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Price manipulation in the Bitcoin ecosystem

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ABSTRACT

To its proponents, the cryptocurrency Bitcoin offers the potential to disrupt payment systems and traditional currencies. It has also been subject to security breaches and wild price fluctuations. This paper identifies and analyzes the impact of suspicious trading activity on the Mt. Gox Bitcoin currency exchange, in which approximately 600,000 bitcoins (BTC) valued at $188 million were fraudulently acquired. During both periods, the USD-BTC exchange rate rose by an average of four percent on days when suspicious trades took place, compared to a slight decline on days without suspicious activity. Based on rigorous analysis with extensive robustness checks, the paper demonstrates that the suspicious trading activity likely caused the unprecedented spike in the USD-BTC exchange rate in late 2013, when the rate jumped from around $150 to more than $1,000 in two months.

1. Introduction

Bitcoin has experienced a meteoric rise in popularity since its introduction in 2009 (Nakamoto, 2008). While digital currencies were proposed as early as the 1980s, Bitcoin was the first to catch on. The total value of all bitcoins in circulation today is around $28 billion (CoinMarketCap, 2017a), and it has inspired scores of competing cryptocurrencies that follow a similar design. Bitcoin and most other cryptocurrencies do not require a central authority to validate and settle transactions. Instead, these currencies use only cryptography (and an internal incentive system) to control transactions, manage the supply, and prevent fraud. Payments are validated by a decentralized network. Once confirmed, all transactions are stored digitally and recorded in a public "blockchain," which can be thought of as an accounting system.

While bitcoin shows great promise to disrupt existing payment systems through innovations in its technical design, the Bitcoin ecosystem[1] has been a frequent target of attacks by financially-motivated criminals. This paper leverages a unique and very detailed data set to examine suspicious trading activity that occurred over a ten-month period in 2013 on Mt. Gox, the leading Bitcoin currency exchange at the time.[2] The first step is to quantify the extent of the suspicious trading

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[1] The Bitcoin ecosystem includes the core network for propagating transactions, the blockchain, and many intermediaries such as currency exchanges, mining pools and payment processors that facilitate trade. This paper uses "Bitcoin" with a capital "B" to refer to the ecosystem and "bitcoin" with a small "b" or BTC to refer to the coin.

[2] See Appendix A for the market share of the cryptocurrency exchanges.

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activity and show that it constitutes a large fraction of trading on the days the activity occurred. The next step is to examine whether and how this trading activity impacted Mt. Gox and the broader Bitcoin ecosystem.

Our main results are as follows. Prices rose on approximately 80% of the days that the suspicious trading activity occurred. By contrast, prices rose on approximately 55% of the days in which no suspicious trading activity occurred. Further, during days with suspicious trades, on average, the USD/BTC exchange rate increased by approximately four to five percent a day. During the same period when no suspicious trades occurred, on average the exchange rate was flat to slightly decreasing. Trading volume increased substantially on days with suspicious trading activity, over and above the suspicious activity.

Rising exchange rates and increased trading volume occurred both (I) on the Mt. Gox exchange where the suspicious trades took place and (II) on the other leading currency exchanges on the days the suspicious activity took place. The price rises on all exchanges were virtually identical, which makes sense given the ability of traders to engage in arbitrage across exchanges.

The suspicious trading activity of a single actor was the likely cause of the massive spike in the USD/BTC exchange rate in which the rate rose from around 150*toover*1,000 in just two months in late 2013. The fall was nearly as precipitous: the Mt. Gox exchange folded due to insolvency in early 2014 and it has taken more than three years for bitcoin to match this rise.

1.1. Why does Bitcoin manipulation matter?

As this paper will show, the first time Bitcoin reached an exchange rate of more than $1,000, the rise was likely driven by manipulation. It took more than three years for these exchange rates to be reached again, and we are left to wonder whether the current spike was driven by legitimate interest or by something more nefarious. But, why should anyone care about possible price manipulation in bitcoin during 2013? After all, the Bitcoin ecosystem is not nearly as important as the New York Stock Exchange. Nonetheless, recent trends indicate that bitcoin is becoming an important online currency and payment system.

Additionally, the total market capitalization cryptocurrency assets has grown stunningly since the end of the period covered by our analysis. In January 2014, the market capitalization of all cryptocurrencies was approximately $14 Billion. As of September 2017, total market capitalization is approximately $145 Billion. That is a ten-fold increase.

In the case of bitcoin, during the one year period ending in mid-May 2017, the market capitalization increased massively, from around 7 Billion USD to 28 Billion USD (CoinMarketCap, 2017a). That is an increase of approximately 300% in one year. The market cap of other cryptocurrencies surged by even more. In the one year period ending in mid-May 2017, the market value of cryptocurrencies excluding bitcoin surged by more than 1900% (CoinMarketCap, 2017b). Hence, cryptocurrencies are becoming more important. So it is important to understand how the Bitcoin ecosystem works or does not.

Further, despite the huge increase in market capitalization, similar to the bitcoin market in 2013 (the period examined), markets for these other cryptocurrencies are very thin. The number of cryptocurrencies has increased from approximately 80 during the period examined to 843 today! Many of these markets are thin and subject to price manipulation.

As mainstream finance invests in cryptocurrency assets and as countries take steps toward legalizing bitcoin as a payment system (as Japan did in April 2017), it is important to understand how susceptible cryptocurrency markets are to manipulation. Our study provides a first examination.

In terms of the macro-economic lessons, cryptocurrency manipulations tie in to a concern in trading in unregulated financial exchanges. The potential for manipulation in the Over-the-Counter (OTC) markets is a significant concern for financial regulators. OTC trading is conducted directly between two parties, without going through a stock exchange. In a recent white paper, the SEC noted that "OTC stocks are also frequent targets of market manipulation by fraudsters."[3] The SEC report also documents that OTC trading has increased significantly over time.[4]

For all of these reasons, it is important to understand how the Bitcoin ecosystem works and how it could be abused. This paper takes an initial step in that direction by quantifying the impact of one prominent manipulation.

1.2. Road map

The paper proceeds as follows. Section 2 discusses background and related work. Section 3 explains our methodology for identifying the STA and details evidence for why these transactions are deemed suspicious. Sections 4 and 5 examine the data in detail, present the findings and show that the results are robust. Section 6 documents the potential for fraudulent trading in the cryptocurrency market today, while Section 7 concludes with further discussion.

[3] Outcomes of Investing in OTC Stocks, by Joshua White, December 16, 2016, U.S. Securities and Exchange Commission Division of Economic and Risk Analysis (DERA).

[4] In 2008 around 16% of U.S. stock trades were of the OTC type. By 2014, OTC trades accounted for 40% of all stock trades in the US. Like cryptocurrency trading, OTC trades are not transparent and not regulated, and there is concern that such trading is more harmful than high-frequency trading via regulated exchanges (McCrank, 2014).