Bitcoin, Economic Policy Uncertainty and Geopolitical Risk: A Systematic Review

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Abstract

Among all the cryptocurrencies in the market, Bitcoin is the most widely discussed and most popular cryptocurrency in the cryptocurrency market. This study aims to review and summarize the existing literature findings pertaining to the impact of geopolitical risk and economic policy uncertainty on Bitcoin. The results shown geopolitical risk and economic policy uncertainty have predictive power on Bitcoin prices. Both economic policy uncertainty and geopolitical risk have positive and negative effects on Bitcoin. The geopolitical risk and economic policy uncertainty able serve as a hedging instrument against Bitcoin. Bitcoin also can act as a safe haven against geopolitical risk and economic policy uncertainty. A summary of further implication from previous study suggested utilizing other uncertainty measures, applying other cryptocurrency, exploring Bitcoin's relationship with other financial assets, and employing alternative methodologies.

Keywords: Bitcoin, Economic Policy Uncertainty, Geopolitical Risk, Systematic Literature Review, Cryptocurrency.

Introduction

In the era of rising technology, financial markets, and payment methods are changing dramatically. The global financial markets will be gradually digitalized and on the verge of a cashless society. In the near future, there will be no more cash in the world's financial

markets. Digital currencies have developed quickly over the last decade. It is an electronic asset applied to digital files as money and only used for electronic transactions, unlike traditional currencies. People use it for investment and online purchases, for instance, cryptocurrency. There has been intense debate and uncertainty about cryptocurrency in the modern global economy over the past decade. As cryptocurrencies are not physical currencies, it may be more difficult to forecast than other conventional assets, even though cryptocurrencies are popular among investors.

Bitcoin is one of the cryptocurrencies, a form of electronic money which is manipulated without government or bank oversight or any central authority but from the Bitcoin blockchain network. During the global financial crisis, Satoshi Nakamoto proposed Bitcoin in November 2008. A technical overview of Bitcoins and its payment system can be found in his whitepaper, 'Bitcoin: A Peer-to-Peer Electronic Cash System'. It employed cryptography and peer-to-peer technologies. The transaction is simpler and cheaper with the reliable cryptographic system to replace the trusted third parties (Nakamoto, 2008). Furthermore, the market capitalization for Bitcoin is \$895.69 billion (last search conducted on 2nd January 2022, based on the https://coinmarketcap.com/). It is the most popular and most representative cryptocurrency in the cryptocurrency market which has the highest ranking in the cryptocurrency market. With its ability to transform most business sectors' supply chain networks, it is rapidly gaining attention among scholars and practitioners (Fosso Wamba et al., 2020). The investors will be able to minimize loss-risks by forecasting the Bitcoin prices.

Bitcoin's relationship with precious metals, etc., has been the subject of numerous studies over the past decades. Nevertheless, most previous studies aimed to predict Bitcoin's return and volatility. Bitcoin price volatility modelling is closely related to risk assessment and investment decisions. In comparison with other financial assets, such as stocks, Bitcoin volatility is high and persistent (Baur et al., 2017). The Bitcoin price will be influenced by the factors of specific demand or supply in digital currencies. Indeed, there have been numerous studies examining various aspects of Bitcoin, including its volatility, price dynamics and its speculative nature. However, the increasing economic-political uncertainty may affect the volatility of the Bitcoin price. Hence, its relationship with economic policy uncertainty and geopolitical risk particular concern to investor. According to Al-Thaqeb and Algharabali (2019), economic policy uncertainty results from uncertain government policies and economic regulation frameworks. The economic policy uncertainty measured based on the (Baker et al., 2016). On the other hand, geopolitical risk refers to the risk of political tensions, terrorist acts, and wars affecting the normal course and peaceful of international relations (Caldara and Iacoviello, 2018). Economic policy uncertainty and geopolitical risk may weaken the investor's confidence in the economy or currencies. Since high economic policy uncertainty and geopolitical risk could drive up the demand for safe haven assets, understanding how these factors can impact Bitcoin's volatility and price dynamics as well as its potential role as a hedging instrument or safe haven asset is crucial for investors seeking to assess its potential as an investment or risk management tool. Moreover, portfolio theory shown diversification is essential to optimize risk and return in portfolios. Portfolio diversification and risk reduction can be achieved by including safe-haven assets such as Bitcoin. Therefore, a systematic literature review has been conducted in this study to provide an evidence-based review pertaining to the impact of geopolitical risk and economic policy uncertainty on Bitcoin. It provided valuable insights to Bitcoin investors in terms of managing their portfolios, specifically when adjusting strategies and implementing risk management

techniques. This study can serve as a benchmark for Bitcoin investors when making predictions and estimations regarding their cryptocurrency returns.

The purpose of this study is to summarize and analyze the findings of the existing studies concerning the impact of economic policy uncertainty (EPU) and/or geopolitical risk (GPR) on the Bitcoin (BTC). We examine the relationship between GPR, EPU and BTC, identify whether BTC is able to act as a hedging tool and/or serves as safe haven against the EPU and GPR. We also explore the directions for future research from the previous study based on the limitations and suggestions to discover the new research domains.

There are 6 sections in this study which are introduction, methodology, results, discussion, future implications, and conclusion.

Methodology

The purpose of this systematic literature review is to analyze the impact of economic policy uncertainty and geopolitical risk on Bitcoin. This research's methodology is intended to increase the transparency of this study.

Eligibility Criteria

Before selecting the articles, we defined the eligibility criteria in advance. Our eligibility criteria consist of both inclusion and exclusion criteria. We only include the articles that meet the inclusion criteria. Articles that meet the exclusion criteria or fail to meet the inclusion criteria will be excluded.

Table 1

The eligibility criteria for selection of articles.

Inclusion criteria	Exclusion criteria	
• Preliminary empirical evidence for the impact of EPU and/or GPR on BTC is required.	 Economics and social science were not the subjects of the papers. 	
• It must be at the final stage of publication.	• Grey literature (Ex: newsletters, internal reports etc.)	
• It should be an English-language paper.		

This study only includes the articles that meet the predefined inclusion criteria. The empirical data of the papers should present the impact of EPU and/or GPR on BTC. A full-length article at the final stage of publication is required. Hence, we will remove the other papers such as conference proceedings, erratum, short survey, etc. Since English is the most commonly used language in academia for research (Ólafsdóttir and Tverijonaite, 2018), only English-language articles were selected in this study.

The papers selected should be relevant to the field of economic and social science. The article needs to apply relevant theory or concept of economic in the study and published in the social science field. Paper with no relation to the topic will be excluded. Furthermore, there was no acknowledgement on the contents of grey literature from peer-reviewed academic publications. Grey literature such as newsletters, conference reports and conference proceedings should not be included in the research synthesis. To ensure the

included articles adhered to scientific standards, we must analyze the sources of data during the article selection.

Search Process

In order to search the related research literature, we use Scopus, one of the largest online library databases. We searched the papers based on the title, abstract or keywords and these factors were considered during the review process. In order to extract a more comprehensive result, the keywords were included in the search engine. In the Boolean operators, however, we allowed AND and OR only. In the search string we applied (Bitcoin* AND (Geopolitic* OR Uncertain*). The asterisks (*) applied to allow the search result more comprehensive and prevent missing terms. These three keywords corresponded with our study's major areas.

For type of source, we restricted our search to book, journal, and book series, while conferences proceedings were rejected. Moreover, as for the document types, we involve books, book chapter, articles, and review while erratum, conference paper, conference review and short survey are excluded. All selected articles are English-language publications and at the final publication stage. In the primary results, all the related articles are published between 2014 and 2021, which covers only 8 years, thus we didn't restrict the publishing year. All selection processes are designed to ensure the papers selected are high quality. The searches have been conducted till 2 May 2021.

Article Selection

To extract the identified records, a Microsoft Excel spreadsheet was created to further analyze the papers that include title, keywords, abstract, author's name with affiliations, journal's title, and year of publication (Pahlevan-Sharif, Mura, and Wijesinghe, 2019). The records were screened by reviewing the abstracts and titles of the papers according to the eligibility criteria. A second selection was conducted and carefully reviewed the full texts after removed the papers didn't meet the inclusion criteria. All selected articles are available access in full text. The Microsoft Excel spreadsheet is modified to analyze the final selected article.

Quality Assessment

In order to evaluate the quality of the selected articles, the journal of the articles adopted the quality assessment based on the SCImago Journal and Country Rank developed by SCImago. The SCImago applied the SCImago Journal Rank (SJR) indicator to examine the quality of the articles (Guerrero-Bote & Moya-Anegón, 2012). Furthermore, to strengthen the result, we also adopted the Australian Business Deans Council (ABDC) journal quality list which developed by Australian Business Deans Council's. The ABDC journal ranking list was suggested by (Pahlevan-Sharif et al., 2019).

Selection Process

A flowchart was created to illustrate the articles selection process. Our flowchart shown the number of articles included and excluded at each stage. This study's selection process is summarized in Figure 1. There were 94 studies identified from Scopus based on keywords searches. The results were reduced to 93 after filtering the duplicates. Next, based on the eligibility criteria, the articles title and abstract were screened, and this stage had eliminated 35 papers. For the remaining 58 papers, the full text was thoroughly reviewed in-depth to ensure their appropriateness. Another 29 papers were removed since they lack of relevant to the scope of our study. The correlation between BTC and EPU or GPR was not significantly

exhibited in their study. Our final analysis included a total of 29 papers in this study for further analysis that fully fulfilled the pre-defined inclusion criteria.



Figure 1. Flowchart diagram for process of selection

Result

Table 2

A summary of the selected papers with journals name, quality assessment and publication year

	SCImago Rank		ABDC	2010	2010	2020	2024	T I
Journal Names	Rank	H- Index	Rank	2018	2019	2020	2021	lotal
Technological Forecasting and Social Change	Q1	117	А			1	1	2
Economics Letters	Q1	100	А			1		1
Resources Policy	Q1	69	В				1	1
International Review of Financial Analysis	Q1	59	А		2			2
Empirical Economics	Q1	56	А				1	1
Research in International Business and Finance	Q1	42	В		1	1		2
Finance Research Letters	Q1	39	А	1	2	1	3	7
Physica A: Statistical Mechanics and its Applications	Q2	166	-		1	1		2
Economic Modelling	Q2	77	А				1	1
International Review of Economics and Finance	Q2	54	-				1	1

Quarterly Review of Economics and Finance	Q2	50	В			1		1
Journal of Multinational Financial Management	Q2	44	В			1		1
Frontiers in Public Health	Q2	41	-				1	1
North American Journal of Economics and Finance	Q2	37	В		1			1
Borsa Istanbul Review	Q2	21	-			1		1
European Journal of Management and Business Economics	Q2	16	-			1		1
Journal of Economics and Finance	Q3	30	В				1	1
Global Economy Journal	Q3	18	В			1		1
Macroeconomics and Finance in Emerging Market Economies	Q4	9	С			1		1
Total				1	7	11	10	29

Table 3

A summary of the quality assessment results

SCImago Rank					ABDC	Rank		
Journal	S	Studie	es		Journ	als	Studi	es
7	36.84%	16	55.17%	A*	-	-	-	-
9	47.37%	10	34.48%	А	6	31.58%	14	48.28%
2	10.53%	2	6.90%	В	7	36.84%	8	27.59%
1	5.26%	1	3.45%	С	1	5.26%	1	3.45%
				N/A	5	26.32%	6	20.69%
19	100%	29	100%		19	100%	29	100%
	SCImag Journal 7 9 2 1 1	SCImago Rank Journals 7 36.84% 9 47.37% 2 10.53% 1 5.26% 19 100%	SCImago Rank Journals Studie 7 36.84% 16 9 47.37% 10 2 10.53% 2 1 5.26% 1 19 100% 29	SCImago Rank Studies Journals Studies 7 36.84% 16 55.17% 9 47.37% 10 34.48% 2 10.53% 2 6.90% 1 5.26% 1 3.45% 19 100% 29 100%	SCImage Rank Studies Image Journals Studies 47 7 36.84% 16 55.17% A* 9 47.37% 10 34.48% A 2 10.53% 2 6.90% B 1 5.26% 1 3.45% C 19 100% 29 100% Y	SCImago Rank Studies ABDC Journals Studies Journals 7 36.84% 16 55.17% A* - 9 47.37% 10 34.48% A 6 2 10.53% 2 6.90% B 7 1 5.26% 1 3.45% C 1 19 100% 29 100% In 100%		$ \begin{array}{c c c c c c c c c c c c c c c c c c c $

Table 2 shown a summary of the quality assessment according to the SCImago and ABDC journal ranking list for the included paper with journal publication names and year of publication. This study included a total of 29 papers from 19 journals. The majority of selected papers were published in Financial Research Letters, which are 7 out of 29 papers. The results shown paper included in this study only 4 years for the year of publication, which are 2018 to 2021, although primary search covered 8 years (2014-2021). In recent years, there have been an increasing number of publications relating to this topic. There was a greatest output in the past three years from 2019 to 2021. This shows the researcher's focus on this subject has grown over time. This study includes only one paper published in 2018, while seven papers from 2019. The paper selected published in 2020 is 11 papers which is the highest. There were 10 selected papers fully meet the inclusion criteria which published in 2021. For the articles published in 2021, the result for primary journal searches till May 2021 only. We expected the number of papers published in this area will rise over time since the BTC investor and academia focusing to the BTC development with paying more attention on the impact of EPU and GPR on the BTC.

The quality assessment results from Table 2 are analyzed and summarized in Table 3. Table 3 shown the overview of quantile distribution for selected paper in SCImago and ABDC journal quality. For SCImago, this study included 7 journals (36.84%) located in the Q1 quantile. It was

found that 16 out of 29 papers (55.17%) were from Q1 which more than 50% of the papers included were from top quality journals, although the journals from this quantile not the most included in this study among the four quantiles. With 9 journals (47.37%) and 10 papers from the Q2 quantile, we included nearly 50% of the journals from this quantile. A total of 2 journals (10.53%) were included with 2 papers (6.90%) for Q3, whereas Q4 consisted of only one journal (5.26%) with one paper (3.45%). In order to reinforce the quality assessment results, the ABDC journal ranking list was applied. The results of ABDC journal ranking list differs slightly from SCImago due to their indicators are measured differently. In this study, no paper was included from A* listed journals. Our most included papers were published in A listed journals (36.84%) with 8 papers (27.59%) from B listed journals. For C listed journals, we included the least number of papers in comparison with other listed journals with only 1 paper (3.45%) by 1 journal (5.26%). There were 6 remaining papers (20.69%) from 5 journals (26.32%) that were not ranked by the ABDC journal ranking list.

Discussion

Table 4

For this study, 29 articles fully fit the inclusion criteria and were selected. The main findings from these articles were further discussed related to the impact of EPU and GPR on BTC.

Type of data frequency utilized in previous studies.						
Data	No. of references	%				
Daily	16	55.17				
Monthly	8	27.59				
Mixed	5	17.24				
Total	29	100				

Table 4 shown the types of data frequency applied by the previous study. The data categorized into three categories: daily, monthly, and mixed data. We categorized the mixed data as the variables of the articles utilized different frequency of data. More than 50% of the selected papers applied daily data for data analysis which consists of 16 papers (55.17%). Moreover, 8 papers (27.59%) used monthly data, while 5 papers (17.24%) utilized mixed data.

Table 5 The data sources used in previous studies

Variables	Sources of data				
Bitcoin Price	https://www.coindesk.com				
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	https://w	ww.investing.com/crypto/bitcoin/historical-data					
	https://finance.yahoo.com/quote/BTC-USD						
	https://coinmarketcap.com/						
	https://www.cryptocompare.com						
	https://bitcoincharts.com/						
https://www.coingecko.com/en							
Coopolitical Rick	https://www.matteoiacoviello.com/gpr.htm						
	https://www.policyuncertainty.com/gpr.html						
	Global EPU	http://www.policyuncertainty.com					
Economic Policy		http://www.policyuncertainty.com					
Uncertainty	US EPU	https://fred.stlouisfed.org/series/USEPUINDXD/					
	UK EPU	https://www.policyuncertainty.com/					
	China EPU	https://economicpolicyuncertaintyinchina.weebly.com/					

The data sources applied in previous literature are summarized in Table 5. The data source was categorized according to the variables involved in this study. The previous studies collected BTC price data from seven sources as revealed in Table 5. As coindesk.com is the most popular website for the historical BTC prices, most of the studies applied it as their source for BTC price data. Furthermore, the selected paper involves GPR collecting the data from two credible sources. Based on the papers included, we conclude that there are four types of economic policy uncertainty namely global EPU, United Kingdom (UK) EPU, China EPU and United States (US) EPU. According to Table 5, EPU data sources vary by country. The previous study data sources can serve as a guide when conducting the data collection.

A summary of selected papers is presented in Table 7 (see Appendix). This study is subdivided into two categories: EPU's impact on BTC and GPR's effect on BTC. Each paper's key information is extracted and organized according to the author, period of data, method, main findings, and limitations of the study. A total of 23 papers examined the impact of EPU on BTC, 3 papers analyzed the impact of GPR on BTC, and 3 papers investigated the impact of both EPU and GPR on BTC. A majority of the selected papers examined the effect of GPR and EPU on BTC by utilizing the quantile-based estimation and Generalized Autoregressive Conditionally Heteroscedastic (GARCH) framework. In addition, most of the studies adopted data starting in 2010.

Impact of Economic Policy Uncertainty on Bitcoin

It has been shown that EPU is predictive of BTC in almost all studies, aside from (Malladi and Dheeriya, 2021). In terms of cryptocurrency dynamics, the EPU is able to be one of the determining factors (Koumba et al., 2019). BTC long-term volatility can be significantly influenced and predict by the EPU (Fang et al., 2019). Moreover, the EPU has the potential to influence different BTC frequency (Al-Yahyaee et al., 2019), especially market conditions in the periods of extreme (Mokni, 2021). Furthermore, in predicting BTC returns, the internet-based index of economic uncertainty measure is more predictive compared to the newspaper-based indicators (Bouri and Gupta, 2021). The EPU had a positive impact on BTC before the BTC crash, however after BTC crashed in December 2017, the EPU has negative impact on BTC (Mokni et al., 2020). BTC is affected both positively and negatively by EPU (Demir et al., 2018; Qin, Su and Tao, 2021). The BTC returns and volatility may increase during times of uprising uncertainty (Paule-Vianez, Prado-Román and Gómez-Martínez, 2020). The

will be significantly greater returns in BTC on days of highest EPU as compared to lowest EPU days (Wang et al., 2020). However, according to Kalyvas et al (2020), EPU was negatively correlated with crash risk of BTC price, which reveals high EPU was associated with low BTC price crash risk.

BTC price is more affected by the US EPU and global EPU when the economic conditions are unfavorable (Al Mamun et al., 2020). According to Shaikh (2020), BTC returns in the US, Japan and China have higher responsive to the EPU, yet Chen and Yen (2020) found US EPU and other countries of Asian have not predictive ability. Moreover, US EPU and BTC have a significant causal relationship, as well BDS test shown nonlinearity can be one of the crucial factors to evaluate the causal relationship between BTC and US EPU (Fasanya et al., 2021). The US EPU influences BTC/USD more than the UK EPU affects BTC/GBP (Wang et al., 2020). BTC is affected both positively and negatively by the US EPU (Umar et al, 2021). Panagiotidids, Stengos and Vravosinos (2019) shown BTC responded positively to the US EPU changes. After the EPU spike days, the US EPU uprise BTC volume of trading and volatility (Wang et al., 2020). The US EPU able to affect the BTC negatively which the BTC's volatility can be reduced by US EPU shocks (Matkovskyy, Jalan & Dowling, 2020; Shaikh, 2020). Moreover, Cheng and Yen (2020) shown China EPU have predictive power on the BTC returns, whereas Panagiotidis et al. (2019) did not find a significant effect. Cheng and Yen (2020) shown China EPU able to raise its predictability on the returns of BTC after China regulated cryptocurrency trading, yet Bouri and Gupta (2021) found cryptocurrency volatility unable to affect by China EPU. Furthermore, Chen at al. (2021) and Shaikh (2020) indicate China EPU were positively correlated with BTC. In contrast, Yen and Cheng (2021) found a negative association between BTC volatility and China EPU. The Japan EPU also negatively affects the BTC since the Japan EPU raise will causes the BTC volatility decrease (Matkovskyy et al., 2020). The increase in European EPU will also increase BTC returns (Panagiotidids et al., 2019).

Global EPU obtain risk premiums when the markets conditions are distressed (Al Mamum et.al., 2020). In average conditions, a strong hedge exists between BTC and EPU (Wu et al., 2019). BTC can be used as a hedging tool against the risk of US EPU (Matkovskyy et al., 2020), China EPU (Chen et al., 2021; Yen and Cheng, 2021) and global EPU (Demir et al., 2018). EPU can be hedged by the BTC (Kalyvas et al., 2020) and the economic uncertainty not limited to newspaper-based or internet-based measure (Bouri and Gupta, 2021). However, Qin et al (2021) shown BTC unable always hedge the EPU. Under bull market conditions, the cryptocurrency market does not have strong hedge against the EPU (Colon et al., 2021; Wu et al., 2019). Fasanya et al (2021) also found BTC unable to hedge the US EPU. Besides, BTC acts more like a safe haven instead of a speculative asset (Paule-Vianez et al., 2020). The MVQM-CAViaR approach indicates BTC is generally immune to spillover effects of EPU risk, whereas the Granger causality test reveals insignificant results (Wang et al. 2019). The BTC can serve as a safe haven during high EPU (Zhou, 2021) but the short run relationship tends to change to the long run (Umar et al., 2021). Under average market conditions, the BTC is able to be considered as a safe haven (Wu et al., 2019). Yet during the extremely bullish and bearish market conditions, the BTC acts as a weak safe haven (Colon et al., 2021; Wu et al., 2019). Furthermore, if BTC impact by EPU positively, the BTC can serve as a safe haven against the EPU, but it unable to sustained if presence of a negative effect (Qin et al., 2021). In terms of US EPU, the BTC also cannot be considered as a safe haven (Fasanya et al., 2021).

Impact of Geopolitical Risk on Bitcoin

The BTC returns and volatility can be forecasted by the GPR (Al-Yahyaee et al., 2019; Aysan et al., 2019). At difference frequencies, the GPR can affect the BTC (Al-Yahyaee et al., 2019). In comparison to US EPU and global EPU, the BTC risk premia and volatility are more influenced by the GPR (Al Mamun et al., 2020). When the economic conditions is unfavourable, the GPR has a greater effect on BTC (Al Mamun et al., 2020; Kyriazis, 2020). GPR has both positive and negative impact on BTC (Su et al., 2020). The BTC volatility is positively influenced by GPR and BTC returns impacted by GPR negatively (Aysan et al., 2019). GPR has a positive effect on BTC (Su et al., 2020) on higher quantiles (Aysan et al., 2019). On the other hand, Kyriazis (2020) shown GPR had negative impact on BTC. When the positive effect exists, the BTC is considered as a valuable asset being immune to GPR but this view is unreliable if exists negative effect (Su et al., 2020).

As a result of distressed market conditions, a risk premium was acquired by the GPR (Al Mamun et al., 2020). The BTC have a potential act as a hedging instrument against the GPR (Aysan et al., 2019), especially the extreme upsides of GPR (Al-Yahyaee et al., 2019). Even though the cryptocurrency market offered strong hedge against GPR, however it cannot serve as a safe haven in most cases (Colon et al., 2021) but Kyriazis (2020) reveals BTC able act as a safe haven against the GPR.

Suggestion from Primary Studies for Future Research

As shown in Table 7 (refers to Appendix), there were some recommendations for future research provided by several previous studies. The suggestions below may assist us in identifying the research gap and discovering the key emerging.

Wang et al. (2019) proposed applied other cryptocurrency instead of BTC such as Litecoin, Ethereum, Ripple, etc. It would be interesting to explore the connection between the uncertainty indices and other cryptocurrencies (Al-Yahyaee et al., 2019; Matkovskyy et al. 2020; Paule-Vianez et al., 2020), the impact of uncertainty indices on alternative cryptocurrencies (Chen et al., 2021) and evaluate whether the current results are still valid (Bouri and Gupta, 2021). It is also possible to determine the elements that results of different exchange rates for BTC based on its intrinsic characteristic (Wang et al., 2020). For instance, we may apply the data of BTC instead of indicates by US dollar (Paule-Vianez et al., 2020). Other uncertainty measures may also be analyzed by using the different countries of cryptocurrency market (Wu et al., 2019).

Furthermore, we may consider to determine the ideal level of uncertainty for cryptocurrencies (Koumba et al., 2019). Alternatively, other uncertainty measures can be adopted to analyze the influences of uncertainty on the cryptocurrency market (Colon et al., 2021; Demir et al., 2018; Paule-Vianez et al., 2020). We can assess other uncertainty and risk indices to analyze the impact on cryptocurrencies by applied the indicators of domestic political risk for large economies such as US, China, Russia, etc (Aysan et al., 2019). A country-level data of EPU index and EPU equity and/or time-variability may also consider used to evaluate the hedging ability of BTC (Fang et al., 2019). Bouri and Gupta (2021) proposed developing a measure of uncertainty by applied the daily data from Google Trends. A high frequency dataset (e.g., intraday data) of risk and uncertainty indices can be used to examine the impact on BTC price (Aysan et al., 2019). For the GPR, the GPR threats and GPR attacks might applied to evaluate the changes in BTC price index (Al-Yahyaee et al., 2019). A better alternative to overall GPR index would be adopted daily GPR sub-indices, for instance, GPR attacks or GPR threats (Aysan et al., 2019).

We can investigate the BTC relationship with other assets such as Swiss francs and US Treasury bonds (Bouri and Gupta, 2021), US dollar, gold, etc. (Qin et al., 2021; Su et al., 2020). We can develop the innovative indexes or applied wider range of conventional assets (Kyriazis, 2020). The returns and volatility of cryptocurrency may include wider range of variables in different regimes and market (Malladi and Dheeriya, 2021). We can employ EPU equities, commodities and bonds as well as utilize the expected shortfall serve as a risk measure to examine the relationship between BTC and EPU (Fang et al., 2019). Besides, the exchange rates can be considered when examine the influence of EPU on various assets (Wang et al., 2020). We also can identify whether different countries of EPU have the predictive ability on different exchange rates of BTC price (Wu et al., 2019).

Moreover, we can apply the modern financial framework as alternative methodologies to evaluate the BTC (Kyriazis, 2020). We may exploit a method to investigate the spillover effect between different BTC market (Wang et al., 2020). For high frequency data, we might consider applying a non-linear approach (Bouri and Gupta, 2021). A multivariate DCC-MIDAS model can apply for analyzing the implication (Fang et al., 2019). In addition, dynamic hedging strategies can be analyzed for their impact on transactions (Mokni et al., 2020). We also can investigate the enhancement of encryption technologies whether can improve the hedging ability and value of BTC (Su et al., 2020).

Conclusion

In this study, we focused on the papers that examined the influences of GPR and EPU on BTC. In order to collect the relevant literature, we selected Scopus, the largest electronic databases. The literature search was conducted based on the keywords derived from the major areas of study. As a result of stage-by-stage filtering, this study only included 29 articles from 19 journals. The included papers published between 2018 and 2021. A quality assessment for journals was conducted based on SCImago Journal and Country Rank and ABDC journal quality list as well as the selected papers key information and main findings were extracted and summarize in this study.

Table 6

Key Findings		
Impact of EPU on BTC		
EPU has predictive power on BTC	Existed	(Al Mamum et al., 2020; Al-Yahyaee et al., 2019; Bouri & Gupta,2021; Cheng & Yen, 2020; Demir et al., 2018; Fang et al., 2019; Fasanya et al.,2021; Koumba et al., 2019; Mokni, 2021; Panagiotidis et al., 2019; Shaikh, 2020; Wang et al., 2020; Yu, 2019)
	Not existed	(Malladi & Dheeriya, 2021)
Impact of EPU on BTC	Positive impact	(Chen et al., 2021; Panagiotidis et al., 2019; Paule-Vianez et al., 2020; Wang et al., 2020)
	Negative	(Kalyvas et al., 2020; Matkovskyy et al.,
	impact	2020; Yen & Cheng, 2021)

	Mixed	(Demir et al., 2018; Mokni et al., 2020;
		Qin et al., 2021; Shaikh, 2020; Umar et
		al., 2021)
Bitcoin act as hedging tool	Existed	(Bouri & Gupta,2021; Chen et al., 2021;
against EPU		Demir et al., 2018; Kalyvas et al., 2020;
		Matkovskyy et al., 2020; Wu et al., 2019;
		Yen & Cheng, 2021)
	Not existed	(Qin et al., 2021)
Bitcoin act as safe haven against	Existed	(Colon et al.,2021; Paule-Vianez et al.,
EPU		2020; Umar et al., 2021; Wang et al.,
		2019; Wu et al., 2019; Zhou, 2021)
	Not existed	(Fasanya et al.,2021)
Impact of GPR on BTC		
GPR has predictive power on BTC	Existed	(Al Mamun et al., 2020; Al-Yahyaee et
		al., 2019; Aysan et al., 2019)
	Not existed	-
Impact of GPR on BTC	Positive	-
	impact	
	Negative	(Kyriazis, 2020)
	impact	
	Mixed	(Aysan et al., 2019; Su et al, 2020)
Bitcoin act as hedging tool	Existed	(Al-Yahyaee et al., 2019; Aysan et al.,
against GPR		2019; Colon et al., 2021)
-	Not existed	-
Bitcoin act as safe haven against	Existed	(Kyriazis, 2020)
GPR	Not existed	(Colon et al., 2021)

Research Methodology

- Generalized Autoregressive Conditional Heteroscedasticity (GARCH) framework
- Quantile based estimation
- Vector Autoregressive (VAR) framework
- Granger causality test
- Ordinary Least Squares (OLS) regression
- Copula based model
- Predictive regression model
- Wavelet approaches
- Model Confidence Set (MCS) test
- Stochastic volatility model
- Brock, Dechert, Scheinkman and LeBaron (BDS) Test

Potential Literature Gaps

- Apply various cryptocurrency (eg: Ethereum, Binance Coin, Litecoin, Tether, etc)
- Adopt other uncertainty and risk indices (eg: trade policy uncertainty, country-level data, etc)
- Employ other assets (eg: gold, oil prices, exchange rates, etc)
- Utilize alternative methodology (eg: non-linear approach, etc)

The main finding in this study summarized in Table 6. Generally, most of the study found GPR and EPU have predictive power on BTC. Both EPU and GPR able affect BTC positively and negatively. BTC can serve as a hedging instrument against the GPR and EPU. The BTC also able act as a safe haven against the GPR and EPU. Furthermore, in most of the selected papers, GARCH framework and quantile-based estimation applied to investigate the impact of EPU and GPR on BTC. Several studies adopted OLS regression, VAR framework and granger causality test and very few studies considered predictive regression model, wavelet approaches, copula-based model, MCS test, stochastic volatility model and BDS test.

The empirical results of this study contributing to Bitcoin investor significantly on the development of portfolio management. This study suggests the investor, policymakers and decision-makers should focus more on the tendency of the EPU and GPR when forecasting the BTC price and return. The investor can include the EPU and GPR in their risk profiles and consider the risks of hedging. In addition, this line of research has the potential to be extended in the future. Future scholars suggested utilizing other cryptocurrency and adopt other uncertainty measure apart from GPR and EPU. The relationship between BTC and other assets may explore in further. The alternative methodologies also can consider applied for BTC analysis.

APPENDIX

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Summary of main finding for previous studies literature

Authors	Data Methodology period	Key Findings	Limitation
Impact of Al Mamun, Uddin, Suleman, Kang (2020)	PU on BTC July 18, • DCC-GJR- 2010 - GARCH October 30, 2016 (daily)	 Global EPU acquire a risk premium during distress market conditions. The unfavorable economic conditions magnify the impact of US EPU and global EPU on 	-
Al- Yahyaee, Rehman, Mensi, Al-Jarrah (2019)	August 31, 2013 - August 30, 2018 (daily) •Cross Wavelet Transform (CWT) •Power Wavelet Coherence (PWC) •Multiple	BTC. • EPU can affects BTC at different frequencies according to PWC and MWC results.	• Examine the future price of BTC and other cryptocurrency nexus uncertainty indices.
Al-Jarrah (2019)	(daily) Wavelet Transform (CWT) • Power Wavelet Coherence (PWC) • Multiple Wavelet Coherence		

Bouri, Gupta (2021)	July 2010 to May 2019 (107 monthly obs.)	(MWC) approaches • EGARCH model	 The internet-based index is more predictive compared to newspaper- based index for economic uncertainty measure when predict the returns of BTC. BTC have hedging ability on both measures. 	 Consider other cryptocurrrency and examine the validility of the current result. Compared the current results with other assets that able hedges against the uncertainty but not consider as a safe haven such as Swiss franc, US Treasury bonds, etc. Utilize daily data
				 from Google Trends to create own measure of uncertainty. For high frequency data, consider employ a nonlinear
				annroach
Chen, Lau, Cheema, Koo (2021)	Decembe r 31, 2019 - May 20, 2020 (142 daily obs.)	 OLS model Generalized Quantile Regression estimation 	 BTC returns affected by Chinese EPU positively and more significant in higher quantiles. The BTC able hedge against China EPU which the raising of uncertainty leads to BTC returns increase. 	• Examine how uncertainty affects alternative cryptocurrency (altcoins) in the era of post-COVID-19.
Cheng, Yen (2020)	2014:M0 2 - 2019:M0 6 (62 monthly obs.)	Predictive regression model	 China EPU have predictive power on monthly return of BTC but this perspective less reliable for US or other Asian countries. EPU able enhances its predictability to the returns on BTC since China changed its cryptocurrency trading 	-

			policy in September 2017.	
Colon, Kim C., Kim H., Kim W (2021)	2013:M0 4 - 2019:M0 8 (980 monthly obs.)	 Panel OLS regression Quantile regression approach 	•The cryptocurrency market can serve as a safe haven and weak hedge against the EPU during bull market conditions.	 Analyze cryptocurrency market reactions using various uncertainty measures.
Demir, Gozgor, Lau, Vigne (2018)	July 18, 2010, - Novembe r 15, 2017 (2678 daily obs.)	 Bayesian Graphical Structural Vector Autoregress ive (BSGVAR) technique OLS estimations Quantile- on-Quantile (QQ) estimations 	 EPU able to predict the returns of BTC. BTC returns influences negatively by EPU. At lower and higher quantiles, EPU have significant positive effect on BTC. BTC can function as a hedging tool against the EPU. 	 Adopt other measures of uncertainty to analyze the cryptocurrency market.
Fang, Bouri, Gupta, Roubaud (2019)	21 Septembe r 2010 - 26 January 2018 (daily, monthly)	• GARCH- MIDAS models • DCC-MIDAS model	 Long-term volatility of BTC can significantly affected by EPU. BTC volatility predictions could be improved with the information from EPU. 	 Examine the hedging ability of BTC on EPU by including the equity and time-variability and/or country-level EPU indices. Utilize DCC-MIDAS multivariate models to analyze the relationship between EPU, BTC, bonds, commodities and equities, as well as employ the expected shortfall as risk measurement to examine the implications.
Fasanya, Oliyide,	July 20, 2010 -	• BDS test	• The nonlinearity plays an important role in	-

Adekoya,	June 26,	• Granger	analyzing the causal	
Agbatogu n (2021)	2020 (2594 daily obs.)	causality test • Non-	relationship between US EPU and BTC shown by BDS test.	
		parametric causality-in- quantile test	 The non-parametric causality-in-quantile test shown a significant causal relationship exist between the US EPU and BTC. The BTC cannot act as a 	
			hedging tools or safe haven against the US EPU.	
Kalyvas, Papakyria kou, Sakkas, Urquhart (2020)	Septembe r 2011 - Decembe r 2018 (daily)	 Univariate and multivariate regression models 	 The high EPU leads to BTC crash risk low which indicates EPU negatively correlated with the crash risk of BTC price. EPU able hedge by BTC. 	-
Koumba, Mudzingi ri, Mba (2019)	10 August 2016 - 23 February 2018 (daily)	• D-Vine pair- copula method	• EPU able act as a key determinant on dynamics of cryptocurrency.	Identify the optimal uncertainty impact level on cryptocurrency.
Malladi, Dheeriya (2021)	08/01/ 2013 - 01/01/20 19 (1363 daily obs.)	 ARMAX model GARCH model VAR model Granger causality tests 	 The daily return of BTC is not correlated with EPU 	 Apply wide range of variables in cryptocurrency volatility and returns depending on the different market and regimes.
Matkovsk yy, Jalan, Dowling	27/04/20 15 - 25/10/20	 Multivariate EWMA models 	• BTC able act as a hedging instrument against the shocks of US EPU.	• Adopt other cryptocurrency to examine if BTC
(2020)	18 (BTC:	 Spearman's rho 	• BTC volatility decreased caused by US FPU shocks.	serves as a link for transmit shocks
	daily; EPU: monthly)	 Diebold and Yilmaz (2012) spillover index GAS models with 	•The Japan BTC market volatility decrease when rising of Japan EPU.	from EPU to other cryptocurrency.
		conditional multivariate		

		Student-t distribution and time- varying scales and correlations • BVAR models with the Litterman/ Minnesota priors • Nonlinear impulse responses with local projections		
Mokni (2021)	2010:M0 9 - 2019:M1 0 (115 monthly obs.)	• Symmetric and asymmetric causality in- quantiles test	 BTC returns predicted better by EPU in most countries during extreme market conditions. At high and intermediate quantiles, EPU have influence on BTC volatility. 	-
Mokni, Ajmi, Bouri, Vo (2020)	May 22, 2014 - January 20, 2020 (1,425 daily obs.)	• DCC- EGARCH	 The EPU correlated positively with BTC before the BTC crash which the rise in EPU level leads to higher BTC optimal weight. The BTC negatively impacted by EPU on dynamic conditional correlation since BTC crash in December 2017. 	 Analyze the impact of transactions on dynamic hedging strategies.
Panagioti dis, Stengos, Vravosin os (2019)	7/27/201 0 - 9/30/201 6 (2258 daily obs.); 7/25/201 0 - 8/31/201 8	 VAR models FAVAR model Granger causality 	 BTC respond positively to European and US EPU which the raising of EPU results BTC returns more attractive. China EPU have impact on BTC but not significant. 	-

	(2960 daily obs.)			
Paule- Vianez, Prado- Román, Gómez- Martínez (2020)	19 July 2010 - 11 April 2019 (daily)	 Simple linear regression Quantile regression model 	 The BTC returns and volatility may increase when the uncertain times rise. BTC act more like a safe haven rather than a speculative asset. 	 Employ other uncertainty measures and utilize the BTC data apart from denoting in US dollar. Identify the effect of EPU on other cryptocurrency.
Qin, Su, Tao (2021)	2010:M0 7 - 2019:M0 6 (108 monthly obs.)	 Bootstrap full- and sub-sample rolling- window Granger causality tests 	 EPU have both positive and negative impact on BTC. The EPU unable always hedge by BTC. The BTC can used as a safe haven or hedge against the EPU when EPU have positive impact on BTC, but this perspective unable sustained during periods 	 Mitigate losses caused by EPU by comparing BTC ability with other assets such as US dollar and gold. Explore the linkage between BTC and other assets.
Shaikh (2020)	July 18, 2010 - Septembe r 15, 2018 (BTC: daily and monthly; US EPU: daily; China, Hong Kong, Japan, Europe, global EPU: monthly)	 Quantile regression Markov regime- switching model 	 with negative impact. The returns of BTC is more responsive to the EPU in Japan, US and China. In China, BTC influenced by EPU positively, while EPU have negative impact on BTC in Japan and US. 	-

Umar, Su, Rizvi, Shao (2021)	2010:M0 6 - 2020: M10 (124 monthly obs.)	 Wavelet- based quantile-on- quantile approach Quantile- based Granger causality 	 BTC can serve as a safe haven when the uncertainties rise, yet the relationship tend to change from short to long run. BTC affected US EPU positively and negatively. 	-
Wang, Li, Shen, Zhang (2020)	US: Septembe r 13, 2011 - Decembe r 31, 2018 (2649 daily obs.) UK: March 29, 2014 - Decembe r 31, 2018 (1732 daily obs.)	• DCC-GARCH model	 BTC returns are significantly higher on highest EPU days compared to lowest days of EPU. The BTC volatility and trading volume increase after the spike days of EPU but it is not reflected in UK EPU. BTC/USD is more affected by US EPU compared to the impact of UK EPU on BTC/GBP. 	 Examine how EPU influences different assets by taking the exchange rates into account. Explore the method to examine the spillover effects between different BTC markets. Investigate the impact factors of different BTC exchange rates with its own intrinsic feature
Wang, Xie, Wen, Zhao (2019)	19 July 2010 - 31 May 2018 (2874 daily obs.; 410 weekly obs.)	 MVQM- CAViaR approach Granger causality risk test 	• The MVQM-CAViaR approach shown BTC immune to EPU risk spillover effect in most cases, while Granger causality risk test shown it is insignificant.	 Examine the impact of EPU on other cryptocurrency (i.e., Ethereum, Litecoin, Ripple, etc) to analyze the ability of cryptocurrency to immune the EPU shocks.
Wu, Tong, Yang, Derbali (2019)	February 02, 2012 - Decembe r 31, 2018 (1532 daily obs.)	 GARCH model Quantile regression with dummy variables. 	• BTC able serve as a strong hedge or safe haven in average market conditions, but when the market condition is extreme bearish and bullish, BTC function as a weak hedge and weak safe haven.	 Adopt other measures of uncertainty to investigate the impact on gold and cryptocurrencies in different countries. Analyze the predictive power of

				different countries EPU on gold and BTC with different exchange rate.
Yen, Cheng (2021)	February 2014 to June 2019 (63 monthly obs.)	• Stochastic volatility model	 The changes of China EPU able affected the BTC volatility which high EPU resulting volatility of BTC lower. BTC able function as a hedging instrument against the EPU risk. The China EPU unable affect the volatility of cryptocurrency after the crypto trading regulates by the Chinese government. 	
Yu (2019)	March 1, 2003 - Septembe r 30, 2018 (daily)	 Model Confidence Set (MCS) test HAR-RV and HAR-CJ models 	 EPU have predictive ability on volatility of BTC. 	-
Zhou (2021)	17 March 2011 - 21 June 2018 (2654 daily obs.)	 EGARCH framework 	• When the EPU is high, BTC can function as a safe haven.	-
Impact of C	SPR on BTC			
Al Mamun, Uddin, Suleman, Kang (2020)	July 18, 2010 - October 30, 2016 (daily)	• DCC-GJR- GARCH	 GPR has more significant effect on BTC risk premia and volatility compared to US EPU and global EPU. GPR obtain a risk premium during distressed market conditions. GPR has greater influences on BTC during unfavorable economic conditions. 	-
Al-	August	• WC	• PWC and MWC indicates	• Analyze the BTC
ranyaee, Rehman	31, 2013 -	• CWT • PWC	GPR can affect BTC at	price index
,				

Mensi, Al-Jarrah (2019)	August 30, 2018 (daily)	• MWC approaches	 GPR have predictive power on BTC price returns and volatility. GPR's extreme upsides can be bedged by BTC 	GPR attacks and GPR threats.
Aysan, Demir, Gozgor, Lau (2019)	July 18, 2010 – May 31, 2018 (2875 daily obs.)	 Bayesian Graphical Structural Vector Autoregress ive (BSGVAR) technique OLS estimations QQ estimations 	 BSGVAR reveals GPR able forecast the BTC returns and volatility. OLS shown GPR have positive and negative effect on BTC volatility and returns respectively. Based on QQ estimations, GPR affects BTC price returns and volatility positively at higher quantiles. BTC able serves as a hedging instrument against GPR. 	 Investigate whether other risk and uncertainty indices have impact on cryptocurrency, for instance, adopt the domestic political risk indicators from large economies such as China, US, Russia etc. Adopting high frequency data, such as intraday data to evaluate the impact of uncertainty and risk indices on BTC prices. Instead of overall GPR index, utilizing the sub-indices of GPR with daily data, for instance, GPR attack and GPR threats.
Kim C., Kim H., Kim W (2021)	2013:M0 4 - 2019:M0 8 (980 monthly obs.)	 Panel OLS regression Quantile regression approach 	• In most cases, cryptocurrency market may act as a strong hedge against the GPR, but cannot use as a safe haven.	-
Kyriazis (2020)	2012:M0 3 - 2020:M0 3 (BTC weekly; GPR monthly)	 ARCH approach GARCH approach 	 GPR have negative impact on BTC. BTC has potential to become profitable during times of crisis that BTC can act as a safe haven against GPR. 	 Apply wide range of innovative indices and conventional assets. Utilize alternative methodologies to analyze BTC

				through a modern financial framework.
Su, Qin, Tao, Shao, Albu, Umar (2020)	2010:07 - 2019:M1 2 (114 monthly obs.)	• Bootstrap full, and the sub-sample rolling- window Granger causality tests	 GPR affects BTC positively and negatively. BTC could be considered as a valuable asset in avoiding GPR when exist positive effect, but this view could not be sustained when negative effect occurs. ICAPM shown GPR influences BTC positively only. 	 Investigate whether enhanced encryption technologies could improve the hedging abilities and value of BTC. The asset or portfolio should be considered when the GPR is high such as BTC, US dollar, gold, etc.

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