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Bitcoin—Upsides, Downsides and Bone of Contention—A Deep Dive

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Abstract

The purpose of this study is to perform a systematic literature review on Bitcoin and unveil its upsides, downside and divergent views from previous studies. The paper presents a systematic literature review of key studies published on Bitcoin between 2008 and 2019. The focus is given to three topics: benefits of Bitcoin; its shortcomings; and divergent views presented by previous cryptocurrency scholars in details. The results indicate that Bitcoin offers four key benefits—its acceptance as a digital currency, effective portfolio diversifier, hedging capabilities and higher security. Literature review revealed five major shortcomings of Bitcoin—weak substitute for traditional currency, higher volatility, idiosyncratic risks, uncertain regulatory impact and its exogenous supply. Finally, the review reveals three major areas wherein cryptocurrency scholars found to have divergent view—acceptance of its hedging capabilities across regions and portfolios, consensus on Bitcoin as highly secured and safe asset and, general acceptance of Bitcoin as a substitute of traditional currencies.

Keywords

Cryptocurrency, Bitcoin, Peer to Peer Electronic Cash System

1. Introduction

"We should be looking at Cryptocurrencies like Bitcoin very seriously because of the way they can be used, particularly by criminals", said Theresa May, the Prime Minister of UK about explaining the danger cryptocurrencies can pose. Cryptocurrencies are becoming increasingly popular due to their creative technology, secured implementation, relevant usage across diverse fields and investment prospects [1]. Due to their assessment of investment assets, they are considered to be an attractive topic for technologist, financial analysts and in-

vestors. Though there are certain issues that are associated with Bitcoin which make them a risky bet especially for financial markets. Most notably, their usage in unregulated markets augments the ambiguity to its perceived valuation and implementation in the relevant context such as temporary shutdown of exchanges in China that resulted in a cascading effect of other exchanges and caused price buster and huge price movements [2].

The increase in market value of Bitcoin indicates that it is an investment asset; however at the same time, its restricted transaction usability forced the previous scholars to question whether it is comparable to gold and currency [3]. Probably due to its potential to replace the existing currency markets, many financial services organizations started questioning its unregulated regime [4]. If Bitcoin becomes the universally accepted medium of transaction and thus replaces the global currencies, this could create unsettling results for large financial firms, influence the monetary policies, financial sector and global economy. In this backdrop, the paper explores the cryptocurrency literature and reviews the key studies published on Bitcoin between 2008 and 2019. The review is structured on three key themes, namely, benefits of Bitcoin, its shortcomings and areas wherein previous cryptocurrency scholars had divergent views.

The study offers two novelties. First, this study revisits benefits and constraints of Bitcoin by reviewing the key papers between 2008 and 2019; thus, this includes the latest findings and evidences provided by cryptocurrency literature. Second, to the author's knowledge, this is the first study that explores divergent observations made by cryptocurrency scholars.

The rest of the paper is organized as follows. Section 2 covers key studies on Bitcoin and outlines its upsides, downsides and divergent outcomes observed by cryptocurrency scholars. Section 3 concludes and outlines the key findings.

2. Bitcoin: Key Studies and Their Findings

In his seminal paper, namely, "Bitcoin as a Peer-to-Peer Electronic Cash System", [5] first talked about the alternative or virtual currency which has a power to compliment the current financial systems and may have potential to root out the current currency market. Following that, many scholars investigated on Bitcoin and outlined advantages, shortcomings and its potential use cases on various businesses. **Table 1** displays the key Bitcoin studies, their upsides and downsides. The findings of the table can be classified into three major categories, advantages of Bitcoin, its shortcomings and inconsistent observations obtained by cryptocurrency scholars.

2.1. Bitcoin: Advantages

Cryptocurrency literature offers four major advantages of Bitcoin. First, Bitcoin as an alternative or virtual currency [3] [6] [7]. Many scholars termed it as an asset. Most notably, [8] who argued that cryptocurrencies are capable of providing required function of money stock and can yield a high degree of macroeco-

nomic stability. On the similar topic, [9] [10] and [11] debated that Bitcoin is a synthetic money and argued that while it has potential to supply the foundation for monetary regimes, it does not require oversight by any monetary authority. To establish that cryptocurrencies play a role of economic exchange, [12] explained several financial and non-financial uses of Bitcoins.

Second, Bitcoin as an effective portfolio diversifier. For example, several cryptocurrency scholar such as [13] [14] [15] explained that cryptocurrencies can be leveraged for managing the risk especially by risk averse investors in the event of negative shocks to the market. Similarly, [3] [16] [17] [18] compared cryptocurrencies with other assets such as gold and debated that it is an effective portfolio diversifier.

Third, leveraging Bitcoin as an effective hedging tool to mitigate risk. For example, [19] debated that Bitcoin returns are negatively associated with the Economic policy uncertainty (EPU) and can serve as a hedging tool against economic policy uncertainty. [13] examined the hedging capabilities of cryptocurrencies and explained that bitcoin can be used as a hedge against American dollar in the short-term. On comparing with gold, he found that Bitcoin possess some of the same hedging abilities as gold and can be included in the variety of tools available to market analysts to hedge market specific risk. [20] investigated the nature of interaction between Bitcoin and financial variables and their transmission mechanisms while analyzing the diversification and hedging effectiveness across gold asset and stock market. The finding suggested that a short position in the Bitcoin market allows hedging the risk investment for various financial assets. Especially, hedging strategies involving gold, oil, equities and Bitcoin reduce portfolio's risk considerably, as compared to the risk of the portfolio made up of gold, oil and equities only.

Fourth, Bitcoin as highly secured digital currency. [3] and [17] debated that due to its public and private key pairs wherein private key helps to decrypt the encrypted messages, it is one of the most secured way of carrying out economic transactions. [16] explained that Bitcoin transactions are immutable, therefore, it ideally cannot be stolen or changed once they are made. [8] argued that Bitcoin provides anonymity to perform transactions. [21] introduced ByzCoin, a new Byzantine consensus protocol that uses scalable collective signing to commit Bitcoin transactions irreversibly.

While there have been other advantages outlined as well such as diverse usage of Bitcoin [8] [12], freedom of payment due to lack of central counterparty [16] [22], low transaction fee due to its digital nature [23] and many more, however they were broadly fitting into these four themes explained by the study.

2.2. Bitcoin: Shortcomings

There are five major shortcomings outlined by cryptocurrency scholars. First, while Bitcoin is a digital currency, it cannot replace the traditional currencies completely due to its digital nature. Most notably, [9] argued that the possibility

of monetary stabilization by a synthetic currency such as Bitcoin may look hypothetical due to its higher volatility. Similarly, [6] argued that as an ideal currency provides a medium of exchange, a store of value, and a unit of account, but bitcoin largely fails to satisfy these conditions.

Second, several scholars argued that Bitcoin's volatility is higher than the volatilities of widely used currencies such as dollar or pound, therefore, this poses a large short-term risk to function like a speculative investment than a currency [6] [8] [24] [25]. Similarly, [26] argued that cryptocurrency market contains its own idiosyncratic risks that are difficult to hedge against. [27] debated that cryptocurrency shows the attributes of speculative bubbles. They built an economic and econometric modelling of Bitcoin prices and explained that Bitcoin exhibits speculative bubbles and the fundamental price of Bitcoin is zero. Similarly, [28] conducted an econometric investigation of the existence of bubbles in the bitcoin market based on bubbles detecting technique proposed by [29]. For the period 2010-2014, they detected a number of short-lived bubbles, most importantly, they found three huge bubbles in the latter part of the period 2011-2013 lasting from 66 days to 106 days, with the last and biggest one demonstrating the departure of Mt Gox exchange in early 2014.

Third, Bitcoin posses several risk such as market risk, the shallow market problem, counterparty risk, transaction risk, operational risk and privacy-related risk [8]. Market risk refers to higher volatility of cryptocurrency due to market factors [26]. Prices are often more volatile and assets are less liquid. Shallow market problem in Bitcoin arises due to limited number of actors involved in the transactions and that makes its prices more volatile [6]. Counterparty risk arises due to lack of central counterparty in Bitcoin transaction as no neutral party intervenes in case of disputes [12]. Transaction risk refers to the transaction immutability which means a transaction cannot be edited once made [9]. Operation risk is related to mass failure of Bitcoin network that could cause hazard and may lead to shut down of Cryptocurrency markets [30]. Privacy risk is linked to the identity of people carrying out Bitcoin transactions. Many Bitcoin scholars explained that Bitcoin transactions are not completely anonymous and can be traced back to individuals [8] [12]. Due to these risks, the acceptance of Bitcoin as a substitute of traditional currency looks to be an unlikely scenario.

Fourth, regulatory impact appears to be a grey area for the usage of Bitcoin. Many scholars argued about its potential regulatory constraints. For example, [3] explained that while the regulatory regime is somewhat unclear due to Bitcoin's digital nature, however potential implementation is likely as the usage increases. [16] [17] [18] argued that potential regulatory implication is likely as cryptocurrency has possibility to be misused and can invite fraud. [31] argued that due to its unregulated usage, Bitcoin may induce money laundering and can be misused for terror financing. [20] argued that tax treatment of Bitcoin is not consistent across borders and suggested that governments across regions should formulate policies to frame consistent tax policies.

Fifth, cryptocurrency supply is exogenous and depends on several factors such as inflation, market policy and economic growth impacts, which makes its price highly unpredictable and volatile. [32] argued that macro financial factors such as inflation, economic output, employment and investments play an important role for the supply of Bitcoin and therefore impact the price discovery of Bitcoin. [33] explained that cryptomarket-related factors such as market beta, trading volume, and volatility are the significant determinant for the cryptocurrencies both in short- and long-run. Besides, attractiveness of cryptocurrencies also plays an important role for price determination [7]. This indicates that price discovery of Bitcoin is a complex phenomenon which is highly influenced by economic and market factors.

2.3. Bitcoin: Divergent Views

While the upsides and downsides of Bitcoin have been clearly outlined by previous scholars, there have been divergent views on four of its attributes. First, acceptance of Bitcoin's hedging capabilities across regions and portfolios. For example, many cryptocurrency scholars such as [13] [19] and [20] hailed Bitcoin as a good hedging mean for economic policy uncertainty and selected currencies *i.e.* American dollars. However, there are many other scholars who argued otherwise. For example, by taking several developed economies, [34] and [35] argued that Bitcoin is a poor hedge for economic uncertainty and is suggested to use for diversification purposes only with an exception of Asian stocks. Similarly, [27] and [36] argued that due to its highly speculative nature, Bitcoin may not be an ideal candidate of hedging. Overall, the topic of hedging through Bitcoin has generated somewhat mixed views across regions and type of assets.

Second, a broader consensus on Bitcoin as highly secured and safe asset. For example, [3] [17] and [16] debated in favor of Bitcoin's security and accepted it as one of the most secured way of doing economic transactions. On the other hand, [12] challenged this premise and argued that while Bitcoin is highly secured due to its private and public key mechanism, its cryptographic keys may be easy enough to crack due to advanced quantum computing. [30] [37] explained about the 51% attack wherein if 51% transactions owned by colluding entities can lead to massive fraud in cryptocurrency landscape. Similarly, [8] debated about Bitcoin's privacy risk and explained while Bitcoin's transactions are anonymized, however due to its distributed ledger technology which is driven by open source, their linkages can be traced using complex algorithms.

Third, acceptance of Bitcoin as a substitute of traditional currencies. While many cryptocurrency scholars [3] [7] [8] [9] [10] argued and accepted Bitcoin as an alternative currency regime, several scholars provided a divergent view and explained Bitcoin's shortcomings that hinder it to be accepted as traditional currency. Most notably, [6] debated that despite of offering a mean for alternative currency, Bitcoin fails to provide a medium of exchange, a store of value and a unit of account. Several cryptocurrency scholars explained concerns on high volatility of Bitcoin and explained that because of this, it fails to be accepted as

Table 1. Literature review: bitcoin—upsides and downsides.

S. No.	Authors (Year)	Major findings/upside outlined	Downside outlined
1.	Nakamoto (2008)	Introduced Bitcoins. Designated it as alternative or virtual currency to replace the traditional currency market	
2	Bell (2013), Androulaki *et al.* (2013), Brito *et al.* (2013), O'Dwyer *et al.* (2014)	1) Classified it close to gold 2) Highly secured due to its SHA algorithm 3) Cryptocurrencies can be an effective portfolio diversifier	Potential regulatory impact due to lack of traditional monetary regime
3	Bradbury (2013) Crosby *et al.* (2016)	Provided several financial and non-financial uses of Bitcoin	1) Cryptographic keys may be easy enough to crack due to quantum computing 2) 51% attack can jeopardize cryptocurrency market
4	Gervais *et al.* (2014), Antonopoulos (2014), Selgin (2015),	1) A synthetic money with potential to supply the foundation for monetary regimes 2) Does not need an oversight by monetary authorities 3) Can yield high degree of macroeconomic stability	1) Undesirable for governments to commit to an immutable cryptocurrency's regime 2) Possibility of monetary stabilization by a synthetic commodity standard may be hypothetical
5	Böhme *et al.* (2015)	1) Defined it as a financial asset 2) Provides privacy and anonymity	Faces several risks such as market risk, the shallow market problem, counterparty risk, transaction risk, operational risk, privacy-related risk, and legal and regulatory risks
6	Brandvold *et al.* (2015)	Information share is dynamic and evolves significantly over time.	Due to its unregulated regime, it may face crime such as money laundering
7	Cheah *et al.* (2015), Cheung *et al.* (2015), Folkinshteyn *et al.* (2015)	Exhibits speculative bubbles	Fundamental price of Bitcoin is zero.
8	Dwyer (2015)	1) Prevent double spending by open source software 2) Its lowest volatilities are lesser than the highest volatilities for gold or dollars	1) Its average volatility is higher than gold or dollars
9	Yermack (2015)	1) Provides a mechanism of alternative currency 2) Its volatility is higher than widely used currencies such as dollar or pound	1) Fails to provide a medium of exchange, a store of value and a unit of account 2) Functions like a speculative investment than a currency
10	Dyhrberg (2016), Shadab *et al.* (2014), Pieters *et al.* (2017)	1) Can be used to manage the risk by risk averse investors 2) Placed between dollar and gold	Volatility is higher than gold and other stable commodities
11	Tschorsch *et al.* (2016)	Cryptocurrency markets is a new investment asset class as they are interconnected with each other and have similar patterns of connectedness with other asset classes	Speculative investment due to higher volatility
12	Bouri *et al.* (2017a), Bouri *et al.* (2017b)	1) Serve as a strong bet for Asian stocks against weekly extreme down movements 2) Suggested to use for diversification purposes only	Poor hedge for economic uncertainty
13	Baur (2018)	1) Displays varied return 2) Speculative trading does not contribute to unprecedented rise and subsequent crash of Bitcoin	Its volatility is attributable to speculative trading.
14	Catania *et al.* (2017)	Large computation memory and leverage effect has a substantial contribution in the volatility dynamic.	
15	Ciaian *et al.* (2018), Sovbetov (2018)	1) BitCoin and altcoin markets are interdependent 2) In long-run, macro-financial indicators drive altcoin price formation	The virtual currency supply is exogenous and therefore plays only a limited role in the price formation.

Continued

16	Corbet *et al.* (2018)	Limited connectedness between cryptocurrency markets and other financial markets such as gold, bond FX, SP 500, VIX and GSCI	Cryptocurrency market contains its own idiosyncratic risks that are difficult to hedge against
17	Demir *et al.* (2018)	Bitcoin can serve as a hedging tool against economic policy uncertainty	
18	Guesmi *et al.* (2018) Dyhrberg (2016)	1) A short position in the Bitcoin market allows hedging the risk investment for various financial assets 2) Portfolio made of gold, oil, equities and Bitcoin reduce portfolio's risk considerably as compared to the risk of the portfolio made up of gold, oil and equities only.	Tax treatment of Bitcoin is not very clear across borders
19	Eyal *et al.* (2018)	Explained an attack on Bitcoin which can have significant consequences: rational miners will prefer to join the selfish miners, and the colluding group will increase in size until it becomes a majority	1) Bitcoin protocol is not incentive-compatible 2) Explained an attack with which colluding miners obtain a revenue larger than their fair share

an ideal substitute for traditional currency [13] [14] [38]. While Bitcoin is fairly well recognized as an alternative currency, however its acceptance as a traditional currency has been questioned. Overall while Bitcoin has been accepted as a synthetic or virtual currency, it's role to replace traditional currency generated mixed opinions.

3. Conclusion

The paper examines key studies in Bitcoin between 2008-2019 to draw upsides, downsides and divergent views. The results indicate that Bitcoin offers following four key benefits. First, its acceptance is as a digital or virtual currency. Second, it acts as an effective portfolio diversifier. Third, it can be used to hedge risk due to its hedging capabilities; fourth, it is considered to be a safe bet due to higher security. The literature review revealed following five major shortcomings of Bitcoin. First, it is a weak substitute for traditional currency. Second, its volatility is relatively higher compared to other assets such as gold or traditional currencies such as American dollar. Third, idiosyncratic risks make this a complex asset. Fourth, despite being an electronic currency, Bitcoin is not regulated and therefore, its regulatory impact is uncertain. Fifth, its supply is exogenous and depends on several factors such as inflation, market policy and economic growth impacts, which makes its price highly unpredictable and volatile. Finally, the review reveals following three major areas wherein cryptocurrency scholars found to have divergent views. First, acceptance of its hedging capabilities is across regions and portfolios. Second, consensus on Bitcoin is highly secured and safe asset and third and finally, general acceptance of Bitcoin is as a substitute of traditional currencies.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Klein, T., Thu, H.P. and Walther, T. (2018) Bitcoin Is Not the New Gold—A Comparison of Volatility, Correlation, and Portfolio Performance. *International Review of Financial Analysis*, **59**, 105-116. https://doi.org/10.1016/j.irfa.2018.07.010

[2] Chuen, D.L.K. (2015) Handbook of Digital Currency: Bitcoin, Innovation, Financial Instruments, and Big Data. Academic Press, Cambridge, MA.

[3] Bell, C. (2013) Bitcoin: Virtual Money or Risky Investment? Technical Report. https://Bankrate.com

[4] Glaser, F., Zimmermann, K., Haferkorn, M., Weber, M.C. and Siering, M. (2014) Bitcoin—Asset or Currency? Revealing Users' Hidden Intentions. *ECIS* 2014. https://ssrn.com/abstract=2425247

[5] Nakamoto, S. (2008) Bitcoin: A Peer-to-Peer Electronic Cash System.

[6] Yermack, D. (2015) Is Bitcoin a Real Currency? An Economic Appraisal. In: *Handbook of Digital Currency*, Elsevier, Amsterdam, 31-43. https://doi.org/10.1016/B978-0-12-802117-0.00002-3

[7] Tschorsch, F. and Scheuermann, B. (2016) Bitcoin and Beyond: A Technical Survey on Decentralized Digital Currencies. *IEEE Communications Surveys & Tutorials*, **18**, 2084-2123. https://doi.org/10.1109/COMST.2016.2535718

[8] Böhme, R., Christin, N., Edelman, B. and Moore, T. (2015) Bitcoin: Economics, Technology, and Governance. *Journal of Economic Perspectives*, **29**, 213-238. https://doi.org/10.1257/jep.29.2.213

[9] Selgin, G. (2015) Synthetic Commodity Money. *Journal of Financial Stability*, **17**, 92-99. https://doi.org/10.1016/j.jfs.2014.07.002

[10] Gervais, A., Karame, G.O., Capkun, V. and Capkun, S. (2014) Is Bitcoin a Decentralized Currency? *IEEE Security & Privacy*, **12**, 54-60. https://doi.org/10.1109/MSP.2014.49

[11] Antonopoulos, A.M. (2014) Mastering Bitcoin: Unlocking Digital Cryptocurrencies. O'Reilly Media, Sebastopol, CA.

[12] Crosby, M., Pattanayak, P., Verma, S. and Kalyanaraman, V. (2016) Blockchain Technology: Beyond Bitcoin. *Applied Innovation*, **2**, 71.

[13] Dyhrberg, A.H. (2016) Hedging Capabilities of Bitcoin. Is It the Virtual Gold? *Finance Research Letters*, **16**, 139-144. https://doi.org/10.1016/j.frl.2015.10.025

[14] Shadab, H.B. (2014) Regulating Bitcoin and Block Chain Derivatives. NYLS Legal Studies Research Paper. https://doi.org/10.2139/ssrn.2508707

[15] Pieters, G. and Vivanco, S. (2017) Financial Regulations and Price Inconsistencies across Bitcoin Markets. *Information Economics and Policy*, **39**, 1-14. https://doi.org/10.1016/j.infoecopol.2017.02.002

[16] Androulaki, E., Karame, G.O., Roeschlin, M., Scherer, T. and Capkun, S. (2013) Evaluating User Privacy in Bitcoin. In: Sadeghi, A.R., Eds., *Financial Cryptography and Data Security*, *FC* 2013, *Lecture Notes in Computer Science*, Springer, Berlin, Heidelberg, 34-51. https://doi.org/10.1007/978-3-642-39884-1_4

[17] Brito, J. and Castillo, A. (2013) Bitcoin: A Primer for Policymakers. Mercatus Center at George Mason University, Arlington, VA.

[18] O'Dwyer, K.J. and Malone, D. (2014) Bitcoin Mining and Its Energy Footprint. 25*th IET Irish Signals Systems Conference* 2014 *and* 2014 *China-Ireland International Conference on Information and Communications Technologies*, Limerick, 26-27 June 2014, 280-285.

[19] Demir, E., Gozgor, G., Lau, C.K.M. and Vigne, S.A. (2018) Does Economic Policy Uncertainty Predict the Bitcoin Returns? An Empirical Investigation. *Finance Research Letters*, **26**, 145-149. https://doi.org/10.1016/j.frl.2018.01.005

[20] Guesmi, K., Saadi, S., Abid, I. and Ftiti, Z. (2018) Portfolio Diversification with Virtual Currency: Evidence from Bitcoin. *International Review of Financial Analysis*, in press. https://doi.org/10.1016/j.irfa.2018.03.004

[21] Kogias, E.K., Jovanovic, P., Gailly, N., Khoffi, I., Gasser, L. and Ford, B. (2016) Enhancing Bitcoin Security and Performance with Strong Consistency via Collective Signing. *Proceedings of* 25*th USENIX Security Symposium*, Austin, TX, 10-12 August 2016, 279-296.

[22] Woo, D. (2013) Bitcoin: A First Assessment.

[23] Kaşkaloğlu, K. (2014) Near Zero Bitcoin Transaction Fees Cannot Last Forever. *The International Conference on Digital Security and Forensics*, VSB-Technical University of Ostrava, Czech Republic, June 2014, 91-99.

[24] Baur, D.G., Dimpfl, T. and Kuck, K. (2018) Bitcoin, Gold and the US Dollar–A Replication and Extension. *Finance Research Letters*, **25**, 103-110. https://doi.org/10.1016/j.frl.2017.10.012

[25] Catania, L. and Grassi, S. (2017) Modelling Crypto-Currencies Financial Time-Series. *SSNR*. https://doi.org/10.2139/ssrn.3028486

[26] Corbet, S., Meegan, A., Larkin, C., Lucey, B. and Yarovaya, L. (2018) Exploring the Dynamic Relationships between Cryptocurrencies and Other Financial Assets. *Economics Letters*, **165**, 28-34. https://doi.org/10.1016/j.econlet.2018.01.004

[27] Cheah, E.T. and Fry, J. (2015) Speculative Bubbles in Bitcoin Markets? An Empirical Investigation into the Fundamental Value of Bitcoin. *Economics Letters*, **130**, 32-36. https://doi.org/10.1016/j.econlet.2015.02.029

[28] Cheung, A., Roca, E. and Su, J.J. (2015) Crypto-Currency Bubbles: An Application of the Phillips-Shi-Yu (2013) Methodology on Mt. Gox Bitcoin Prices. *Applied Economics*, **47**, 2348-2358. https://doi.org/10.1080/00036846.2015.1005827

[29] Phillips, P.C., Shi, S. and Yu, J. (2015) Testing for Multiple Bubbles: Historical Episodes of Exuberance and Collapse in the S & P 500. *International Economic Review*, **56**, 1043-1078. https://doi.org/10.1111/iere.12132

[30] Bradbury, D. (2013) The Problem with Bitcoin. *Computer Fraud & Security*, **2013**, 5-8. https://doi.org/10.1016/S1361-3723(13)70101-5

[31] Brandvold, M., Molnár, P., Vagstad, K. and Andreas Valstad, O.C. (2015) Price Discovery on Bitcoin Exchanges. *Journal of International Financial Markets, Institutions and Money*, **36**, 18-35. https://doi.org/10.1016/j.intfin.2015.02.010

[32] Ciaian, P., Kancs, A. and Rajcaniova, M. (2018) Virtual Relationships: Short-and Long-Run Evidence from BitCoin and Altcoin Markets. *Journal of International Financial Markets, Institutions and Money*, **52**, 173-195. https://doi.org/10.1016/j.intfin.2017.11.001

[33] Sovbetov, Y. (2018) Factors Influencing Cryptocurrency Prices: Evidence from Bitcoin, Ethereum, Dash, Litcoin, and Monero. *Journal of Economics and Financial Analysis*, **2**, 1-27.

[34] Bouri, E., Gupta, R., Tiwari, A.K. and Roubaud, D. (2017) Does Bitcoin Hedge Globalun Certainty? Evidence from Wavelet-Based Quantile-in-Quantile Regressions. *Finance Research Letters*, **23**, 87-95. https://doi.org/10.1016/j.frl.2017.02.009

[35] Bouri,E., Molnár, P., Azzi, G., Roubaud, D. and Hagfors, L.I. (2017) On the Hedge and Safe Haven Properties of Bitcoin: Is It Really More Than a Diversifier? *Finance*

Research Letters, **20**, 192-198. https://doi.org/10.1016/j.frl.2016.09.025

[36] Folkinshteyn, D., Lennon, M.M. and Reilly, T. (2015) The Bitcoin Mirage: An Oasis of Financial Remittance. *Journal of Strategic and International Studies*, *Forthcoming*.

[37] Eyal, I. and Sirer, E.G. (2018) Majority Is Not Enough: Bitcoin Mining Is Vulnerable. *Communications of the ACM*, **61**, 95-102. https://doi.org/10.1145/3212998

[38] Dwyer, G.P. (2015) The Economics of Bitcoin and Similar Private Digital Currencies. *Journal of Financial Stability*, **17**, 81-91. https://doi.org/10.1016/j.jfs.2014.11.006