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Cryptocurrency-Related Announcements and Stock Returns: Emerging Market Evidence

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Abstract

This study examines investors' reactions to crypto-related announcements by public firms in an emerging market. The sample firms are divided into two groups, direct and indirect, based on their level of investment commitment in cryptocurrency. We contribute to the literature by presenting empirical evidence of short-term abnormal returns surrounding the crypto-related announcement day, indicating positive reactions from investors in an emerging market. Firms investing directly in cryptocurrency are associated with higher abnormal returns than those investing indirectly. Additionally, direct-investment firms become more correlated with and sensitive to Bitcoin price movements after crypto-related announcements, indicating a stronger tie with the cryptocurrency market. In light of these results, investors and market participants are reminded to monitor the evolving relationship between firms investing in cryptocurrencies and their stock performance and the potential spillover effects on broader financial markets in emerging economies.

Keywords: cryptocurrency, announcement effect, stock returns, emerging mark

1. Introduction

The exponential returns and wild fluctuations of cryptocurrency attract investors and speculators. Bitcoin—the most popular and dominant cryptocurrency—surged by approximately 60% in 2021. However, this return declined in the first half of 2022. Blockchain is the backbone of cryptocurrency and one of the most innovative technologies in recent years. A number of corporations have adopted blockchain technology in numerous areas, such as tracking items through supply chains and settlement processes for financial transactions (Autore et al., 2021). In September 2021, El Salvador became the first country to adopt Bitcoin as legal tender, followed by the Central African Republic in April 2022. Owing to the instability of their domestic currencies, Carrick (2016) argues that Bitcoin is an appropriate instrument to complement emerging market currencies.

Thailand, a leading emerging country in Southeast Asia, is no exception to the cryptocurrency frenzy. The number of cryptocurrency trading accounts in the country increased exponentially and surpassed the growth rate of stock trading accounts in 2021 (Polkuamdee, 2021). According to the Digital 2022: Global Overview Report, approximately one in five Internet users aged 16–64 owned cryptocurrency in Thailand, which is the highest proportion worldwide (Kemp, 2022). Following the maniacal interest of domestic investors, public companies in Thailand started announcing their engagement in cryptocurrency and blockchain. The most notable case was the majority stake acquisition announcement of Siam Commercial Bank (SCB), Thailand's oldest bank, in Bitkub, the largest digital asset exchange operator in the country, in November 2021 (SCB, 2021). Inevitably, the overwhelming cryptocurrency boom also attracted fraudsters who lured ignorant

investors into cryptocurrency scams such as Ponzi schemes and fake Initial Coin Offerings (ICOs). As such, the Securities and Exchange Commission of Thailand (SEC) enacted legislation in 2018 to regulate the offering of digital assets and businesses undertaking digital asset-related activities. At the same time, it aimed to protect investors by facilitating adequate information disclosure and reducing the risks of fraud and deception.

This study contributes to the literature in three ways. First, we present empirical evidence that cryptocurrency announcements in an emerging market elicit short-term positive reactions. Recent studies on the international markets (Autore et al., 2021; Cahill et al., 2020; Cheng et al., 2019; Yen & Wang, 2021) reveal that investors react positively to the disclosures of public firms that relate to blockchain or cryptocurrency. The evidence suggests that engagement in blockchain or cryptocurrency creates value for shareholders. By contrast, S. Li et al. (2022) state that stock returns decrease after firms become involved in the blockchain business. Therefore, there are discrepancies in the literature. Further, while existing literature concentrates on the US market, this study explores the phenomenon in the context of an emerging market. Second, we demonstrate that firms' level of engagement in digital assets affects the degree of abnormal returns. In addition to a unique dataset from public firms in an emerging country, the originality of this study lies in dividing the sample into subgroups by the level of investment commitment in crypto-related businesses. A proportion of the firms announced investing directly in cryptocurrency or Bitcoin mining, while others merely accepted cryptocurrency as a means of payment. We present investors' reactions to each group of firms. Lastly, unlike the literature that analyzes the spillover effect between representative stock market indices and Bitcoin (Bouri et al., 2018; Kakinuma, 2022; Kantaphayao &

Sukcharoensin, 2021), this study examines the interconnectedness between firms announcing cryptocurrency investments and Bitcoin. Specifically, we show that firms with direct investments in cryptocurrency become more sensitive to Bitcoin price movements, indicating a volatility spillover effect from the cryptocurrency market to the stock market. Investors consider firms with a high level of cryptocurrency investment commitment as an asset class equivalent to cryptocurrency.

The remainder of this study is organized as follows. Section 2 reviews the related literature and develops the research hypotheses. Section 3 describes the data and the methodology used. Section 4 presents the results. Section 5 draws conclusions and discusses implications, research limitations, and suggestions for future work.

2. Literature Review and Hypothesis Development

2.1 Reactions to Corporate Cryptocurrency Announcements

Blockchain is arguably a revolutionary technology at a level equivalent to the Internet. Although this innovative technology has not gained full public confidence in terms of security and legal protection, early adopters have attempted to apply blockchain technology in their businesses. The literature suggests that investors' reactions to the firms' announcements related to blockchain are favorable, generating significant abnormal returns around the announcement day (Cheng et al., 2019; Yen & Wang, 2021).

Blockchain technology has potential for practical uses, such as supply chain management, data storage, or voting, and cryptocurrency is one of its most significant real-world applications (Hashemi Joo et al., 2020). Cryptocurrency is fundamentally a digital payment system backed by a decentralized distributed digital ledger. However, it is often criticized for being speculative due to its extreme volatility in price. Cheah and Fry (2015) conclude that Bitcoin has no fundamental value, and Corbet et al. (2018) argue that Bitcoin and Ethereum were in a bubble state based on data up to 2017. A few public corporations are suspected of capitalizing on the trend by adding "Bitcoin" to their names (Jain & Jain, 2019) or announcing their own ICO. One such example is Eastman Kodak, a photography company that announced the creation of KODAKCoin in 2018. After the announcement, its share quadrupled, raising concerns that it could be taking advantage of a cryptocurrency bubble for short-term gains (Corbet et al., 2020). Despite these criticisms, empirical evidence suggests there exists a price premium after cryptocurrency-related announcements (Akyildirim et al., 2020). As the adoption of cryptocurrency by firms is still considered eccentric, prior studies have focused on developed markets, where innovation usually springs. As empirical evidence from emerging markets is scarce, we posit:

H_1: Cryptocurrency-related announcements are associated with positive stock returns in emerging markets.

2.2 Announcement Categorization

As blockchain has the potential for various real-life applications, firms take different approaches to utilizing this revolutionary technology. Cheng et al. (2019) categorize blockchain announcements into two types using a content analysis of the

8-K disclosures: speculative and existing. Speculative firms announce vague future plans related to blockchain, whereas existing firms provide definite information about available blockchain services and products. Their results indicate that investors were tricked by and overreacted to the announcements made by speculative firms. Yen and Wang (2021) divide disclosures into blockchain and cryptocurrency and conclude that only blockchain disclosures are price-relevant. By contrast, Akyildirim et al. (2020) identify speculative firms' hype-and-dump price behavior after their cryptocurrency announcements. Thus, there seems to be a discrepancy in the literature. Autore et al. (2021) use a different approach and categorize announcements by investment stage. Advanced firms are currently using or will immediately use blockchain technology, whereas preliminary firms are still in the research and development stage. Their results indicate that the announcements by advanced firms are associated with higher reactions without subsequent price reversals. This study proposes that firms announcing direct investment in cryptocurrency earn a higher market reaction than those investing indirectly. Details of the classification into direct and indirect firms are discussed in Section 3.1.

H_2: Firms announcing direct investment in cryptocurrency earn higher market reactions.

2.3 Interconnection with Bitcoin

There is an inconsistency regarding the integration of cryptocurrency and stock markets in the literature. For example, Baur et al. (2018) argue that Bitcoin is not correlated with other financial assets such as stocks, bonds, and commodities. By contrast, Z. Li and Meng (2022) find a dynamic correlation between renewable energy stocks and cryptocurrencies. Additionally, Symitsi and Chalvatzis (2018) and

Kakinuma (2022) report return and volatility spillovers between equity and cryptocurrencies, suggesting that the two assets are interconnected. When a corporation announces blockchain technology and cryptocurrency involvement, investors possibly perceive them at equivalent levels. Indeed, Cahill et al. (2020) indicate that the recent Bitcoin performance significantly explains the abnormal returns of firms that have partaken in such announcements. Their results hint that firms were exploiting the frenzy when the Bitcoin price was soaring. Akyildirim et al. (2020) extend the analysis by examining correlations between cryptocurrency markets and speculative firms that changed their names to include cryptocurrency words. After speculative firms' announcements, their stock prices comoved with cryptocurrency markets and disconnected from their industry peers, indicating a stronger interaction between the speculative firms and cryptocurrency. This study speculates that the firms announcing direct investment in cryptocurrency become more interconnected with Bitcoin than those investing indirectly.

H_3: Firms announcing direct investment in cryptocurrency become more interconnected with Bitcoin.

3. Data and Methodology

3.1 Data

The announcements related to cryptocurrency include direct investments in cryptocurrency and digital tokens, Bitcoin mining, development of own digital tokens, cryptocurrency exchanges, and development of ICO platforms. Firms that announce the acceptance of cryptocurrencies as a means of payment are also included in the analysis. The sources are the Stock Exchange of Thailand, company

press releases, and local media reports. The first announcement date in the sample is January 8, 2021, and the last is February 14, 2022. To control confounding events, we excluded firms that had an earnings announcement three days before and after the cryptocurrency-related announcement. A total of 26 crypto-related announcements were manually collected. If the announcement was made after the market closed, the stock price the following day was used for calculation. Daily prices of stock, market index, Bitcoin, and market capitalization data were retrieved from the S&P Capital IQ.

The announcements are divided into two groups: direct and indirect. Firms that directly invest in crypto-related businesses are assigned to direct, while those that accept cryptocurrencies as a means of payment[1] or invest in cryptocurrency exchanges are grouped as indirect. The direct group possesses cryptocurrency and digital assets that show up on their balance sheets, whereas the indirect group does not directly own them. The division represents the level of commitment in crypto-related business. We confirmed direct firms' possession of cryptocurrency, digital assets, or investment in the related business in subsequent financial statements after the announcements. Table 1 summarizes the sample.

[1] On March 23, 2022, the SEC announced a ban on using cryptocurrency as a medium of payment for goods and services.

Table 1. Sample summary

Group	Sample Size	Announcement	Number of Firms
Direct	10	Invest in cryptocurrency/digital token	3
		Start Bitcoin mining	6
		Develop own digital token	1
Indirect	16	Accept cryptocurrency as a means of payment	8
		Invest in ICO portal/cryptocurrency exchange platform	8
Total	26		

Notes: This table shows the frequency and details of announcements. Direct firms directly invest in crypto-related businesses. Indirect firms accept cryptocurrencies as a means of payment or invest in cryptocurrency exchange platforms. Sample period: January 8, 2021, to February 14, 2022.

Daily returns are calculated as the first difference in the natural logarithms of prices. Using the market model, the following formula estimates the abnormal returns for each company:

$$AR_{i,t} = R_{i,t} - \alpha - \beta_i (R_{m,t}) \quad (1)$$

where $AR_{i,t}$ is the abnormal return for stock *i* on day *t*, $R_{i,t}$ is the actual return for stock *i* on day *t*, and $R_{m,t}$ is the market return (the SET index). β_i is estimated using pre-event window [-210, -30] for each stock *i* and the SET index. For each stock *i*, the cumulative abnormal return (CAR) for an event window $[T_1, T_2]$ is calculated as:

$$CAR_{i;\,T_1,T_2} = \sum_{t=T_1}^{T_2} AR_{i,t} \quad (2)$$

The cumulative average abnormal return (CAAR) across all stocks (*N*) is computed as:

$$\overline{CAAR}_{T_1,T_2} = \frac{\sum_{i=1}^{N} CAR_{i;\,T_1,T_2}}{N} \quad (3)$$

We calculate t-statistics for each event window to examine the significance of CAAR. The t-statistic is calculated as:

$$t_{CAR_{T1,T2}} = \frac{\overline{CAR_{T1,T2}}}{\frac{1}{\sqrt{N}}\sigma(\overline{CAR_{T1,T2}})} \quad (4)$$

$$\text{where } \sigma(\overline{CAR_{T1,T2}}) = \left(\frac{\sum_{i=1}^{N}(CAR_{i;T_1,T_2} - \overline{CAR_{T1,T2}})^2}{N-1}\right)^{1/2} \quad (5)$$

3.2 Bootstrapping Regression

The small sample size of this study poses statistical problems. MacKinlay (1997) finds that most event studies' abnormal returns are not normally distributed. To cope with this problem, Tsiotsou and Lalountas (2005) recommend a regression model using a dummy variable and bootstrap technique. Chou (2004) also argues that stock returns do not follow a normal distribution and supports a bootstrap approach to multivariate event studies. The bootstrap approach is advantageous because it does not rely on specific distributional assumptions. The dummy variable represents an event date, and the bootstrap technique responds to the non-normality problem in abnormal returns. The bootstrap approach generates more accurate inferences than the ones based on asymptotic theory (MacKinnon, 2002). This methodology is also implemented by Giroud and Mueller (2010), Kurek (2016), and Hu et al. (2023). Another major benefit of bootstrapping is that the distributions of the variable can be unknown (Tsiotsou & Lalountas, 2005). Thus, the following model is tested to identify abnormal returns:

$$R_{i,t} = \alpha + \beta_1 (R_{m,t}) + \beta_2 D\_event_t + \beta_3 D\_direct_i + \beta_4 lnsize_{i,t} + \epsilon_{i,t} \quad (6)$$

where R is a return for stock i, R_m is a market return, D_event is a dummy variable that takes 1 in the event windows and 0 otherwise, D_direct is a dummy variable that takes 1 if stock i is a Direct firm and 0 otherwise, and $lnsize$ is the log of the market cap of stock i. The testing period is 20 days before and after the

announcement day, [-20,20]. The event windows are [-1,1], [-2,2], [-10,10], and [0]. Equation (6) is iterated 1,000 times to obtain robust standard errors for parameter estimation. Significant coefficients on *D_event* represent abnormal returns for each event window.

3.3 DCC-GARCH Model

This study further analyzes volatility interdependence between the stock returns of firms that made crypto-related announcements and Bitcoin. Two separate portfolios are constructed: direct and indirect. When the firm makes an announcement related to cryptocurrency, direct and indirect stocks are included in each portfolio. The first announcements by direct and indirect firms were made on April 22, 2021, and January 8, 2021, respectively. The volatility interdependence is tested until the end of February 2022. The dynamic conditional correlation-generalized autoregressive conditional heteroskedasticity (DCC-GARCH) model of Engle (2002) estimates time-varying volatilities and the correlation between portfolios and Bitcoin. The DCC-GARCH captures a dynamic correlation between financial time series based on past volatility and is a widely used model for testing the contagion effect. We follow Akyildirim et al. (2020) to employ this model to investigate whether Bitcoin volatility influences firms associated with cryptocurrency. This model is suitable for investigating this study's H_3, the co-movements between the crypto market and firms that have made crypto-related announcements. Furthermore, we are interested in the dynamics between Bitcoin and the sample firms, as investors supposedly treat them differently after their crypto-related announcements. Cryptocurrencies are high-risk assets, and we analyze whether investors perceive their corporate utilization as a strategy with a comparable level of risk.

The DCC-GARCH model is specified as:

$$H_t = D_t R_t D_t \tag{7}$$

where H_t is the conditional variance matrix, D_t is the diagonal matrix of conditional standard deviation $\sqrt{h_{it}}$, and R_t is the diagonal matrix of time-varying correlations. Conditional variance h_{it} is estimated by the univariate GARCH (1,1) model:

$$h_{it} = \omega_i + \alpha_i \varepsilon_{i,t-1}^2 + \beta_i h_{ii,t-1} \tag{8}$$

where ω_i is the constant, α_i is short-term autoregressive conditional heteroskedasticity (ARCH effect), and β_i is long-term persistence (GARCH effect). $\omega_i, \alpha_i,$ and β_i are non-negative and $\alpha_i + \beta_i < 1$. The multivariate GARCH is specified as:

$$Q_t = (1 - \delta_1 - \delta_2)\bar{Q} + \delta_1 Q_{t-1} + \delta_2 Z_{t-1} Z'_{t-1} \tag{9}$$

where Q_t is the systematic positive definitive conditional covariance matrix and $\bar{Q}$ is the unconditional covariance of the standardized residuals (Z_t). δ_1 and δ_2 are non-negative, and $\delta_1 + \delta_2 < 1$. In DCC-GARCH (1,1), the dynamic conditional correlation matrix P_t is as follows:

$$P_t = (diag(Q_t))^{-0.5} Q_t (diag(Q_t))^{-0.5} \tag{10}$$

3.4 Impulse Response Analysis

To illustrate the additional linkage between the stock returns of firms that made crypto-related announcements and Bitcoin, we conduct impulse response analysis. Specifically, we test responses of the direct and indirect portfolios to one standard deviation of a shock by Bitcoin. The analysis captures the sign, magnitude, and persistence of responses of the stock portfolio to shock in the Bitcoin movement.

The impulse response analysis is often utilized in the event study literature focusing on the cryptocurrency market (C. Ma et al., 2022; Panagiotidis et al., 2019; Tang & Liu, 2023) as the model can analyze the dynamic effects of an event on financial variables over time. The estimation model is appropriate for this study because it can identify how rapidly shocks in the cryptocurrency market are communicated to the sample stock portfolios (Sahoo & Kumar, 2022). The impulse response functions are estimated with the following vector autoregressive (VAR) model:

$$R_t = \mu + \delta R_{t-1} + \varepsilon_t \tag{11}$$

where R_t is a pair of returns on the portfolios and Bitcoin at time *t*, δ is a 2 × 2 matrix of parameters, μ is a 2 × 1 vector of constants, and ε_t is the error term.

4. Results

4.1 Descriptive Statistics

Table 2 reports the summary statistics of the abnormal returns on the announcement day [0]. Panel A shows the average abnormal returns on the event day for the entire sample and for each investment group. The average abnormal return for the entire sample is 3.52%, which is not surprising because cryptocurrencies gained more attention during this study's sample period. Direct-investment firms generate higher abnormal returns (5.59%) than indirect-investment firms (2.23%), but their volatility is higher too. Panel B indicates that distinct differences between the two groups are based on the firm size. Direct firms are much smaller than indirect firms. The direct group's high volatility and small size characteristics are similar to those of Autore et al.'s (2021) advanced firms, defined as firms in a more advanced investment stage of blockchain technology adoption.

Innovative firms tend to be smaller (Stock et al., 2002), and small firms are more volatile.

Table 2. Abnormal returns of cryptocurrency announcements

	Mean	STDV	Min	Max	N
Panel A: Abnormal Return on the Announcement Day					
All	0.0352	0.0858	-0.0482	0.2531	26
Direct	0.0559	0.1136	-0.0482	0.2531	10
Indirect	0.0223	0.0638	-0.0210	0.2509	16
Panel B: Market Capitalization					
Direct	8,091.23	10,672.38	605.68	34,789.23	10
Indirect	125,425.11	158,107.57	3,680.15	469,326.00	16

Notes: Panel A shows the descriptive statistics of the average abnormal returns on the announcement day [0] for the entire sample and for each group. Panel B shows the market capitalization by group in million Thai Baht 30 days prior to the announcement. Direct firms directly invest in crypto-related businesses. Indirect firms accept cryptocurrencies as a means of payment or invest in cryptocurrency exchange platforms. Sample period: January 8, 2021, to February 14, 2022.

Table 3 reports the CAAR for various pre- and post-announcement windows. The first row shows the CAAR for the entire sample. The CAAR for all announcement windows are positive and highly significant: 3.79% for [-1,1], 7.59% for [-10,10], and 4.25% for [-20,20]. The pre-event window [-20,2] indicates a 1.42% CAAR with significance, suggesting information leakage and insider trading, which are common in emerging markets (Boubaker et al., 2015; Nguyen et al., 2017). A closer look reveals that these significantly positive CAARs are driven by direct firms. In the pre-announcement window [-20, -2], the CAAR of the direct group is positively significant (8.79%), while that of the indirect group is negatively significant (-3.17%). For announcement windows [-1,1], [-10,10], and [-20,20], the direct group posts positively significant abnormal returns. However, the CAAR of the indirect group is significant only in the [-1,1] window and is negatively significant (-3.15%) in a wider window [-20,20]. In the post-announcement window

[2,20], the CAAR of indirect firms is significantly negative (2.75%), indicating a post-announcement price reversal. These initial univariate test results support H_1 and H_2.

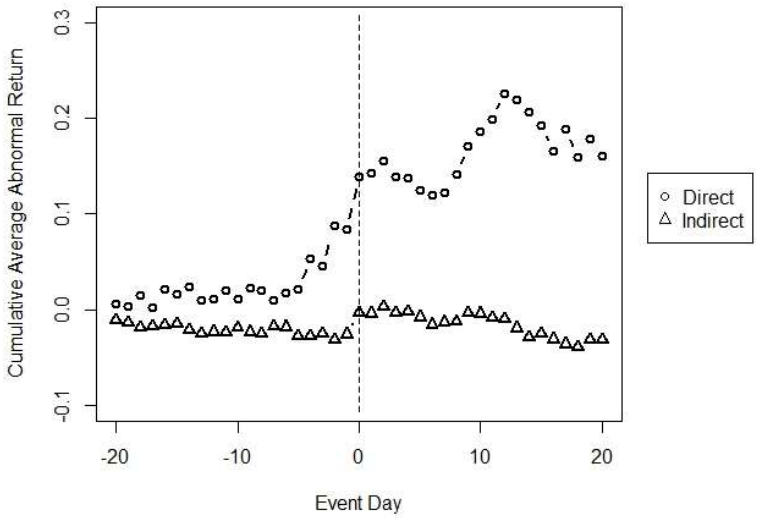
Table 3. Cumulative abnormal return

Event Window	[-20,-2]	[-1,1]	[-10,10]	[-20,20]	[2,20]
All	0.0142*	0.0379***	0.0759***	0.0425***	-0.1573
Direct	0.0879**	0.0543**	0.1651**	0.1611**	0.0188
Indirect	-0.0317***	0.0277***	0.0202	-0.0315**	-0.0275***

Notes: This table reports the average cumulative abnormal return for a pre-announcement window [-20,-2], announcement windows [-1,1]; [-10,10]; [-20,20], and post-announcement window [2, 20], for the entire sample and for each group. Direct firms directly invest in crypto-related businesses. Indirect firms accept cryptocurrencies as a means of payment or invest in cryptocurrency exchange platforms. Sample period: January 8, 2021, to February 14, 2022. *, **, *** represents statistical significance at 5%, 1%, and 0.1% level, respectively.

Figure 1 exhibits the CAAR in event window [-20,20], separated by investment group. The CAAR of direct stocks increases leading to the announcement day and goes up further until 12 days after the announcement. The rise of CAAR illustrates investors' high expectations for firms' commitment to cryptocurrency. The sharp pre-announcement increase indicates information leakage, consistent with the empirical evidence in emerging markets in Asia (J. Ma et al., 2009). After the twelfth day, the CAAR sharply drops, demonstrating the mean reversion in the post-announcement period. Contrary to direct firms, the indirect group's CAAR is flat throughout the event window. The only noticeable point for indirect firms is a slight jump on the announcement day.

Figure 1. Cumulative average abnormal return



Notes: This figure shows the cumulative average abnormal return (CAAR) in event window [-20, 20]. The sample firms are separated by investment group. Direct firms directly invest in crypto-related businesses. Indirect firms accept cryptocurrencies as a means of payment or invest in cryptocurrency exchange platforms. Sample period: January 8, 2021, to February 14, 2022.

4.2 Bootstrapped Regression

Table 4 summarizes the bootstrapped regression results. Our focus here is on the event dummy variable, which equals one in the event windows. The event dummy variables in Columns (1)-(4) are significant for all event widows, indicating significant returns by firms' crypto-related announcements. Thus, H_1 is supported. Consistent with prior studies (Autore et al., 2021; Cahill et al., 2020; Cheng et al., 2019), investors react positively to public firms' cryptocurrency adoption. The parameter of the event dummy is the largest on the announcement day (event window [0]), showing a strong favorable response from investors. The direct dummy variable is also significant for all event windows. Firms' investment commitment level in cryptocurrency affects the stock returns. The results conform to Autore et al. (2021) in that firms announcing advanced stages of blockchain adoption are associated with higher reactions. In this study, firms announcing direct investment

in cryptocurrency earn significant returns, providing support for H_2. Columns (5)–(8) in Table 3 report the significant event dummy variable regardless of the size effect. The significance of the direct dummy variable weakens after controlling for firm size, but it is still weakly significant across different event windows. Cahill et al. (2020) state that smaller firms show larger reactions to blockchain announcements. However, the results support that firm size factor does not play an important role in an emerging market (Liu et al., 2022).

Table 4. Bootstrapped regression results

	Event Window							
	(1) [-1,1]	(2) [-2,2]	(3) [-10,10]	(4) [0]	(5) [-1,1]	(6) [-2,2]	(7) [-10,10]	(8) [0]
Market	1.320***	1.316***	1.300***	1.297***	1.319***	1.313***	1.298***	1.294***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Event	0.017***	0.013**	0.006**	0.037***	0.017***	0.013***	0.006**	0.037***
	(0.006)	(0.004)	(0.018)	(0.000)	(0.000)	(0.005)	(0.025)	(0.000)
Direct	0.008***	0.008**	0.008***	0.008***	0.006*	0.006*	0.006*	0.006*
	(0.004)	(0.013)	(0.003)	(0.004)	(0.074)	(0.084)	(0.071)	(0.059)
Size (log)					-0.001	-0.001	-0.001	-0.001
					(0.474)	(0.495)	(0.516)	(0.500)
Constant	-0.001	-0.002	-0.003	-0.001	0.005	0.005	0.003	0.006
	(0.386)	(0.367)	(0.121)	(0.386)	(0.574)	(0.608)	(0.726)	(0.611)
R-square	0.067	0.066	0.061	0.074	0.068	0.066	0.062	0.075
R-square adj.	0.065	0.063	0.059	0.072	0.064	0.063	0.058	0.071
p-value for F-stat	(<0.01)***	(<0.01)***	(<0.01)***	(<0.01)***	(<0.01)***	(<0.01)***	(<0.01)***	(<0.01)***
No.of obs	1,066	1,066	1,066	1,066	1,066	1,066	1,066	1,066

Notes: The table reports the result of the following bootstrapped regression with 1,000 sample replications:

$$R_{i,t} = \alpha + \beta_1 (R_{m,t}) + \beta_2 D\_event_t + \beta_3 D\_direct_i + \beta_4 lnsize_{i,t} + \epsilon_{i,t}$$

R is a return for stock *i*, R_m is a market return, *D_event* is a dummy variable that takes 1 in the event windows and 0 otherwise, D_direct is a dummy variable that takes 1 if stock *i* is a Direct firm and 0 otherwise, and $lnsize$ is the log of the market cap of stock *i*. The testing period is 20 days before and after the announcement day, [-20,20]. *, **, *** represents statistical significance at 10%, 5%, and 1% level, respectively.

4.3 Robustness Test

4.3.1 Institutional Ownership

We conduct a robustness test to determine whether significant abnormal returns around the announcement date are influenced by an announcing firm's institutional ownership. Institutional investors utilize information more effectively and sensibly than retail investors (Cohen et al., 2002), and stocks with high institutional ownership are more efficiently priced (Boehmer & Kelley, 2009). In contrast, retail investors may not respond to announcements rationally (Welagedara et al., 2017). Thus, we investigate whether a low concentration of institutional ownership (i.e., a high concentration of retail investors) in a firm is attributable to short-term abnormal returns. We obtain the firm's institutional ownership (IO) in the last quarter before the announcement date and then group the firms in quartiles. We obtain the CAAR of the bottom (Low IO quartile) and top (High IO quartile) 25th percentile by IO. Table 5 reports the CAAR separated by IO concentration. Low IO firms generally post higher cumulative abnormal returns, but the differences between the low and high IO firms are not significant, confirming that the ownership structure does not influence the crypto-related announcement effect.

Table 5. Cumulative abnormal return by institutional ownership

Event Window	[-20, -2]	[-1, 1]	[-10, 10]	[-20, 20]	[2, 20]
Low IO	0.0915	-0.0116	0.1613	0.2066	0.1266
High IO	-0.0185	0.0020	0.1581	0.0097	0.0257
Mean Equality Test (t-stat)	0.1101	0.0137	0.1436	0.1968	0.1009
	(1.28)	(0.33)	(0.93)	(1.50)	(1.05)

Notes: This table reports the average cumulative abnormal return for a pre-announcement window [-20, -2], announcement windows [-1, 1]; [-10, 10]; [-20, 20], and post-announcement window [2, 20], for the firms in the bottom (Low IO quartile) and top (High IO quartile) 25th percentile by IO. Sample period: January 8, 2021, to February 14, 2022.

4.3.2 Cryptocurrency Market Condition

The significant announcement effect can be attributed to favorable cryptocurrency market conditions. Cahill et al. (2020) show that Bitcoin price level plays a significant role in explaining abnormal returns. In light of the significant links between investor sentiment and Bitcoin price (Koutmos, 2023; Mokni et al., 2022), we examine whether the significant announcement effect is due to the rising Bitcoin price. Thus, we include the log of the Bitcoin price as a control variable in Equation (6). Table 6 reports the results. Even after controlling for the price of Bitcoin as a proxy of the cryptocurrency market condition, both the event dummy variables and the direct dummy variables are significant across the columns. This confirms our earlier results that investors react favorably to the sample firms' crypto-related announcements, and their positive reactions are higher for firms directly investing in cryptocurrency. The parameters of Bitcoin price fail to affect the sample firms' stock returns, which aligns with Klöckner et al. (2022).

Table 6. Bootstrapped regression results with controlling cryptocurrency market condition

	Event Window							
	(1) [-1,1]	(2) [-2,2]	(3) [-10,10]	(4) [0]	(5) [-1,1]	(6) [-2,2]	(7) [-10,10]	(8) [0]
Market	1.321***	1.314***	1.300***	1.296***	1.318***	1.312***	1.298***	1.293***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Event	0.017***	0.013***	0.006**	0.037***	0.017***	0.013***	0.006**	0.037***
	(0.000)	(0.000)	(0.029)	(0.000)	(0.000)	(0.005)	(0.031)	(0.000)
Direct	0.007***	0.008***	0.008***	0.008**	0.006*	0.006*	0.006*	0.006*
	(0.007)	(0.000)	(0.006)	(0.012)	(0.089)	(0.064)	(0.076)	(0.076)
Size (log)					-0.001	-0.001	-0.001	-0.001
					(0.517)	(0.531)	(0.516)	(0.483)
BTC Price	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.001
(log)	(0.858)	(0.866)	(0.851)	(0.772)	(0.871)	(0.852)	(0.904)	(0.723)
Constant	-0.022	-0.002	-0.018	-0.024	-0.011	-0.009	-0.008	-0.013
	(0.842)	(0.367)	(0.819)	(0.770)	(0.913)	(0.889)	(0.945)	(0.785)
No.of obs	1,066	1,066	1,066	1,066	1,066	1,066	1,066	1,066

Notes: The table reports the result of the following bootstrapped regression with 1,000 sample replications:

$$R_{i,t} = \alpha + \beta_1 (R_{m,t}) + \beta_2 D\_event_t + \beta_3 D\_direct_i + \beta_4 lnsize_{i,t} + \beta_5 lnBTC\ Price_t + \epsilon_{i,t}$$

R is a return for stock *i*, R_m is a market return, *D_event* is a dummy variable that takes 1 in the event windows and 0 otherwise, D_direct is a dummy variable that takes 1 if stock *i* is a Direct firm and 0 otherwise, $lnsize$ is the log of the market cap of stock *i*, and $InBTC\ Price$ is the log of the Bitcoin price in Thai Baht. The testing period is 20 days before and after the announcement day, [-20, 20].*, **, *** represents statistical significance at 10%, 5%, and 1% level respectively.

4.3 DCC-GARCH

Table 7 reports the estimated results of the DCC-GARCH model for Bitcoin and stock portfolios. The most relevant parameters for this study are δ_1 and δ_2 which indicate the short-run and long-run persistence of shocks on the dynamic conditional correlations, respectively. The long-run volatility impacts of Bitcoin on the direct and indirect stock portfolios are 0.813347 and 0.916827, respectively, and both are significant, while the short-run shock is not significant. The stability is

confirmed because $(\delta_i + \delta_i)$ is below 1. These values suggest that the volatility transmission from Bitcoin to the stock portfolios is not immediate but is persistent in the long term. The average dynamic conditional correlation with Bitcoin shows a clear difference between the two portfolios. The direct portfolio exhibits a higher average correlation compared to the indirect portfolio (0.0702 vs 0.0115). The average correlations are small but statistically different from 0. Figure 2 illustrates the time-varying dynamic correlations with Bitcoin price. The direct portfolio correlates with Bitcoin in the range of 0.04-0.12, whereas the indirect portfolio's correlation with Bitcoin remains approximately 0.0115 with infinitesimal fluctuation. These results indicate that, after announcing investments in cryptocurrency, firms with a high level of investment commitment are more influenced by Bitcoin volatility than those with a low level of commitment. Thus, H_3 is supported. This reflects that investors partially identify the direct firms with cryptocurrency.

Table 7. DCC-GARCH results

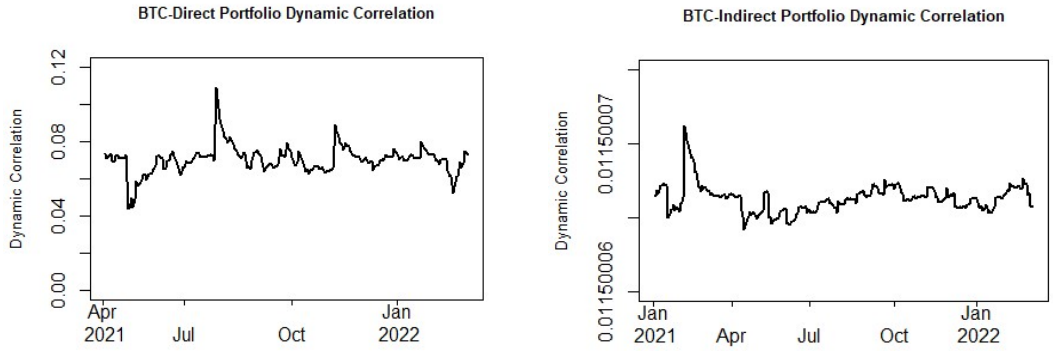
	BTC_Direct Portfolio	BTC_Indirect Portfolio
w_1	0.000000 (1.000)	0.000000 (0.999)
w_2	0.000041 (0.169)	0.000002 (0.443)
a_1	0.000002 (0.892)	0.000962*** (0.009)
a_2	0.109661 (0.121)	0.036449 (0.263)
b_1	0.998679*** (0.000)	0.997744*** (0.000)
b_2	0.834574*** (0.000)	0.947289*** (0.000)
δ_1	0.003561 (0.848)	0.000000 (0.984)
δ_2	0.813347*** (0.000)	0.916827*** (0.000)
corr	0.0702*** (0.000)	0.0115*** (0.000)

Notes: *** represents statistical significance at 1% level.

Table 7 reports the estimation results of the DCC-GARCH model. δ_1 and δ_2 represent the short-run and long-run persistence of shocks on the dynamic conditional correlations between Bitcoin and the group-sorted portfolios. *corr*

represents the average correlation in the tested period. Two separate portfolios are constructed: Direct and Indirect. When the firm makes an announcement related to cryptocurrency, both direct and indirect stocks are included in each portfolio. The first announcements by direct and indirect firms were made on April 22, 2021, and January 8, 2021, respectively. The volatility interdependence is tested until the end of February 2022.

Figure 2. Dynamic correlation with Bitcoin



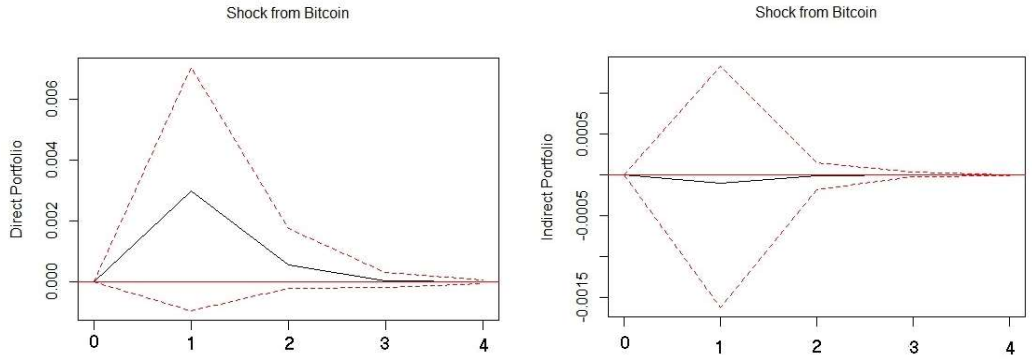
Notes: This figure displays the dynamic correlation between Bitcoin and the direct portfolio (left) and indirect portfolio (right). Direct and indirect stocks are included in each portfolio when the firm makes a cryptocurrency-related announcement. The first announcements by direct and indirect firms were made on April 22, 2021, and January 8, 2021, respectively. The volatility interdependence is tested until the end of February 2022. The y-axis scale is one-hundredth of the Bitcoin-direct portfolio dynamic correlation (left) and hundred-millionth of the Bitcoin-indirect portfolio dynamic correlation (right).

4.4 Impulse Response Analysis

The results of the impulse response analysis in Figure 3 confirm that the impact of the Bitcoin shock is larger for the direct portfolio than the indirect portfolio. After the Bitcoin impulse unit shock, the direct portfolio has a positive response on day 1, and it gradually diminishes toward day 3. Conversely, the indirect portfolio does not have a noticeable reaction. The results verify that direct firms become sensitive to the Bitcoin price movement. It also reflects investor sentiment (Ghaemi Asl et al.,

2021). The positive or negative sentiment in the cryptocurrency market can affect crypto-related stocks in the same direction.

Figure 3. Impulse response analysis



Notes: The figure displays one standard deviation shock from Bitcoin to Direct portfolio (left) and Indirect portfolio (right) with 1,000 bootstrap runs. 95% confidence bands are represented by the dashed line.

5. Conclusion

Consistent with prior international evidence, the results show that cryptocurrency announcements receive short-term positive reactions in the emerging market. Blockchain, a potentially revolutionary technology, is an underlying system for cryptocurrency, and the market favorably values public firms' cryptocurrency announcements. The results further suggest that firms directly investing in cryptocurrency have higher abnormal returns than those investing indirectly. Following cryptocurrency announcements, direct firms became more correlated with and sensitive to Bitcoin price, indicating a stronger tie with the cryptocurrency market. Inevitably, direct firms become vulnerable to the wild cryptocurrency fluctuations, raising higher risk concerns.

This study has some limitations. The sample size and study period are rather limited. As more corporations adopt blockchain and cryptocurrency in emerging markets, larger samples and longer time-series data will strengthen the validity of the announcement effect and its relationship to the cryptocurrency market. Furthermore, our sample period overlaps with the highly uncertain period caused by the COVID-19 pandemic, and Z. Z. Li et al. (2022) indicate that such uncertain times affect the correlation between Bitcoin and the stock market. The fear and uncertainty due to the pandemic might have affected our results. Future research can explore the possible motives of corporate managers for crypto announcements. Lang and Lundholm (2000) find that firms increase corporate disclosure to hype the stock before seasoned equity offerings. Crypto-related announcements could also fall into this strategy.

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