BITCOIN - ASSET OR CURRENCY? REVEALING USERS' HIDDEN INTENTIONS

Complete Research

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Abstract

Digital currencies are a globally spreading phenomenon that is frequently and also prominently addressed by media, venture capitalists, financial and governmental institutions alike. As exchange prices for Bitcoin have reached multiple peaks within 2013, we pose a prevailing and yet academically unaddressed question: What are users' intentions when changing their domestic into a digital currency? In particular, this paper aims at giving empirical insights on whether users' interest regarding digital currencies is driven by its appeal as an asset or as a currency. Based on our evaluation, we find strong indications that especially uninformed users approaching digital currencies are not primarily interested in an alternative transaction system but seek to participate in an alternative investment vehicle.

Keywords: Digital Currency, Bitcoin, Investor Behavior, Decision Making in Electronic Markets.

1 Introduction

Digital currencies propose a shift away from the established design of financial system infrastructures. Information systems and technological solutions like peer-to-peer connectivity and cryptographic algorithms allow for decentralized organisation, operational security and transparency, thus opposing the centrally coordinated and less transparent traditional monetary systems' structures (Samuelson, 1968). Against the backdrop of the recent economic crisis, this new breed of currencies is gaining public attention. As public trust in the current structure of the financial system crumbles, alternative concepts become more relevant and introduce innovative concepts for future currency systems.

The digital currency that attracts most attention within this context is Bitcoin, proposed by Nakamoto (2008). Bitcoin is an electronic financial mechanism providing features that resemble an established currency system with its own money creation and transaction regime but relies on a decentralized organizational structure. In contrast to the central bank's discretionary decision making, money creation in the Bitcoin system is transparently realized by a distributed and open algorithm, facilitating the reliability of expectations about the future supply of money. Likewise, the infrastructure allows near-real-time transaction monitoring via the public peer-to-peer network. The entire transaction history is stored in a 'chain' (Nakamoto, 2008) of transactions, frequently referred to as Blockchain.

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The Blockchain represents all verified and valid transactions between users of the network. In contrast to previous digital currencies which can rather be seen as community currencies being available to a community of users participating in online games, Bitcoin has a wider focus and is independent from a central institution responsible for money creation. Thus, such an innovative system is not only attracting a steadily increasing level of media attention, but also increasing global dissemination and growing to a market capitalization of roughly $13 billion as of December 2013.

The story of Bitcoin is, however, equally unique as it is controversial. With a dollar value of $0.3 per Bitcoin in January 2011, the exchange rate skyrocketed through $1300 in November 2013. This considerable increase in dollar value and foremost the volatile exchange rate fluctuations in early and late 2013 not only incur the attention of national regulators, but also raise concerns about the utility of the Bitcoin transaction system and the rationality of its users. Foremost, the high exchange rate volatility provides indications that Bitcoin is not utilized as alternative transaction system, but rather considered as a speculative financial asset. In 2012, the European Central Bank stated that Bitcoin should be considered as a high-risk system for its users from a financial perspective. Up to now it is not easy to assess whether or not the Bitcoin system might be a pyramid or even a Ponzi scheme (European Central Bank, 2012). China has announced to prohibit the use of Bitcoin as currency for financial institutions (Ruwitch and Sweeney, 2013).

Taking into account these considerations as well as recent developments, we pose the following central research question: *What are users' intentions when changing their domestic currency into a digital currency?* We therefore test users' intentions with respect to two general possible purposes: First, Bitcoin serving as an alternative payment system, where users acquire Bitcoin to easily and cheaply execute financial (cross-border) transactions or buy and sell goods. Second, we test if Bitcoin users seek an alternative, highly speculative asset, where users primarily acquire Bitcoin in order to accumulate returns when exchange rate rises. To answer this question, our analysis is split into two consecutive steps. At first, we analyze the users' attention directedness, i.e. the way uninformed people get in touch with Bitcoin, and try to reveal which of these two purposes they intent to pursue. Secondly, we cross-validate the observations of our first analysis by evaluating possible behavioral objectivity biases that new users are likely to be subject to.

In contrast to previous research on centralized community currencies, with Bitcoin, we investigate a decentralized system which is independent from a central institution responsible for money creation. A system that also has a broader focus beyond specific communities as, for example, online game communities. Furthermore, in comparison to other digital currencies, analyzing Bitcoin offers the unique possibility to investigate the specific transaction behavior of its users, since transactions are publicly available through the Bitcoin Blockchain mechanism. Consequently, we extend previous research that only focuses on technological rather than economic issues related to Bitcoin by studying the aggregated behavior of new and uninformed Bitcoin users within the time span from 2011 to 2013. We seek to identify the intentions why people gather information about Bitcoin and their motivation to participate subsequently.

Our results provide strong indications that newly attracted users primarily limit their relation to Bitcoin to trading on exchanges. Although the Bitcoin payment system is still predominant in terms of absolute transaction volumes, we find that users' current focus and growth is limited to trading on exchanges. Facing our results, we further argue that the recent dissemination of Bitcoin is lead by a shift of the average users' intention regarding the utilization of Bitcoin. New users do not seem to consider Bitcoin's original purpose of being used as an alternative transaction system. They tend to solely perceive Bitcoin as an alternative investment vehicle.

The remainder of our work is structured as follows. Section 2 provides an overview of recent literature on digital currencies and points out the, so far academically uncovered, perspective of the digital markets and their users. In section 3, we develop our hypotheses in order to address our initial research

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question. Section 4 highlights our methodology to validate our developed hypotheses by means of an empirical study. Finally we discuss and conclude our findings in the last section.

2 Background and Related Work

2.1 Digital currencies

Before the emergence of Bitcoin, there have been several examples of digital currencies that attracted a wide range of attention. These currencies have the design of a local community currency in a closed environment, for instance in the case of online games, and are designed to be payment opportunity within these specific environments. Kaplanov (2012) reaches the conclusion that Bitcoin mostly resembles a community currency. Research conducted in this area, however, at best provides distantly related results regarding utilization and behavior. For an alternative examination of the features of Bitcoin and a legal classification refer to (Krohn-Grimberghe and Sorge, 2013). Authorities like the Internal Revenue Service (IRS) and the Financial Crimes Enforcement Network (FINCEN) acknowledge Bitcoin as (convertible) virtual currency with respect to its functionality but distinguish it from a "real" currency due to the lack of having a legal tender status in any country (FINCEN, 2013; IRS, 2014). From a tax perspective in the USA, Bitcoin and virtual currencies in general a treated as a commodity. The European Banking Authority (EBA) and the European Central Bank (ECB) apply the term virtual currency (European Central Bank, 2012; European Banking Authority, 2013).

For example, the digital currency Linden Dollar which is rooted in the virtual world of Second Life (http://secondlife.com/) experienced a similar media hype like Bitcoin. Ernstberger (2009) analyzes policies for virtual money based on Linden dollar. He finds that Linden dollars are used as money equivalent and hence extend the spending of money into a virtual environment. Put differently, he discovers that users in second life spend money in a way similar to the way people spend money in the real world. As the economy of Second Life is bound to the given platform, previous research neglects aspects of Linden Dollar's economical-technical relationship, but focuses on its unique potential as virtual environment for virtual education and learning (Zhu et al., 2007). Previous research did not address economical effects of Linden dollar, as Second Life is mostly seen as a new paradigm of learning supported by a virtual community currency (Molka-Danielsen, 2009).

Another example for a more successful digital currency is virtual gold embedded in the virtual ecosystem of the massive multiplayer game "World of Warcraft" (http://us.battle.net/wow/en/). While these currencies were quite successful inside their environment, due to the closed design of these systems, they never achieved a spillover into the real world like Bitcoin seems capable of. The closedness of the system hampers empirical analyses on the economic impact and the relation to other currencies. In contrast, Bitcoin allows analyzing the emergence of a digital currency in an open, i.e. decentralized environment, enabling wider analytical and empirical analyses.

Henceforth, we will, if helpful, refer to Bitcoin as a cryptocurrency due to its unique features differing from features of other digital currencies, e.g. those mentioned above.

2.2 Technical Issues, Risks and Anonymity

Previous work on Bitcoin can roughly be divided into two streams. The first stream of research has been targeting the design and the technology underlying the decentralized infrastructure of Bitcoin, i.e. its protocol and risks arising on a technical level. Various techniques based on network theory have been applied to conduct analyses regarding transaction anomalies and possibilities of de-anonymizing single entities in the Blockchain. For instance, Reid and Harrigan (2011) show that users and Bitcoin addresses may be mapped passively by the usage of centralized services such as currency exchanges and online wallets. On the basis of a day-to-day usage scenario of Bitcoin on a university campus, Karame et al. (2012) analyze with a quasi-simulative approach the anonymity of Bitcoin-users. They

find that 40% of the students can be profiled passively which therefore also leads them to reject the anonymity hypothesis regarding Bitcoin. In addition, Karame et al. (2012) show that double spending is possible under the circumstance of a fast payment (i.e. a payment which is not verified in the Blockchain) and therefore they propose a modification of the current Bitcoin implementation. Clark and Essex (2012) leverage the Bitcoin-system to introduce a method to securely timestamp a document.

The second research stream on Bitcoin focuses on the risks involved in the Bitcoin ecosystem. Brezo and Bringas (2012) analyze the risks involved with cryptocurrencies by the example of Bitcoin. They highlight that Bitcoin is vulnerable to speculation and misinformation and they also criticize that no regulatory body oversights the market. A vital component in the Bitcoin-ecosystem are currency-exchanges as they link traditional currencies with the digital ones. Due to the fact that they are not regulated and are thus not subject to risk mitigation and governance requirements, they have a substantial default risk, e.g. caused by hacker attacks or even technical problems. Consequently, Moore and Christin (2012) analyze the main factors which contribute to a default of these exchanges. They find that popularity and transaction volume decrease the probability of a closure. Analyzing the conversion rate on currency exchanges, Buchholz et al. (2012) show that the price risk (volatility of the currency rate) had a positive effect on price development in 2011 - a characteristic which is also shared by asset bubbles. This leads them to the conclusion that the Bitcoin ecosystem is currently in a state of an asset bubble.

The range of perspectives, taken so far by academic research, neglects the user perspective and therefore the layer connecting the technological infrastructure with the established economies. Put differently, the layer of businesses and users has not been taken into account adequately, although it is residing on top of the technical infrastructure and is the link which is leveraging the idea of a peer-to-peer based digital currency into the established economic global environment.

Consequently, this analysis is focusing on retail users trading Bitcoin on exchanges and trading goods against Bitcoin respectively, i.e. by paying with Bitcoin in online shops.

The focus of this study is to close the previously outlined research gap and to extend the current streams of technically focused literature with a perspective on the users' motivation to adopt Bitcoin. Our intention, motivating this work, is to draw a holistic picture of what cryptocurrencies currently are - speculative investment or payment system - and how the volumes traded on exchanges and in the network can provide means to draw conclusions on the prevailing usage of cryptocurencies.

3 Research Hypotheses

3.1 Bitcoin as a currency

Before we analyze the transaction volumes, we provide a brief introduction to the general features of a currency in order to derive the two purposes cryptocurrencies can serve.

There is an ongoing discussion about whether Bitcoin is primarily an alternative currency or just a speculative asset (European Central Bank, 2012). The theoretical discussion about money being an asset or a currency is summed up by Laidler (1969). To analyze the intention of the users, we first specify the properties of a currency that are relevant for our analysis. According to Kaplanov (2012); (European Central Bank, 2012; Laidler, 1969; FINCEN, 2013), a currency can be used as a means of trade, a vehicle to store value, or a unit of account in order to compare the value of different goods or services.

All three purposes imply that Bitcoin represents a certain value for every user, either as of today or in the future. As it is irrelevant for our research question whether Bitcoin suits as a unit of account, we focus on the storage of value and the means of trade purpose. In the case that a user wants to trade it

against goods or services, both counterparties of the transaction must come up with a similar valuation of the currency at the same point in time. In order to use Bitcoin to store value over time, users need to quantify their expectations about the future value of the currency.

Several theoretical models have been proposed in order to determine the value of established currencies. For example, Interest Rate Arbitrage, (Covered) Interest Rate Parity, as well as Supply and Demand Equilibrium models as explained in Hull (2009). The names of the former two already indicate that the interest is substantial for the underlying valuation approach. Without going into detail, we sum up that this is the case for all theoretical valuation approaches, except for supply and demand equilibriums.

Bitcoin, however, does not provide the feature of an interest rate in contrast to traditional currencies, where interest rates are provided by central banks and interest rate term structures are derived from bonds with differing maturities. Hence, valuation models relying on a given interest rate are rendered meaningless. Users are left to determine the value of Bitcoin themselves, doing so by gathering and evaluating information in news and web resources, e.g., on Wikipedia as a first step. Their valuation is reflected in prices quoted on exchanges. The price - and implicitly its value - is therefore determined on exchanges by users that want to buy Bitcoin (demand) and users that want to sell Bitcoin (supply), quoting the prices they are willing to pay or receive. Considering that the total supply of Bitcoin is deterministic by design, it follows that an increasing growth of the demand side is leading to increasing prices. Sellers can ask for higher and higher prices, as there are people willing to pay higher prices for a good with limited supply (Harris, 2003).

The novelty of both the design and the features of a cryptocurrency, combined with its immediate global availability over the internet, lead to an exponential growth of demand. This is in accordance with the findings of Lee (2003) and Rogers (2004), who model the lifecycle of innovations and identify radicality of innovation as catalyst for speed of diffusion. Additionally, Glaser et al. (2014) find that media coverage is significantly driving price volatility. People, that are reached by information on the innovation and additionally identify a personal utility regarding that innovative design, are likely to become users. If the innovation is diffusing globally and the rate of reached potential users is growing faster than the supply of Bitcoin, then we observe exponentially increasing prices on exchanges, as was the case twice in 2013 and once in 2011 and 2014.

Up to this point, it is irrelevant which purpose users are pursuing when they decide to buy Bitcoin. For every user who wants to participate immediately, the entrance point is most likely an electronic exchange, especially for new and rather uninformed users. Every new user will therefore generate trading volume on an exchange by changing her domestic currency into Bitcoin.

However, in the case users want to use Bitcoin as a means of trade, one would expect that, after buying Bitcoin at an exchange, users are going to spend at least some of their newly acquired coins to buy goods or pay for services, i.e., increase the Bitcoin network transaction volume. Hence, if users' intention focuses on the currency, i.e., the payment aspect of Bitcoin, we will likely observe a relation between the number of new participants and the Bitcoin network volume. We thus hypothesize:

H1a: An increase in the number of Bitcoin participants is associated with an increase in the Bitcoin network volume.

Note that this relation could either manifest in a direct connection between both volumes like in our hypothesis, or in an indirect connection, where the increasing number of participants increases the exchange volume, which may further increase network volume. The rationale behind this indirect linkage is that especially new participants need to acquire Bitcoins upfront of any usage, which is most likely to happen via exchanges. Within the empirical part of our analysis, we will test for both, the direct and the indirect way.

3.2 Bitcoin as an asset

In accordance to hypothesis H1a, it follows that if Bitcoin participants seek to use Bitcoin primarily as an asset, they will not leave a footprint within the Blockchain, i.e., the Bitcoin transaction tracking system. This is supported by the common practice of exchanges to keep internal accounts on behalf of their customers. That is, the exchanges are handling accounts of their customers in an internal accounting system, guaranteeing for keeping record of the on-exchange purchased and sold Bitcoins without actually transferring these Bitcoin through the Blockchain. We would expect that those users' Bitcoins primarily remain within the exchange internal systems. We therefore hypothesize:

H1b: An increase in Bitcoin participants is positively associated with an increase in the Bitcoin exchange volume.

Although an additional interrelation between Bitcoin exchange volume and network volume is not assumable, we will test for such a relation in section 5. We further add another dimension of analysis in order to determine if the average user's intention focuses solely on the asset component.

Users pursuing Bitcoin for its purpose as an alternative asset also lack a valid valuation method and are therefore forced to build their expectations about future prices based on any information they can acquire from any available source. Sources of information can be social media, news paper articles, friends and peers as well as internet communities, among others. Given that there is no fundamental pricing methodology available, these sources of information are likely to have a higher influence on prices. Negative news like the announcement of security issues revealed in the underlying protocol should concern users who are using Bitcoin for operational transactions and push some users to re-evaluate the utility and usability and eventually sell their Bitcoin, hence lowering prices on exchanges.

Furthermore, given the innovative character and the volatile historical price, they are likely to be aware that they invest in an instrument with a high price uncertainty. Hence, it is a valid assumption that these users only invest a small amount of their total portfolio. They buy Bitcoin at an exchange and store it, waiting for prices to rise. The three distinguishing features of Bitcoin, i.e. ease of bilateral transactions, anonymity and security are not of interest for users not actually using the network. Hence, as they do not intend to use the network, these users are therefore not affected by negative news regarding security issues or infrastructure failures. There is one exception to this argument. If Bitcoin is legally rendered meaningless, e.g. by change of law in the user's country of residence, they immediately lose their value. In this case users who are speculating on future price improvements are affected.

It is worth noting, that the negative event of Mt. Gox's default primarily affected the possibility to withdraw fiat money or Bitcoin from the internal system of the exchange. This event, however, affected the means users were managing their investment and only indirectly related to Bitcoin itself due to the simultaneous announcement of the exploitation via a protocol bug. This bug, however, was for long publicly known, i.e., available information and according to the efficient market hypothesis already reflected within prices. The subsequent price recovery further supports our hypotheses and renders this type of event a singularity that affected a subset of users at their account infrastructure in the first place and Bitcoin only in an indirect way, i.e., by recalling the risk of an exchange to default in an unregulated environment.

Hence, losses or negative news regarding the infrastructure or network functionality are likely to have no influence on prices, as users are investing in Bitcoin being fully aware of the high risk level and do not use Bitcoin as a means of trade. Even if their position is moving against them, they are likely to hold their position, hoping for prices to rise again.

Contrary to the negligible influence of negative news, positive news are more likely to exert a positive influence. On the one hand, they attract new users and on the other hand, positive news assert already

invested users to stay invested. News should therefore not have a negative influence on prices if users are using Bitcoin as a highly speculative investment vehicle.

We sum up our arguments and hypothesize:

H2: Prices are not influenced by negative news regarding the Bitcoin protocol itself but are influenced by positive news regarding the same context.

4 Dataset

The time window to be analyzed in this study covers the range from 2011/01/01 through 2013/10/08 and includes a large fraction of early Bitcoin history and most importantly the growth phase of late 2012 and early 2013. Time series data are available for the most relevant exchange in terms of traded volumes, namely Mt. Gox, which accounted for an average of 83 percent of the U.S. exchange traded Bitcoin volume during the observation time span. We obtain transaction data via the web-based Bitcoin data provider Bitcoincharts that aggregates trades on a daily basis. Our dataset comprises Open, High, Low and Close prices as well as exchange volumes in BTC on a daily basis. We also acquire data, aggregated on a daily basis, that is stored within the Bitcoin Blockchain in order to determine the Bitcoin network volume. The Bitcoin network volume comprises Bitcoin transfers caused by monetary transactions within the Bitcoin currency network.

Most important, both volumes are disjoint, meaning that their growth is driven by independent mechanisms. A person that has the intention to buy goods or services with Bitcoin will at first increase the number of Bitcoin traded at an exchange as he changes traditional money into Bitcoin. The volume of this transaction is not included in the Blockchain as the Bitcoin stay at the exchange. He will only increase Blockchain network volumes when he withdraws the Bitcoin from the exchange and pays for a good or transfers his Bitcoin to another entity. Thus, both transactions are counted separately. Based on this separation, we are able to closely monitor the transaction volumes for each system and are further able to distinguish whether the two volumes grow separately or if both are affected by new users. Figure 1 depicts the time series of Bitcoin exchange and network volumes.

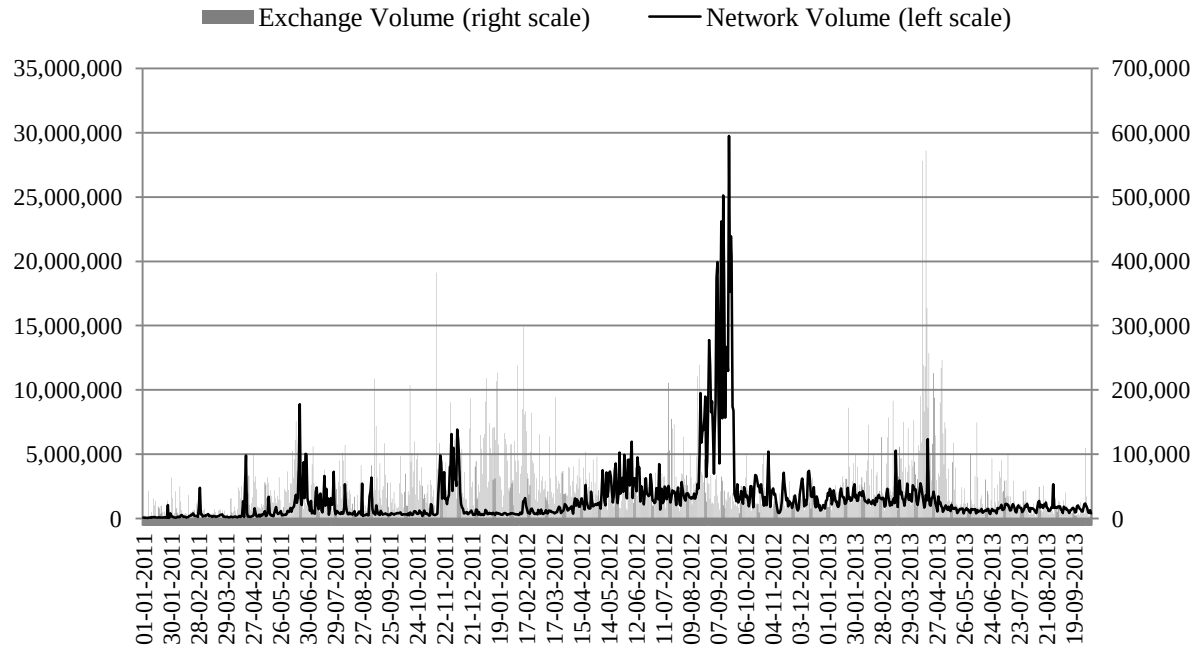

Figure 1. Bitcoin Exchange and Network Volumes

We additionally utilize a proxy for potential new users' attention. We follow Wang (2013) to identify the mass of particularly uninformed users, i.e., users who have only limited knowledge about Bitcoin and therefore acquire initial information from an initial source of information - Wikipedia. We use the daily hits on the English Bitcoin Wikipedia page as a proxy for measuring user attention. Figure 2 provides an overview on the number of daily hits on the English Bitcoin Wikipedia and the daily Bitocin exchange rate.

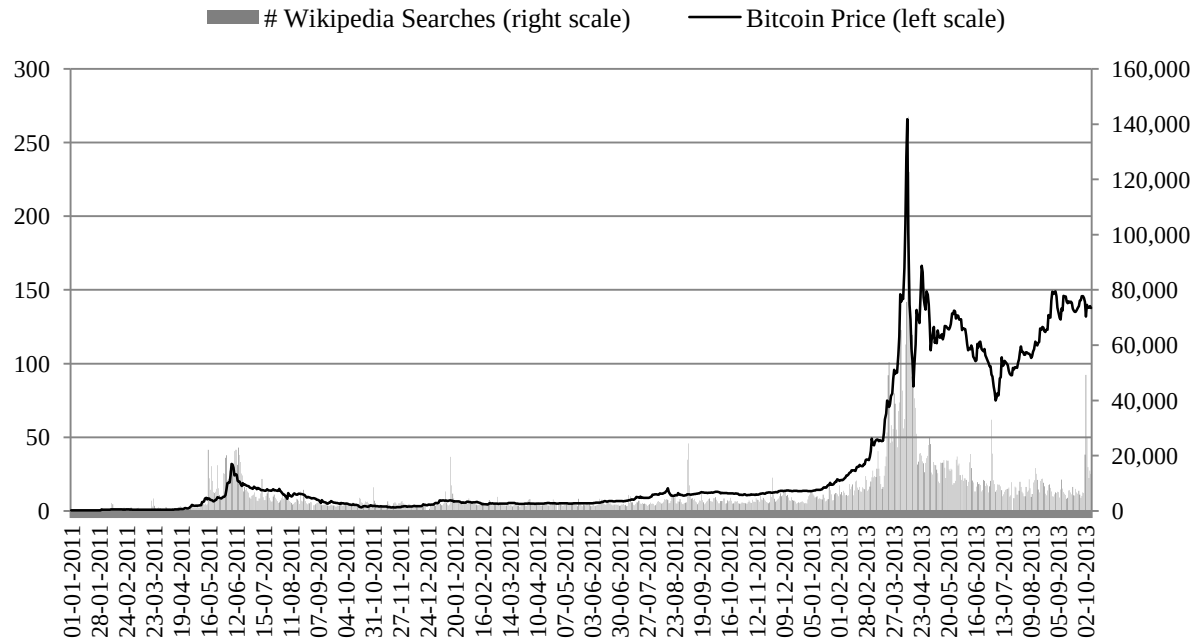

Figure 2. Bitcoin Exchange Rate and Wikipedia Searches on Bitcoin

In order to investigate users' rationality and dispassion towards their Bitcoin price evaluation, we acquire different major events in order to make the insights on user behaviour more expressive. The dates of 24 events are gathered from https://en.bitcoin.it/wiki/History, comprising significant events that may have affected the Bitcoin community and therefore will most likely evoke Bitcoin price corrections indicated by abnormal returns in the exchange rate. The events focus either on exceptional positive (new exchange launches, legal successes or significant news articles) or negative (major system bugs, thefts, hacks or exchange breakdown) news which are directly related to the Bitcoin system, security and infrastructure.

5 Empirical Study

5.1 Analysis of Bitcoin transaction and network volume

We strive to assess in first place what intentions especially new and uninformed users joining the Bitcoin community have and how they use Bitcoin, i.e., as currency or asset. Thus, we analyze whether new users seek to mainly acquire Bitcoin for its alternative transaction purpose by analyzing Bitcoin volume time series data introduced in the previous subsection. Regarding hypothesis one, we expect that if they actually intend to use Bitcoin as means of payment, we could observe a similar growth in exchange und network volumes driven by waves of new customers. At least, we should observe a persistent volume migration and interaction between the exchange and network system.

That is, the average customer will attend an exchange in order to change domestic money for Bitcoins and most likely, later on, pay with these Bitcoins for goods or services. It follows that both volumes

will stay in proportion and likewise both volumes interact. Otherwise, if most customers only attend the exchange to trade Bitcoin as investment asset, we will observe a disequilibrium-facilitating trend in favour to exchange traded volumes.

Subsequently, our approach is to forecast network and exchange volume via Wikipedia Bitcoin traffic and additional control variables. Thus taking into account the intention of new, i.e., uninformed users.

According to Asteriou and Hall (2007), most macro-economic time series are trended and therefore non-stationary. The problem with trended, i.e. non-stationary time series is that standard ordinary least-squares regressions can easily be biased in cases where independent and dependent variables share the same trend but share no causal relation. In order to achieve stationarity, we rely on first order differences of daily data points for each variable which is sufficient in order to reach stationarity according to the Dickey-Fuller Test (results omitted due to space constrains – are available on request). Additionally, the prediction and explanation of time series is prone to time periods of conditional heteroskedasticity, i.e., temporal periods of structural volatility changes and autoregressive dependencies which are characteristically for financial time series (Asteriou and Hall, 2007) and are especially prominent in our sample period. We therefore rely on an Autoregressive Conditional Heteroskedasticity (ARCH) estimation of the volumes to eliminate such periods within the errors. We test the ARCH appropriateness within an auxiliary regression as proposed by Asteriou and Hall (2007) (results omitted due to space constraints – are available on request). Subsequently, we predict daily volume changes within the network and exchange by both respective lagged volume changes as well as lagged Wikipedia traffic changes. Additionally, we add various control variables for weekday, year and month effects as stated in Harris (1986). Our regression setup is:

$$\Delta Y_t = a_0 + \sum_{i=1}^{7} a_i \Delta ExchangeVolume_{t-i} + \sum_{j=1}^{7} a_{j+7} \Delta NetworkVolume_{t-j} + a_{15} \Delta Wiki_{t-1} + \sum_{j=16}^{n} a_j \Delta C_{j,t-1} + e_t, \quad (1)$$

$$e_t \sim N(0, h_t), \quad (2)$$

$$h_t = b_0 + b_1 e_{t-1}^2 + b_2 h_{t-1}. \quad (3)$$

Δ illustrates first order differenced values, where Y stands for Bitcoin network [exchange] volume, $Wiki$ the Wikipedia Bitcoin traffic and C represents the controls for the lagged returns, the lagged exchange [network] volume as well as the daily controls and e is the error term. In our case, e is normally distributed with mean zero and standard deviation h, while this uncertainty is likewise affected by its lagged past values h_{t-1} and the past squared residuals (GARCH 1,1) as proposed by Asteriou and Price (2001).

For each volume, we perform three regressions. First, we perform a parsimonious model with lagged Wikipedia traffic and an one order autoregressive term. Within the second model, we add controls for day, month and year effects and Bitcoin lagged returns. At last, we further add the corresponding lagged network [exchange] volume, the event dummies and extend the autoregressive order to up to seven lags, inheriting a whole week of past volume changes in order to increase the robustness of our results. Significant coefficients of the autoregressive term as well as the ARCH and GARCH terms indicate the appropriateness of the ARCH estimation approach. We additionally report Akaike and Bayesian Information Criterion in order to measure and monitor the relative quality of our models.

Table 1 exhibits the results of the volume regressions. We find that, on average, additional people searching on Wikipedia for Bitcoin information eventually participate in exchange trading, i.e. they are likely to trade on exchanges. In particular, an increase in Wikipedia search volume drives future exchange volume growth (thus, H1b can be accepted), which stays significant within all models. In contrast, we do not observe such an effect on network volumes (so H1a has to be rejected).

	Bitcoin Exchange Volume			Bitcoin Network Volume		
Variable	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
$\Delta Wiki_{t-1}$	1.590 (0.007)	1.189 (0.021)	1.529 (0.014)	-11.624 (0.402)	-10.493 (0.183)	-2.892 (0.643)
$\Delta ExchangeVolume_{t-1}$	-0.472 (0.000)	-0.456 (0.000)	-0.685 (0.000)		-0.334 (0.704)	0.0580 (0.789)
$\Delta ExchangeVolume_{t-2}$			-0.494 (0.000)			
$\Delta ExchangeVolume_{t-3}$			-0.454 (0.000)			
$\Delta ExchangeVolume_{t-4}$			-0.417 (0.000)			
$\Delta ExchangeVolume_{t-5}$			-0.274 (0.000)			
$\Delta ExchangeVolume_{t-6}$			-0.190 (0.000)			
$\Delta ExchangeVolume_{t-7}$			-0.138 (0.000)			
$\Delta NetworkVolume_{t-1}$		0.001 (0.453)	0.001 (0.250)	-0.152 (0.001)	-0.184 (0.000)	-0.423 (0.000)
$\Delta NetworkVolume_{t-2}$						-0.405 (0.000)
$\Delta NetworkVolume_{t-3}$						-0.492 (0.000)
$\Delta NetworkVolume_{t-4}$						-0.366 (0.000)
$\Delta NetworkVolume_{t-5}$						-0.297 (0.000)
$\Delta NetworkVolume_{t-6}$						-0.281 (0.000)
$\Delta NetworkVolume_{t-7}$						-0.140 (0.000)
$OC - Return_{t-1}$		-22,683.681 (0.213)	-25,201.363 (0.275)		-54,544.262 (0.797)	115,600.720 (0.196)
$PositiveEvents_t$			-3,344.504 (0.339)			-46,085.612 (0.361)
$NegativeEvents_t$			-3,176.982 (0.592)			-4,823.951 (0.898)
Constant	4,328.010 (0.065)	9,046.605 (0.017)	6,414.051 (0.356)	29,220.044 (0.076)	159,238.910 (0.003)	-49,207.046 (0.360)
Time Dummies	No	Yes	Yes	No	Yes	Yes
ARCH - Coefficients						
ARCH	0.415 (0.206)	0.383 (0.000)	0.475 (0.000)	0.782 (0.000)	0.877 (0.000)	1.414 (0.000)
GARCH	0.680 (0.000)	0.707 (0.000)	0.657 (0.000)	0.525 (0.000)	0.530 (0.000)	0.364 (0.000)
Statistics						
BIC	23,976	23,960	23,760	29,593	29,548	29,347
AIC	23,947	23,832	23,588	29,564	29,421	29,175
Observations	1,004	1,004	998	1,004	1,004	998

Table 1. Regression Results on Exchange and Network Volumes (p-values in parentheses).

One explanation might be that there is a transitory delay in the migration from the exchange to the network system. That is, users might need additional time after buying Bitcoins to actively use them for payment purposes. However, as indicated in both the second and third regressions, there is no subsequent migration between exchange and network volumes, at least within the last three years. That is, both increases in Wikipedia searches or exchange volumes do not affect network volumes. We

therefore conclude that uninformed users most likely stay with exchange trading after their first contact, holding Bitcoin as alternative investment asset and eventually will neither contribute to nor participate in the Bitcoin currency network.

5.2 Analysis of Bitcoin prices

While the previous section has shown the attitude of new users towards the Bitcoin exchange mechanism, we investigate whether indications of this bias already affect Bitcoin prices. We therefore rely on the positive and negative events concerning the overall Bitcoin infrastructure and progresses. As Table 1 has already shown, exchange as well as network volumes do not react to such news. That is, users do not systematically adjust their trading and activity pattern towards such events. We therefore apply a test whether both events do affect Bitcoin prices.

The semi-strong-form of the Efficient Market Hypothesis (EMH) claims both that prices reflect all publicly available information and that prices instantly change to reflect new public information. We therefore test if both kinds of events equally affect Bitcoin prices (Fama, 1970). Although we are not interested in proofing the EMH for the Bitcoin market, we seek to evaluate whether there is a one-sided bias towards positive Bitcoin events as indication for the increasing attraction of the Bitcoin investment vehicle that may explain a fraction of the continuous growth in Bitcoin prices that is characteristically throughout our observation period. We rely on a regression similar to the previous one:

$$r_t = a_0 + \sum_{i=1}^{7} a_i r_{t-i} + a_8 \Delta Wiki_t + a_9 Igood_t + a_{10} Ibad_t + \sum_{j=11}^{n} a_j \Delta C_{j,t} + e_t, \quad (4)$$

$$e_t \sim N(0, h_t), \quad (5)$$

$$h_t = b_0 + b_1 e_{t-1}^2 + b_2 h_{t-1}. \quad (6)$$

Again, Δ designates first order differenced values, where r_t is the open-to-close Bitcoin return at date *t*. We then rely on the previous introduced exogenous variables starting with one to seven autoregressive terms of past open-to-close returns, changes in Wikipedia Bitcoin traffic, the event dummies and exchange as well as network volume changes.

Starting with a parsimonious model we test for the univariate impact of the variables of interest. We first include the Wikipedia traffic on the Bitcoin article as well as the event dummies separately. The first model in Table 2 indicates that the interest of new users, proxied by the amount of Wikipedia traffic, does not, on average, influence future Bitcoin returns. These results remain consistent throughout all models. However, Model 2 to 4 indicate that there is an asymmetric bias of Bitcoin returns towards Bitcoin related events. Within all Models, the coefficient of positive events remains statistically larger than zero, indicating that such events temporarily drive Bitcoin returns. However, focusing on the coefficient of the negative events dummy, we do not observe any price correction effect after negative news within each of our models. While Model 2 only includes the events and the time series dummies, Model 3 and 4 further add additional controls and further lags of the endogenous variable, the results however remain robust. Thus, we can conclude that Bitcoin users seem to be positively biased towards Bitcoin, while serious negative events, like thefts and hacks, are apparently not serious enough to lead to significant price corrections (H2 is accepted). Concerning the most recent events within the Bitcoin system in early 2014, these results may appear quite counter-intuitive, foremost considering the price corrections following the shutdown of Mt. Gox. This period is coined by a significant price drop which is clearly contrary to the suggested results. However, since our observation period largely covers the early boom phase in 2012, it is reasonable to conclude, based on our results, that a larger fraction of this recent growth in value and the following one was attributed to an asymmetric processing of price relevant information and the negligence of major security issues

and negative indication which indicate a prevailing bias in the investors' evaluation within this boom period.

	Bitcoin Open-to-Close Return			
Variable	Model 1	Model 2	Model 3	Model 4
$OC - Return_{t-1}$	0.044 (0.348)	0.049 (0.306)	0.058 (0.212)	0.061 (0.182)
$OC - Return_{t-2}$				0.041 (0.254)
$OC - Return_{t-3}$				-0.024 (0.536)
$OC - Return_{t-4}$				0.033 (0.395)
$OC - Return_{t-5}$				-0.003 (0.913)
$OC - Return_{t-6}$				0.088 (0.017)
$OC - Return_{t-7}$				0.000 (0.994)
$\Delta Wiki_{t}$	0.000 (0.225)	0.000 (0.290)	0.000 (0.303)	0.000 (0.411)
$\Delta ExchangeVolume_{t}$			-0.001 (0.000)	-0.000 (0.000)
$\Delta NetworkVolume_{t}$			0.000 (0.530)	0.000 (0.460)
$PositiveEvents_{t}$		0.015 (0.027)	0.013 (0.072)	0.014 (0.045)
$NegativeEvents_{t}$		0.000 (0.967)	0.002 (0.637)	0.003 (0.543)
Constant	0.023 (0.000)	0.022 (0.000)	0.026 (0.000)	0.022 (0.000)
Time Dummies	Yes	Yes	Yes	No
ARCH - Coefficients				
ARCH	0.458 (0.000)	0.437 (0.000)	0.325 (0.000)	0.320 (0.000)
GARCH	0.693 (0.000)	0.703 (0.000)	0.755 (0.000)	0.756 (0.000)
Statistics				
BIC	-2,971	-2,959	-2,972	-2,922
AIC	-3,094	-3,092	-3,114	-3,094
Observations	1,005	1,005	1,005	999

Table 2. Regression Results on the Bitcoin Exchange Rate (p-values in parentheses).

6 Discussion and Conclusion

In contrast to early digital currencies which are connected with central institutions for money supply and which are limited to certain communities, for instance in the field of online games, Bitcoin represents a decentralized currency that has gained popularity within the media and attracted a large user base. Previous research only investigated the technological aspects of Bitcoin as a cryptocurrency, disregarding the user perspective on Bitcoin. In this paper we investigate a fundamental research question: What intentions are users following when changing a domestic currency into a cryptocurrency like Bitcoin? We therefore analyze whether the demand for exchanging the domestic currency into Bitcoin increases along with initial attention on Bitcoin and whether the actual usage of Bitcoin, i.e. using Bitcoin as a currency in order to buy or sell goods, also increases.

In order to investigate this research question empirically, trading data of a Bitcoin exchange, transaction data from the Bitcoin Blockchain, visitor statistics for the Bitcoin Wikipedia article and dates of important Bitcoin events were collected. Our research design is based on following a two step approach. Step one comprises investigating whether Bitcoin intra-network transaction and on-exchange trading volumes are linked. In a second step, we elaborate if new users have an impact on both types of volume and draw conclusions about the users' intentions.

Consequently, we contribute to the literature on digital and cryptocurrencies in general and to the literature on Bitcoin in specific by providing indications that new Bitcoin users rather use it as an asset than as a currency. The interest of new users has an influence on the Bitcoin volume traded at the exchange but not on the volume within the Bitcoin system. One interpretation of the results is that exchange users buying Bitcoin for the first time are likely to keep these Bitcoins in their exchange wallet for speculation purposes and do not have the intention to use these acquired Bitcoins for paying goods or services. Furthermore, the interpretation that Bitcoin is used as asset is also supported by the fact that Bitcoin returns react on news events related to this digital currency. However, we find indications that Bitcoin users are limited in their level of professionalism and objectivity, which is highlighted by their bias towards positive news.

Thus, new users tend to trade Bitcoin on a speculative investment intention basis and have low intention to rely on the underlying network as means for paying goods or services. To add further robustness to our analysis we added manifold control parameters while our results stay the same. Yet, we face several limitations about the time series consistency and generalizability of our results. Our analysis only covers the last three years of Bitcoin history. However, we provide indications about recent progress and dissemination within this digital currency.

Furthermore, we are aware that our analysis is mainly based on the exchange data of a single exchange. Nevertheless, Mt. Gox covered 80% of overall exchange volume related to Bitcoin during the observation time span, hence we argue that investigating Mt. Gox data gives appropiate insights on the Bitcoin ecosystem.

Within future research, we plan to include smaller exchanges as well and analyze how they relate to the incumbent ones. Additionally, in order to investigate whether fundamental characteristics of financial markets also hold for Bitcoin markets, we plan to extend our analysis by investigating if possibilities for inter-exchange arbitrage exist and whether behavioral biases such as herding dominate the Bitcoin user decision making.

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