Investor attention and Bitcoin futures market

Zih-Ying Lin and Chuan-Chih Wu*

ABSTRACT

This research explores the relationship between abnormal investor attention and Bitcoin futures return by using several Google search keywords covering Bitcoin futures to measure investor attention in its futures market. The empirical findings show that abnormal investor attention significantly negatively correlates to Bitcoin futures return when the market declines. We further consider the effect of COVID-19 and Bitcoin market crash on such a correlation and present that the relation becomes more pronounced during the latter downward periods, but find only a weak effect on such a relation during the epidemic. Finally, we provide evidence after controlling for Bitcoin spot return that the negative relation between investor attention and Bitcoin futures return is still significant, especially during a Bitcoin crash.

Keywords: Bitcoin futures market; Bitcoin crash; COVID-19; Investor attention.

JEL Classification: G14.

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1. Introduction

Cryptocurrencies are a new type of financial assets and have been gaining the attention of traders and regulators (Aslan and Sensoy, 2020). Bitcoin futures were launched by the Chicago Board Options Exchange (CBOE) and Chicago Mercantile Exchange (CME) in December 2017. Subsequently, several studies discuss the effects of the introduction of Bitcoin futures on spot markets (Kochling et al., 2019; Kim et al., 2020; Liu et al., 2020; Shynkevich, 2020) and the price discovery of Bitcoin between futures market and spot market (Baur and Dimpfl, 2019; Fassas et al., 2020). However, the literature lacks any analysis of investor attention issues in the Bitcoin futures market.

Several studies examine the correlation between investor attention and cryptocurrency markets (Liu and Tsyvinski, 2020; Subramaniam and Chakraborty, 2020; Lin, 2021; Smales, 2022). Liu and Tsyvinski (2020) indicate that investor attention strongly predicts future cryptocurrency returns. Subramaniam and Chakraborty (2020) use a quantile causality approach to look into the impact of investor attention in cryptocurrency prices and suggest that the attention-induced price pressure hypothesis only appears at higher quantiles. Lin (2021) employs Granger causality tests and points out that past cryptocurrency returns influence future attention and lead to weak reverse results. Smales (2022) finds that greater investor attention is associated with higher returns and volatility.

The Bitcoin futures market is, however, different from the spot market, and investors in the futures market can hold both long and short positions. In other words, individual investors can be net buyers and net sellers in the futures market. It is not yet clear what the impact of investor attention is on the Bitcoin futures market. We thus fill this gap in the literature and aim to provide new evidence in this burgeoning market.

Prior studies have examined how COVID-19 affects the cryptocurrency market (Montasser et al., 2022; Cevik et al., 2023). Montasser et al. (2022) find that COVID-

19 influences the cryptocurrency market's efficiency. Cevik et al. (2023) do not find a COVID-19 effect on Bitcoin's returns or volatility and support that Bitcoin is insulated from some global economic developments. Several studies investigate the impact of COVID-19 on futures markets, including the Bitcoin futures market (Wu et al., 2021; Park, 2022), index futures markets (Banerjee, 2021), and commodity futures market (Zhang and Wang, 2022). Wu et al. (2021) point out that the Bitcoin futures market dominates the price discovery process, but the Bitcoin price discovery leadership switched to the spot market during the COVID-19 pandemic. Park (2022) indicates that compared to the pre-pandemic regime when belief dispersion increased due to market stress reducing Bitcoin futures returns, trading volume and volatility did increase during the pandemic regime. Banerjee (2021) focuses on China and its main trading partners in index futures markets and note that most developed and emerging markets encountered financial contagion during COVID-19. Zhang and Wang (2022) suggest that the COVID-19 pandemic affects long-run commodity futures markets' volatility. Emm et al. (2021) target trade-related activity on global derivatives markets during the COVID-19 pandemic and indicate that futures and options volumes (open interest) significantly increase in pandemic periods.

Several studies on behavior issues discuss the relationship between investor attention of COVID-19 and the stock market (Chundakkadan and Nedumparambil, 2021; Smales, 2021; Wang et al., 2021). Chundakkadan and Nedumparambil (2021) consider 59 countries and state that the search volume during the pandemic negatively relates to daily returns. Smales (2021) uses coronavirus as a search keyword and also supports that investor attention negatively influences global stock returns the during COVID-19 crisis period. Wang et al. (2021) consider unexpected and expected investor attention to the COVID-19 pandemic and show that unexpected (expected) investor

attention is harmful (informational) to the stock market. These studies note that COVID-19 affects investor attention and further influences the financial market. As mentioned above, we therefore further discuss the effect of unexpected events (COVID-19) on the relation between investor attention and the Bitcoin futures market.

Previous studies contend that investor behavior changes during market decline periods (Michayluk and Neuhauser, 2006; Aman, 2013). Michayluk and Neuhauser (2006) suggest investor overreaction in times of market crisis, implying that investors overreact when the market goes down. Aman (2013) finds that stock price crashes increase with media coverage. In the cryptocurrency market, Subramaniam and Chakraborty (2020) find that investors pay more attention when the market has lower returns. Anastasiou et al. (2021) also find that investors pay more attention to crisis-related information and hence affect cryptocurrencies' prices. Hattori and Ishida (2021) examine investors' arbitrage between the Bitcoin spot and futures markets and point out that there are few arbitrage profit opportunities when the market is "normal", but large arbitrage profit opportunities increase when the Bitcoin market "crashes".

Several studies discuss the relationship between the introduction of Bitcoin futures and Bitcoin prices (returns) (Liu et al., 2020; Hattori and Ishida, 2021). Liu et al. (2020) find significantly negative results and offer that the launch of Bitcoin futures is to an extent responsible for Bitcoin crash. However, Hattori and Ishida (2021) suggest that Bitcoin futures did not lead to the Bitcoin crash at the end of 2017. As noted above, we thus consider the effect of Bitcoin crash on the relation between investor attention and the Bitcoin futures market.

Based on daily Bitcoin futures transaction data for the sample period from December 18, 2017 to December 31, 2022, a summary of the findings runs as follows. First, we show the effect of extreme returns on abnormal investor attention (ASVI) to

confirm the findings of other studies (Da et al., 2011; Wang et al., 2017) and find that investors do pay more attention when the market goes down, especially for after the COVID-19 pandemic and Bitcoin crash periods. Second, we examine how ASVI affects Bitcoin futures return before and after COVID-19. The results show after COVID-19 that investors pay more attention when Bitcoin futures return moves lower. Third, we further consider the effect of Bitcoin crash and find that the Bitcoin futures market attracts more investor attention during Bitcoin crash periods and has lower returns. Finally, we use two alternative average ASVI measures and control for spot return to robust our main results. We find that average ASVI measures have a negative impact, especially for Bitcoin crash periods. We also see that the negative relation between investor attention and Bitcoin futures return is still significant during Bitcoin crash periods even when we control for the effect of spot returns.

The rest of this paper is organized as follows. Section 2 describes details of our hypotheses' development. Section 3 gives the data and statistics. Section 4 discusses our empirical methodology. Section 5 reports our empirical results. Section 6 offers the conclusions drawn herein.

2. Hypotheses' development

The literature has investigated the relationship between investor attention and cryptocurrency markets (Liu and Tsyvinski, 2020; Subramaniam and Chakraborty, 2020; Lin, 2021). Liu and Tsyvinski (2020) indicate that investor attention significantly forecasts future cryptocurrency returns. Subramaniam and Chakraborty (2020) adopt a quantile causality test and argue that investor attention induces the price pressure hypothesis only at higher quantiles. Lin (2021) utilizes Granger causality tests and suggests that past cryptocurrency returns affect future attention, but reverse results are weak.

Several studies discuss investor attention in futures market, including Chen et al. (2016), Han et al. (2017), Kou et al. (2017), Wang et al. (2017), and Wu et al. (2021). Some of them find a mixed result (Han et al., 2017; Kou et al., 2017). Han et al. (2017) present that investor attention can positively or negatively significantly impact 13 commodity futures when they control the effect of macroeconomic variables. Kou et al. (2017) also focus on the commodity futures market and indicate that higher attention predicts positive or negative futures returns. Wu et al. (2021) find a positive result and that investor attention positively affects contemporaneous commodity futures returns.

Other studies suggest that investor attention negatively impacts the futures market (Chen et al., 2016; Wang et al., 2017). Chen et al. (2016) study China's stock index futures market and show that the negative effects of consumer price index (CPI) news releases on short-term futures prices are more pronounced with higher investor attention. Wang et al. (2017) also focus on China's index futures market and state that before restrictions on futures trading one cannot find a significant result. After restrictions are set in place, a negative relation exists between investor attention and futures returns. Based on these findings, we know that investors in the futures market are different from those in the stock market. Individual investors can hold both long and short positions, implying that in the futures market they can be net buyers and net sellers. We therefore formulate three alternative hypotheses as follows.

Hypothesis 1a. *Investor attention of Bitcoin futures positively relates to its return.*

Hypothesis 1b. *Investor attention of Bitcoin futures negatively relates to its return.*

Hypothesis 1c. *Investor attention of Bitcoin futures does not relate to its return.*

The literature has also examined how investor attention affects the financial market during COVID-19 (Chundakkadan and Nedumparambil, 2021; Smales, 2021; Wang et al., 2021). Chundakkadan and Nedumparambil (2021) indicate that search volume

about the pandemic negatively relates to stock returns. Smales (2021) suggests that greater investor attention leads to lower market returns in G7 and G20 countries during the COVID-19 pandemic. Wang et al. (2021) find that investor attention relates to the COVID-19 epidemic influence on stock market stability.

Several studies have indicated how COVID-19 affects the futures market (Borgards et al., 2021; Zhang et al., 2022; Zhang and Wang, 2022; Park, 2022). Borgards et al. (2021) investigate the impact of COVID-19 on 20 commodity futures and find that overreaction behavior is higher during the COVID-19 pandemic. Zhang et al. (2022) examine the effect of COVID-19 on U.S. and China oil futures markets and point out that daily changes in pandemic severity has a negative effect on the short-term transient correlation. Zhang and Wang (2022) indicate that the pandemic impacts long-run volatilities for commodity futures returns. Park (2022) discusses how the COVID-19 affects the Bitcoin futures market and suggests that Bitcoin futures returns decrease during the pandemic regime due to market stress and greater belief dispersion. As mentioned above, we therefore consider the effect of COVID-19 on the relation between investor attention and the Bitcoin futures market and build the next hypothesis.

Hypothesis 2. *Investors pay more attention to the Bitcoin futures market during COVID-19 periods.*

Michayluk and Neuhauser (2006) state that investor overreact during market declines, suggesting investor overreaction during times of market crisis. Aman (2013) investigates the impact of media coverage on stock price crashes and suggests that crash frequency increases with media coverage. Subramaniam and Chakraborty (2020) use a quantile causality approach to examine the relation between investor attention and cryptocurrencies' returns. They find that investor attention negatively affects cryptocurrencies' returns at the extreme low quantile, implying that investors pay more

attention when the market has lower returns. Anastasiou et al. (2021) state that investors in cryptocurrency markets pay more attention to information related to a crisis from Google Searches. Their results support that investors' attention affects cryptocurrencies' prices and leads to price crash risk behavior. Hattori and Ishida (2021) note that investors' arbitrage between the Bitcoin spot and futures markets has few profit opportunities when the market is "normal", but large profit opportunities increase when the Bitcoin market "crashes". We thus have the next hypothesis as follows.

Hypothesis 3. *Investors pay more attention to the Bitcoin futures market during Bitcoin crash periods.*

3. Data

We obtain daily nearest Bitcoin futures contract data (BTC c1) from Eikon DataStream, including opening price, closing price, volume, open interest, minimum price, and maximum price.[1] The U.S. Commodity Futures Trading Commission (CFTC) regulation 18.04 requires all reportable traders to complete form 40 showing their current open futures positions as of Tuesday each week. We therefore use Tuesday as a benchmark and have 1270 observations from December18, 2017 to December 31, 2022.[2] Figure 1a shows the trend for both Bitcoin futures price and its spot price in our sample periods. We find that they have similar patterns and dramatically increase at the end of 2020. COVID-19 seems to push up the price of both Bitcoin spot and futures markets. Figure 1b presents Bitcoin futures return and its spot return for entire periods. We find that both Bitcoin spot and futures returns fluctuate more before COVID-19.

< FIGURE 1a AND FIGURE 1b ABOUT HERE >

<TABLE 1 ABOUT HERE>

[1] We use the nearest Bitcoin futures contract data, because it is more liquid and has more complete data.

[2] The Chicago Mercantile Exchange (CME) started to trade Bitcoin futures on December 18, 2017.

Based on the literature, we use search volume index (SVI) to proxy for investor attention. SVI obtains data from Google Trends, and it is a standardized index between 0 and 100. However, daily data can be downloaded from Google that only span 270 days at a time, implying that we cannot download all the sample periods at once. In order to get a longer time range, we first separately download daily data for 180 days of values and also download monthly data for the whole time series. We merge the daily data for each month into a single time series by multiplying their values with the corresponding monthly data and then dividing by 100. We thus get a normalized daily SVI in its selected time range.

Following Da et al. (2011), we next calculate abnormal investor attention (ASVI) using SVI. We adopt five search keywords related to Bitcoin futures: "Bitcoin futures", "Btc futures", "Btc futures price", "Bitcoin futures price", and "Btc futures trading". In addition, we use two alternative average ASVI measures to robust our results and show the detailed information in Table 1. Figure 2a and Figure 2b exhibit SVI and ASVI from December18, 2017 to December 31, 2022. In Figure 2a we find that Bitcoin futures attention is higher during periods of the introduction of Bitcoin futures, Bitcoin crash, and COVID-19. Figure 2b also shows that Bitcoin futures' abnormal attention is higher in these periods.

<TABLE 1 ABOUT HERE>

<FIGURE 2a AND FIGURE 2b ABOUT HERE>

In Table 2 we see that "Btc futures" and "Bitcoin futures price" as search keywords have higher mean values 4.58 and 6.50, respectively. This implies that investors on average search "Btc futures" and "Bitcoin futures price" much more. In addition, we find that all the search keywords used in this study have positive ASVI mean values. This suggests that on average ASVI is higher than the median of the previous five days' ASVI. "Btc futures price" as search keyword (ASVI (3)) and "Btc futures trading" as

search keyword (ASVI (5)) have higher mean values 0.25 and 0.21, respectively. "Bitcoin futures" as search keyword (ASVI (1)), "Btc futures" as search keyword (ASVI (2)), and "Bitcoin futures price" as search keyword (ASVI (4)) have similar mean values.

We also present the summary statistic features of Bitcoin futures in Table 2, including return, volatility, volume, and open interest. The mean value of Bitcoin futures return is 0.10%, the lowest value is -23.49% on March 12, 2019, and the highest value is 24.9% on May 13, 2019. The mean value of volatility is 2.60%, and the maximum (minimum) value is 15.21% (0.30%). Bitcoin futures volume and open interest have 6,247 and 4,615 mean values, respectively.

<TABLE 2 ABOUT HERE>

4. Methods

Other studies find that ASVI is positively associated with extreme return in stock and futures markets (Da et al., 2011; Wang et al., 2017). We thus first examine such a relation, following the regressions proposed by Wang et al. (2017). The model is:

$$ASVI_t = \alpha + \beta_1 Abs\_Ret_t + \beta_2 Dummyup_t + \beta_3 Dummyup_t * Abs\_Ret_t + \beta_4 Vol_t + \beta_5 OI_t + \varepsilon_{i,t}, \quad (1)$$

where $ASVI_t$ refers to abnormal futures attention on day t. Abs_Ret_t is the absolute value of future returns on day t. $Dummyup$ is defined as the market run-ups in day t and is equal to one when the return is positive and zero otherwise. Vol_t is the percentage change in Bitcoin futures' volume on day t. OI_t is the percentage change of open interest on Bitcoin futures at day t. More detailed information related to control variables appear in Table A1. The sample period is from December 18, 2017 to December 31, 2022.

<TABLE 3 ABOUT HERE>

Studies suggest that the macroeconomy can affect the financial market (Petkova, 2006; Vozlyublennaia, 2014; Lin, 2021). Fang et al. (2019) indicate that global economic policy uncertainty influences Bitcoin. We therefore modify the Wang et al. (2017) regression model to consider the effect of macro-economic variables in our regression model, shown as follows:

$$\begin{aligned} Ret\_f_t &= \alpha + \beta_1 ASVI_t + \beta_2 Dummyup_t + \beta_3 Ret\_f_{t-1} \\ &\quad + \beta_4 Dummyup_t * ASVI_t + \beta_5 Volatit_t + \beta_6 Vol_t + \beta_7 OI_t \\ &+\beta_8 GEPU_t + \beta_9 TERMSP_t + \beta_{10} DSP_t + \beta_{11} TB_t + \beta_{12} perioddummy + \varepsilon_{i,t}, \end{aligned} \quad (2)$$

where Ret_f_t is Bitcoin futures return on day t. $Volatit_t$ is the realized volatility of Bitcoin futures on day t. We follow Bollen and Inder (2002), using $\sqrt{\frac{(\ln High_t - \ln Low_t)^2}{4\ln 2}}$ to calculate realized volatility. High and Low are the highest and lowest prices of Bitcoin futures on day t, respectively. The global economic policy uncertainty index (GEPU), term spread (TERMSP), default spread (DSP), and two-year Treasury bill rate (TB) appear in detail in Table A1. In addition, we control for period fixed effects following Wu et al. (2021).

We re-run the regression of equations (1) and (2) using the sub-sample to test the effect of COVID-19 and Bitcoin crash. The sample of COVID-19 periods is from March 11, 2020 to December 31, 2022.[3] We define "Bitcoin crash period" by more than a 70% drop from the highest to lowest value, similar to Hattori and Ishida (2021). Bitcoin crash appears two times during our sample periods: December 18, 2017 to December 14, 2018 and November 9, 2021 to June 29, 2022.

5. Empirical results

[3] World Health Organization (WHO) announced that the outbreak had become a "global pandemic" on March 11, 2020.

This section investigates the correlation between investor attention and Bitcoin futures return. Section 5.1 presents our preliminary results and considers extreme return in the regression model. We then explore two potential channels (COVID-19 and Bitcoin crash) driving our findings. Section 5.2 discusses the effect of COVID-19. Section 5.3 considers the impact of Bitcoin crash. Section 5.4 controls the spot market effect in our studies and provides two alternative average ASVI measures to robust our preliminary results.

5.1 Preliminary results

We first examine the positive relation between ASVI and extreme returns to confirm other studies' arguments in Table 3 (Da et al., 2011; Wang et al., 2017). The dependent variables show different search types of ASVI about Bitcoin futures and present ASVI (1), ASVI (2), and ASVI (4) positively significantly correlate with extreme return (absolute return). This implies that extreme return does affect abnormal investor attention no matter whether Bitcoin futures return is negative or positive. The coefficient of the interaction terms is negative, indicating that the positive relation turns weak when the market is up, as in Panel A. The results suggest that investors seem to pay more attention when the market goes down.

We also consider the effect of COVID-19 and Bitcoin crash in Panel B/C and Panel D/E, respectively. We find that extreme return positively affects ASVI before and after COVID-19. If we look at the coefficient of the interaction terms, we do not find a significant result before COVID-19. However, we see negatively significant results after COVID-19, especially for ASVI (1), ASVI (2), and ASVI (4). We get similar results when we consider the Bitcoin crash. The extreme return still positively impacts ASVI no matter without or with Bitcoin crash. The interaction terms have a

negative effect during Bitcoin crash, especially for ASVI (1) and ASVI (4). However, we do not find a significant result for Bitcoin market without crash.

<TABLE 3 ABOUT HERE>

We next discuss the effect of ASVI on futures returns in Table 4. Models (1), (3), and (5) show that most coefficients of ASVI are insignificant except for ASVI (2). It seems that ASVI does not relate to the futures' price movements. The results support Hypothesis 1c. This can be explained by investors in the futures market being different from stock market investors who hold both long and short positions. Thus, individual investors in the Bitcoin futures market can be net buyers and net sellers.

Models (2), (4), and (6) show the results with the market-up dummy and its interaction term. We find that the coefficients of ASVI (interaction term) in Model 2 are negatively (positively) significant, especially for ASVI (1), ASVI (2), and ASVI (4). This implies that investors may pay more attention when the market declines. Our results are consistent with the argument of Baur and Smales (2022), who indicate that leveraged money traders in the Bitcoin futures market tend to hold the largest positions (net short), and other types of traders follow them to adjust their own positions in subsequent periods.

<TABLE 4 ABOUT HERE>

5.2 The COVID-19 effect

The literature has investigated the relationship between investor attention and stock returns during the COVID-19 pandemic (Chundakkadan and Nedumparambil, 2021; Smales, 2021). These papers suggest that higher investor attention toward the pandemic negatively affects stock returns. In addition, several studies indicate the impact of COVID-19 on the futures market (Borgards et al., 2021; Zhang et al., 2022; Park, 2022). Borgards et al. (2021) focus on the commodity futures market and state

that overreaction behavior is higher during the epidemic. Zhang et al. (2022) establish the impact of COVID-19 on the oil futures markets. Park (2022) finds that COVID-19 leads to lower Bitcoin futures returns. In this study we therefore consider the effect of COVID-19 on the relation between investor attention and the Bitcoin futures market.

Table 5 shows the results before COVID-19. Models (1), (3), and (5) present that the ASVI effects on futures returns and returns for the next day and the next two days are not significant. This finding is the same with our main results in Table 4 when we consider the full sample. The results also support when the market lacks a short-selling restriction that ASVI does not relate to futures price movements.

Models (2), (4), and (6) show the impact of ASVI on futures return when we add the dummy variable for a market moving up (dummyup) and its interaction term. We find that the interaction variable dummyup × ASVI positively significantly relates to the contemporaneous returns for ASVI (1) and ASVI (4) when market run-ups occur. Model (6) shows that the interaction variable dummyup × ASVI negatively relates to returns for the next two days when market run-ups occur. The results of Model (2), (4), and (6) for ASVI (1) imply that investor attention predicts futures return reversals in the short term.

<TABLE 5 ABOUT HERE>

We also present the results after COVID-19 and show them in Table 6. We find that the coefficients of all ASVI negatively impact Bitcoin futures return, but only ASVI (2) has a significant result. Our results provide weak evidence that investors search for more information about Bitcoin futures during the COVID-19 pandemic. This supports Hypothesis 2 when we use the search volumes of “Btc futures” to proxy for investor attention (ASVI (2)).

<TABLE 6 ABOUT HERE>

5.3 The Bitcoin crash effect

Several studies indicate that investors' behaviors overreact during a market crisis (Michayluk and Neuhauser, 2006; Aman, 2013). Michayluk and Neuhauser (2006) suggest that investors react excessively in times of market crisis. Aman (2013) also indicates that stock price crashes increase with media coverage. In the cryptocurrency market, Subramaniam and Chakraborty (2020) use a quantile causality approach and find that investor attention negatively influences cryptocurrencies' returns at the extreme low quantile. They suggest that investors pay more attention and thus have lower returns. Anastasiou et al. (2021) find that cryptocurrency investors' behavior does affect price crash risk, indicating that investors pay more attention to information streaming from crisis-related keywords in Google Search volumes.

We show the results without and with Bitcoin crash in Table 7 and Table 8, respectively. We find that ASVI does not have a significant impact on futures price movements in Table 7's Model (1), (3), and (5). This supports Hypothesis 1c. However, the interaction variable dummyup × ASVI positively significantly relates to the contemporaneous returns for ASVI (1), ASVI (2), and ASVI (4) in Model (2) of Table 7. The results are similar when using the full sample.

<TABLE 7 ABOUT HERE>

Table 8 presents the results of considering the two Bitcoin crash periods: December 18, 2017 to December 14, 2018 and November 9, 2021 to June 29, 2022. We find that the coefficients of ASVI (1), ASVI (2), and ASVI (4) negatively significantly impact Bitcoin futures return in Model (1). Our results suggest that investors search more for keywords related to Bitcoin futures when the market goes down, especially for Bitcoin crash periods. The results support Hypothesis 3 and are also consistent with other studies' arguments.

<TABLE 8 ABOUT HERE>

5.4 Robust analysis

5.4.1 The effect of spot returns

The literature has examined the correlation between Bitcoin spot market and Bitcoin futures market (Baur and Dimpfl, 2019; Jalan et al., 2021; Shynkevich, 2021). Baur and Dimpfl (2019) indicate that spot price leads futures price, suggesting this is due to the Bitcoin spot market having higher trading volume and longer trading hours globally. Jalan et al. (2021) find that the introduction of Bitcoin futures leads to a downward impact on USD Bitcoin spot market return. Shynkevich (2021) suggests that the introduction of Bitcoin futures leads to greater informational efficiency in the Bitcoin spot market.

As mentioned above, we therefore control Bitcoin spot return in our regression model (Wu et al., 2021) and show the results in Table 9. We present the full sample results in Panel A and find that only the coefficient of ASVI (4) in Model (1) has a significant effect on Bitcoin futures return. In Panel B we see that ASVI (4) in Model (1) also has a negatively significant impact on Bitcoin futures return when we control the effect of spot return. In Panel C we find that the coefficients of ASVI (1), ASVI (2), and ASVI (4) in Model (1) are still negatively significant, implying that investor attention related to Bitcoin futures indeed affects its return during Bitcoin crash even when we control the spot return. The results also robust our previous findings.

<TABLE 9 ABOUT HERE>

5.4.2 Refined ASVI

We follow the method of Wu et al. (2021) and use the average ASVI for three keywords for Bitcoin futures as a new proxy for investor attention: “Bitcoin”, “Bitcoin price”, and “Bitcoin futures”. We consider Bitcoin and its code (BTC) to calculate SVI for Bitcoin futures. The refined SVI is:

$$SVI^{\text{ave}} = \text{Average}\left(SVI_{Bitcoin\,(BTC)} + SVI_{Bitcoin\,(BTC)price} + SVI_{Bitcoin\,(BTC)\,futures}\right) \quad (3)$$

where SVI^{ave} is the average daily SVI. $SVI_{Bitcoin\,(BTC)}$ is the search volume using Bitcoin (BTC) as the keyword, $SVI_{Bitcoin\,(BTC)\,price}$ is the search volume using Bitcoin (BTC) with "price" as the keyword, and $SVI_{Bitcoin\,(BTC)\,futures}$ is the search volume using Bitcoin (BTC) with "futures" as the keyword. We then calculate $ASVI^{\text{ave}}$ by SVI^{ave} and use it to robust our analysis.

Panel A of Table 10 presents the result after COVID-19 periods, where we find no significant result. One possible reason is that average ASVI also includes the attention of Bitcoin price (i.e., spot price). This may capture the part of attention from the spot market. However, the result is consistent with other studies' findings (Caferra et al., 2021; Cevik et al., 2023) that indicate no significant impact of the COVID-19 pandemic on the Bitcoin market.

In Panel B of Table 10 we find that no matter what, both types of average ASVI ($ASVI^{\text{ave}}$ (1) or $ASVI^{\text{ave}}$ (2)) negatively significantly influence Bitcoin futures return during Bitcoin crash periods. This implies that investor attention from spot and futures market search volumes do affect Bitcoin futures return when the Bitcoin market crashes. In sum, our results support that Bitcoin crash directly impacts the relation between Bitcoin investor attention and its futures return. However, we do not find strong evidence for the impact of the COVID-19 pandemic on such a relation.

<TABLE 10 ABOUT HERE>

6. Conclusions

Most studies in the literature on Bitcoin futures topics concentrate on the effect of the introduction of Bitcoin futures or price discovery. We extend the literature by targeting the issue of Bitcoin investor behavior. We find that abnormal investor attention does not have a significant impact on Bitcoin futures return, which can be explained by investors can hold both long and short positions in the Bitcoin futures

market. However, we do see that abnormal investor attention negatively affects the futures return when we consider the market-up dummy variable in our regression model. We suggest that investors in the Bitcoin futures market pay more attention when the market declines.

We further discuss the effect of COVID-19 and Bitcoin crash on the relationship between investor attention and Bitcoin futures return. We do not find a significant result before COVID-19, but present weak evidence after COVID-19. This suggests that COVID-19 does not strongly impact the Bitcoin futures market. In contrast, we note that investor attention has a strong effect on the Bitcoin futures market during Bitcoin crash. The futures market attracts more attention during a crash and has lower futures return. In addition, we control for the effect of spot return to robust our findings, and the results are still significant.

This paper overall supports the view that investors pay more attention to the Bitcoin futures market when the market is going down. It offers useful information for investors who invest in the Bitcoin futures market and who are concerned about any Bitcoin crash effects upon it.

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Appendix

Table A1 Variables' definitions and sources

This table shows all the variables used in this paper, including dependent variables, independent variables, and macro-economic variables. We report their definitions and sources.

Variable	Definition	Source
Dependent variables		
Search volume index (SVI)	Divide the number of queries for the keyword by the highest number of searches in the period range and normalize it to a relative value of 0 to 100.	Google Trend
Abnormal investor attention (ASVI)	The log of SVI_t minus the log of the median SVI of the previous five days.	Da et al. (2011)
Independent variables		
dummyup	The value is equal to one when the return is positive and zero otherwise.	Wang et al. (2017)
Vol	Daily percentage change in Bitcoin futures' volume.	
OI	Daily percentage change of open interest in Bitcoin futures.	
Ret_f_t	Daily return of Bitcoin futures at day t.	
Abs_ Ret	Daily absolute value of Bitcoin futures returns.	
$Volati_t$	Realized volatility of Bitcoin futures at day t.	Bollen and Inder (2002)
R_t^{spot}	Return of spot Bitcoin at day t.	Wu et al. (2021)
Macro-economic variables		
Global economic policy uncertainly (GEPU)	GEPU is a GDP-weighted average of national EPU indices for 20 countries: Australia, Brazil, Canada, Chile, China, France, Germany, Greece, India, Ireland, Italy, Japan, Mexico, the Netherlands, Russia, South Korea, Spain, Sweden, the United Kingdom, and the United States.	http://www.policyuncertainty.com/global_monthly.html.
Term spread (TERMSP)	10-year Treasury constant maturity minus 2-year Treasury constant maturity.	Federal Reserve Economic Data (FRED)
Default spread (DSP)	Moody's seasoned Aaa corporate bond minus 10-year Treasury rate.	
Treasury bond rate (TB)	U.S. two-year Treasury bond rate.	

Figure 1a Futures price and spot price of Bitcoin

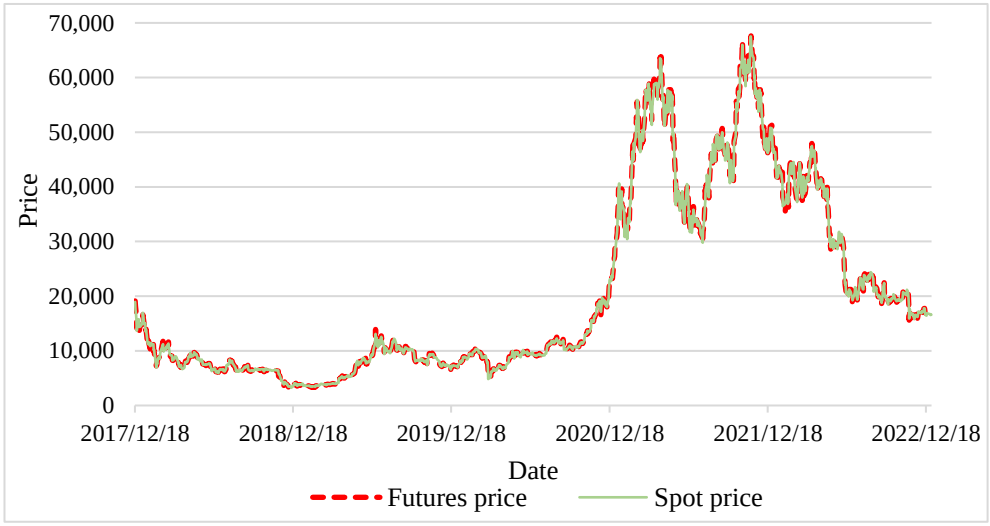

Figure 1b Futures return and spot return of Bitcoin

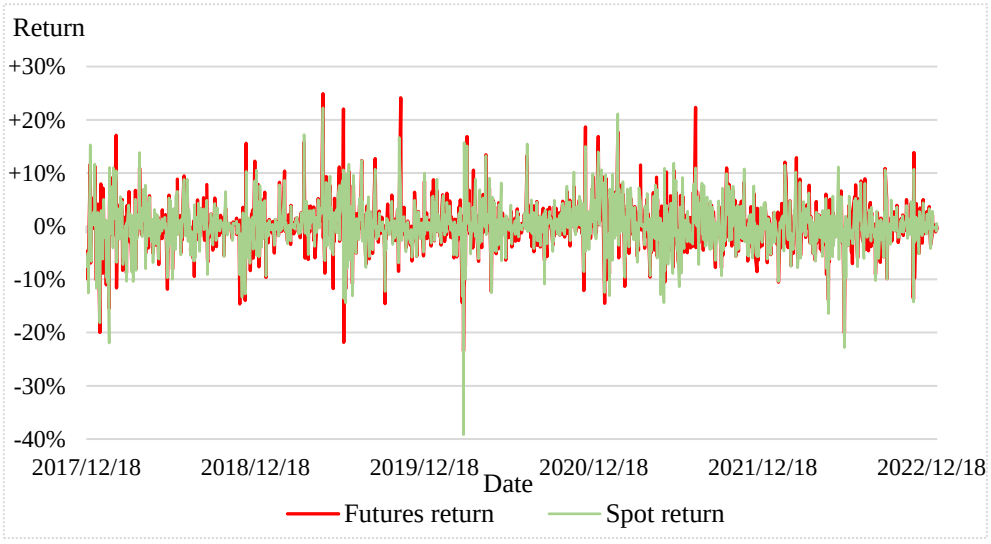

Figure 2a SVI of Bitcoin futures

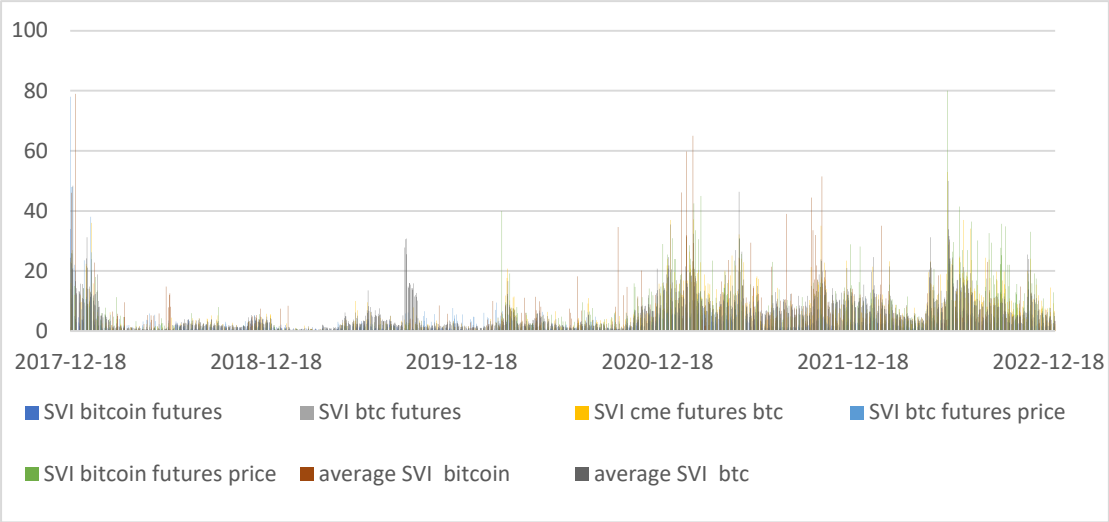

Figure 2b ASVI of Bitcoin futures

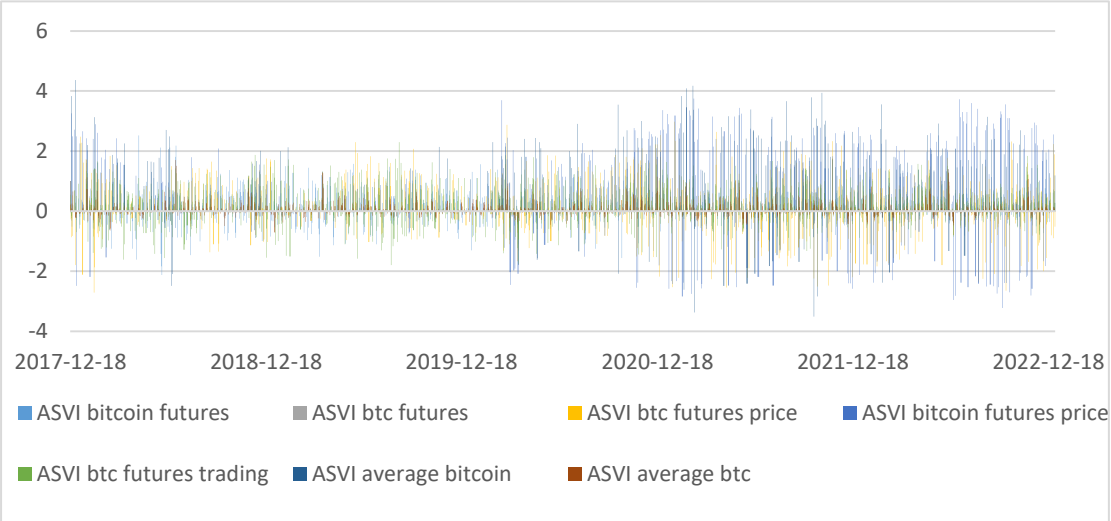

Table 1 Search terms of Bitcoin futures

This table shows five Bitcoin futures' search terms and two alternative average measures. The average measures follow Wu et al. (2021) and include the search keywords for both spot market and futures market.

Bitcoin futures	**Search term**
(1)	Bitcoin futures
(2)	Btc futures
(3)	Btc futures price
(4)	Bitcoin futures price
(5)	Btc futures trading
Average of three search keywords	**Search term**
(1)	Average (Bitcoin + Bitcoin price + Bitcoin futures)
(2)	Average (Btc + Btc price + Btc futures)

Table 2 Sample statistics

This table shows the summary statistics of SVI, ASVI, and Bitcoin futures, including mean, median, standard deviation (Std.), minimum (Min.) and maximum (Max.). Bitcoin futures' return and volatility show percentage values. The sample period is from December 18, 2017 to December 31, 2022.

Search volume index (SVI)	**Mean**	**Median**	**Std.**	**Min.**	**Max.**
Bitcoin futures	2.22	1.40	2.52	0	34
Btc futures	4.58	2.16	6.34	0	53
Btc futures price	2.99	0.00	6.88	0	80
Bitcoin futures price	6.50	3.70	7.95	0	70
Btc futures trading	1.62	0.00	5.89	0	79
Average bitcoin	7.28	5.51	6.51	0.79	71.67
Average btc	6.28	4.36	6.15	0.32	50.00
Abnormal search volume index (ASVI)	**Mean**	**Median**	**Std.**	**Min.**	**Max.**
Bitcoin futures	0.17	0.17	0.53	-2.12	2.53
Btc futures	0.12	0.00	0.79	-2.72	2.98
Btc futures price	0.25	0.00	1.12	-3.23	3.75
Bitcoin futures price	0.17	0.11	0.62	-1.79	2.30
Btc futures trading	0.21	0.00	0.84	-3.51	4.37
Average bitcoin	0.06	0.02	0.24	-0.72	1.70
Average btc	0.07	0.03	0.35	-1.16	1.63
Bitcoin futures	**Mean**	**Median**	**Std.**	**Min.**	**Max.**
Return	0.10	0.00	4.69	-23.49	24.90
Volatility	2.60	2.12	1.76	0.30	15.21
Volumes	6,247	5,400	4,358	141	44,896
Open interest	4,615	3,528	3,197	85	15,071

Table 3 Determinants of ASVI

This table shows the results of the regression models on the relationship between absolute return and investor attention. Panel A presents the results based on the full sample from 2017/12/18 to 2022/12/31. Panels B and C present the results based on the sub-sample before and after COVID-19, respectively. Panels D and E present the results based on the sub-sample without and with Bitcoin crash, respectively. Without Bitcoin crash periods are full sample periods excluding Bitcoin crash periods. Table A1 summarizes the variable definitions and data sources. ***, ** and * are statistical significance at the 1%, 5%, and 10% levels, respectively.

	Dependent variable is ASVI									
Panel A:	**Full sample (2017/12/18 to 2022/12/31)**									
	ASVI (1)		**ASVI (2)**		**ASVI (3)**		**ASVI (4)**		**ASVI (5)**	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.0863	(3.01)***	0.0324	(0.74)	0.2346	(4.11)***	0.0694	(2.06)**	0.1741	(4.40)***
Abs_Ret	3.2129	(4.79)***	3.5115	(2.78)***	0.9487	(0.70)	3.7526	(4.50)***	1.5794	(1.56)
dummyup	0.0074	(0.18)	0.053	(0.84)	-0.0744	(-0.92)	0.0356	(0.74)	0.0168	(0.28)
dummyup*Abs_Ret	-1.3223	(-1.49)	-3.1331	(-1.94)*	0.1039	(0.06)	-2.3473	(-2.13)**	-1.1548	(-0.83)
Vol	0.0085	(0.64)	0.0112	(0.64)	0.0157	(0.57)	0.001	(0.07)	-0.0051	(-0.33)
OI	-0.0148	(-0.89)	-0.0187	(-0.81)	0.0479	(1.42)	0.0086	(0.49)	0.0004	(0.02)
R^2	0.0315		0.0131		0.0092		0.0253		0.0021	
Panel B:	**Before COVID-19 (2017/12/18 to 2020/3/10)**									
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.1327	(2.88)***	0.1005	(2.01)**	0.0783	(2.23)**	0.0528	(1.03)	0.094	(2.65)***
Abs_Ret	2.4043	(2.70)***	1.4315	(0.89)	2.3701	(1.84)*	3.2175	(2.70)***	1.2744	(1.27)
dummyup	-0.0375	(-0.55)	0.0112	(0.16)	-0.0614	(-1.20)	0.0327	(0.45)	0.0068	(0.12)
dummyup*Abs_Ret	-0.0595	(-0.05)	-0.5129	(-0.26)	0.0763	(0.05)	-1.1472	(-0.73)	-0.7456	(-0.49)
Vol	0.0027	(0.11)	-0.0016	(-0.06)	-0.0625	(-2.28)**	-0.0229	(-0.97)	-0.0209	(-1.06)
OI	-0.0292	(-0.97)	0.0406	(1.73)*	0.093	(1.72)*	0.0116	(0.42)	0.0273	(1.02)
R^2	0.0228		0.0141		0.0462		0.0191		0.0056	
Panel C:	**After COVID-19 (2020/3/11 to 2022/12/31)**									
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.0393	(1.10)	-0.0474	(-0.71)	0.3656	(3.43)***	0.076	(1.69)*	0.2394	(3.45)***
Abs_Ret	4.13	(4.11)***	5.8597	(3.44)***	0.0318	(0.01)	4.4995	(3.75)***	1.9807	(1.13)
dummyup	0.0568	(1.17)	0.1185	(1.19)	-0.1022	(-0.70)	0.0452	(0.72)	0.0157	(0.16)
dummyup*Abs_Ret	-2.71	(-2.23)**	-5.944	(-2.49)**	0.0666	(0.02)	-3.6634	(-2.44)**	-1.5554	(-0.67)
Vol	0.0139	(0.89)	0.0213	(0.95)	0.0666	(2.46)**	0.018	(1.03)	0.0057	(0.27)
OI	-0.0023	(-0.11)	-0.0694	(-2.08)**	0.027	(0.70)	0.0106	(0.49)	-0.0195	(-0.91)
R^2	0.0579		0.0291		0.0138		0.0437		0.0026	
Panel D:	**Without Bitcoin crash**									
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.083	(2.43)**	0.0439	(0.77)	0.2298	(3.05)***	0.0827	(1.92)*	0.1408	(2.79)***
Abs_Ret	2.8758	(3.64)***	2.6426	(1.47)	-0.0921	(-0.05)	3.451	(3.01)***	2.6327	(1.76)*
dummyup	0.0059	(0.13)	0.0636	(0.81)	-0.0195	(-0.19)	0.0305	(0.51)	0.0555	(0.77)
dummyup*Abs_Ret	-0.0624	(-0.06)	-2.4153	(-1.14)	0.1238	(0.05)	-1.9523	(-1.37)	-2.6001	(-1.48)
Vol	-0.0008	(-0.06)	0.0395	(2.16)**	0.0279	(0.88)	-0.0032	(-0.21)	0.0076	(0.41)
OI	-0.0002	(-0.01)	-0.0397	(-1.29)	0.0549	(1.24)	0.0104	(0.49)	-0.0119	(-0.49)
R^2	0.0388		0.0132		0.0115		0.0188		0.005	
Panel E:	**With Bitcoin crash (2017/12/18 to 20/12/14 and 2021/11/9 to 2022/6/29)**									
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.1037	(2.02)**	0.0003	0.00	0.2528	(3.00)***	0.0471	(0.87)	0.2242	(3.41)***
Abs_Ret	3.3942	(2.98)***	5.1751	(3.19)***	2.3559	(1.27)	4.1301	(3.48)***	0.3175	(0.23)
dummyup	0.0308	(0.37)	0.034	(0.32)	-0.2447	(-1.81)*	0.0416	(0.51)	-0.0574	(-0.47)
dummyup*Abs_Ret	-5.2262	(-3.11)***	-4.1982	(-1.58)	2.4141	(0.80)	-3.2314	(-1.74)*	1.7887	(0.55)
Vol	0.0446	(1.61)	-0.1039	(-4.75)***	-0.0411	(-1.34)	0.0207	(0.66)	-0.0592	(-2.02)**
OI	-0.0494	(-2.16)**	0.0477	(1.91)*	0.0459	(1.03)	0.0007	(0.02)	0.0346	(1.43)
R^2	0.0529		0.053		0.0216		0.0443		0.0082	

Table 4 Effect of ASVI on futures returns

This table presents the results of the regressions using five ASVI on future return. All the variables' definitions and data sources are presented in Table A1. The sample period is from December 18, 2017 to December 31, 2022. *, **, and *** are statistical significance at the 10%, 5%, and 1% levels, respectively.

	Model (1)		**Model (2)**		**Model (3)**		**Model (4)**		**Model (5)**		**Model (6)**	
	$Ret\_f_{(t)}$		**$Ret\_f_{(t)}$**		**$Ret\_f_{(t+1)}$**		**$Ret\_f_{(t+1)}$**		**$Ret\_f_{(t+2)}$**		**$Ret\_f_{(t+2)}$**	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0058	(-0.26)	-0.0155	(-0.93)	-0.0045	(-0.20)	-0.0039	(-0.18)	0.0009	(0.04)	-0.0016	(-0.08)
ASVI(1)	-0.0024	(-0.90)	-0.0113	(-4.17)***	0.0018	(0.69)	-0.0058	(-1.62)	0.0041	(1.50)	0.0092	(2.75)***
dummyup	-	-	0.0601	(32.65)***	-	-	0.0036	(0.90)	-	-	0.0063	(1.70)*
dummyup*ASVI(1)	-	-	0.0207	(5.18)***	-	-	0.0157	(3.11)***	-	-	-0.0105	(-1.89)*
Control variables	Yes		Yes		Yes		Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
R^2	0.0458		0.506		0.0139		0.023		0.0118		0.017	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0062	(-0.28)	-0.02	(-1.20)	-0.0041	(-0.19)	-0.0052	(-0.23)	0.0017	(0.08)	0.0005	(0.03)
ASVI(2)	-0.0037	(-1.90)*	-0.007	(-3.29)***	0.002	(1.09)	0.0023	(0.86)	0.0012	(0.64)	0.0016	(0.64)
dummyup	-	-	0.0626	(32.11)***	-	-	0.0049	(1.21)	-	-	0.0053	(1.44)
dummyup*ASVI(2)	-	-	0.0083	(2.83)***	-	-	-0.0007	(-0.21)	-	-	-0.0011	(-0.29)
Control variables	Yes		Yes		Yes		Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
R^2	0.049		0.4997		0.0146		0.0161		0.0101		0.0119	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0059	(-0.26)	-0.0186	(-1.09)	-0.0038	(-0.17)	-0.0040	(-0.18)	0.0009	(0.04)	-0.0012	(-0.05)
ASVI(3)	-0.0003	(-0.27)	-0.0005	(-0.43)	-0.0004	(-0.28)	-0.0024	(-1.17)	0.0007	(0.53)	0.0020	(1.32)
dummyup	-	-	0.0631	(31.33)***	-	-	0.0041	(1.00)	-	-	0.0060	(1.57)
dummyup*ASVI(3)	-	-	0.0022	(1.27)	-	-	0.0044	(1.61)	-	-	-0.0025	(-1.02)
Control variables	Yes		Yes		Yes		Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
R^2	0.0452		0.4934		0.0136		0.0177		0.01		0.0127	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0057	(-0.25)	-0.0172	(-1.03)	-0.0045	(-0.20)	-0.0056	(-0.25)	0.0015	(0.07)	-0.0001	(-0.01)
ASVI(4)	-0.0034	(-1.45)	-0.0087	(-3.67)***	0.0019	(0.77)	0.0007	(0.20)	0.001	(0.43)	0.0034	(1.12)
dummyup	-	-	0.0611	(31.59)***	-	-	0.0047	(1.17)	-	-	0.0058	(1.56)
dummyup*ASVI(4)	-	-	0.0139	(4.16)***	-	-	0.0024	(0.49)	-	-	-0.0049	(-1.03)
Control variables	Yes		Yes		Yes		Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
R^2	0.0471		0.5015		0.0141		0.0159		0.01		0.0127	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0056	(-0.25)	-0.0185	(-1.10)	-0.0034	(-0.16)	-0.0044	(-0.20)	0.0014	(0.07)	0.0000	(0.00)
ASVI(5)	-0.0019	(-1.15)	-0.0019	(-1.23)	-0.0025	(-1.46)	-0.002	(-0.79)	0.0007	(0.42)	0.0005	(0.24)
dummyup	-	-	0.0633	(31.41)***	-	-	0.0051	(1.26)	-	-	0.0053	(1.42)
dummyup*ASVI(5)	-	-	0.0016	(0.70)	-	-	-0.0009	(-0.28)	-	-	0.0003	(0.10)
Control variables	Yes		Yes		Yes		Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
R^2	0.0462		0.4931		0.0154		0.017		0.0099		0.0116	

Table 5 Effect of ASVI on futures returns before COVID-19

This table reports the results of the regressions using subsamples based on before COVID-19. Model (1) (Model (2)), Model (3) (Model (4)), and Model (5) (Model (6)) show results without (with) dummyup and its interaction term at days t, t+1, and t+2, respectively. All the variables' definitions and data sources are presented in Table A1. The sample period is from December 18, 2017 to March 10, 2020. *, **, and * ** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Before COVID-19 (2017/12/18 to 2020/3/10)												
	Model (1)		**Model (2)**		**Model (3)**		**Model (4)**		**Model (5)**		**Model (6)**	
	Ret_f$_{(t)}$		**Ret_f$_{(t)}$**		**Ret_f $_{(t+1)}$**		**Ret_f $_{(t+1)}$**		**Ret_f $_{(t+2)}$**		**Ret_f $_{(t+2)}$**	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.0094	(0.19)	-0.0017	(-0.04)	0.0093	(0.21)	0.0121	(0.27)	0.0529	(0.91)	0.0464	(0.80)
ASVI(1)	0.0002	(0.05)	-0.0081	(-2.70)***	0.0004	(0.12)	-0.0065	(-1.43)	0.0053	(1.48)	0.0125	(3.06)***
dummyup	-	-	0.0602	(18.71)***	-	-	0.0120	(2.11)**	-	-	0.0039	(0.70)
dummyup*ASVI(1)	-	-	0.0177	(3.54)***	-	-	0.0146	(2.19)**	-	-	-0.0148	(-2.04)**
Control variables	Yes		Yes		Yes		Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
R^2	0.0449		0.4659		0.0176		0.0368		0.0296		0.0385	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.0092	(0.19)	-0.0086	(-0.22)	0.0094	(0.21)	0.0064	(0.14)	0.0510	(0.88)	0.0501	(0.86)
ASVI(2)	-0.0005	(-0.12)	-0.0066	(-1.48)	0.0019	(0.42)	0.0008	(0.15)	0.0053	(1.21)	0.0066	(1.11)
dummyup	-	-	0.0619	(18.39)***	-	-	0.0133	(2.23)**	-	-	0.0024	(0.41)
dummyup*ASVI(2)	-	-	0.0108	(1.60)	-	-	0.0018	(0.19)	-	-	-0.0031	(-0.36)
Control variables	Yes		Yes		Yes		Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
R^2	0.0450		0.4584		0.0181		0.0288		0.0296		0.0302	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.0106	(0.22)	-0.0065	(-0.17)	0.0045	(0.10)	0.0026	(0.06)	0.0539	(0.92)	0.0534	(0.90)
ASVI(3)	0.0014	(0.27)	-0.0029	(-0.59)	-0.0048	(-0.93)	-0.0099	(-1.27)	0.0042	(1.17)	0.0045	(1.17)
dummyup	-	-	0.0623	(18.62)***	-	-	0.0126	(2.23)**	-	-	0.0026	(0.46)
dummyup*ASVI(3)	-	-	0.0121	(1.62)	-	-	0.0117	(1.13)	-	-	-0.0004	(-0.06)
Control variables	Yes		Yes		Yes		Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
R^2	0.0451		0.4576		0.0199		0.0342		0.0270		0.0274	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.0087	(0.18)	-0.0103	(-0.27)	0.0101	(0.23)	0.0068	(0.15)	0.0518	(0.89)	0.0514	(0.87)
ASVI(4)	-0.0010	(-0.29)	-0.0065	(-2.04)**	0.0016	(0.45)	-0.0007	(-0.16)	0.0029	(0.82)	0.0051	(1.31)
dummyup	-	-	0.0614	(18.31)***	-	-	0.0131	(2.29)**	-	-	0.0027	(0.48)
dummyup*ASVI(4)	-	-	0.0130	(2.62)***	-	-	0.0052	(0.71)	-	-	-0.0051	(-0.70)
Control variables	Yes		Yes		Yes		Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
R^2	0.0451		0.4614		0.0180		0.0301		0.0267		0.0282	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.0065	(0.13)	-0.0118	(-0.31)	0.0056	(0.12)	0.0042	(0.09)	0.0452	(0.76)	0.0479	(0.80)
ASVI(5)	-0.0049	(-1.12)	-0.0040	(-0.89)	-0.0056	(-1.30)	-0.0028	(-0.38)	-0.0077	(-1.97)**	-0.0023	(-0.41)
dummyup	-	-	0.0632	(18.00)***	-	-	0.0140	(2.43)**	-	-	0.0033	(0.58)
dummyup*ASVI(5)	-	-	0.0013	(0.20)	-	-	-0.0053	(-0.62)	-	-	-0.0105	(-1.38)
Control variables	Yes		Yes		Yes		Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
R^2	0.0473		0.4545		0.0209		0.0325		0.0316		0.0350	

Table 6 Effect of ASVI on futures returns after COVID-19

This table presents the results of the regressions using subsamples based on after COVID-19. Model (1), Model (2), and Model (3) show the results at days t, t+1, and t+2, respectively. All the variables' definitions and data sources are presented in Table A1. The sample period is from March 11, 2020 to December 31, 2022. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	After COVID-19 (2020/3/11 to 2022/12/31)					
	Model (1)		**Model (2)**		**Model (3)**	
	$Ret\_f_{(t)}$		**$Ret\_f_{(t+1)}$**		**$Ret\_f_{(t+2)}$**	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0062	(-0.25)	0.0070	(0.28)	0.0168	(0.69)
ASVI(1)	-0.0034	(-0.77)	0.0060	(1.46)	0.0037	(0.93)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.0607		0.0239		0.0219	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0072	(-0.29)	0.0092	(0.38)	0.0183	(0.76)
ASVI(2)	-0.0043	(-2.06)**	0.0025	(1.30)	0.0000	(-0.02)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.0668		0.0233		0.0208	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0070	(-0.28)	0.0092	(0.38)	0.0176	(0.73)
ASVI(3)	-0.0004	(-0.29)	0.0001	(0.10)	0.0004	(0.33)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.0599		0.0210		0.0209	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0054	(-0.22)	0.0080	(0.33)	0.0183	(0.76)
ASVI(4)	-0.0049	(-1.50)	0.0031	(0.90)	-0.0001	(-0.03)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.0632		0.0223		0.0208	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0070	(-0.28)	0.0100	(0.41)	0.0173	(0.72)
ASVI(5)	-0.0014	(-0.79)	-0.0019	(-1.02)	0.0029	(1.78)*
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.0607		0.0228		0.0250	

Table 7 Effect of ASVI on futures returns without Bitcoin crash

This table presents the results of the regressions using subsamples without Bitcoin crash. Without Bitcoin crash periods are full sample periods excluding those during a Bitcoin crash (2017/12/18 to 2018/12/14 and 2021/11/9 to 2022/6/29). Model (1) (Model (2)), Model (3) (Model (4)), and Model (5) (Model (6)) show the results without (with) dummyup and its interaction term at days t, t+1, and t+2, respectively. All the variables' definitions and data sources are presented in Table A1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Without Bitcoin crash											
	Model (1)		**Model (2)**		**Model (3)**		**Model (4)**		**Model (5)**		**Model (6)**	
	Ret_f$_{(t)}$		**Ret_f$_{(t)}$**		**Ret_f $_{(t+1)}$**		**Ret_f $_{(t+1)}$**		**Ret_f $_{(t+2)}$**		**Ret_f $_{(t+2)}$**	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0210	(-0.69)	-0.0252	(-1.15)	-0.0055	(-0.17)	-0.0091	(-0.29)	-0.0063	(-0.20)	-0.0063	(-0.20)
ASVI(1)	0.0050	(1.47)	-0.0096	(-2.97)***	0.0043	(1.23)	-0.0060	(-1.27)	0.0046	(1.30)	0.0072	(1.72)*
dummyup	-	-	0.0585	(27.46)***	-	-	0.0051	(1.02)	-	-	0.0033	(0.76)
dummyup*ASVI(1)	-	-	0.0266	(5.20)***	-	-	0.0216	(3.19)***	-	-	-0.0054	(-0.76)
Control variables	Yes		Yes		Yes		Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
R^2	0.0318		0.4927		0.0144		0.0299		0.0160		0.0172	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0170	(-0.56)	-0.0216	(-0.97)	-0.0037	(-0.12)	-0.0051	(-0.16)	-0.0036	(-0.12)	-0.0041	(-0.13)
ASVI(2)	-0.0022	(-0.92)	-0.0061	(-2.13)**	0.0018	(0.83)	0.0012	(0.37)	0.0002	(0.08)	0.0001	(0.03)
dummyup	-	-	0.0624	(26.03)***	-	-	0.0069	(1.35)	-	-	0.0027	(0.61)
dummyup*ASVI(2)	-	-	0.0075	(2.01)**	-	-	0.0009	(0.20)	-	-	0.0001	(0.02)
Control variables	Yes		Yes		Yes		Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
R^2	0.0305		0.4776		0.0133		0.0163		0.0137		0.0141	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0173	(-0.57)	-0.0218	(-0.97)	-0.0038	(-0.12)	-0.0051	(-0.16)	-0.0062	(-0.20)	-0.0070	(-0.22)
ASVI(3)	-0.0003	(-0.23)	-0.0004	(-0.29)	0.0005	(0.29)	-0.0012	(-0.48)	0.0014	(0.90)	0.0031	(1.86)*
dummyup	-	-	0.0630	(25.28)***	-	-	0.0063	(1.23)	-	-	0.0036	(0.79)
dummyup*ASVI(3)	-	-	0.0013	(0.63)	-	-	0.0034	(1.07)	-	-	-0.0034	(-1.19)
Control variables	Yes		Yes		Yes		Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
R^2	0.0292		0.4726		0.0125		0.0174		0.0148		0.0172	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0173	(-0.57)	-0.0216	(-0.97)	-0.0034	(-0.11)	-0.0051	(-0.16)	-0.0046	(-0.15)	-0.0051	(-0.16)
ASVI(4)	-0.0017	(-0.64)	-0.0071	(-2.58)**	0.0014	(0.48)	-0.0015	(-0.35)	0.0029	(1.01)	0.0033	(0.92)
dummyup	-	-	0.0609	(25.69)***	-	-	0.0064	(1.26)	-	-	0.0028	(0.64)
dummyup*ASVI(4)	-	-	0.0130	(3.28)***	-	-	0.0058	(1.01)	-	-	-0.0006	(-0.11)
Control variables	Yes		Yes		Yes		Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
R^2	0.0297		0.4742		0.0127		0.0173		0.0152		0.0157	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0171	(-0.56)	-0.0203	(-0.90)	-0.0024	(-0.07)	-0.0043	(-0.13)	-0.0048	(-0.15)	-0.0050	(-0.16)
ASVI(5)	-0.0022	(-1.13)	-0.0033	(-1.71)*	-0.0014	(-0.69)	0.0006	(0.20)	0.0033	(1.86)*	0.0022	(0.97)
dummyup	-	-	0.0626	(25.66)***	-	-	0.0078	(1.51)	-	-	0.0022	(0.51)
dummyup*ASVI(5)	-	-	0.0033	(1.26)	-	-	-0.0039	(-0.99)	-	-	0.0021	(0.59)
Control variables	Yes		Yes		Yes		Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
R^2	0.0308		0.4597		0.0130		0.0174		0.0174		0.0182	

Table 8 Effect of ASVI on futures returns with Bitcoin crash

This table presents the results of the regressions using subsamples with Bitcoin crash periods (2017/12/18 to 2018/12/14 and 2021/11/9 to 2022/6/29). Model (1), Model (2), and Model (3) show the results at days t, t+1, and t+2, respectively. All the variables' definitions and data sources are presented in Table A1. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

With Bitcoin crash (2017/12/18 to 2018/12/14 and 2021/11/9 to 2022/6/29)						
	Model (1)		**Model (2)**		**Model (3)**	
	Ret_f$_{(t)}$		**Ret_f$_{(t+1)}$**		**Ret_f $_{(t+2)}$**	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.0525	(0.97)	0.0381	(0.69)	0.0809	(1.44)
ASVI(1)	-0.0138	(-3.37)***	0.0008	(0.22)	0.0041	(0.91)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.1740		0.0327		0.0494	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.0606	(1.12)	0.0390	(0.70)	0.0801	(1.43)
ASVI(2)	-0.0065	(-1.81)*	0.0025	(0.74)	0.0043	(1.13)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.1566		0.0343		0.0517	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.0646	(1.18)	0.0373	(0.67)	0.0777	(1.38)
ASVI(3)	-0.0005	(-0.23)	-0.0037	(-1.46)	-0.0016	(-0.68)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.1461		0.0386		0.0480	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.0608	(1.14)	0.0392	(0.71)	0.0765	(1.36)
ASVI(4)	-0.0085	(-1.92)*	0.0035	(0.78)	-0.0028	(-0.72)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.1569		0.0346		0.0480	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.0640	(1.16)	0.0297	(0.55)	0.0707	(1.24)
ASVI(5)	-0.0005	(-0.18)	-0.0061	(-1.85)*	-0.0055	(-1.88)*
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.1461		0.0492		0.0550	

Table 9 Control for the effect of spot return

This table presents the results of the regressions control for spot return. The regressions are based on the full sample from 2017/12/18 to 2022/12/31 in Panel A. The regressions are based on the sub-sample after COVID-19 in Panel B. The regressions are based on the sub-sample with Bitcoin crash in Panel C. Model (1), Model (2), and Model (3) show the results at days t, t+1, and t+2, respectively. All the variables' definitions and data sources are presented in Table A1. ∗, ∗∗, and ∗∗∗ are statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Full sample (2017/12/18 to 2022/12/31)

	Model (1)		**Model (2)**		**Model (3)**	
	$Ret\_f_{(t)}$		**$Ret\_f_{(t+1)}$**		**$Ret\_f_{(t+2)}$**	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0003	(-0.03)	-0.0037	(-0.17)	0.0009	(0.04)
ASVI(1)	-0.0003	(-0.27)	0.0020	(0.78)	0.0041	(1.50)
Ret^{spot}	0.8466	(26.29)***	0.4166	(4.49)***	-0.0127	(-0.19)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.7166		0.0635		0.0119	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0004	(-0.03)	-0.0033	(-0.15)	0.0016	(0.08)
ASVI(2)	-0.0009	(-0.89)	0.0020	(1.16)	0.0012	(0.64)
Ret^{spot}	0.8458	(26.23)***	0.4165	(4.47)***	-0.0133	(-0.20)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.7168		0.0642		0.0102	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.0002	(0.02)	-0.0026	(-0.12)	0.0009	(0.04)
ASVI(3)	-0.0005	(-0.73)	-0.0006	(-0.47)	0.0007	(0.54)
Ret^{spot}	0.8468	(26.37)***	0.4170	(4.51)***	-0.0143	(-0.21)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.7167		0.0633		0.0101	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.0000	(0.00)	-0.0035	(-0.16)	0.0014	(0.07)
ASVI(4)	-0.0024	(-2.10)**	0.0012	(0.48)	0.0011	(0.44)
Ret^{spot}	0.8462	(26.42)***	0.4150	(4.45)***	-0.0146	(-0.22)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.7167		0.0633		0.0100	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0008	(-0.07)	-0.0028	(-0.13)	0.0014	(0.07)
ASVI(5)	0.0014	(1.58)	-0.0017	(-0.99)	0.0006	(0.41)
Ret^{spot}	0.8484	(26.26)***	0.4126	(4.43)***	-0.0121	(-0.18)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.7171		0.0639		0.0099	

Table 9 Control for the effect of spot return (cont'd)

Panel B: After COVID-19 (2020/3/11 to 2022/12/31)						
	Model (1)		**Model (2)**		**Model (3)**	
	Ret_f$_{(t)}$		**Ret_f $_{(t+1)}$**		**Ret_f $_{(t+2)}$**	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0031	(-0.26)	0.0069	(0.29)	0.0168	(0.69)
ASVI(1)	-0.0035	(-1.56)	0.0049	(1.25)	0.0039	(0.97)
Ret^{spot}	0.8021	(18.07)***	0.3939	(3.32)***	-0.0534	(-0.56)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.6973		0.0753		0.0229	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0043	(-0.36)	0.0086	(0.38)	0.0184	(0.76)
ASVI(2)	-0.0019	(-1.63)	0.0022	(1.22)	0.0000	(-0.00)
Ret^{spot}	0.7999	(17.84)***	0.3956	(3.33)***	-0.0506	(-0.53)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.6977		0.0752		0.0216	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0037	(-0.31)	0.0089	(0.39)	0.0177	(0.73)
ASVI(3)	-0.0005	(-0.65)	-0.0001	(-0.04)	0.0005	(0.34)
Ret^{spot}	0.8022	(17.97)***	0.3974	(3.35)***	-0.0512	(-0.54)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.6966		0.0733		0.0219	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0028	(-0.24)	0.0079	(0.34)	0.0183	(0.76)
ASVI(4)	-0.0038	(-2.15)**	0.0020	(0.62)	0.0000	(0.01)
Ret^{spot}	0.8013	(18.13)***	0.3949	(3.32)***	-0.0506	(-0.53)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.6983		0.0739		0.0217	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0049	(-0.41)	0.0092	(0.40)	0.0174	(0.72)
ASVI(5)	0.0013	(1.37)	-0.0011	(-0.58)	0.0028	(1.73)*
Ret^{spot}	0.8042	(17.81)***	0.3939	(3.31)***	-0.0415	(-0.44)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.6971		0.0739		0.0256	

Table 9 Control for the effect of spot return (cont'd)

Panel C: With Bitcoin crash (2017/12/18 to 2018/12/14 and 2021/11/9 to 2022/6/29)						
	Model (1)		**Model (2)**		**Model (3)**	
	$Ret\_f_{(t)}$		**$Ret\_f_{(t+1)}$**		**$Ret\_f_{(t+2)}$**	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.0521	(0.97)	0.0382	(0.69)	0.0808	(1.44)
ASVI(1)	-0.0136	(-3.31)***	0.0007	(0.21)	0.0042	(0.92)
Ret^{spot}	0.0019	(1.16)	-0.0002	(-0.35)	0.0004	(0.88)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.1755		0.0327		0.0494	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.0592	(1.10)	0.0392	(0.70)	0.0802	(1.43)
ASVI(2)	-0.0072	(-1.95)*	0.0027	(0.76)	0.0043	(1.12)
Ret^{spot}	0.0033	(1.93)*	-0.0005	(-0.82)	-0.0003	(-0.42)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.1612		0.0345		0.0517	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.0639	(1.17)	0.0374	(0.67)	0.0776	(1.38)
ASVI(3)	-0.0005	(-0.21)	-0.0037	(-1.46)	-0.0016	(-0.68)
Ret^{spot}	0.0024	(1.47)	-0.0003	(-0.58)	0.0002	(0.51)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.1487		0.0386		0.0479	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.0601	(1.13)	0.0392	(0.71)	0.0765	(1.36)
ASVI(4)	-0.0084	(-1.90)*	0.0035	(0.78)	-0.0027	(-0.72)
Ret^{spot}	0.0024	(1.45)	-0.0002	(-0.38)	0.0002	(0.53)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.1594		0.0346		0.0480	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.0634	(1.15)	0.0298	(0.55)	0.0707	(1.24)
ASVI(5)	-0.0004	(-0.14)	-0.0062	(-1.85)*	-0.0055	(-1.87)*
Ret^{spot}	0.0024	(1.48)	-0.0004	(-0.81)	0.0000	(0.20)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.1487		0.0429		0.0550	

Table 10 Refined average ASVI

This table presents the results of the regressions for average ASVI ($ASVI^{ave}$) at days t, t+1, and t+2, respectively. The regressions are based on the sub-sample after COVID-19 in Panel A. The regressions are based on the sub-sample with Bitcoin crash in Panel B. SVI^{ave} is the average daily $SVI_{Bitcoin\ (BTC)}$, $SVI_{Bitcoin\ (BTC)\ price}$, and $SVI_{Bitcoin\ (BTC)\ futures}$. $SVI_{Bitcoin\ (BTC)}$ is the search volume using Bitcoin (BTC) as the keyword, $SVI_{Bitcoin\ (BTC)\ price}$ is the search volume using Bitcoin (BTC) with "price" as the keyword, and $SVI_{Bitcoin\ (BTC)\ futures}$ is the search volume using Bitcoin (BTC) with "futures" as the keyword. We then calculate $ASVI^{ave}$ by SVI^{ave}. $ASVI^{ave}(1)$ and $ASVI^{ave}(2)$ use Bitcoin and its code, respectively. All the variables' definitions and data sources are presented in Table A1. ∗, ∗∗, and ∗∗∗ are statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: After COVID-19 (2020/3/11 to 2022/12/31)						
	$Ret\_f_{(t)}$		**$Ret\_f_{(t+1)}$**		**$Ret\_f_{(t+2)}$**	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	-0.0081	(-0.33)	0.0104	(0.42)	0.0184	(0.77)
average $ASVI^{ave}(1)$	0.0061	(0.51)	-0.0092	(-0.97)	-0.0015	(-0.18)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.0605		0.0227		0.0208	
Intercept	-0.0065	(-0.27)	0.0091	(0.37)	0.0179	(0.74)
average $ASVI^{ave}$ (2)	-0.0038	(-0.62)	0.0011	(0.20)	0.0017	(0.34)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.0605		0.0210		0.0209	
Panel B: Bitcoin bubble (2017/12/18 to 2018/12/14 and 2021/11/9 to 2022/6/29)						
	$Ret\_f_{(t)}$		**$Ret\_f_{(t+1)}$**		**$Ret\_f_{(t+2)}$**	
Parameter	Coeff.	t value	Coeff.	t value	Coeff.	t value
Intercept	0.0573	(1.07)	0.0382	(0.69)	0.0773	(1.38)
average $ASVI^{ave}$ (1)	-0.0253	(-1.78)*	0.0035	(0.46)	-0.0029	(-0.37)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.1625		0.0330		0.0470	
Intercept	0.0618	(1.17)	0.0378	(0.68)	0.0778	(1.38)
average $ASVI^{ave}$ (2)	-0.0216	(-2.53)**	0.0065	(1.13)	0.0016	(0.21)
Control variables	Yes		Yes		Yes	
Period fixed effects	Yes		Yes		Yes	
R^2	0.1681		0.0347		0.0469	