

Where Did the Money Come From? Investigating Sources of Bitcoin Investment in South Korean Crypto Market

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ABSTRACT

This paper investigates the potential sources of funds invested in cryptocurrency market. This is to understand the potential transmission of systemic risk from the cryptocurrency market to traditional capital markets, which might threaten financial safety regulations. Using the daily Bitcoin trading data from 2010 to 2020 traded in Korea, we find a regime change in September 2017 when the trading volume hits the peak. Pre-2017 September data yields positive and significant relationship between Bitcoin and KOSPI trading volume, but post-2017 data provides negative and significant relationship. With such results, we can conjecture that, in the early stage of Bitcoin market development, the successful investment stories in Bitcoin market increase the total capital with high-risk profile. With the popularity of Bitcoin investment, that is, risk tolerance of equity investors also increases. Later, on the other hand, the capital with high-risk profile flew from the traditional financial market, KOSPI to Bitcoin market.

Keywords: Cryptocurrency, Fund Source, Equity Market, Systemic Risk.

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1. INTRODUCTION

Despite the warnings and mounting criminal and civil enforcement actions of regulators around the globe, cryptocurrency market continue to attract numerous investors, trading coins and participating initial coin offerings (ICOs). At its peak in 2021, exponentially growing cryptocurrency market hit near one-trillion-dollar market capitalization.

Many investors were attracted by the rally triggered by Tesla and Musk in the early 2021 and responded by providing more liquidity to cryptocurrency market. Such new capital injection made cryptocurrency market rally even stronger. Encouraged by the solid performance of the cryptocurrency market, in addition, more and more investors took leveraged positions with the expectation of continued rally. The most well-known cryptocurrency, Bitcoin, is a volatile digital asset with previous experiences of boom and bust cycles. Price of Bitcoin, like many other cryptocurrencies, has drastically increased over the course of 2021, hitting an all-time high in mid-April, then it collapsed back down to where it was in the late 2020.

At this point, financial regulators and financial institutions are keen to know the answer

for this question: “ If cryptocurrency market collapses, are we really going to see a collapse of our financial system?” Since the financial crisis of 2008, all regulators are very concerned about systemic risk of cryptocurrency market. Because cryptocurrency market platforms often rely on shadow banks, many crypto market participants are out of the traditional regulatory territory. Indeed, many of cryptocurrency market participants have severely lacking compliance controls. Also, there are no adequate consumer protection and cyber security protection policies. Moreover, media is keen on reporting chronicles of cryptocurrency market despite of the endemic challenges of cryptocurrency market: systemic risk. Increasing media exposure of stories about successful investors amplifies public attention. In turn, investors tend to take heavily leveraged positions in cryptocurrency market, which strengthens the speculative nature of cryptocurrency market. All of these situations put the entire industry into prevailing operational and systemic risk.

The main purpose of this study is to understand the potential transmission of systemic risk from the cryptocurrency market to traditional capital markets, which might threaten financial safety regulations. For the research, we need to identify and understand various sources of money invested in cryptocurrency market. More specifically, we need to investigate the following typical questions: 1) Is cryptocurrency market systemically related to other financial markets? 2) Did the money come from stock market? and 3) Do gamblers and lottery buyers also buy cryptocurrencies? The question 1 is about systemic risk, the question 2 is about financial market liquidity and the question 3 is about level of speculation in cryptocurrency market. These questions are that regulators are curious about but usually do not have answers yet. Considering the size and growth of the cryptocurrency market, the results of this study have important implications for understanding capital flows and systemic risk in the cryptocurrency market, and thus financial stability policy.

For the empirical analyses, we use Bitcoin trading data in Korea. We choose *Bitcoin* among approximate 10,000 cryptocurrencies, because it is the leading cryptocurrency and has received the most attention from crypto-investors. In addition, Bitcoin has the largest market capitalization and trading volume among all cryptocurrencies. We further limit our empirical analysis to Bitcoin market in Korea because of its uniqueness and isolated environment. Korea has played an important role in the world cryptocurrency market since 2015. For example, Bitcoin trade takes only 30% of total Korean cryptocurrency trading volume (i.e. 70% for altcoin trading) while the figure's world average is around 60% (i.e. 40% for altcoin trading). The existence of *Kimchi premium*¹ also indicates the uniqueness of cryptocurrency prices in South Korean exchanges compared other global exchanges outside of Korea. This is largely seen in the price of the major cryptocurrencies (i.e. Bitcoin and Ethereum). Kimchi premium gives two important implications about South Korean cryptocurrency market. 1) The price of cryptocurrency traded in Korea could be (much) different from the world average and 2) the Korean crypto market is isolated from the rest of the world and money does not move freely.

The unique characteristics of Korean cryptocurrency market thus provides a good opportunity to investigate the questions raised by financial regulators around the globe. Relatively isolated and closed cryptocurrency market with high trading volume, wide and deep market liquidity, and flourishing trade data make Korean cryptocurrency market

¹ The name "kimchi premium" is a reference to the fermented cabbage dish that is a staple in Korean cuisine.

academically very attractive. Especially, isolated market environment with high level of data availability leads to ease in interpreting empirical analysis results. Hence, our empirical analysis on Bitcoin market in Korea could provide significant insight on the nature of cryptocurrency market and crypto investors.

Using the daily Bitcoin trading data from 2010 to 2020 in Korea, we find that there is no significant relationship between KOSPI and Bitcoin trading volume over the whole period. If we divide the sample period, however, we find a regime change in September 2017 when the trading volume hits the peak. Pre-2017 September data yields positive and significant relationship between Bitcoin and KOSPI trading volume, but post-2017 data provides negative and significant relationship. Therefore, we can conjecture that, in the early stage of Bitcoin market development, the successful investment stories in Bitcoin market increase the total capital with high-risk profile. With the popularity of Bitcoin investment, that is, risk tolerance of equity investors also increases. Later, on the other hand, the capital with high-risk profile flew from the traditional financial market, KOSPI to Bitcoin market.

We confirm our conjecture on the change in investors' risk averseness with gambling and lottery activities. Using Lotto/ Horse Racing ticket sales, we find the significantly negative relation between KOSPI trading volume and ticket sales. We also find no significant relationship between Lotto/ Horse Racing ticket sales and Bitcoin trading volume before the September of 2017, but positive and significant relationship after the September of 2017. Thus, we can argue that the popularity of Bitcoin investments reduces investors' risk averseness. After September 2017 when the Bitcoin trading became mundane, equity capital become sources of fund in Bitcoin and gambling market.

Up to the best knowledge of authors, this is the first research to analyze the source of capital inflows in the cryptocurrency market. In addition, this study expands the scope of the analysis on cryptocurrencies. In general, previous studies focus on characteristics of cryptocurrencies or the role of cryptocurrency as an alternative financial asset. However, this paper examines the connectivity between the equity market and the cryptocurrency market. We further explore the relation between gambling and cryptocurrency market to gauge the speculative level of cryptocurrency investment. Therefore, our study broadens the understanding of the nature and systemic risk of cryptocurrency market.

Our findings also have policy implications of cryptocurrency market regulations. We show that after September 2017, the capital flows from the equity market to Bitcoin market. With an additional result showing the positive relation between gambling activities and Bitcoin trading, we can guess the high speculation level in cryptocurrency market. In short, our results confirm the financial regulators' concerns on the systemic risk of cryptocurrency market. Thus, this research provides the pathway to cryptocurrency market regulations.

The rest of the paper is structured as follows. Section 2 briefly reviews previous research on cryptocurrencies. Section 3 introduces theoretical models and hypotheses on the relationships among stock market, cryptocurrency, and lotto/horse racing ticket sales. The empirical results and robustness check are discussed on Section 4. Finally, Section 5 concludes.

2. LITERATURE REVIEW

As cryptocurrency market experiences extremely high volatility and hence receives much attention from public, academics also give much interest and there are plenty of literature

regarding cryptocurrencies and crypto markets. Previous studies investigate various aspects of crypto environment.

There are research area related to Bitcoin based on the nature of Bitcoin as a financial asset. In this strand, Bitcoin can be used to improve portfolio diversification. For instance, Briere *et al.* (2015) focused on the exceptionally high average return and volatility of Bitcoin, and remarkably low correlation with other financial assets over the 2010-2013 period, and prove that even a small proportion of Bitcoin may dramatically improve the risk-return trade-off of well-diversified portfolios. From this portfolio diversification view, Guesmi *et al.* (2019) confirmed earlier suggestions, and suggested that short position in the Bitcoin market allowed hedging the risk investment for all different financial assets.

Since the Bitcoin is considered as alternative asset class and proxy of a currency, a lot of researchers compared the Bitcoin with gold in portfolio diversification. For instance, Dyhrberg (2016a, 2016b, 2020) compared Bitcoin with gold and the US dollar and conclude that Bitcoin can be classified in between gold and the US dollar on a scale from the pure medium of exchange advantages to the pure store of value advantages. Selmi *et al.* (2018), Klein *et al.* (2018), Henrique and Sadorsky (2018) and Symitsi and Chalavatzis (2019) also cover the possibility of replacing gold with Bitcoin in the portfolio.

Baur *et al.* (2018) uses daily Bitcoin price and trade volume data from 2010 to 2015. They employ a simple OLS with SP500, Gold, Silver, international currencies (EUR, AUD, JPY, GBP, CNY, HUF, USD), WTI and Natural gas as control variables to find that Bitcoin is uncorrelated with traditional asset classes such as stocks, bonds and commodities both in normal times and in financial turmoil. They also empirically find that Bitcoins are used as a speculative investment, not as medium of exchange. Urquhart and Zhang (2019) finds that Bitcoin is a hedge for the CHF, RUE and GBP. Bitcoin is diversifier for the AUD, CAD and JPY. And Bitcoin is safe haven during turmoil in the CAD, CHF and GBP.

Ciaian *et al.* (2018) employs daily Bitcoin and some alternative coin price data between 2012 and 2016 to investigate the relationship between Bitcoin and alternative coin price movements. They find that 1) Bitcoin and altcoin markets are highly interdependent, 2) The Bitcoin-altcoin price relationship is stronger in the short-run than in the long-run and 3) Macro-financial developments determine virtual currency prices stronger in the short- than the long-run.

However, the sources of funds invested into Bitcoin are not clear until now. Main research related to the sources of funds only comments on illegal activities of Bitcoin including Cai and Wang (2018), Seo *et al.* (2018). Foley *et al.* (2021) insist that there is a significant and positive relationship between a country's individualism and its use of Bitcoin. In addition, Lee (2020) insist that lay Bitcoin investors present themselves not simply as calculative investors but also as enchanted gamblers in Korea.

To understand the relationship between trading volume and public information in financial assets, Foster and Viswanathan (1993) points out how to control public information to affect trading volume. Bessembinder *et al.* (1996), Rhieu (1999), and recently Kim *et al.* (2020) uses similar approach to examine the impact of information on trading volume. In these researches, mean absolute deviation, market return and change in short balance are used as control variables for public information.

There are other potential control variables based on news effects or public interests in Bitcoin. Aalborg *et al.* (2019), Matta *et al.* (2015), and Livaic and Perlsic (2019) suggested that the trading volume of Bitcoin can be predicted from Google searches for

“Bitcoin”. Shen *et al.* (2019) provide an evidence that the number of tweets is a significant driver of next day trading volume. Jerdack *et al.* (2018) find that online search popularity and the volume of trade in unrelated stock markets positively and negatively, respectively, influence Bitcoin trading volume. On the other hand, they did not find any statistical evidence on that the underlying sentiment behind relevant financial news influence Bitcoin trading volume.

Other than information issues, banking system in emerging market, the role of stable transfer system, and blockchain transaction are also considered affecting Bitcoin trading volume. Bouraoui (2020) finds evidence of significant relationship between the local Bitcoin trading volume in 21 emerging countries and the associated banking system access in the short-term. Ante *et al.* (2021) points out that in the hours around stable coin transfers abnormal returns and trading volumes are significant. Also, Ante (2020) insists that blockchain transaction is a relevant aspect of Bitcoin’s trading, as informed traders make use of the information in general and adjust their expectations based on the degree of information asymmetry.

From the statistical point of view, some researches concentrate on the issues of clustering nature of volatility in trading volumes and returns of Bitcoin. As can be seen in various financial time series data, serial clustering of volatility in time series are widely observed in Bitcoin trade data. Based on this property, GARCH model is widely used in previous researches such as Dyhrberg (2016a, b), Bouri *et al.* (2017), Urquhart and Zhang (2019), Guesmi *et al.* (2019) and Chan *et al.* (2019) in various formats. Chan *et al.* (2019) employs daily, weekly and monthly Bitcoin trading data from 2010 to 2017 and uses CCC-GARCH technique with control variables of Euro Stoxx, Nikkei, Shanghai-A, SP500 and TSX. They find that Bitcoin is an effective strong hedge for all indices under monthly frequency, but daily and weekly returns do not demonstrate strong hedge properties. Guesmi *et al.* (2019) uses daily trading data of Bitcoin in 2012-2018 with VARMA(1,1)-DCC-GJR-GARCH model to find a short position in the Bitcoin market allows hedging the risk investment for all different financial assets.

By investigating the previous literature studying cryptocurrencies, we find the following three issues about understanding sources of funds invested in Bitcoin. First, there is no literature explicitly studying the sources. Second, the results from previous studies imply mixed evidences about sources of funds invested in Bitcoin. Third, we are still in the stage of understanding how cryptocurrency market behaves.

From these findings, it is clear that identifying sources of funds invested in Bitcoin have not been seriously investigated yet and therefore this study can advance the current stage of cryptocurrency market analysis from the academic perspective. This paper intends to fill such gap in the existing literature by investigating and analyzing the nature of funds invested in cryptocurrency market. We believe that the findings of this paper can expand our understanding regarding cryptocurrency market and add new venue to the existing literature of crypto world.

3. MODELS AND HYPOTHESIS

3.1. Hypothesis Development

As previously noted, regulators are deeply concerned with the innate systemic risk between the existing traditional financial markets (e.g. stock and fixed income markets) and cryptocurrency market. Identifying the sources of funds invested in cryptocurrency market can help understanding the systemic risk. Since the nature and characteristics of

cryptocurrency market is very different from fixed income market, this paper concentrates the relationship between stock market and cryptocurrency market. Hence, we first investigate whether the fund invested in Bitcoin came from stock market. If this is true, shocks in Bitcoin market should have a statistically significant influence on stock market. Therefore our first hypothesis is as follows.

H1: The Bitcoin trading affects equity market.

With appearance of the Bitcoin, the regulators concern the money run from the equity market to the Bitcoin market. Because of the high volatility of Bitcoin market, investors especially with a high-risk preference could choose the crypto market rather than the stock market. Therefore, our first hypothesis is about whether there is a significant relation between the volume of equity market and that of Bitcoin market. If we follow the regulators' concern, we expect the substitute effect dominates between the stock market and Bitcoin market.

In addition, we have to consider the possibility of regime change in the Bitcoin market since the Bitcoin market data covers from the infant stage to fully blown one. At the infant stage, stock market participants usually ignore on investing since the risk is too high. As the Bitcoin market is getting matured with higher liquidity, then potential investors will consider including Bitcoin into the portfolio. Therefore, the substitute effect of Bitcoin may emerge after the market grows enough to attract existing investors. Thus, our second hypothesis is below:

H2: The Bitcoin trading boom in 2017 cause a regime change in the capital with high risk profile.

If we look into the Bitcoin boom in more details, the turning point is September, 2017. With some of successful investment stories, more people are getting interested in the Bitcoin market. As you can see in *Figure 1*, there is a high spike in the volume of Bitcoin trading in September, 2017. Thus, the nation-wide popularity of Bitcoin trading could lead to an increase of risk tolerance on investors, and, in turn increases the total volume of equity market. As a result, we can argue that the complementary effect of Bitcoin emerges at the initial stage of Bitcoin market development.

On the other hand, the popularity of Bitcoin could, however, make the investors with a high risk preference switch their investments into Bitcoin. Therefore, we anticipate a negative relationship between the volume of equity market and Bitcoin trading after September 2017 when Bitcoin market is matured. With the second hypothesis, we would like to confirm our expectation on a regime switch in 2017.



Figure 1 Bitcoin Trading Volume

This figure shows the Bitcoin trading volume in South Korea from July, 2017 to December 2017. We choose this period to check the trend in Bitcoin trading during the boom market in 2017, which could cause the regime change in the relationship between KOSPI and Bitcoin volume. The data is acquired from “kr.investing.com.”

3.2. Empirical Model

To test the abovementioned hypotheses, we regress the following linear model ²:

$$\begin{aligned}
 \text{KOSPI VOL} = & \alpha_s + \beta_{s0} \text{BC VOL} + \beta_{s1} \text{MAD}^{\text{EW}} + \beta_{s2} |\text{R}_m^{\text{VW}}| + \sum_{i=1}^J \delta_{sj} |\Delta \text{Short}| \\
 & + \sum_{k=1}^5 \eta_{sk} C_{sk} + \varepsilon_s
 \end{aligned} \tag{1}$$

KOSPI VOL represents the volume of the KOSPI stock market and **BC VOL**, the main variable of interest, means the volume of the Bitcoin market. To analyze the relationship between the volume of the stock market and the cryptocurrency market, we additionally control the market- and firm-specific information. To control the firm-specific information, we include **MAD^{EW}** (Mean Absolute Deviation), which contains the firm-specific information incorporated in the market and is defined as follows:

$$\text{MAD}^{\text{EW}} = \frac{1}{N} \sum_{j=1}^N |R_{jt} - \beta_j R_{mt}^{\text{VW}}|$$

We also control the market wise information with $|\text{R}_m^{\text{VW}}|$ and $|\Delta \text{Short}|$. $|\text{R}_m^{\text{VW}}|$ represent the absolute value of market return and $|\Delta \text{Short}|$ represent the change in short balance in the equity market. Last, we include C_{sk} , the dummy variables for day of the week to control the effect of daily difference in equity market volume throughout the week. We acquire data for Korean stock market from FnGuide, and information for Bitcoin trading from the website ‘kr.investing.com’.

The model is based on the seminal article of Bessembinder *et al.* (1996) that analyze the behavior of trading volume with information flows and cross-sectional divergence in

² Time scripts are intentionally omitted for the purpose of clear presentation of equations hereafter.

opinions. This model is widely adopted to focus on the trading volume in various markets such as stock and option markets.³

3.3. Empirical Confirmation: Lotto, Horse Racing Ticket Sales, and Equity Market

If we observe an increase in investors with a high risk preference from the analysis of H2, we could confirm the change in risk averseness with gambling activities. The gambling capital is a representative of high-risk high-return investment. By exploring the relationship between the purchase in gambling and the equity market trading, thus, we could verify whether the risk averseness of equity investors reduce or not. This argument leads into the third hypothesis.

H3: *With a reduction in risk averseness of equity investors, the purchases in Lotto and Horse Racing ticket sales flow into the equity market.*

For the analysis, we focus on two gambling activities: *Lotto* and *Horse Racing ticket sales*. Both are regulated by Korean government, and in turn, the purchase data is credible. With reliable data provided by Korean government, we check the argument in H3. If the popularity of Bitcoin trading increase the capital with high-risk profile in equity market, we could expect that the negative relation between the purchases in Lotto and Horse Racing ticket sales, and the trading volume of the stock market.

3.4. Expanded Analysis: Lotto, Horse Racing Ticket Sales, and Bitcoin Trading

The basic analyses of H1 and H2 presume that the sources of fund in Bitcoin market are related to equity market. However, the gambling capital can be another source of fund in Bitcoin market, because people betting for the gambling are following investments with a high risk profile. Hence, we examine the relationship between Bitcoin trading and purchases in Lotto and Horse Racing ticket sales with the fourth hypothesis.

H4: *With the increase of risk tolerance, Lotto and Horse Racing ticket and bitcoin trading volume should be complementary.*

If the appetite for the risk increases as a result of successful return profile from bitcoin investments, there should be a positive relationship between Bitcoin trading volume and purchases in Lotto and Horse Racing ticket sales.

4. EMPIRICAL RESULTS

4.1. GARCH Analysis of Base Model: Equity Market and Bitcoin Trading

To test our first hypothesis we use GARCH model to take into account the crowding effect in financial market. Specifically, we run the following GARCH(1,1) model:

$$\begin{aligned} \text{KOSPI VOL} = & \alpha_s + \beta_{s0} \text{BC VOL} + \beta_{s1} \text{MAD}^{\text{EW}} + \beta_{s2} |\text{R}_m^{\text{VW}}| \\ & + \sum_{j=1}^J \delta_{sj} |\Delta \text{Short}| + \sum_{k=1}^5 \eta_{sk} \text{C}_{sk} + \varepsilon_s \end{aligned} \quad (2)$$

³ For recent examples, Chen and Sabherwal (2019) use this model to check the investor overconfidence theory in the option market. Siganos *et al.* (2017) take this model to analyze the sentiment divergence in the stock market trading.

$$\varepsilon_{st} \sim N(0, h_{st}), \text{ where } h_{st} = a_{s0} + a_{s1}e_{s,t-1}^2 + b_{s1}h_{s,t-1}$$

The sample period is from July 2010 to December 2020. We start from July 2010, where Bitcoin data begins. Table 1 presents results on GARCH analyses of the first hypothesis.

H1: The Bitcoin trading affects equity market.

Table 1, column (1) reports the GARCH analysis over the sample period. As you can see there is no significant relationship between KOSPI and Bitcoin trading volume. However, we should not conclude that Bitcoin trading has no impact on the equity market. If a regime change occurs over the sample period, it is possible that the analysis over the whole sample period shows insignificant relation between KOSPI and Bitcoin trading volume. Therefore, we conduct further analyses on the subsample period in the following section.

4.2. GARCH Analysis of Dynamic Estimation: Equity Market and Bitcoin Trading

H2: The Bitcoin trading boom in 2017 cause a regime change in the capital with high risk profile.

It is possible that the Bitcoin trading boom changes the paradigm in the capital flow with high risk preferences. The successful stories of Bitcoin investments could attract more investors to enjoy high return and high risk. That is, the successful stories could reduce the average investors' risk averseness. On the another hand, the spike in Bitcoin trading in 2017 could make investors with high risk preferences move from equity to Bitcoin market to follow higher risk-return profile. To examine this regime change, we divide the sample period into before and after the Bitcoin trading spike in September, 2017. Following the regime change story, we expect a positive β_{s0} before September 2017, and a negative β_{s0} after September 2017. Table 1, column (2) and (3) confirm our expectation.

Before September 2017, the relationship between the trading volume of equity and Bitcoin market is positively significant at the 1% level. This positive relationship switches into negative after September 2017. Therefore, it confirms the regulators' concerns about the impact of Bitcoin trading on the systemic risk of equity market. To further explore the relationship between systemic risk of equity and Bitcoin market, we did yearly analyses and the results are presented in Table 2. As you can see, there is overall positive relations between equity and Bitcoin trading at the beginning of Bitcoin market. However, the relationship changes into negative around September 2017. We visualize the time-series change in the relationship in Figure 2.

Figure 2 shows the time trend of a beta coefficient of Bitcoin trading volume throughout the sample period from July, 2010 to December, 2020. The beta coefficients are from the GARCH analysis on the relationship between KOSPI volume and Bitcoin volume in Table 2.

Table 1 The Relationship Between KOSPI Volume and Bitcoin Volume

This table summarize the results on GARCH analysis in equation (1). The dependent variable is the KOSPI market volume and the main variable of interest is the Bitcoin trading volume. We also include control variables: the mean absolute deviation (*MAD*), the absolute value of market ret (*ABS_MktRet*), the change in short balances ($\Delta Short$), and dummy variables for day of the week (not reported) to control the impact of firm-specific and market-wide factors on KOSPI volume. The z-statistics are reported in parentheses and *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

| Dependent Variable: | (1) | (2) | (3) |
|----------------------------------|-----------------------|-----------------------|-----------------------|
| KOSPI VOL | 2010.07-2020.12 | 2010.07-2017.8 | 2017.09-2020.12 |
| BC VOL | 4.288*** (2.62) | 213.127*** (8.07) | -12.087*** (-5.71) |
| MAD | 117.787*** (29.51) | 114.857*** (23.72) | 201.316*** (30.49) |
| ABS_MktRet | 14.139*** (9.61) | 1.231 (0.49) | 12.500*** (3.13) |
| $\Delta Short$ | -0.752*** (-6.04) | -0.236 (-1.32) | -1.494*** (-3.76) |
| Constant | 114.441*** (13.66) | 115.460*** (12.08) | 57.699*** (3.39) |
| ARCH | | | |
| L.arch | 0.928*** (32.95) | 0.695*** (16.40) | 1.041*** (13.55) |
| L.garch | 0.042*** (4.04) | 0.166*** (5.46) | 0.042 (1.55) |
| Observations | 2,724 | 1,854 | 870 |
| Chi2 | 3176 | 723.6 | 3523 |
| Prob > Chi2 | 0 | 0 | 0 |

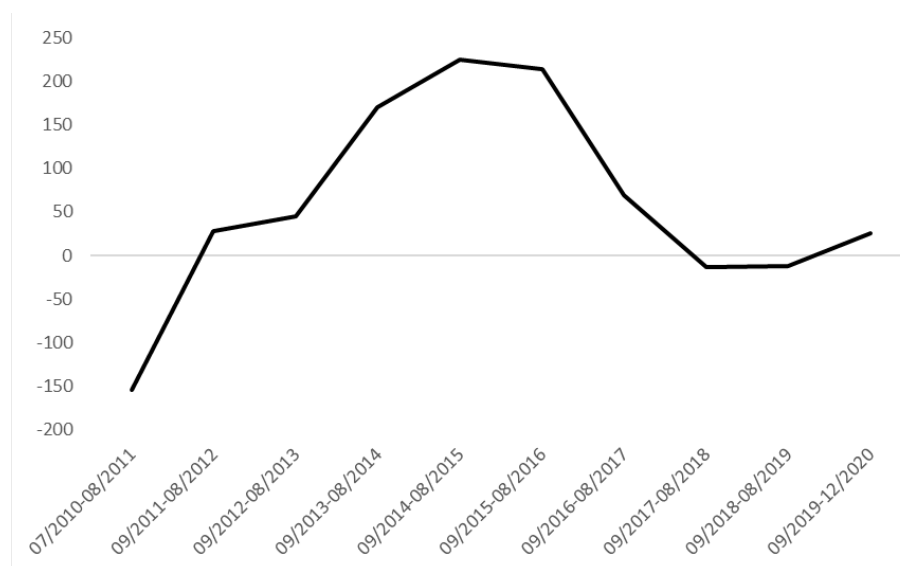


Figure 2 The Change in Beta Coefficient of Bitcoin Trading Volume

Table 2 Yearly Analysis of the Relationship Between KOSPI Volume and Bitcoin Volume

This table summarizes the results on GARCH analysis in equation (1). The dependent variable is the KOSPI market volume and the main variable of interest is the Bitcoin trading volume. We also include control variables: the mean absolute deviation (*MAD*), the absolute value of market return (*ABS_MktRet*), the change in short balances (*ΔShort*), and dummy variables for day of the week (not reported) to control the impact of firm-specific and market-wide factors on KOSPI volume. The z-statistics are reported in parentheses and *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively

| Dependent Variable: | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---------------------|-----------------------|----------------------|----------------------|----------------------|-----------------------|----------------------|----------------------|-----------------------|-----------------------|-----------------------|
| KOSPI VOL | 2010.07-2011.8 | 2011.09-2012.8 | 2012.09-2013.8 | 2013.09-2014.8 | 2014.09-2015.8 | 2015.09-2016.8 | 2016.09-2017.8 | 2017.09-2018.8 | 2018.09-2019.8 | 2019.09-2020.12 |
| BC VOL | -151.913 (-1.05) | 27.512 (0.25) | 45.156 (0.48) | 170.322 (1.27) | 224.276** (2.32) | 214.215** (2.48) | 69.721 (0.65) | -14.032 (-1.46) | -11.578*** (-4.12) | 25.867*** (2.68) |
| MAD | 104.962*** (13.54) | 92.055*** (7.83) | 41.751*** (2.71) | 125.770*** (8.84) | 131.660*** (10.71) | 56.794** (2.47) | 108.644*** (4.94) | 194.703*** (16.03) | 49.374** (2.43) | 378.885*** (23.03) |
| ABS_MktRet | 4.642 (1.01) | -11.640** (-2.06) | -4.654 (-0.53) | 3.065 (0.51) | 5.380 (0.53) | 33.528*** (4.30) | 11.352 (0.85) | 5.314 (0.49) | 14.757 (1.54) | -11.411 (-1.15) |
| ΔShort | 0.727 (1.01) | 0.397 (0.52) | -1.971*** (-5.26) | -0.363 (-0.74) | -1.571** (-2.02) | -1.771** (-2.33) | -0.147 (-0.30) | 0.806 (0.89) | 1.062 (1.32) | -0.250 (-0.27) |
| Constant | 163.166*** (13.43) | 237.159*** (7.48) | 269.075*** (8.27) | 38.006 (1.61) | 85.271*** (3.26) | 271.332*** (6.90) | 128.612*** (4.18) | 4.710 (0.16) | 281.723*** (8.04) | -10.562 (-0.23) |
| ARCH | | | | | | | | | | |
| L.arch | 0.470*** (4.77) | 0.645*** (4.86) | 1.113*** (7.98) | 0.288** (2.32) | 0.651*** (8.65) | 0.739*** (5.54) | 0.815*** (6.46) | 0.473*** (3.60) | 0.734*** (5.67) | 0.830*** (7.37) |
| Observations | 288 | 262 | 260 | 260 | 261 | 262 | 261 | 261 | 260 | 349 |
| Chi2 | 363.8 | 64.34 | 56.97 | 94.93 | 148.1 | 65.48 | 72.53 | 286 | 56.01 | 643.6 |
| Prob > Chi2 | 0 | 6.52e-11 | 1.83e-09 | 0 | 0 | 0 | 0 | 0 | 2.81e-09 | 0 |

4.3. Empirical Confirmation: Lotto, Horse Racing Ticket Sales, and Equity Trading

In the previous section, we find that the Bitcoin trading boom reduces the average investors' risk averseness and make more capital with high-risk profile flow into equity market. In this section, we would like to confirm this argument with the third hypothesis.

H3: *With a reduction in risk averseness of equity investors, the purchases in Lotto and Horse Racing ticket sales flow into the equity market.*

Since Lotto and Horse Racing ticket sales are weekly data, we run the OLS regression rather than the GARCH specification.[§] Specifically, we run the following regression:

$$KOSPI\ VOL = \alpha_s + \beta_{s0}SALES + \beta_{s1}MAD^{EW} + \beta_{s2}|R_m^{vw}| + \sum_{i=1}^J \delta_{sj} |\Delta Short| + \sum_{k=1}^5 \eta_{sk} C_{sk} + \epsilon_s \tag{3}$$

In equation (3), The dependent variable is the weekly volume of KOSPI market and the main variable of interest (*SALES*) is the weekly sales of Lotto and Horse Racing ticket sales market.

Table 3 The Relationship Between Lotto/Horse Racing ticket Sales and KOSPI Volume
 This table summarize the results on OLS analysis of the relationship between KOSPI and Bitcoin trading volume. The dependent variable is the weekly volume of KOSPI market and the main variable of interest is the weekly sales of Lotto and Horse Racing ticket sales market. We also include control variables: the mean absolute deviation (*MAD*), the absolute value of market ret (*ABS_MktRet*), the change in short balances (*ΔShort*), and dummy variables for day of the week (not reported) to control the impact of gambling market-specific and economy-wide factors on KOSPI volume. The z-statistics are reported in parentheses and *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

| Dependent Variable | KOSPI WEEKLY VOL | | |
|----------------------|----------------------|----------------------|------------------------|
| | (1) | (2) | (3) |
| | 2010.07-2020.12 | 2010.07-2017.8 | 2017.09-2020.12 |
| SALES | -0.017*** (-5.54) | -0.000 (-0.15) | -0.026*** (-7.07) |
| MAD | 57.636*** (5.44) | 68.497*** (6.78) | -6.718 (-0.20) |
| ABS_MktRet | 0.012 (0.00) | -11.103** (-2.23) | 25.847* (1.73) |
| Weekly ΔShort | -0.431 (-0.28) | -0.816 (-0.61) | 3.063 (1.03) |
| Constant | 750.512*** (6.58) | 158.053* (1.93) | 1,281.737*** (7.09) |
| Observations | 502 | 356 | 146 |
| R-squared | 0.341 | 0.257 | 0.735 |

As shown in Table 3, there is a negative relationship between Lotto/Horse Racing ticket

[§] Since the Lotto/Horse Racing ticket sales data are on a weekly basis, we decide the GARCH specification should not be applied hereafter.

sales and KOSPI trading volume over the whole sample period. The relationship is economically significant at the 1% level. If we divide into two subsample period, however, the coefficients are only significant after September 2017. Our speculation on this phenomenon is that high risk, high return assets such as Lotto/Horse Racing ticket sales are not considered seriously for the financial market participants. Therefore, we need to investigate if the emergence of the Bitcoin market should have an effect on financial market participants attracted by higher risk bearing goods.

4.4. Expanded Analysis: Lotto, Horse Racing Ticket Sales, and Bitcoin Trading

To examine the sources of fund in Bitcoin market, we also analyze the relation between Lotto/Horse Racing ticket sales and Bitcoin trading volume. Since the capital in Bitcoin market generally follows high risk and high return, we could expect that the gambling capital is another source of fund in Bitcoin market. This argument leads to the fourth hypothesis:

H4: *With the increase of risk tolerance, Lotto and Horse Racing ticket and bitcoin trading volume should be complementary.*

We examine the above hypothesis with the below equation:

$$BC\ VOL = \alpha_s + \beta_{s0}SALES + \beta_{s1}MAD^{EW} + \beta_{s2}|R_m^{VW}| + \sum_{k=1}^5 \eta_{sk} C_{sk} + \varepsilon_s \quad (4)$$

If the capital in Bitcoin market is from the gambling capital, we should find a negative β_{s0} in equation (4). As you can see from Table 4, there is economically significant relationship between Lotto/Horse Racing ticket sales and Bitcoin trading volume for the entire period and the period after September 2017. As the Bitcoin markets attract capitals with higher risk profile, it looks like that people also are getting interested in the other high risk, high return chances, that is, Lotto/Horse Racing ticket sales.

4.5. Robustness Test

For the robustness check, we examine the relationship between the trading volume of KOSDAQ market and that of Bitcoin market. We also check the regime change and results are presented in Table 5.

As shown in Table 5, we can also confirm the regime switch with KOSDAQ market data. Before September 2017, there is a significantly positive relationship between KOSDAQ and Bitcoin trading volume. That is, the popularity of Bitcoin trading reduces the average investors' risk averseness, which leads to the more investment in KOSDAQ market. After September 2017, however, the higher Bitcoin trading volume relates to the lower KOSDAQ trading volume. The negative relationship is economically significant at 10% level. Therefore, we can gauge that the sources of fund in Bitcoin market comes from KOSDAQ market. This result, thus, assures financial regulators' concern on the liquidity reduce in equity market because of the Bitcoin trading.

Table 4 The Relationship Between Lotto/Horse Racing ticket Sales and Bitcoin Volume
 This table summarizes the results on OLS analysis of the relationship between Lotto/Horse Racing ticket sales and Bitcoin trading volume. The dependent variable is the weekly volume of KOSPI market and the main variable of interest is the weekly sales of Lotto and Horse Racing ticket sales market. We also include control variables: the mean absolute deviation (*MAD*) and the absolute value of market ret (*ABS_MktRet*) from the *Lotto* and *Horse Racing ticket sales* data. We further include dummy variables for day of the week (not reported) to control the impact of gambling market-specific and economy-wide factors on Bitcoin weekly volume. The z-statistics are reported in parentheses and *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

| Dependent Variable | BC WEEKLY VOL | | |
|--------------------|----------------------|--------------------|---------------------|
| | (4) | (5) | (6) |
| | 2010.07-2020.12 | 2010.07-2017.8 | 2017.09-2020.12 |
| SALES | 0.013** (2.18) | 0.001 (0.84) | 0.027* (1.78) |
| MAD | 0.169*** (2.92) | 0.758** (2.02) | 10.159 (0.95) |
| ABS_Ret | -0.941*** (-2.90) | -0.610* (-2.00) | -2.345 (-0.18) |
| Constant | -367.642* (-1.80) | 45.827 (1.33) | -627.987 (-1.16) |
| Observations | 380 | 270 | 110 |
| R-squared | 0.105 | 0.126 | 0.324 |

5. CONCLUSION

In this paper, we investigate the potential sources of funds invested in cryptocurrency market. We develop the following four hypotheses and empirically test their relevance.

- H1: The Bitcoin trading affects equity market.
- H2: The Bitcoin trading boom in 2017 cause a regime change in the capital with high risk profile.
- H3: With a reduction in risk averseness of equity investors, the purchases in Lotto and Horse Racing ticket sales flow into the equity market.
- H4: With the increase of risk tolerance, Lotto and Horse Racing ticket and bitcoin trading volume should be complementary.

Using Bitcoin, KOSPI, Lotto and Horse Racing ticket sales data from July 2010 to December 2020, our empirical finding can be summarized as follows.

- There is no significant relationship between KOSPI and Bitcoin trading volume over the whole sample period.
- Pre-2017 September data yields positive and significant relationship between Bitcoin and KOSPI trading volume, but post-2017 data provides negative and significant relationship.

Table 5 The Relationship Between KOSDAQ Volume and Bitcoin Volume

This table summarize the results on OLS analysis of the relationship between KOSDAQ and Bitcoin trading volume.. The dependent variable is KOSDAQ market volume and the main variable of interest is Bitcoin trading volume. We also include control variables: the mean absolute deviation (*MAD*), the absolute value of market ret (*ABS_MktRet*), the change in short balances ($\Delta Short$), and dummy variables for day of the week (not reported) to control the impact of firm-specific and market-wide factors on KOSPI volume. The z-statistics are reported in parentheses and *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively

| Dependent Variable | KOSPI VOL | | | KOSDAQ VOL | | |
|----------------------------------|------------------------|-----------------------|------------------------|------------------------|-----------------------|------------------------|
| | (1) 2010.07-2020.12 | (2) 2010.07-2017.8 | (3) 2017.09-2020.12 | (4) 2010.07-2020.12 | (5) 2010.07-2017.8 | (6) 2017.09-2020.12 |
| BC VOL | 27.234*** (8.07) | 368.252*** (11.49) | -3.684 (-0.66) | 67.093*** (6.93) | 916.688*** (11.17) | -16.342* (-2.19) |
| MAD | 192.109*** (11.68) | 137.805*** (7.42) | 246.429*** (10.02) | 216.705*** (10.44) | 116.940*** (8.75) | 492.764*** (6.49) |
| ABS_MktRet | 17.571 (1.99) | -6.979 (-1.05) | 27.379 (1.78) | 19.675 (1.84) | -17.185* (-2.63) | -56.370** (-2.80) |
| $\Delta Short$ | -1.687** (-4.31) | -0.050 (-0.21) | -3.389*** (-5.06) | -0.381 (-1.61) | 0.055* (2.35) | -3.210* (-2.13) |
| Constant | 46.593 (1.97) | 93.513** (3.01) | 63.967 (1.78) | 166.336*** (4.79) | 239.656*** (9.83) | 18.448 (0.14) |
| Observations | 2,724 | 1,854 | 870 | 2,724 | 1,854 | 870 |
| R-squared | 0.166 | 0.180 | 0.199 | 0.089 | 0.130 | 0.149 |

- Lotto/Horse Racing ticket sales are negatively related to KOSPI trading volume.
- We find no significant relationship between Lotto/Horse Racing ticket sales and Bitcoin trading volume before September 2017 but find positive and significant relationship after September 2017.

Overall, our results support a regime switch in capital flows: in the early stage of Bitcoin market, Bitcoin boom reduces risk-averseness of investors and exhibits the complementary effect for equity investment. As Bitcoin market is getting matured with higher liquidity, however, investors with high risk profile move from equity to Bitcoin investment. We confirm our results with gambling activities: Lotto and Horse Racing ticket sales. The results verify a reduction in investors' risk-averseness and an increase in investment in higher risk bearing goods. In short, this paper validates financial regulators' concern about the systemic risk of Bitcoin trading boom. That is, the popularity of Bitcoin trading can reduce the liquidity in equity market. Moreover, since Bitcoin and equity market are connected, the systemic risk of Bitcoin market can be transferred to equity market.

Previous research on the cryptocurrency market is focused on the technical characteristics of cryptocurrency, and the characteristics of the cryptocurrency market as a capital market. Risk transfer to other capital markets, and systemic risk analysis that may appear as a result are still actively in progress. This study is expected to broaden the understanding of the relation between the traditional capital market and the cryptocurrency market in terms of systemic risk. In addition, the results of this study will be able to draw important implications for future cryptocurrency regulations and policies. In accordance with our results, the South Korean government plans to introduce the Digital Asset Basic Act, which regulates transactions of digital assets and related activities such as initial coin offerings. With new crypto regulations, the government expects to reduce the systemic risk and enhance the safety in crypto transactions.

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