Is Bitcoin a Viable E-Business?: Empirical Analysis of the Digital Currency's Speculative Nature

Research-in-Progress

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Abstract

Ever since its creation by the presumed pseudonymous Satoshi Nakamoto, Bitcoin has garnered significant attention as an innovative online payment system. The purpose of this paper is to discover the degree to which the participation of a Bitcoin user is dependent on the speculative opportunities in the Bitcoin market and, accordingly, to test Bitcoin's competence against traditional currency. Using a panel data set from one of the largest Bitcoin traders in Asia, we find that $1 increase in arbitrage between market prices is associated with 0.1 more log-ins of users. However, the paper also suggests that such a speculative nature might not be strong enough to dominate user behaviors entirely. The findings report that the actual reason for Bitcoin's incompetence as a form of currency against the conventional tools of trade may be attributable to its low level of network effects.

Keywords: Bitcoin, digital currency, market viability, network effect, user behavior, customer participation

Introduction

Since its creation by the presumed pseudonymous Satoshi Nakamoto, Bitcoin has garnered significant attention as an innovative online payment system. As the first decentralized cryptocurrency, Bitcoin offers an open source, peer-to-peer cryptographic electronic payment system that operates with no central authority (Nakamoto, 2008). Such a unique characteristic is present because Bitcoin is entirely dependent on its users for the creation and the transaction of bitcoins. In this era of information and technology, the creation and the existence of Bitcoin represent opportunities for new possibilities.

Beyond the face value contributions to the market, Bitcoin posits value in its usage as currency. Exceeding total market capitalization of 3.5 billion USD by September, 2015, Bitcoin is one of the few that has shown actual progress in establishing its status as real money - used for making real purchases - among the recent attempts at developing a stable electronic payment system. As the network size of Bitcoin users increases, many multinational corporations, including Amazon, Paypal, Alipay and Starbucks, have begun to accept bitcoins. A wide range of real goods, varying from daily necessities to luxuries, can now be purchased with the digital currency. Though still limited in its options, Bitcoin functions successfully as a medium of exchange. Moreover, the digital currency presents advantages over traditional transaction mediums in some aspects. Examples include Bitcoin's instant accessibility from any place in the world, its low transaction costs, and the ability to detect fraudulent charges (Van Alstyne, 2014), positioning Bitcoin as an attractive alternative to credit cards. With many people acknowledging its potential, Bitcoin is estimated to reach 4.7 million active users by the end of 2019 (Holden, 2015).

Despite the expanding size of the Bitcoin acceptance market, the ongoing debate regarding Bitcoin's confusing status as currency is not about to cool down. Is Bitcoin currency? Or is it a mere investment material? Due to massive volatility in price, which is inherent in digital currency, the dominant opinion claims that Bitcoin is more of a speculative vehicle than a replacement to the traditional medium of trade. As to whether Bitcoin becomes a supplement to today's monetary system or slowly advances toward its much-anticipated demise after the price bubble pops, even the experts have varying opinions. A lack of research on this topic is one possible contributing factor to the debate's continuity.

The purpose of this paper is to test the speculative nature of the Bitcoin market and further examine Bitcoin's chance of taking hold as a legitimate payment system. In doing so, the paper sets up two specific objectives and empirically tests them accordingly. The first objective of the paper is to discover the degree to which the participation of a Bitcoin user is dependent on the speculative opportunities in the Bitcoin market. The type of a speculative opportunity studied in this paper is the arbitrage opportunity that occurs within Bitcoin transactions. The second objective of the paper is to test Bitcoin's competence against traditional currency. The theories of network effects and switching costs are utilized in the process. Two sets of data are employed in this paper: individual level user transaction data from the largest Korean Bitcoin exchange, *Korbit*, and Bitcoin open market data. In the following sections, we review prior research in relation to this paper. We then proceed to describe the dataset used in the analysis and suggest hypotheses for testing, followed by the results of the analysis. Concluding remarks and discussion are presented in the final section.

Literature Review

Bitcoin is a rising financial vehicle that has attracted strong attention from experts in various fields. A number of scholars have shown interest in the topic, and a variety of relevant issues, ranging from methods to improve the structural aspects of Bitcoin (Barber et al., 2012) to fraud regulation (Dion, 2013; Plassaras, 2013), have attracted scholars' attention. The economic viability of Bitcoin has also proven to be an attractive thesis for several researchers (Buchholz et al., 2012; Yermack, 2013; Ciaian et al., 2014; Kristoufek, 2013). However, the general attitude of the researchers toward the digital currency's economic viability is not quite positive. Despite a number of companies that accept Bitcoin, researchers seem to believe that Bitcoin's behavior resembles the behavior of a speculative investment rather than that of a currency. By proving that Bitcoin's price has no correlation with conventional exchange rates and further identifying Bitcoin's distinctions from conventional currency, Yermack (2013) argues that Bitcoin behaves more like a speculative vehicle than a currency. Buchholz et al. (2012) confirm the speculative nature of the digital currency by demonstrating that volatility has a statistically significant positive effect on price prior to the peak of the price bubble. Ciaian et al. (2014) present that the largest drivers of Bitcoin prices

are the supply and demand of the digital currency itself, highlighting Bitcoin's inherent volatility in price. Kristoufek (2013) finds that Bitcoin prices are directly related to investors' attractiveness in response, reflecting the speculative purpose of the users. Among the researchers who have investigated the topic of Bitcoin, or cryptocurrency in general, there seems to be consensus regarding the speculative nature of the digital currency. This paper primarily aims to contribute to the literature by assessing the influence of arbitrage opportunities on the participation of Bitcoin users.

The second research objective of the paper stems from the following research question: Is it possible for Bitcoin to hold its own against conventional currency? Even if Bitcoin's speculative nature is determined not to be as strong as expected, if users refuse to use Bitcoin over what is already available to them, namely conventional currencies and associated tools, then Bitcoin, despite its presumed advantages, will soon have to close down. Only a few exceptions, namely *FinTech* systems like *Paypal, Alipay* and other mobile payment systems, have survived, and so far, none have succeeded in replacing the conventional currency system. Is it because the current currency system is really the greatest currency system that can ever be created? Dowd and Greenway (1993) offer an explanation to the rock-hard dominance of the current, conventional currency over new currencies through network effects and switching costs. Dowd and Greenway's model on currency competition shows that a better alternative currency is unlikely to be chosen over the conventional payment system when network effects and switching costs are present. Network effects are the effects one user of a good has over the value of that product (Shapiro and Varian, 1999). The value of connecting to a network is dependent on the number of others who are connected to it. Positive network externalities have also been considered across information systems (IS) literature (Kauffman et al., 2000; Gallaugher and Wang, 2002; Liu et al., 2011; Burtch, 2011). As more people use the same currency, said currency can be exchanged among more people, and thereby the value of the currency is bound to increase. Another factor attributed to the rock-solid dominance of the conventional currency is the switching cost. Broadly, switching cost refers to the loss associated with changing products, brands, or suppliers (Thompson and Cats-Baril, 2002). Types of switching costs include exit costs, learning costs, emotional costs, and installation costs, among many others. When switching to new currencies, with high probability, learning costs and exit costs can arise during the reckoning stage of the new currency, during changes in the units in which the prices are quoted, and during necessary changes to the records (Dowd and Greenway, 1993; Luther, 2013)

One interesting aspect in this fight between Bitcoin and conventional currency is that Bitcoin is a financial system which is entirely dependent on its network of users and the network effects incurred. Unlike other tools of the trade – namely, gold – Bitcoin is without an intrinsic value, and its value is realized only when people recognize its value. By offering an explanation of Bitcoin's performance as currency through network effects, the paper examines Bitcoin's chance at survival.

Data and Hypotheses

As briefly aforementioned, the paper utilizes two sets of data: Bitcoin open market data and individual level transaction data from one of the largest Bitcoin exchanges in Korea, *Korbit*. A Bitcoin exchange is a platform from which bitcoins are bought and sold. The transacted bitcoins can then be transferred to fiat currencies, such as US dollars, and users can also freely insert fiat money in exchange for Bitcoin.

The *Korbit* data was collected for approximately half a year, from July 04, 2014, to the present, mid-January 2015. The number of utilized dates records a total of 195 days. The open market data was collected from Quandl and Bitcoincharts.com. The data contains information on individual users and reports the financial behavior of the users accordingly. Positioning user identifier variables as the panel variable, we have reformulated the dataset into a daily panel dataset. The key variables are as follows.

- *Korbit price*: The daily price of 1 Bitcoin on *Korbit*. The daily price is calculated by averaging the fluctuating Bitcoin transaction prices per day. For statistical convenience, we have calculated the *Korbit* price in dollars from the original won value using exchange rates.
- *Exchange rate*: The daily won/dollar exchange rates.
- *Price difference*: The difference between the Bitcoin market price and the Bitcoin *Korbit* price. The price deviation is calculated by subtracting the *Korbit* price, divided by the dollar-won exchange rate, from the Bitcoin market price.
- *Login counts*: Login counts of a user.

- *Korean out*: The frequency (counts) in which a user draws fiat money (Korean dollars) out of his or her account.
- *Platform*: A digital platform by which a user is logged in. The base platform is a computer platform. Other platforms that offer *Korbit* services are API platforms and mobile platforms.
- *Korbit volume*: The daily total amount of bitcoins traded on *Korbit*.
- *Bitfinex volume*: The daily total amount of bitcoins traded on Bitfinex.
- *BTCChina volume*: The daily total amount of bitcoins traded on BTCChina.
- *OKCoin volume*: The daily total amount of bitcoins traded on OKCoin.
- *BitStamp volume*: The daily total amount of bitcoins traded on BitStamp.
- *BTC-e volume*: The daily total amount of bitcoins traded on BTC-e.
- *Age*: Age of a user.
- *Gender*: Gender of a user.

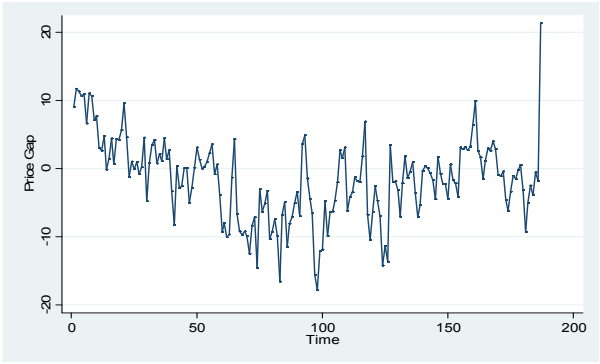

Figure 1. Price gap between the market price and the *Korbit* price

In examining the data, it is notable that there is a gap between the Bitcoin market price and the *Korbit* price. The price gap persists from the very beginning of the service to the present. (Figure 1) In this analysis, we assume that arbitrage opportunities can be operationalized by the price difference. The bigger the gap in prices, the more speculative, short-term investors will be interested in purchasing the digital currency for investment purposes, of course. Among the available data, we believe that one key variable which summarizes the activity of a user is log-in counts. The more the user is interested in participating in bitcoin transactions, the more often he or she will log in. Therefore, we believe log-in counts represent the degree of customer participation. Following the existing literature on Bitcoin's speculative nature, customer participation is expected influenced by speculative opportunities, and users are more likely to log in when arbitrage opportunities are present.

> ***H1a****: The price gap between the Bitcoin market price and the Korbit price is directly related to the log-in counts of a Korbit user.*

Although not as specific as price gap, the exchange rate can also be an indicator of speculative opportunities. The exchange rate of interest in this paper is the USD/KRW exchange rate. In economics, high exchange rates undervalue a currency, in this case, Korean currency. Having an undervalued Korean dollar means an increase in the price difference between the Bitcoin open market price and the *Korbit* price, thus creating more speculative opportunities. Based on the same logic identified in H1a, log-in counts are likely to increase as exchange rates increase.

> ***H1b****: Exchange rates are directly related to the log-in counts of a Korbit user.*

Other than log-in counts, one other variable that indicates the degree of customer participation is the frequency with which a user draws fiat money out of a Bitcoin account. Of course, a Bitcoin exchange is rightfully equipped with the functions of exchanging fiat money for Bitcoins and vice versa. Nevertheless, those who treat Bitcoin as a speculative vehicle rather than their long-term financial tool are expected to draw fiat money out more often. The frequency of the behavior is anticipated to increase when there are

money-making opportunities present, which in this case are the arbitrage opportunities represented by the price gap. If the data inspection shows that the price gap is positively correlated with the drawing out counts of fiat money, the Korean dollar in this case, then it may provide evidence regarding the speculative nature of Bitcoin users. Based on the existing studies regarding the opportunistic behaviors of Bitcoin users, the prediction is that there will be a direct relationship between the price gap and the Korean dollar drawing out counts. Applying the same logic used in H1b, another prediction is that the Korean dollar drawing out counts are positively related to exchange rates.

> ***H2a****: The price gap between the Bitcoin market price and the Korbit price is directly related to the Korean dollar drawing out counts.*

> ***H2b****: Exchange rates are directly related to the Korean dollar drawing out counts*

H1 and H2 function as the indicators of the first research objective of the study: the relationship between Bitcoin user participation and speculative opportunities. As for the second research objective of the study, testing for Bitcoin's competency against the conventional currency, this paper adopts Dowd and Greenway's (1993) perspective on technology acceptance and its two primary components: network effects and switching costs. Taking on Luther's (2013) point of view that switching costs related to Bitcoin may actually be manageable, this paper aims to examine the existence of network effects within Bitcoin and its strength against conventional currency. Due to the very definition of Bitcoin, it only makes sense that network effects are present within the Bitcoin market. To demonstrate the existence of network effects within Bitcoin, the total volume of bitcoins traded in each of the top five Bitcoin exchanges are brought into the equation. The top five Bitcoin exchanges are BTCChina, Bitfinex, BTC-e, BitStamp, and OKCoin. Based on the last 30 days' transactions, bitcoin amounts traded in BTCChina represent up to 48% of the entire bitcoin volume available in the market, followed by Bitfinex with a 22% portion, BTC-e with 7%, and BitStamp with 7%. Although OKCoin does not appear on the Bitcoin volume distribution charts as one of the major players, in recent days, OKCoin has recorded the highest average Bitcoin price and Bitcoins traded per day. The total amounts of Bitcoins traded in these five exchanges represent more than 84% of the entire Bitcoins available. Taking this into account, financial behaviors that occur within these five exchanges appear to be a close representative of the Bitcoin market. The prediction is that the increase in the volume of bitcoins traded in these exchanges also has a positive influence on the log-in frequency. If such a pattern is observed, it may provide empirical support for the existence of network effects within the Bitcoin market.

> ***H3a****: Due to network effects, the amount of bitcoins traded in the major Bitcoin exchanges have a direct relationship with the log-in frequency of Korbit users.*

Nevertheless, considering Bitcoin's current status in the competition against conventional currency, it is expected that the strength of the network effect is not as strong as first predicted.

> ***H3b****: The degree of influence that the amounts of Bitcoins traded in the major Bitcoin exchanges has over the log-in frequency of Korbit users may not be very high.*

We estimate the effect of *Price Gap*, *Korbit Price* and *Exchange Rates* on users' log-in frequency to test the initial hypothesis. We control the observed characteristics of users using the dummy variables of age and gender. Further, our estimation incorporates fixed effects for users in order to consider unobserved characteristics of individual users. Equation 1, presented below, captures our econometric model. In this equation, users are indexed by *i,* and time is indexed by *t*.

$$Login\ Counts_{it} = \beta_0 + \beta_1(Price\ Gap_{it}) + \beta_2(Korbit\ Price_{it}) + \beta_3(Exchange\ Rates_{it}) + Control_i(age, gender_i) + a_i(user\ fixed\ effect_i) + \varepsilon_{it} \quad (1)$$

In the following analysis, we replace the dependent variable of *Login Counts* with *KRW Draw Out Counts* to identify the factors for drawing fiat money out. For the independent variables, we add the dummy variables of the platforms to investigate which platform may influence money drawing. Additionally, for the identification of network effects, we incorporate the variables of transaction volumes of other bitcoin marketplaces. Since both dependent variables utilized in this paper are count variables, to confirm for the validity of the analyses, fixed effects Poisson regressions are carried out as well.

Results

The results are demonstrated in the tables below. Table 1 examines whether the price difference between the market price and the *Korbit* price influences Bitcoin user participation. Notice that in all models, the age and gender of the users are taken into account and controlled for. Weekly information in which the events took place was sought to be controlled for, but as there exists expansion of the market based on the passage of time, incorporating a weekly variable was only considered for and not included in the model. Column (1) of Table 1 inspects a total of 376 users, whereas column (2) of Table 1 omits user data with only one raw and reports on 303 users who are actually participating in the Bitcoin society. Hypothesis 1a predicts a direct relationship between the level of price deviation and user log-in frequencies. This path is found to be statistically significant in both models conducted (Table 1 column 1: β=0.1020, p<0.001, Table 1 column 2: β=0.0241, p<0.001). Therefore, Hypothesis 1a is supported. With regard to Hypothesis 1b, the prediction that user log-in frequencies are directly influenced by exchange rates is supported as well (Table 1 column 1: β=0.0249, p<0.001, Table 1 column 2: β=0.0120, p<0.001). Although not previously hypothesized, *Korbit*'s Bitcoin price demonstrates a statistically significant inverse relationship with log-in frequencies. This confirms H1a with more credibility because low *Korbit* Price is expected to lead to a higher price difference.

VARIABLES	(1) Fixed Effects	(2) Poisson
Price Gap	0.1020***	0.0241***
	(0.0025)	(0.0015)
Korbit Price	-8.76e-06***	-3.74e-06***
	(2.22e-07)	(1.50e-07)
Exchange Rates	0.0249***	0.0120***
	(0.0006)	(0.0004)
Age	(Yes)	(Yes)
Gender	(Yes)	(Yes)
Observations	5,108	5,035
R-squared	0.682	
Number of id	376	303

Dependent variable is the *Log-in Counts*. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 1. Arbitrage Chances and Customer Participation

Onto Hypothesis 2, Table 2 investigates the relationship between the price gap and the fiat money drawing out frequency. As in Table 1, the first column of Table 2 reports results from conducting fixed effects regression, and the second column of Table 2 reports results from conducting Poisson fixed effects regression models. Both the findings in column (1) and the findings in column (2) show that the price gap between the open market Bitcoin price and the *Korbit* price is directly related to the fiat money drawing out frequency. However, both results have high p-values, and Hypothesis 2a (Table 2 column 1: β=0.0016, p>0.1, Table 2 column 2: β=0.0098, p>0.1) is not statistically supported. However, Hypothesis 2b is statistically supported in both the fixed effects regression and the Poisson fixed effects regression models (Table 2 column 1: β=0.0018, p<0.001, Table 2 column 2: β=0.0136, p<0.001). The findings confirm a direct relationship between exchange rates and fiat money drawing out frequencies.

VARIABLES	(1) Fixed Effects	(2) Poisson
Price Gap	0.0016	0.0098
	(0.0012)	(0.0068)
Exchange Rate	0.0018***	0.0136***

	(0.0002)	(0.0015)
API platform	0.0015	0.0935
	(0.0789)	(0.5640)
Mobile platform	0.0126	0.2270
	(0.0606)	(0.2970)
Age	(Yes)	(Yes)
Gender	(Yes)	(Yes)
Observations	5,108	4,377
R-squared	0.1080	
Number of id	376	185

Dependent variable is the *KRW Draw Out Counts*. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 2. Arbitrage Chances and Customer Reaction by Drawing Fiat Money Out

Other than the hypothesized predictions, Table 2 also inspects the role of platforms on the fiat money draw-out frequency. The platform factor is considered based on the assumption that different platforms are likely to impose different influences on log-in frequencies, because each platform provides users with different degrees of accessibility, especially considering the fact that users are acting on their speculative nature. A mobile platform, for example, now promises greater accessibility to the Bitcoin market, Bitcoin wallet, and Bitcoin accounts than other platforms, thanks to the widespread adoption of smartphones. However, Table 2 shows that access through different platforms is not related to fiat money draw-out frequencies. Had the Bitcoin users only perceived Bitcoin as a speculative investment tool, the mobile platform would have had even greater influence over the fiat money draw-out frequencies. The findings from Table 2 suggest that Bitcoin's speculative nature might not be as strong as expected.

VARIABLES	(1) Fixed Effects	(2) Poisson
Korbit Volume	0.0027***	0.0009***
	(0.0001)	(5.22e-05)
Bitfinex Volume	1.11e-05***	2.58e-06***
	(7.43e-07)	(2.32e-07)
BTCChina Volume	-0.0059***	-0.0021***
	(0.0004)	(0.0002)
OKCoin Volume	0.0008**	0.0002
	(0.0004)	(0.0002)
BitStamp Volume	0.0051***	0.0019***
	(0.0004)	(0.0002)
BTC-e Volume	0.0035***	0.0011***
	(0.0004)	(0.0002)
Age	(Yes)	(Yes)
Gender	(Yes)	(Yes)
Observations	5,108	5,035
R-squared	0.3130	
Number of id	376	303

Dependent variable is the *Log-in Counts*. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 3. The Presence of Network Effects within the Bitcoin Market

Recognizing the possibility that Bitcoin's inherent nature in speculative investments might not be as strong as anticipated, Table 3 inspects the existence and the strength of network effects, representing Bitcoin's chance at becoming real money and lasting over the long-term. H3a is partially supported, as all of the major exchanges and their transacted volume of Bitcoins except for *BTCChina* impose statistically significant influence upon a user's participation in the Bitcoin market. Further examining the analysis, H3b is supported, as the degree of influence, or the strength of network effects, imposed by the transacted bitcoin volume of the major exchanges is considerably low (β values are all very low).

Discussion and Conclusion

Many experts have commented on the economic viability of Bitcoin. This paper adds to the literature by approaching the topic through an empirical analysis with individual-level Bitcoin transaction data. The dominant view among researchers regarding Bitcoin market viability is that the nature of Bitcoin is speculative, and Bitcoin would experience difficulties in as assuming the role of a legitimate currency. The findings in this paper concur with the dominant view that the nature of Bitcoin is speculative, but at the same time, the findings of the paper suggest that such a speculative nature might not be as strong as dominating user behaviors entirely.

The goal of this paper is to discover the degree to which the participation of a Bitcoin user is dependent on the speculative opportunities in the Bitcoin market and examine Bitcoin's competence against traditional currency. By conducting fixed effects regression and Poisson fixed effects with a panel dataset from *Korbit*, the paper discovers that customer participation in Bitcoin is indeed speculative and shows that $1 increase in arbitrage between market prices is associated with 0.1 more log-ins of users. Such speculative intention, however, is discovered to be not as strong as being the sole reason in participating in Bitcoin market. The paper finds that accessing to *Korbit* website through different platforms is not related to fiat money draw-out frequencies of users. If it had been the case that the Bitcoin users only perceived Bitcoin as a speculative investment tool, the mobile platform, a platform with faster speed and high mobility, would have had even greater, statistically significant influence over the fiat money draw-out frequencies compared to other platforms. The paper utilizes Dowd and Greenway's (1993) model of currency acceptance and demonstrates that the actual reason for Bitcoin's incompetence as a form of currency against the conventional tools of trade may be attributable to its low level of network effects.

The research findings suggest a new direction of survival for Bitcoin, or cryptocurrencies in general. By actively utilizing methods to attract users and forming a strong network, Bitcoin and other cryptocurrencies may stand a better chance of taking hold in the currency market.

One of the possible directions for making further contributions involves delving deeper into the network effects of Bitcoin. The results of the analysis show that there are network effects among the major Bitcoin exchanges with the exception of *BTCChina*, which is the biggest Bitcoin exchange, representing up to 48% of the Bitcoins available on the market. Before conducting this analysis, the speculation was that transactions in *BTCChina* would directly affect the behaviors of *Korbit* users. The actual results of the study instead reveal an inverse relationship. Delving deeper into the issue and inspecting on how the users of the biggest platform of Bitcoin treat the digital currency could lead to helpful insights. Another suggestion is a careful examination of Bitcoin-related events and how such events affect the behaviors of participants. By determining the extent to which the media and related events affect the level of customer participation, an actual portion of users who are in the market for reasons other than quick investments may be identified. Through the identification of loyal participants, various policies that promote them to become the hubs of networks could be installed, leading to stronger networks.

However, these research findings focus on only one side of Dowd and Greenway's (1993) model. When switching to new currencies, Dowd and Greenway (1993) explain that learning costs and exit costs can occur during the reckoning stage of the new currency, during changes in the units in which the prices are quoted, and during necessary changes in records. This paper takes on Luther's perspective that switching costs to Bitcoin could be sufficiently low and focuses on network effects. Still, by incorporating switching costs into future research, more complete contributions would result.

As one of the few digital currencies that have lasted long enough to attract the interest of researchers, Bitcoin points to possibilities for a new future. Throughout the studies of Bitcoin and its ecosystem, it is clear that financial vehicles will better adapt to this ever-changing society of technologies as time goes on.

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