RESEARCH ARTICLE

RISK AND RETURN BITCOIN

Isfenti Sadalia[1], Rico Nur Ilham[2], Erlina[3], Khaira Amalia Fachrudin[4], Amlys Syahputra Silalahi[5]

*[1]*Faculty of Economic and Bussiness, Universitas Sumatera Utara, Indonesia*
Jl. Prof.T.M.Hanafiah Kampus USU Medan
[2] isfentisadalia@gmail.com

#[2]*Doctoral Program, Faculty Economic and Bussiness,Universitas Sumatera Utara, Indonesia*
[1]riconurilham@unimal.ac.id

*[3]*Faculty Of Economic and Bussiness, Universitas Sumatera Utara, Indonesia*
Jl.TM Hanafiah Kampus USU Medan 20155
[3]erlinaroesli1966@yahoo.com

*[4]*Faculty Of Economic and Bussiness, Universitas Sumatera Utara, Indonesia*
Jl.TM Hanafiah Kampus USU Medan 20155
[4]khairaamalia@yahoo.co.id

*[5]*Faculty Of Economic and Bussiness, Univeritas Sumatera Utara, Indonesia*
Jl.TM Hanafiah Kampus USU Medan 20155
[5]amlys.silalahi@gmail.com

Abstract : We establish that the risk-return tradeoff of cryptocurrencies (Bitcoin, Ripple, and Ethereum) is distinct from those of stocks, currencies, and precious metals. Cryptocurrencies have no exposure to most common stock market and macroeconomic factors or to the returns of currencies and commodities. In contrast, we show that the cryptocurrency returns can be predicted by factors which are specific to cryptocurrency markets – there is a strong time-series momentum effect and proxies for investor attention strongly forecast cryptocurrency returns. We provide an extreme value analysis of the returns of Bitcoin. A particular focus is on the tail risk characteristics and we will provide an in-depth univariate extreme value analysis. Those properties will be compared to the traditional exchange rates of the G10 currencies versus the US dollar. For investors - especially institutional ones - an understanding of the risk characteristics is of utmost importance. So for bitcoin to become a mainstream investable asset class, studying these properties is necessary. Our Endings show that the bitcoin return distribution not only exhibits higher volatility than traditional G10 currencies, but also stronger non-normal characteristics and heavier tails. This has implications for risk management, financial engineering (such as bitcoin derivatives)-both from an investor's as well as from a regulator's point of view. To our knowledge, this is the first detailed study looking at the extreme value behaviour of the cryptocurrency Bitcoin.

Keywords : Bitcoin, Risk and Return, Portfolio Management

JEL Classifications: M1, E0,

I. Introduction

A. *Introduction to Bitcoins*

Bitcoin, the world's first decentralized digital currency, is a cryptocurrency, "Cryptocurrency in its purest form is a peerto-peer version of electronic cash. It allows online payments to be sent directly from one party to another without going through a financial institution." [1]. The most fascinating part is that Bitcoins which are worth hundreds of dollars are just a record of transactions available to the public and not physical coins or even files on a computer. Despite their price volatility, Bitcoins currently have a market capitalization of over $10 Billion, there are 15800600 [2] Bitcons in circulation and over 8 million Bitcoin Wallet users. Let us understand the factors which set Bitcoin apart from the fiat currencies, and have been responsible for the surge in their demand.

B.Accessibility

Bitcoins can be converted into all the major currencies of the world (at least 32 countries) [3]. Since Bitcoins can be used in every country across the world, people have access to the global market as a whole, it is axiomatic that better ideas and higher quality of growth will ensue. [3] Reduction in Transaction Costs Bitcoins can be transferred directly between individuals without having to go through a checking agency or a bank or any other third party. Given that the accessing and transacting the Bitcoin network, which nobody owns, is free of cost, there is a significant reduction in the transaction costs. [3]

C.Optimal Portfolio Construction

To construct the optimal portfolio, we calculate the standard deviation, the mean and hence the Sharpe ratio for the equallyweighted portfolio. Then using Solver in Excel, we maximize the Sharpe ratio for three cases-

1. No Short selling
2. Unconstrained Short selling is allowed
3.Minimum holding constraint with no short selling

INDIVIDUAL ASSETS		
Asset	**mean**	**stdev**
BTC	0.69%	8.01%
S&P500	0.05%	0.97%
GOLD	0.01%	1.08%
REAL ESTATE	0.04%	0.96%
BARCLAYS BOND	-0.05%	2.19%
MXEF	0.00%	1.03%
OIL	-0.09%	3.18%
BALTIC	-0.06%	2.56%

Source: https://newsletter.coingecko.com/landing/2019-q3.

In other columns of Fig. 1, we have the mean and standard deviations of the returns on the various assets classes considered.

We conclude that cryptocurrency returns have low exposures to traditional asset classes – stocks, currencies, and commodities. Our findings cast doubt on popular explanations that the behavior of cryptocurrencies is driven by its functions as a stake in the future of blockhain technology similar to stocks, as a unit of account similar to currencies, or as a store of value similar to precious metal commodities. At the same time, the returns of cryptocurrency can be predicted by two factors specific to its markets – momentum and investors attention. Our findings call into question popular explanations that supply factors such as mining costs, price-to-"dividend" ratio, or realized volatitility are useful for predicting the behavior of cryptocurrency returns. Finally, we document that the blockchain technology embodied in cryptocurrencies has a potential to affect a number of important industries.

D.Algorithmic Trading

The Algorithmic Bitcoin Trading Market is quite established and there are a lot of websites which allow to either use their bots or build your own bots and trading strategies using your own algorithms. Some examples include:

- CryptoTrader provides the users with the facilities of ready-made Bitcoin trading bots which can either be used for free or be bought. https://tradewave.net/ [4] also offers similar features to users.
- HassOnline provides fully customizable bots with the ability to recognize a wide array of signals in the market and implement quite a few profitable strategies.

E.Country Acceptance

This section compares the outlook of different countries and their governments towards Bitcoin including the taxation policies by the central banks.

Table II
Comparative Analysis Of The Acceptance Level Of Bitcoin By Different Countries

Country	Acceptence	Outlok Towards Bitcoin
USA	High	IRS considers Bitcoin as a property and hence there is a Capital Gains Tax imposed on Bitcoin transactions. But in general, a positive outlook and the acceptance of Bitcoin as a currency is high.
UK	High	Bitcoin is considered as "Private Money" and the profit and losses on the transactions are subject to Capital Gains Tax. No VAT on Bitcoin it self intransactions.
Germany	High	Bitcoin is recognized as "Private Money". But in June 2013, all the Bitcoin transactions in Germany were exempted from Capital gains Tax indicating an accepting attitude towards the digital currency
Canada	High	Bitcoins come under the various taxation policies of the government
Denmark	High	Bitcoins come under the various taxation policies of the government
Australia	High	The government removed the double taxation of GST on Bitcoin transactions in a move indicating a positive outlook. Companies in Australia are allowed to trade in Bitcoins.
EU	High	A big boost to the Bitcoin economy occurred when the European Court of Justice ruled not to charge VAT on Bitcoin transactions as it is to be treated like "Money"
China	Medium	Banking institutions and employees are banned from engaging in Bitcoin transactions, bur common citizens can both trade and mine Bitcoins.
India	Medium	The RBI has no plans to regulate to Bitcoins, as of now, but had cautioned the users about virtual Currencies including Bitcoin.
Japan	Medium	Individuals allowed, but banks and institutions not allowed to transact with Bitcoins. Consumption tax on Bitcoin transactions.
Bangladesh	Ilegal	Usage of Bitcoins is banned. If caught transacting in Bitcoins, it can lead to incarceration under the country's anti-money laundering laws.
Russia	Ilegal	“Ministry of Finance calls it a 'money surrogate' which is illegal “

II. RESEARCH METHOD

This research includes the type of literature study research by looking for references to theories and scientific journals that are relevant to the case or problem found. The theoretical references obtained by the study of literature studies serve as the basic foundation and the main tool in conducting research. This study uses the Literature study method based on several previous studies and scientific journals that discuss Bitcoin as a payment instrument in buying and selling transactions.

A.Research Objectives

This study aims to see the potential of tax revenue from Bitcoin transactions, because in various countries that have applied tax levies on Virtual currency has been proven to be able to increase the country's income and to respond to growing issues regarding virtual money transactions in the world.

III.DISCUSSION

A.Acceptance

Despite Bitcoin being a revolutionary currency and providing features unlike any other financial instrument and giving you a higher risk adjusted return as seen in Section III, it is still a relatively new asset class does not make sense for an investor to add Bitcoins to his portfolio until he has a decent idea about the acceptance of Bitcoin as a medium of exchange. This section discusses the acceptance of Bitcoins at 3 different fronts- by Countries, by Banks and by Merchants. As can be seen from Table II, Bitcoin had a growing market capitalization. the increasing confirmed transactions per day (Current Average: 231,960 transaction per day) and a continuously stabilizing volatility in the price level.

The current volatility of Bitcoin according to the Bitcoin Volatility Index is 2.28% (as on 29th August 29, 2016).Thus, it appears as if the general outlook towards Bitcoin, currently, is positive. Let us explore the acceptance of Bitcoins across the different fronts that we discussed earlier, Countries, Banks, and Merchants

we started by introducing Bitcoin and discussed the basic technicalities associated with it. As we moved on to Section II, we saw that with the continuously growing number of financial derivatives and exchange platforms dealing with Bitcoins, the progress being made on Bitcoin in the financial industry is staggering and it is not unreasonable to conclude that the currency is past its nascent stage.

B.Bitcoin Return

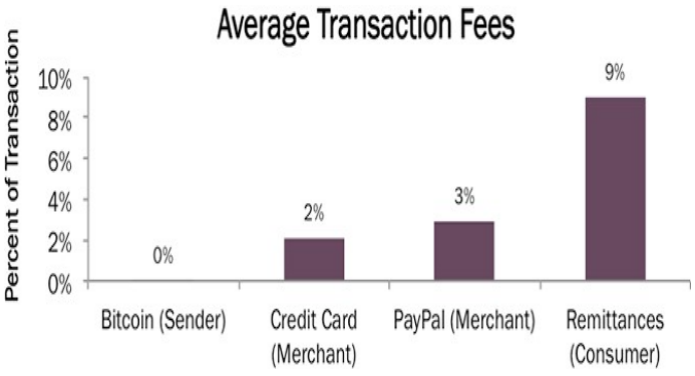
The Bitcoin returns are positively skewed at all frequencies in contrast to the stock returns which are negatively skewed. The skewness increases from 0.80 at the daily frequency to 1.76 at the weekly frequency, and to 4.32 at the monthly frequency. The corresponding kurtosis is 15.21 at the daily frequency, 10.25 at the weekly frequency, and 25.38 at the monthly frequency. The bitcoin returns have high probabilities of exceptional negative and positive daily returns.

Table III : **Comparative The Bitcoin Daily Return**

COVARIANCE-VARIANCE MATRIX								
	Return S&p 500	Return BTC	Return Barclays Capital	Return oil	Return Real estate	Return gold	Return MXEF	Return baltic
Return S&p 500	0.0054%	0.0026%	-0.0008%	0.0078%	0.0073%	0.0000%	0.0049%	-0.0004%
Return BTC	0.0026%	0.6428%	0.0577%	0.0611%	0.0045%	0.0001%	0.0005%	-0.0008%
Return Barclays Capital	-0.0008%	0.0577%	0.0481%	0.0497%	-0.0004%	0.0011%	0.0003%	-0.0009%
Return oil	0.0078%	0.0611%	0.0497%	0.1009%	0.0056%	0.0048%	0.0073%	0.0008%
Return Real estate	0.0073%	0.0045%	-0.0004%	0.0056%	0.0092%	0.0011%	0.0054%	-0.0010%
Return gold	0.0000%	0.0001%	0.0011%	0.0048%	0.0011%	0.0118%	0.0010%	-0.0008%
Return MXEF	0.0049%	0.0005%	0.0003%	0.0073%	0.0054%	0.0010%	0.0105%	-0.0005%
Return Baltic	-0.00038%	-0.00081%	-0.00087%	0.00083%	-0.00103%	-0.00077%	-0.00046%	0.000655305

For example, the probability of a -20 percent daily return "disaster" is almost 0.5 percent; the probability of a 20 percent daily return "miracle" is almost 1 percent. The Ripple and Ethereum returns have similar characteristics: (1) positively skewed at all frequencies and having high kurtosis; and (2) high probabilities of exceptional negative and positive daily returns.

Bitcoins are much more volatile than traditional at currencies. In the risk management of financial instruments, it is important to assess the probability of rare and extreme events. We will use extreme value theory to statistically model such events and compute extreme risk measures. Extreme value distributions will be matched to the tails of Bitcoin returns and compared to the tails of traditional at currencies. We will also compute two tail risk measures, value at risk and expected shortfall for Bitcoin.



Source:https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3226806 1/ Risks and Returns of Cryptocurrency by Yukun Liu, Aleh Tsyvinski :: SSRN

Many Bitcoin transactions have spread to various types of shopping. starting from being absorbed in the process of online shopping, credit card payments and purchasing other needs.

To attract users' interest in increasing bitcoin transactions, a number of gift and bonus models were made in the Bitcoin trading transaction process. Many gift methods such as credit card pieces and other merchant.

C.Distribution of Bitcoin In Currency

Bitcoins are much more volatile than traditional at currencies. In the risk management of financial instruments, it is important to assess the probability of rare and extreme events. We will use extreme value theory to statistically model such events and compute extreme risk measures. Extreme value distributions will be aceipted to the tails of Bitcoin returns and compared to the tails of traditional at currencies. We will also compute two tail risk measures, value at risk and expected shortfall for Bitcoin.

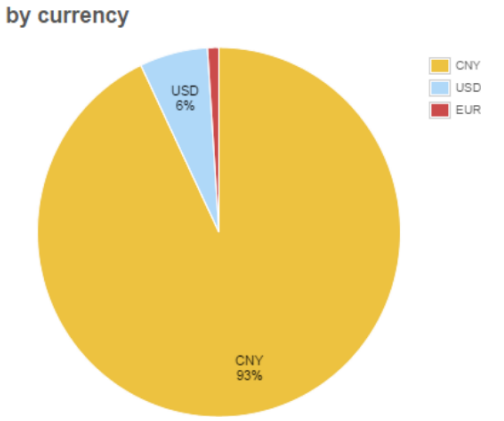


Figure : III.Distribution Of Bitcoin and an in-depth look at the acceptance level in different countries.

1. Russia

It is called as “Surrogate Currency” by the Ministry Of Finance and it is illegal to mine or issue Bitcoins. But it will consider Bitcoin as a foreign currency or tax purposes and will allow foreign trading of virtual currency.

2. Spain

The country has exempted Bitcoin transactions from VAT, Un like USA where IRS has said Bitcoins transactions will be taxed.

3. China

Times have definitely changed from when earlier the country banned crypto-currencies which led to a more than 20% fall in regulatory sort of framework, which, according to the policy makers, will help trace the citizens’ stolen Bitcoins.

Banks and financial institutions are still banned from dealing in Bitcoins, but over 90% of daily trading volume in Bitcoin is processed in Chinese Yuan.

D.Risk Exposures

In this section, we establish facts on factor loadings and on exposures to stocks, currencies, and precious metals commodities. Throughout this section, t-statistics in parentheses and brackets are based on regular and bootstrapped standard errors.

Table IV. Bitcoin Returns Factor Loadings

(Percentage)	CAPM	3-Fac	4-Fac	5-Fac	6-Fac
ALPHA	18.91**	18.20**	17.66**	16.72**	15.98*
	(2.42)	(2.30)	(2.18)	(2.07)	(1.94)
	[2.55]	[2.34]	[2.28]	[2.61]	[2.54]
MKTRF	3.34	3.79	4.00	4.57*	4.85*
	(1.45)	(1.56)	(1.60)	(1.81)	(1.86)
	[1.94]	[2.08]	[1.94]	[2.14]	[2.06]
SMB		−1.29	−1.26	0.45	0.55
		(-0.36)	(-0.35)	(0.12)	(0.14)
		[-0.55]	[-0.54]	[0.15]	[0.16]
HML		−3.02	−2.41	−3.80	−3.01
		(-0.81)	(-0.59)	(-0.79)	(-0.58)
		[-1.22]	[-0.84]	[-0.97]	[-0.67]
MOM			1.08		1.35
			(0.38)		(0.47)
			[0.48]		[0.59]
RMW				6.16	6.39
				(1.07)	(1.10)
				[1.35]	[1.41]
CMA				2.47	2.40
				(0.35)	(0.33)
				[0.27]	[0.24]
R-Squared	0.02	0.04	0.04	0.05	0.05

The common stock factor exposures of the Bitcoin returns. For the risk factors, we choose the CAPM, Fama French 3-factor, Carhart 4-factor, Fama French 5-factor, and Fama French 6-factor models. The alphas for all of the considered models are statistically significant. The unconditional alpha of the period is 22.45 percent per month.

The CAPM adjusted alpha decreases to 18.91 percent per month – a reduction of about 16 percent. The CAPM beta is large at 3.34 but not statistically significant. The beta is statistically significant at the 10-percent level only for the 5-factor and 6-factor models. The corresponding alphas are 16.72 and 15.98 percent per month. The exposures to the other factors are not statistically significant.

The exposures to the SMB factor is not stable across the specifications: both the magnitude and the signs change when 5-factor and 6-factor models are

considered. The exposures to the HML factor are negative and have consistent magnitudes and signs; this suggests that Bitcoin returns may comove more with growth rather than with value firms. The exposures to the RMW factor are positive and are estimated slightly more accurately than other statistically not significant factors; this suggests that Bitcoin returns comove more with high profit rather than low profit firms. The point estimates on the MOM and CMA factors are very inaccurate

Finance literature has documented more than a hundred factors for predicting the cross-section of stock returns (see, e.g., summarizes in Feng, Giglio, and Xiu, 2017 and Chen and Velikov, 2017). To investigate whether any of those factors may be important in pricing cryptocurrencies, we estimate the loadings of the 155 common factors from Andrew Chen's website. One caveat is that this dataset ends at the end of 2016 and thus does not cover the most recent return experiences. Therefore, it can only be meaningfully used for the analysis of Bitcoin. We report the results in the Appendix, due to the large number of factors. We find that only four out of the 155 factors are significant, but those four factors do not form any discernible patterns.

E.Negative Effect

We have shown that unconditionally investor attention positively predicts cryptocurrency returns. In this section, we further investigate whether negative investor attention predicts cryptocurrency returns. We construct a ratio between Google searches for the phrase "Bitcoin hack" and searches for the word "Bitcoin" to proxy for negative investor attention. Table 28 shows the results of the predictive regressions. The ratio negatively and significantly predicts 1-5 week Bitcoin retruns. For example, a one-standard-devation increase of the ratio leads to a 2.75 percent decrease of Bitcoin returns in next week.

In this section, we first estimate the exposures of the Fama French 30 industry groups to the cryptocurrency risk. Second, we continue with a finer industry classification and investigate the cryptocurrency risk exposures of 354 SIC industries in the US and 137 CIC industries in China. These exposures which can be thought of as an index indicating the potential winners and losers from the current and future development of blockchain. Through out this section, t-statistics in parentheses and brackets are based on regular and bootstrapped standard errors.

F.Extreme value distributions

Extreme value distributions are distributions characterizing the tails of a distribution. Since we are interested in the risk characteristics of Bitcoin, we are focusing on extreme events, in particular very large negative returns. In extreme value theory, two distributions play an important role: the generalized Pareto distribution as well as the generalized extreme value distribution.

Bitcoin and the generalized extreme value distribution In probability theory and statistics, the generalized extreme value (GEV) distribution is a family of continuous probability distributions developed within extreme value theory to combine the Gumbel, Fréchet and Weibull families also known as type I, II and III extreme value distributions. The Fisher Tippett–Gnedenko theorem is a general result in extreme value theory regarding asymptotic distribution of extreme order statistics. The maximum of a sample of iid random variables after proper renormaliza-tion can only converge in distribution to one of three possible distributions, the Gumbel distribution, the Fréchet distribution, or the Weibull distribution. Credit for the extreme value theorem (or convergence to types theorem) is given to (Gnedenko 1948).

The role of the extremal types theorem for maxima is similar to that of the central limit theorem for averages, except that the central limit theorem applies to the average of a sample from any distribution with…nite variance, while the Fisher-Tippet-Gnedenko theorem only states that if the distribution of a normalized maximum converges, then the limit has to be one of a particular class of distributions. It does not state that the distribution of the normalized maximum does converge. The existence of a limit distribution requires regularity conditions on the tail of the distribution. Despite this, the GEV distribution is often used as an approximation to model the maxima of long (nite) sequences of random variables.

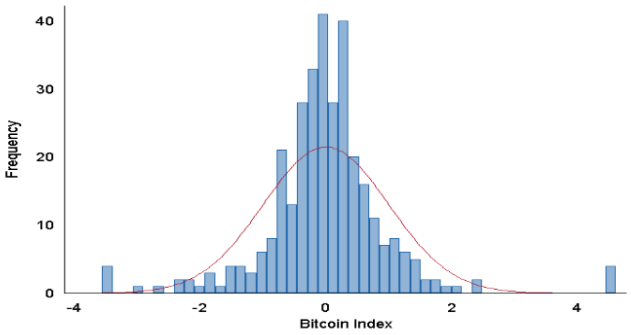


Figure: IV.Virtual Currency Index and Frequency of China

In this section, we estimate the 354 U.S. SIC 3-digit industries' on cryptocurrency returns and 137 of China's CIC industries exposures on Bitcoin returns, controlling for the excess market returns.

Specifically, we regress each industry's stock returns on the contemporaneous Bitcoin returns and the excess stock market returns. Each industry's stock return is calculated as value-weighted returns from individual publicly listed companies in the industry. The complete results are reported in the Appendix for conciseness. We then standardize the exposure estimates to have mean zero and standard deviation of one to create an index of the exposures of the industries to the cryptocurrencies. The histogram of the values of the index for each cryptocurrency for the 354 US industries.

Tabel V. Compare Of Country Exposure to Bitcoins Rerturn

x100	U.S.	Europe	Japan	AsiaExJapan	North America
BITCOIN	0.72	0.95	0.77	0.33	0.68
	(1.45)	(1.42)	(1.40)	(0.46)	(1.35)
ALPHA	0.90**	0.43	0.55	0.36	0.82**
	(2.49)	(0.89)	(1.37)	(0.69)	(2.24)
R-squared	0.02	0.02	0.02	0.00	0.02

Source : Risks and Returns of Cryptocurrency by Yukun Liu, Aleh Tsyvinski,SSRN

Furthermore, we examine the exposures of different regions to Bitcoin risk. Table V documents our findings.

We obtain the return series of the different regions from Kenneth French's website. U.S., Europe, Japan, and Canada have similar exposures to Bitcoin risk – all positive but not statistically significant. Note that the point estimate for Europe is somewhat higher and for AsiaExJapan is significantly lower than the rest.

IV.CONCLUSION

The major focus of this paper was analyzing the effect of adding Bitcoins to your portfolio and as we saw in Section III, they give a better risk adjusted return portfolio, which should be persuasive enough for people to start considering Bitcoins as a new asset class. Based on the discussion in Section IV, we can conclude that the global outlook towards Bitcoin has been shaping into a more positive one by the day, with countries both developing and developed, major banks and a continuously increasing number of merchants embracing this technology.

Our findings cast doubt on popular explanations that the behavior of cryptocurrencies is driven by its functions as a stake in the future of blockhain technology similar to stocks, as a unit of account similar to currencies, or as a store of value similar to precious metal commodities. At the same time, the returns of cryptocurrency can be predicted by two factors specific to its markets – momentum and investors attention. Our findings call into question popular explanations that supply factors such as mining costs, price-to-"dividend" ratio, or realized volatitility are useful for predicting the behavior of cryptocurrency returns. Finally, we document that the blockchain technology embodied in cryptocurrencies has a potential to affect a number of important industries.

REFERENCE

[1] Lam Pak Nian, David LEE Kuo Chuen Sim Kee Boon, Introduction to Bitcoin, Institute for Financial Economics, Singapore Management University, Singapore.

[2] Blockchain charts. "Blockchain Charts The most trusted source for data on the Bitcoin blockchain." https://blockchain.info/charts/total- Bitcoins

[3] Coindesk Price and Data "Bitcoin Legality - Map of Regulatory Landscape." http://www.coindesk.com/Bitcoin-legal-map/

[4] Tradewave, Inc. "Build your own automated Bitcoin trading strategy." https://tradewave.net/

[5] ME group, "CME Group and Crypto Facilities Announce Launch of Bitcoin Reference Rate and Real-Time Index." http://investor.cmegroup.com/investorrelations/releasedetail.cfm?ReleaseID=968356

[6] Abadi, Joseph and Markus Brunnermeier. 2018. "Blockchain economics." Tech. rep., mimeo Princeton University.

[7] Asness, Clifford S, Tobias J Moskowitz, and Lasse Heje Pedersen. 2013. "Value and momentum everywhere." The Journal of Finance 68 (3):929–985.

[8] Asvanunt, Attakrit and Scott Richardson. 2016. "The credit risk premium." Working Paper .

[9] Barro, Robert J. 2006. "Rare disasters and asset markets in the twentieth century." The Quarterly Journal of Economics 121 (3):823–866.

[10] Biais, Bruno, Christophe Bisiere, Matthieu Bouvard, and Catherine Casamatta. 2018. "The blockchain folk theorem." Working

Paper .

[11] Coles, S. and S. Coles (2001, 12). An introduction to statistical modeling of extreme values (2 ed.). London: Springer-Verlag New York.

[12] Ferro, C. A. T. and J. Segers (2003, 05). Inference for clusters of extreme values. Journal of the Royal Statistical Society: Series B (Statistical Methodology) 65 (2), 545–556.

[13] Gnedenko, B. V. (1948). On a local limit theorem of the theory of probability. Uspekhi Mat. Nauk 3 (3(25)), 187–194.

[14] Hosking, J. R. M. and J. R. Wallis (1987, 08). Parameter and quantile estimation for the generalized pareto distribution. Technometrics 29 (3), 339–349.III, J. P. (1975, 01). Statistical inference using extreme order statistics. The Annals of Statistics 3 (1), 119–131.

[15] Kristoufek, L. (2015, 04). What are the main drivers of the bitcoin price? evidence from wavelet coherence analysis. PLOS ONE 10 (4), e0123923.

[16] Nakamoto, S. (2009). Bitcoin: A peer-to-peer electronic cash system.

[17] Sapuric, S. and A. Kokkinaki (2014, 10). Bitcoin Is Volatile Isnt that Right? Springer.

[18] Schwert, G. W. (2011, 07). Stock volatility during the recent nancial crisis. European Financial Management 17 (5), 789–805. 13