryptocurrencies in the market by capitalization as at 31/12/2017



Source: own elaboration based on data from coinmarketcap.com.

Bitcoin is the first decentralized digital currency, which can be described as proceeding without a central bank or single administrator. The network is described as the peer-to-peer and transactions are done directly, without an intermediary. Such transactions are checked by network through the system of cryptography and recorded in a public distributed ledger called a blockchain. Bitcoin was invented by an unknown individual or group of people under the name Satoshi Nakamoto with release of as open -source software in 2009. Bitcoins are created in a process known as mining. They can be exchanged for other currencies, products, and services [Brito, Castillo 2013, pp. 1–7].

Ripple is a real-time gross settlement system (RTGS), currency exchange and remittance network created by the Ripple company. The Ripple Transaction Protocol (RTXP) or Ripple protocol, is described as a distributed open source internet protocol – ledger and national cryptocurrency abbreviated to XRP (ripples) [Carson 2014]. Ripple released in 2012 was provided to enable "secure, instantly and nearly free global financial transactions of any size with no chargebacks" [Bradbury 2014]. The main idea is to support tokens representing fiat currency, cryptocurrency, commodity or any other unit of value such as frequent flier miles or mobile minutes. At its core of system, Ripple is based on a shared and public network or ledger, which uses a consensus process that allows for payments, exchanges and remittance in a distributed process.

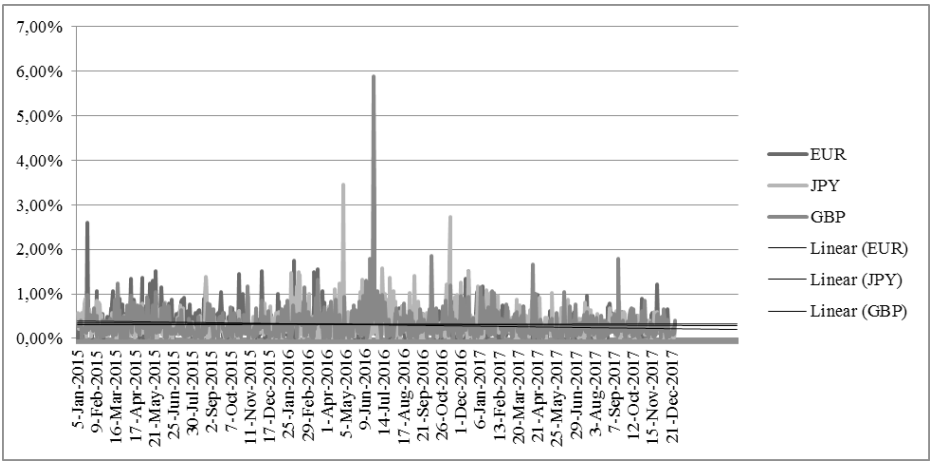
Introduced in 2015, Ethereum is a decentralized software mechanism that provided Smart Contracts and Distributed Applications to be done and run without any downtime, fraud, control or interference from any third party. Ethereum should not only be treated as a platform but also a programming language based on a blockchain technology. It helps developers to build and publish distributed applications. The potential applications of Ethereum are widely usable. According to Ethereum, it can be used to "codify, decentralize, secure and trade just about anything" [investopedia.com].

Comparison of exchange rate volatility

1-day volatility

Firstly, the 1-day volatility will be analyzed. In the case of currencies, the fiat was characterized by a low level, which is shown in Chart 3. The highest increase in 1-day volatility concerns GBP in June 2016, which is related to the Brexit referendum. It amounted to around 6% then. The volatility of currency exchange rates usually fluctuated in the range of 0-1%, which is confirmed by the trend lines.

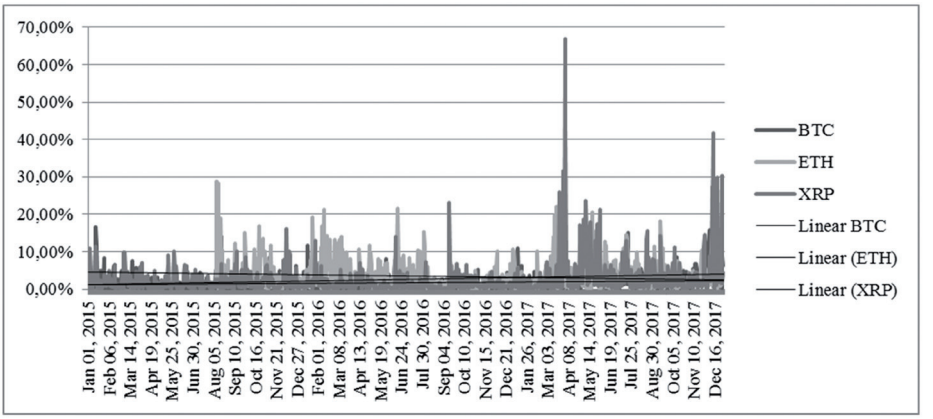
Chart 3. 1-day volatility of EUR, JPY and GBP exchange rates in 2015–2017



Source: own elaboration based on data from nbp.pl.

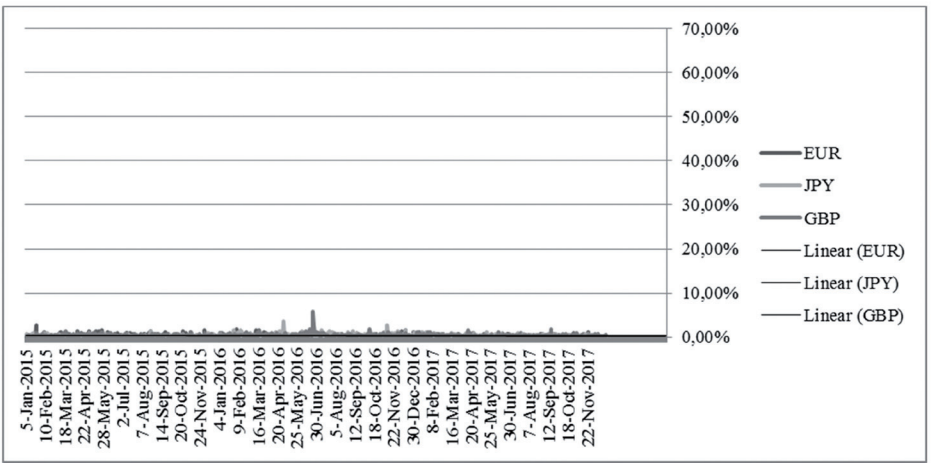
The 1-day volatility of the cryptocurrency differs significantly – chart 4 and 5 have been scaled in a standardized manner. The variability of 1-day cryptocurrencies often exceeds 10%, which means high volatility. In turn, trend lines are aiming for 5%, which means that the volatility on the average level persists for the majority of the analyzed period.

Chart 4. 1-day volatility of BTC, ETH i XRP exchange rates in 2015–2017



Source: own elaboration based on data from coinmarketcap.com.

Chart 5. 1-day volatility of EUR, JPY and GBP exchange rates in 2015–2017 – the scale is similar as on Chart 4



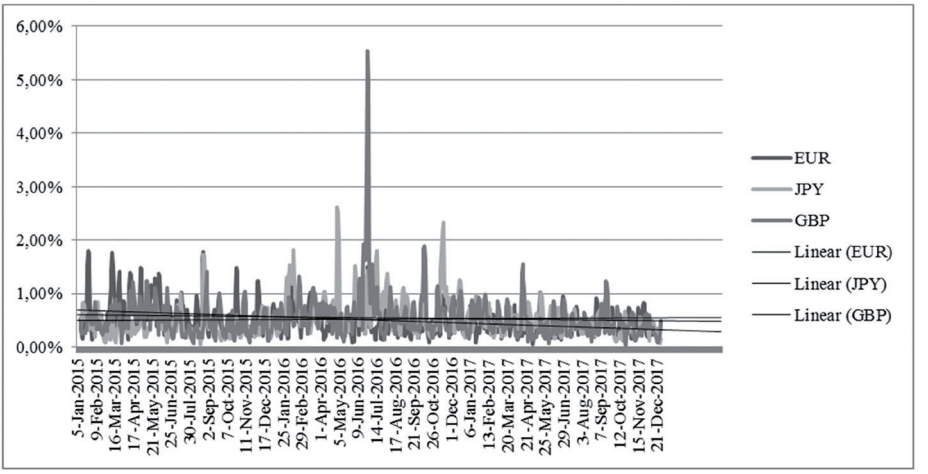
Source: own elaboration based on data from nbp.pl.

1-week volatility

The volatility of the rates in the weekly period is presented in Chart 6. In comparison to the 1-day, slightly higher levels of volatility can be observed, which should be considered as standard situation as the studied period has been extended. However, traditional currencies are still characterized by low volatility its values are usually in

the range of 0-1%. Definitely less often weekly variability reaches the value in the 1–2%. In turn, exceeding the level of 2% occurred only a few times, and this was most often the result of high uncertainty caused by significant events for the economy, such as the referendum on Brexit.

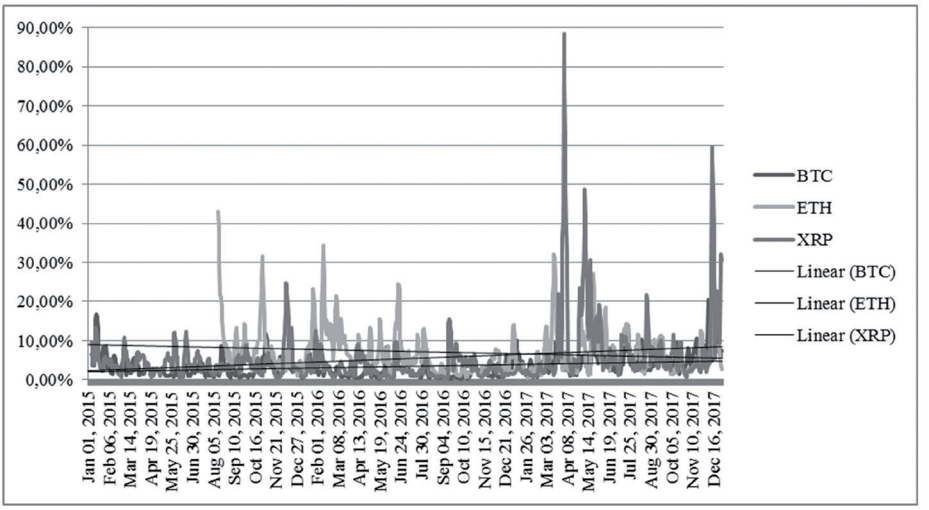
Chart 6. 1-week volatility of EUR, JPY and GBP exchange rates in 2015–2017



Source: own elaboration based on data from nbp.pl.

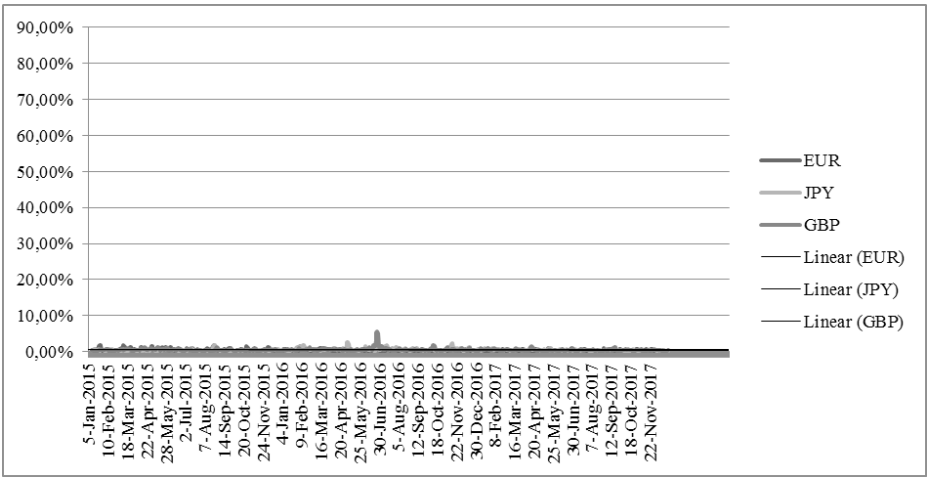
In the case of weekly volatility of cryptocurrency rates, as of traditional currencies, a slight increase in the level of volatility could be noted (Chart 7). Ethereum currency was characterized by the highest volatility, especially in the first year of the market debut, i.e. August 2015 – August 2016. In addition, there are several changes in the Ripple course, which resulted from information appearing on the market, which were considered by investors to be significant for the further fate of this cryptocurrency. Against the background of the other two cryptocurrencies, Bitcoin recorded the smallest volatility of the exchange rate. It is still higher than for traditional currencies, which can be observed by comparing Charts 7 and 8.

Chart 7. 1-week volatility of BTC, ETH and XRP exchange rates in 2015–2017



Source: own elaboration based on data from coinmarketcap.com.

Chart 8. 1-week volatility of EUR, JPY and GBP in the years 2015–2017 – the scale similar as on Chart 7



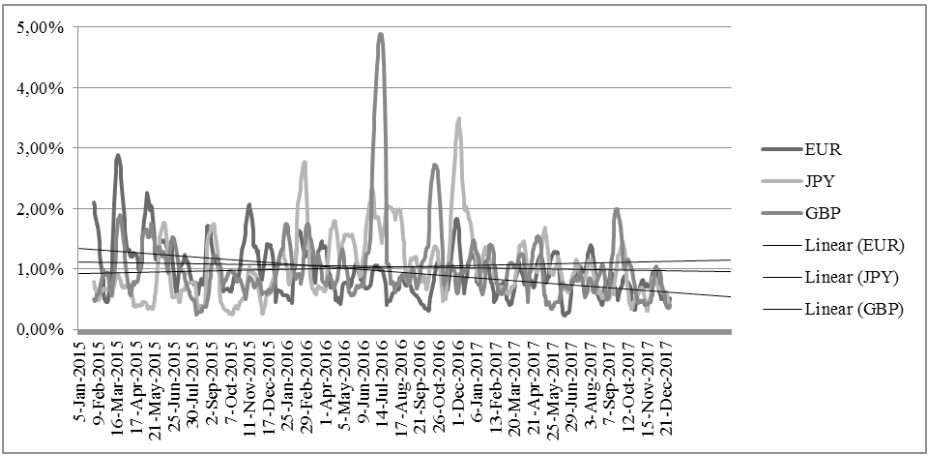
Source: own elaboration based on data from nbp.pl.

1-month volatility

Trend lines determining the level of monthly volatility for traditional currencies differs around the level of 1%, i.e. is characterized by low volatility. This is shown in Chart 9. Once

again in June 2016, a clear change to GBP could be observed, when 1-month volatility approached the level of 5%.

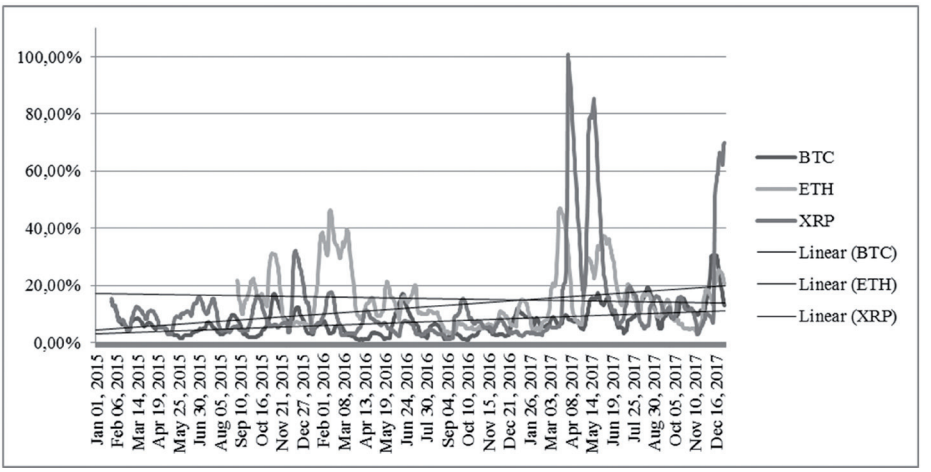
Chart 9. 1-month volatility of EUR, JPY and GBP exchange rates in 2015–2017



Source: own elaboration based on data from nbp.pl.

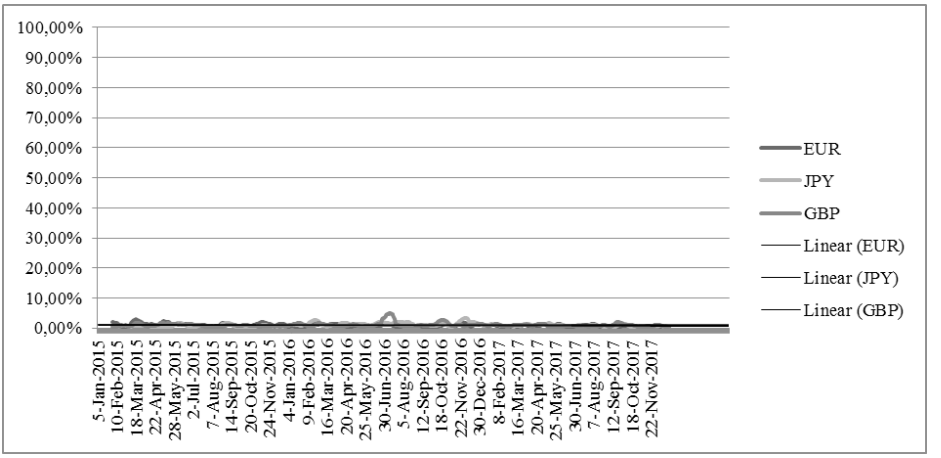
In turn, the 1-month volatility in the case of cryptocurrencies fluctuates around the level of 10%, however, short-term, sudden exchange rate changes often exceed this level. The biggest changes, reaching even 80–100% on a month-to-month basis, were noted by Ripple. The variability at 20–45% was achieved by Ethereum. On their background, Bitcoin was characterized by the smallest volatility, but still significantly higher than traditional currencies (Chart 11).

Chart 10. 1-month volatility of BTC, ETH and XRP exchange rates in 2015–2017



Source: own elaboration based on data from coinmarketcap.com.

Chart 11. 1-month volatility of EUR, JPY and GBP rates in 2015–2017 – scale as in Chart 10



Source: own elaboration based on data from nbp.pl.

1-year volatility

The values of the annual exchange rate volatility for all analyzed currencies are presented in Table 2. Among traditional currencies, the highest annual volatility was observed in GBP in 2016. In the case of cryptocurrency, the highest volatility was observed in 2017. The highest value of was reached by Ripple – 135.71%.

Table 2. 1-year volatility of selected fiat currencies and cryptocurrencies in 2015–2017

	Fiat Currency			Cryptocurrency		
Year	EUR	JPY	GBP	BTC	ETH	XRP
2015	2,52%	1,66%	1,81%	21,78%	27,67%	42,09%
2016	2,25%	5,24%	6,19%	24,50%	37,49%	14,01%
2017	4,52%	1,56%	2,88%	101,18%	83,37%	135,71%

Source: own elaboration based on data from coinmarketcap.com oraz nbp.pl.

Summary

The aim of the paper was to compare and assess the volatility of main crypto- and fiat currencies in the period of years 2015–2017. The results of the conducted reearch confirmed that the cryptocurrencies selected for the study in relation to the so-called traditional currencies were characterized by significantly higher volatility in the analyzed period at all adopted time horizons – day, week, month and year. In several scientific publications, there was a statement not supported by scientific research, identical with the conclusions from this article, about the much higher exchange rate volatility of cryptocurrencies against fiat currencies. However, the added value of this article is the analysis of data using statistical methods and proving on their basis that the exchange rate volatility of cryptocurrencies far exceeds the exchange rate volatility of fiat.

The volatility of traditional currencies in the analyzed period usually was in the range of 1–2%, due to the fact that these currencies can be considered as stable, characterized by low volatility. On the other hand, the variability of cryptocurrencies was 5–15%, so they assumed values considered as medium and high volatility. Based on the obtained results, it should be recognized that cryptocurrencies are definitely less stable than traditional currencies. It is caused by, inter alia a high volume of speculative transactions in general cryptocurrencies. In order to be able to recognize cryptocurrencies as a stable currency in the future, the volatility should be at a lower level.

Cryptocurrencies have existed in the economic cycle since 2009, but their dynamic growth has been in recent years. Further research should be conducted on the volatility of their rates, also in relation to traditional currencies, because it is possible that over time they will gain stability or, on the contrary, there will be rapid changes in their value. In addition, new cryptocurrencies are still emerging, which exchange rate fluctuations may significantly differ from the variability of the current major cryptocurrencies, i.e. BTC, ETH, XRP. In the case of some of the new currencies, their creators try to introduce changes and improvements that lead to eliminating the inconvenience

in their use to conclude daily transactions. It may also be possible to stabilize their exchange rates against traditional currencies.

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