



Contents lists available at ScienceDirect

Research in International Business and Finance

journal homepage: www.elsevier.com/locate/ribaf

Price dynamics and speculative trading in bitcoin



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A B S T R A C T

Few innovations in the money markets have brought more attention by regulators and policy makers than the digital currency Bitcoin. However, few studies in the literature have examined the price dynamics of Bitcoin. Besides providing an exploratory glance at the value and volatility of the Bitcoin across time, we also test whether the unusual level of Bitcoin's volatility is attributable to speculative trading. Results in this study do not find that, during 2013, speculative trading contributed to the unprecedented rise and subsequent crash in Bitcoin's value nor do we find that speculative trading is directly associated with Bitcoin's unusual level of volatility.

1. Introduction

With the exception of perhaps currency derivatives, few financial innovations in money markets have drawn more attention by regulators and policy makers than the advent of the digital currency Bitcoin. Unregulated by governments, Bitcoin has become popular for both consumers and retailers as its value has increased from a few cents to as high as \$1132.26 during the recent past. The popularity of Bitcoin by retailers might be due to lower transaction fees relative to other credit card processors. Bitcoin's popularity among consumers might be related to its unregulated structure or the privacy afforded by its anonymity. For these reasons, the U.S. Senate recently held hearings regarding potential risks associated with Bitcoin.¹ Amidst all of this interest, surprisingly few academic studies have explored Bitcoin's exchange rate dynamics and its functionality as a medium of exchange. The objective of this study is to take a step in this direction.

The objective of this study is twofold. First, we seek to provide some stylized facts about the price dynamics of Bitcoin. Second, and perhaps more interesting, we test the hypothesis that speculative trading in Bitcoin is responsible for its unusual level of volatility. The volatility of the digital currency might question whether or not Bitcoin functions as currency. While Bitcoin has certainly been used as medium of exchange for many consumers thus far, others have raised concerns that Bitcoin is less of a currency and more of a speculative investment.² Prior research suggests that speculation can lead to a destabilization of asset prices (Hart and Kreps, 1986; Stein, 1987). To the extent that Bitcoin volatility is indeed induced by speculative trading, such trading may reduce its role as a viable currency. Approximating speculative trading is a difficult task given that the motives to trade are not observed. However, Llorente, Michaely, Saar, and Wang (2002), provide an intuitive measure of speculative trading that captures the level of volume-induced return autocorrelation. Using this measure, we test the hypothesis that the unusually high volatility observed in Bitcoin is attributable to speculative trading.³

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¹ During the 2013 Senate Hearing, Senator Thomas R. Carper suggest that digital currencies such as Bitcoin, which are untraceable, can be used to fund criminal activity such as the distribution of weapons, child pornography, and murder-for-hire.

² See, for example, the following two articles in the New York Times. <http://www.nytimes.com/2013/04/15/opinion/krugman-the-antisocial-network.html> <http://krugman.blogs.nytimes.com/2013/12/28/bitcoin-is-evil/>

³ Throughout this study, we estimate volatility following the breadth of literature related to generalized ARCH models. See, for example, Engle (1982), Bollerslev (1986), and Engle and Kroner (1995).

<http://dx.doi.org/10.1016/j.ribaf.2017.05.010>

Received 3 May 2017; Accepted 5 May 2017

Available online 10 May 2017

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Results in this study show that the value of Bitcoin remained well below \$20 from the start of our time period (September 2010) to the beginning of 2013. In 2013, the value of Bitcoin was as low as \$13 and as high as \$1132. In the months that followed the spike in Bitcoin's value, the digital currency lost approximately 60% of its value. These price dynamics seem to indicate the presence of a bubble in Bitcoin (Blanchard, 1979; Flood and Hodrick, 1990; Scheinkman and Xiong, 2003). The estimated volatility for Bitcoin during our sample time period is nearly 6% which is nearly twice as large as the average volatility of 51 other currencies. When examining speculative trading in Bitcoin, to our surprise, we do not find an unusual amount of this type of trading during our sample time period. In fact, during the latter part of 2013–Bitcoin's bubble period – we do not observe any speculative trading according to the methods of Llorente et al. (2002).

Observing low levels of speculative trading during our sample time period is not tantamount to identifying the relationship between speculative trading and volatility. Additional tests show that speculative trading is not positively related to Bitcoin volatility and, if anything, a significant negative relation exists. These results are robust to univariate tests and multivariate tests that use GMM with controls for Newey and West (1987) standard errors. We find further robustness when examining alternative measures of volatility. Similar conclusions are drawn in a number of probit regressions that capture days with extreme changes in the value of Bitcoin. We find that the likelihood of these days occurring is negatively related to the level of speculative trading. These findings suggest that, to the extent that we properly capture speculative trading, such trading is not associated with higher levels of volatility in Bitcoin.

Our study contributes to the literature in three important ways. First, we provide some initial findings about the exchange rate dynamics of Bitcoin. Second, we show that despite the substantial rise in the value of Bitcoin, speculative trading during this period was not unusually high. Third, we demonstrate that the level of speculative trading is not directly associated with the volatility of Bitcoin. The rest of the study follows. Section 2 presents a background on Bitcoin. Section 3 describes the data. In Section 4, we present the results from our empirical tests. Section 5 offers some concluding remarks.

2. The background on bitcoin

As mentioned in the previous section, the objective of this study is to first present some stylized facts about the historic price dynamics of Bitcoin. Second, we test the hypothesis that speculative trading in Bitcoin can explain the presence of the unusually high level of volatility in Bitcoin. In order to further motivate our tests, we discuss the background of Bitcoin. The peer-to-peer electronic monetary system was initially described in a short research paper by Nakamoto (2008), in which the objective of a digital currency is outlined along with how the digital currency could be created and implemented. Nakamoto (2008) discusses the weaknesses of the existing electronic payment system and identifies the high costs of mediating disputes in the existing system. To overcome the inherent trust issues regarding the electronic payment system, Nakamoto (2008) argues that a cryptographic proof would allow, “any two willing parties to transact directly with each other without the need for a trusted third party”. The cryptographic proof would provide fraud protection to both sellers and buyers. The intention of the digital currency was to improve of the existing electronic payment system by allowing individuals to exchange electronic coin using digital signatures, which acts as proof of ownership.

The first Bitcoin transactions occurred in January 2009. More than two years later, various reports estimated the circulation of Bitcoin to be more than 6.5 million with about 10,000 users. While the early transactions in Bitcoin appeared to function according to the initial intentions, soon reports began to appear that Bitcoin was being used to purchase illegal drugs. Policy makers around the world became concerned with the anonymity afforded by Bitcoin. In 2013, two U.S. Senate Committee hearings took place. In the committee hearings, testimony about the anonymity of the digital currency brought about additional concerns. Senator Chuck Schumer, for instance, compared Bitcoin to a form online money laundering. Shortly after the congressional testimony, a forum was held in Washington D.C. where additional concerns were raised about the how the anonymity could be used to purchase child pornography. These concerns lead to the creation of a Senate task force that sought out the experts regarding the digital currency, which ultimately found that Bitcoin had yet to replace more traditional ways of funding criminal activity. To date, millions of Bitcoin remain in circulation and, in general, the use of the digital currency remains unregulated in the U.S.

Beyond the potential to fund criminal activity, economists have voiced concerns that, because of the price dynamics, Bitcoin functions more as a speculative asset than as a traditional medium of exchange. Because of its anonymity, Bitcoin may be a target by speculators. Reports have attempted to link the meteoric rise and subsequent collapse in the value of Bitcoin to speculative trading. These reports seem to have merit as the theoretical literature nicely describes the link between speculation and bubbles/crashes in different asset markets. Stein (1987), for example, shows that the presence of speculation can inhibit arbitrage and lead to destabilized asset prices. Shiller (1981) provides some additional insight regarding the link between speculation and the destabilization of prices in equity markets. In particular, Shiller suggests that the observed excess volatility in speculative prices contradicts the efficient markets hypothesis. This link between speculation and volatility provides the framework for our analysis. While our investigation is focused on the idea that speculation might adversely affect Bitcoin as a medium of exchange, examining the informational efficiency of Bitcoin prices may be an important avenue for future research.

3. Data description

We obtain price and volume data from Bitcoin Charts, which provides financial and technical data about the Bitcoin network. Both price and volume data are available on July 17th, 2010. The end of our sample time period is June 1st, 2014. We also gather historical exchange-rate data for 51 other currencies during the same time period from Bloomberg. The purpose in doing so is to provide a simple benchmark when examining Bitcoin volatility.

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