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Risk and Return of Blockchain Announcements in Chinese Stock Market – An Event Study

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Abstract

Prior research has demonstrated that blockchain announcements are associated with significant stock market reactions on the day of the announcement. However, it is unclear what factors may influence the positive market reaction at the firm level. Moreover, it is unclear whether national policies will affect positive market reactions. Using an event study methodology, we examine investors' reactions to blockchain announcements issued by Chinese listed companies, taking organizational factors and national policies into account. Results indicate that the stock market reacts positively to blockchain announcements in the IT sector on the day of the announcement. However, there are no significant differences between manufacturing companies and other companies regarding abnormal stock returns. In addition, a CIO (or CTO) and a high percentage of executives with a background in R&D will enhance the positive stock market reaction. Furthermore, we demonstrate that national policies play a significant role in influencing positive stock market reactions.

Keywords: Blockchain, Stock Market Reaction, Strategic Signal, Event Study

Introduction

Blockchain, a decentralized and distributed ledger for record-keeping, has become one of the most innovative technologies in recent years. Since Satoshi Nakamoto proposed the concept of Bitcoin in his Bitcoin white paper (Nakamoto 2008) in 2008, the technology and infrastructure behind it - blockchain - has attracted widespread attention. Over the past ten years, the development of blockchain technology has moved from "Blockchain 1.0", marked by cryptographic digital currency, and "Blockchain 2.0", marked by smart contracts, to the "Blockchain 3.0" application stage, which establishes cross-organizational mutual trust. Blockchain technology has a wide range of potential applications, including tracking goods through supply chains, maintaining digital records, and streamlining the clearing and settlement process for financial transactions (Autore et al. 2021). According to Chen et al. (2019), blockchain is one of the newest and fastest-growing financial technology innovations as well as the most valuable to the adopting companies. Overall, blockchain technology is becoming increasingly popular among countries and companies.

In China, the government and companies are enthusiastic about blockchain technology and promoting its application. First, the Chinese government recognizes the importance of blockchain technology and has

enacted policies to support it. On December 27, 2016, the State Council issued a five-year plan for China's national informatization (2016-2020) [1]. The National Informatization Plan included blockchain technology for the first time. Then, on October 24, 2019, Xi Jinping, general secretary of the Communist Party of China (CPC) Central Committee, underscored the critical role of blockchain technology in the new round of technological innovation and industrial transformation, urging more efforts to quicken development in the sector. Xi made the remarks Thursday while presiding over a group study session of the CPC Central Committee Political Bureau on the development and trend of blockchain technology[2]. Given the above national policies and guidelines, Chinese companies have responded to the call to announce the adoption of blockchain technology. According to Forbes' latest 2022 Global Blockchain 50 list[3], 14% of which are Chinese companies. For example, Ant Group has created 30 applications that have generated over 100 million blockchain tracking documents, including patents, vouchers, and warehouse receipts. Another example is Baidu, the fourth-largest tech company in China, with more than 20,000 developers developing financial applications using its open-source blockchain technology. It generated $47 million in revenue last year. The blockchain field in China is making exciting developments, primarily driven by a combination of supportive policies from the Chinese government and a positive response from Chinese companies.

However, blockchain technology has not only potential returns but also risks. On the one hand, similar to other information technology (IT) investments and innovations (Mattke et al. 2019), blockchain technology can increase a firm's value by improving its competitive position. Typically, a company's blockchain announcement signals that it values blockchain technology and actively participates in technological innovation, which may attract investors' attention and increase its stock price (Wijayana and Achjari 2020). Therefore, investors may reach a favorable evaluation of a company that indicates technological innovation by issuing a blockchain announcement. On the other hand, recent studies have shown that innovation and new technology can increase uncertainty and risk (Dewan et al. 2007; Tian and Xu 2015). As noted in Forbes' latest 2022 Global Blockchain 50 list[3], "Venture capital" is the newest trend in the blockchain space, with more than $32 billion expected to be invested in the sector. It has been shown that blockchain announcements can generate firm market value in stock markets in the US and developed countries (Cheng et al. 2019; Klöckner et al. 2022). As far as we know, few blockchain announcement studies have been conducted in China. Based on resource theory, Liu et al. (2022) confirmed that blockchain announcements caused a significant positive market reaction in the Chinese stock market. Overall, these studies indicate that blockchain announcements are positively associated with abnormal stock returns. However, Liu et al. (2022) show that firm characteristics such as firm size and firm innovation capability do not affect the stock market response to blockchain announcements. Therefore, given the exciting progress made by Chinese companies in the blockchain field, we pose the following research question: what factors may affect investors' positive reactions to the companies issuing blockchain announcements at the firm level in the Chinese stock market? Moreover, will national policies influence investors' positive responses?

Considering the above research gap, we investigate the impact of factors at the firm and national levels on the Chinese stock market reactions to blockchain announcements. First, we consider the factors at the firm level, including industry classification, the existence of a CIO (or CTO), and the ratio of executives with an R&D background. In addition, given the Chinese policies mentioned above, we also consider the role of national policies in influencing the market reaction to blockchain announcements. Using an event study approach, we explore investors' reactions to blockchain announcements in the Chinese stock market. Our sample covers announcements about blockchain technology made by A-share listed companies on the Shanghai Stock Exchange and Shenzhen Stock Exchange, collected from January 1, 2016, to June 31, 2021. A classic example of our sample announcements is that Tunghsu Azure Renewable Energy Co., Ltd. announced its investment in energy blockchain company Rongchain Technology on June 28, 2018. Additionally, Montnets Cloud Technology Group Co., Ltd. announced that its open-source blockchain platform development was completed on April 2, 2019. The results of this study show that the Chinese stock market reacts positively to blockchain announcements. Moreover, this positive reaction is particularly evident among companies in IT-related industries. Meanwhile, companies with a CIO (or CTO) or a high percentage of executives with an R&D background in the company's top management team elicit a more positive stock market reaction. Furthermore, the result demonstrates that national policies for blockchain technology enhance the stock market's positive reaction to blockchain announcements.

[1] https://english.www.gov.cn/policies/latest_releases/2016/12/27/content_281475526646686.htm
[2] https://www.chinadaily.com.cn/a/201910/25/WS5db3001ca310cf3e35573b5e.html
[3] https://www.forbes.com/sites/michaeldelcastillo/2022/02/08/forbes-blockchain-50-2022/?sh=1179dc3231c6

The study offers several important contributions to the literature on blockchain technology. First, we find that investors react positively to blockchain announcements in the Chinese stock market. Specifically, we demonstrate that our sample companies have significant average abnormal positive returns on the announcement date and two days before the announcement date. Our study provides richer evidence for the conclusion that blockchain technology initiatives can increase the short-term stock value of firms (Cheng et al. 2019; Klöckner et al. 2022; Liu et al. 2022). Second, as prior literature suggests that firm characteristics, including firm size and innovation capability, do not affect stock market reactions to blockchain announcements (Klöckner et al. 2022; Liu et al. 2022), we explore what factors at the firm level may affect the stock market reactions. The findings suggest that investors positively evaluate blockchain announcements issued by IT-related industry companies, while they are less positive for manufacturing companies, possibly anticipating additional challenges. Further, we find that companies with a CIO (CTO) or a high percentage of executives with an R&D background have a stronger positive response in the stock market. Our findings add to the information systems and operations management literature on IT initiatives (e.g., Bose and Leung 2019; Boyd et al. 2019; Hendricks et al. 2007) about the value of blockchain initiatives and the influencing factors of firm characteristics. Third, we examine how national policies affect stock market reactions to blockchain announcements, demonstrating that supportive national guidelines for blockchain technology enhance positive stock market reactions to blockchain announcements. The findings of our study also have practical implications. We show under which conditions organizations can send stronger positive signals to the stock market.

The rest of the paper is organized as follows. In the next section, we describe the theoretical background of this study and develop our hypotheses. Then, we present our data set and research methodology. Subsequently, we show the results of our analysis and then discuss them and the theoretical contributions and practice implications. Finally, we identify the limitations of our study and point out future research directions.

Theoretical Background

We explore the impact of blockchain announcements on company stock prices from the signaling theory perspective. Michael Spence first proposed the signaling theory to solve the information asymmetry problem in the labor market (Connelly et al. 2011). The theory has been applied to other fields, such as marketing management, human resource management, and information system. The signaling theory applied to the stock market means that corporate insiders (e.g., executives or managers) act as information transmitters, issuing signals to transmit information in a situation of information asymmetry, and the party lacking information (e.g., stockholders) can predict and thus react positively or negatively based on the signals. Organizations often rely on strategic signals - implicit or explicit statements of organizational motivations, goals, and current actions - to influence stakeholder perceptions and behaviors. The efficient market hypothesis assumes that the stock market reacts to new information in a timely and rational manner so that the stock price will adjust quickly to new information and be a reasonable estimate of its intrinsic value (Fama 1995).

Previous research in IS field has concentrated mainly on the impact of IT investments on firms' market value (e.g., Dehning et al. 2003; Dos Santos et al. 1993). For example, Dehning et al. (2003) investigated the value effect of the stock market by considering the strategic role of IT investments. Overall, research has demonstrated that IT investments positively impact a firm's market value (Bharadwaj et al. 1999) and that the market responds positively to announcements of IT investments (Dos Santos et al. 1993).

Besides investments, related literature has also examined the value relevance of other strategic signals firms send to stakeholders through the announcement of initiatives, such as green supply chain management initiatives (Bose and Pal 2012). Further, existing literature in IS suggests that companies can signal anticipated actions by announcing a new technology initiative, such as e-commerce (Dewan and Ren 2007). Considering blockchain technology (one of the most innovative technologies in recent years), Cheng et al. (2019) examine the US stock market and find that investors tend to overreact to companies' initial blockchain disclosures. Furthermore, Klöckner et al. (2022) estimate the impact of blockchain initiatives on the firm's market value and find that blockchain announcements are associated with a significant average abnormal return of 0.30% on announcement day by an international event study. Moreover, Liu et al. (2022) demonstrate that blockchain announcements elicit a significantly positive market reaction on the release day in the Chinese stock market.

Research Hypotheses

Blockchain Announcements and Stock Market Reaction

In recent years, blockchain, a highly disruptive emerging digital technology, the need to integrate and leverage this new technology has attracted the attention of companies from various industries in China. Blockchain technology, also known as distributed ledger technology, is jointly maintained by multiple parties and uses cryptographic algorithms to secure data transmission and access, achieving consistent storage, transparency, trustworthiness, and tamper-proof data traceability. Based on core technologies such as cryptography, consensus algorithms, P2P networks, and smart contracts, blockchain provides a trust-building mechanism for information and value transfer exchange in an untrustworthy environment.

According to signal theory, companies announcing blockchain announcements send stakeholders a strategic signal about adopting blockchain technology. Blockchain technology effectively reduces intermediaries, streamlines processes, improves efficiency, and reduces costs but also improves supply chain traceability, enhances data and knowledge sharing, secures and expedites payments between organizations, and automates order processing. However, companies face uncertainties in adopting blockchain technology, and it is complex and challenging to integrate and leverage the technology to improve existing business or create new business. In addition, the development and adoption of blockchain technology are associated with costs, including resources and personnel. Therefore, only those companies that value the benefits of blockchain technology over the costs of developing it will make strategic decisions and signal their strategies accordingly. Overall, companies that make blockchain announcements send a strategic signal of aggressive adoption of the new technology. Therefore, we assume that investors will value blockchain announcements:

Hypothesis 1 (H1)*: Blockchain announcements are positively associated with abnormal stock returns.*

Factors at the Firm Level Influencing the Stock Market Reaction

Several studies have examined different factors that influence the impact of information technology on the performance of finance companies (Bose and Leung 2019; Ranganathan and Brown 2006). These factors can be both internal and external to the focal firm. According to Melville et al. (2004), internal factors relate to the characteristics of the focal firm, while external factors relate to industry and country factors. As the application of blockchain technology expands to various industries, we first focus on industry factors. Specifically, we discuss whether the industry classification of listed companies announcing blockchain announcements affects stock market reactions. Second, we incorporate corporate governance structures and discuss the impact of the existence of a CIO (or CTO) and the proportion of executives with an R&D background in the announcing firm. Third, we further explore the role of national policy factors.

From encrypted digital currencies to optimized financial markets, blockchain applications have gradually reconstructed many traditional applications, such as supply chains, the Internet of Things, and data management. As a result, the application area of blockchain has expanded to various industries. Considering the industry factors, we focus on the IT and manufacturing industries. With the development and application of advanced technologies such as the Industrial Internet of Things, Blockchain, and Artificial Intelligence, more manufacturing enterprises are transforming into intelligent enterprises (Qu et al. 2019). According to Song and Zhu (2021), blockchain technology can assist smart manufacturing systems (SMSs) overcome difficulties due to its features such as decentralization, traceability, trackability, disintermediation, and auditability. Overall, investors may value manufacturing firms that announce blockchain announcements more positively.

At the same time, data privacy has received considerable attention in recent years since big data has become the main driving force of the next-generation IT industry. With this, blockchain technology, based on privacy and security features, will naturally receive much attention from the IT industry. Therefore, we believe the stock market reaction to IT companies announcing blockchain announcements is positive. We therefore hypothesize:

Hypothesis 2a (H2a)*: Abnormal stock returns of blockchain announcements are positively associated with the manufacturing industry classification.*

***Hypothesis 2b (H2b)**: Abnormal stock returns of blockchain announcements are positively associated with the IT industry classification.*

Considering the firm's governance structure, the strategic importance of a firm's IT capabilities is prompting many companies to effectively appoint chief information officers (CIOs) to manage these assets (Chatterjee et al. 2001). Besides, the significant role of technology in strategic business activities and new-product development has driven companies to create a Chief Technology Officer (CTO) position to lead and direct technology development activities. CTOs' role effectively promotes innovation and financial improvements (Hartley 2011). So, stock markets might interpret the existence of a CIO (or CTO) as a positive signal. Hence, we hypothesize:

***Hypothesis 3 (H3)**: Abnormal stock returns of blockchain announcements are positively associated with the existence of a CIO (or CTO) in the announcing firm.*

Blockchain technology is a complex and emerging technology, and the associated R&D is related to the innovation capacity of firms. Previous research has found that TMT characteristics affect the innovation capability of firms directly or through the intensity of their R&D investment (Yuan et al. 2014). Moreover, the top managers' previous functional experiences with R&D have a positive effect on the firm's explorative innovation activities (Lee et al. 2017). On this basis, we believe that TMT with a high proportion of R&D backgrounds value the benefits of blockchain technology more and are more inclined to adopt blockchain technology to improve existing businesses or create new ones. Therefore, we believe that TMT, with a high proportion of an R&D background, might send a positive signal to the stock market when the firm announces blockchain announcements. Therefore, we hypothesize:

***Hypothesis 4 (H4)**: Abnormal stock returns of blockchain announcements are positively associated with a high proportion of executives with an R&D background in the announcing firm.*

National Policies Influencing the Stock Market Reaction

The Chinese government influences Chinese companies' business operations and innovation practices in various ways, so companies need to consider the government an essential external agent and its potential influence. First, the government is vital in determining China's institutional environment, which can significantly influence firms' innovation activities (Ma et al. 2015). Second, support from the government plays a vital role in the allocation of innovation resources. The government provides funding, tax subsidies, and other support to enterprises, which reduces their R&D costs. Third, maintaining good relations with the government aids the company's political legitimacy. In the Chinese context, political legitimacy helps companies to enhance their positive image and bring some indirect support to them. At the same time, companies that maintain good relations with the government can grasp government policy developments more promptly and accurately and adjust their corporate innovation activities to take maximum advantage of the policy benefits or opportunities offered by the government. Therefore, we hypothesize:

***Hypothesis 5**: Abnormal stock returns of blockchain announcements are positively associated with supportive national policies for blockchain technology.*

Research Methodology

According to the extant literature, we employed an event study to investigate the stock market to blockchain announcements (Brown and Warner 1985; Klöckner et al. 2022; Liu et al. 2022). This methodology has been widely used in IS literature, such as in transformational IT investments (Dehning et al. 2003; Dos Santos et al. 1993). In this study, we conduct the event study in six steps: collecting the sample of announcements, screening announcements, retrieving stock returns data, choosing the appropriate time window, calculating the abnormal returns, and conducting subsampling analyses (Drechsler et al. 2019).

Data

We collect our sample announcements using "blockchain" as the keyword to search the announcements published on the website of the Shanghai Stock Exchange and the Shenzhen Stock Exchange. We covered the period from January 1, 2016, to June 31, 2021, because the State Council issued a five-year plan on China's national informatization (2016-2020) on December 27, 2016. According to the plan, blockchain

was included as a strategic technology for the first time. Since then, the Chinese government began to promote the development of blockchain technology and its applications, and companies have paid more attention to it. We initially acquired 1088 announcements.

We screened the announcements and excluded the irrelevant announcements (e.g., announcements mentioning blockchain technology but not reporting on their adoption). Moreover, we filtered the periodic reports, including annual and quarterly reports, to focus on blockchain announcements. Following the above steps, the research sample contains 164 blockchain announcements from 142 companies.

Next, we matched all remaining announcements with stock returns data. We download the daily price and trading data of all A-share stocks from the database of China Stock Market and Accounting Research (CSMAR) from January 1, 2016, to December 31, 2021. In this step, we filtered out the firms with no stock price data or that were not continuously listed over the estimation and event period (Drechsler et al. 2019). Our final sample contained 160 blockchain announcements.

Estimation Method

The basic idea of the event study approach is to compare the actual stock market returns caused by an event with the estimated stock market expected stock returns in a hypothetical scenario where no event occurs. Firstly, we identify the event date as day 0. If an announcement is announced on a non-trading day, the first trading day after that is regarded as day 0. Following existing literature, we use the market model to estimate daily common stock returns (Brown and Warner 1985). The model is expressed as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \tag{1}$$

R_{it} is the individual stock return considering cash dividend reinvestment of stock i on trading day t, and R_{mt} is the daily market return on trading day t, which is equal to the daily market return considering cash dividend reinvestment (equal-weighted average method). α_i is the intercept, β_i is the slope, and ε_{it} is the error term. Consistent with existing literature, we use an estimation window of 255 trading days between day – 300 and day -45 before the event day (Chatterjee et al. 2001; Drechsler et al. 2019; Sabherwal and Sabherwal 2005). Then, we use the ordinary least squares method to estimate the coefficients ($\hat{\alpha}_i$ and $\hat{\beta}$) and calculate the abnormal return (AR), which expresses the difference between the actual stock returns and the expected returns, by the following equation:

$$AR_{it} = R_{it} - \left(\hat{\alpha}_i + \hat{\beta}_i R_{mt}\right) \tag{2}$$

Referring to the existing literature, we concentrate on the ARs for a short period between day -2 to day 2 (Drechsler et al. 2019; Liu et al. 2022; Modi et al. 2015). We then calculate the average abnormal returns for all companies using the following formula to measure the impact of the event on the company on a single day:

$$AAR_t = \frac{1}{n}\sum_{i=1}^{n} AR_{it} \tag{3}$$

Next, we calculate the cumulative abnormal return (CAR) during the event window $[t_1,\ t_2]$ using the following formula to measure the impact of the event on the company over the event window:

$$CAR_{[t_1,t_2]} = \sum_{t=t_1}^{t_2} AAR_t \tag{4}$$

Referring to the existing literature, we use both a parametric (the t-test and the Patell Test) and non-parametric test (Generalized Sign Test) to evaluate the statistical significance of investors' reactions (Bose and Leung 2019; Chatterjee et al. 2001; Drechsler et al. 2019).

Subsampling Analysis

Referring to previous event studies in IS research, we conduct subsampling to test our hypothesis (Drechsler et al. 2019; Im et al. 2001). In each analysis, we split our sample into groups and then evaluated

whether the abnormal returns on the stock market were significantly different from zero for both groups. In doing so, we relied on several additional measures discussed in more detail in the following.

Industry. Among our sample companies, 67 companies belong to the manufacturing industry, accounting for 47.18%, and 36 companies belong to the information transmission, software, and information technology service industry, accounting for 25.35%. Thus, we categorize the companies into three groups: manufacturing, IT, and other industries.

Existence of CIO (or CTO). In order to assess the existence of a CIO (or CTO) in the company, we consider a company to have a CIO (or CTO) if the company listed the above position before the event day in annual reports.

The percentage of Executives with an R&D background. Background information of executives is obtained from the database of China Stock Market and Accounting Research (CSMAR). We calculated the ratio of executives with an R&D background and used the median to classify the sample into two groups. Thus, the ratio larger than the median was assigned 1; otherwise, it was assigned 0.

Results

Descriptive Statistics

Our sample, with a total of 160 announcements, includes 138 single and 22 multiple announcements. The first blockchain announcement in our sample occurred in 2016. As shown in Figure 1, the number of the first event increased substantially from 2016 to 2018, while the number has decreased since 2018. Further, the number of multiple announcements increased gradually from 2019 to 2020. To ensure the consistency of our estimations, we only include the first event of multiple announcements of the same firm at first.

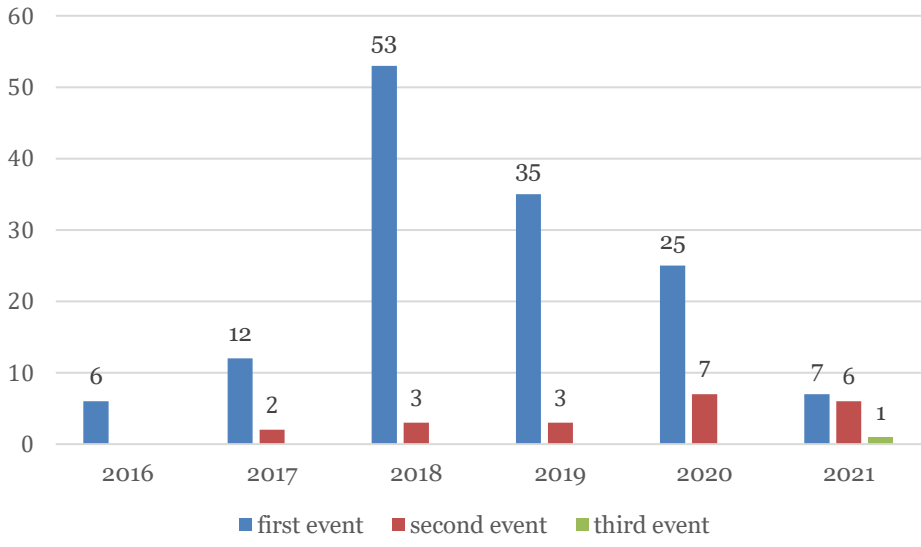

Figure 1. Distribution of blockchain announcements across time

Investors' Reaction to blockchain announcement

Table 1 presents the average abnormal return (AAR) for all firms in our sample on different event days. Moreover, we report the number of the t-test and the Patell and Generalized Sign Test. We find a significant positive mean abnormal stock return of 0.42% ($t = 1.93$, $p < 0.01$; Patell Test: p-value < 0.01; Generalized Sign Test: p-value < 0.10) on the announcement date (day 0) in our sample. Moreover, we also see significant positive mean abnormal stock returns on day -2 and day -1.

Event Day	Obs.	Mean	T-Test Value	Patell Test Value	Generalized Sign Test Value
-2	138	0.68%	3.13***	4.00***	1.75*
-1	138	0.47%	2.12**	3.52***	1.92*
0	138	0.42%	1.93***	14.66***	1.75*
1	138	-0.42%	-1.92*	9.71***	-1.16
2	138	-0.29%	-1.35	2.13**	-0.14
*, **, *** statistically significant at the 0.10, 0.05, and 0.01 levels.					
Table 1. Average abnormal stock return					

Table 2 depicts the cumulative abnormal stock return for different configurations of the event window and reports the corresponding score of the parametric and non-parametric tests. We find a positive effect of blockchain announcements on cumulative abnormal stock return in all event windows except the event window [0;2]. The effect is also statistically significant when considering the event window [-2; 0] and the event window [-1; 0].

Hypothesis 1 suggests that blockchain announcements lead to a positive stock market reaction. Overall, our results in Tables 1 and 2 support this first hypothesis. We find the expected positive effect for abnormal and cumulative stock returns on day 0. Moreover, the effect is also positive and statistically significant in the event windows [-2;2] and [-1;1]. Thus, H1 is supported.

Event Window	Obs.	Mean	T-Test Value	Patell Test Value	Generalized Sign Test Value
[-2;2]	138	0.86%	1.72*	20.76***	0.04
[-2;0]	138	1.57%	4.08***	14.95***	1.75*
[-1;1]	138	0.47%	1.22	19.49***	2.26**
[-1;0]	138	0.89%	2.83***	13.88***	2.43**
[0;1]	138	0.00%	0.01	21.53***	0.04
[0;2]	138	-0.29%	-0.75	22.76***	-0.48
*, **, *** statistically significant at the 0.10, 0.05, and 0.01 levels.					
Table 2. Cumulative abnormal stock return					

Effects of Firm-level Factors on Investors' Reactions

Hypothesis 2 argues that abnormal stock returns of blockchain announcements are positively associated with the manufacturing industry and IT industry classification. Panel A in Table 3 depicts the results of our subsampling analysis concerning the industry. Although the number of firms in the manufacturing industry is most in our sample, we observe that investors tend to show the same positive reaction to firms announcing the adoption of blockchain technology in the manufacturing industry and other industries on event day 0. Furthermore, we can observe significant and negative cumulative abnormal returns in the event window [-2;2] and [-1;1]. Therefore, H2a is not supported.

In contrast, blockchain announcements in the Information transmission, software, and information technology service industry are accompanied by a stronger positive reaction from the stock market. On the event day -2, we observe a sizeable effect of 2.08% that is statistically significant according to both the parametric and non-parametric test (t-test: p-value < 0.01; Pattel Test: p-value < 0.01; Generalized Sign Test: p-value < 0.05). What's more, we also observe a sizeable effect of 4.36 % which is also statistically significant for the overall event window [-2;0]. Therefore, H2b is supported.

Event Day / Window	-2	-1	0	1	2	[-2;2]	[-1;1]	[-2;0]	[-1;0]	[0;1]	[0;2]
Panel A											
Manufacturing industry											
Obs.	65	65	65	65	65	65	65	65	65	65	65
Mean	0.40%	-0.14%	0.32%	-0.70%	-0.65%	-0.78%	-0.53%	0.58%	0.18%	-0.39%	-1.04%

T-Test Value	1.21	-0.43	0.96	-2.13**	-1.97**	-1.02	-0.90	0.98	0.37	-0.81	-1.77*
Patell Test Value	1.82*	0.91	17.49***	14.04***	2.82***	20.84***	21.38***	12.56***	13.28***	27.41***	29.04***
Generalized Sign Test Value	0.44	-0.06	0.93	-1.56	-0.06	-2.06**	0.19	-0.06	0.44	-1.06	-0.31
IT industry											
Obs.	35	35	35	35	35	35	35	35	35	35	35
Mean	2.08%	1.53%	0.75%	-0.66%	-0.34%	3.36%	1.62%	4.36%	2.28%	0.09%	-0.25%
T-Test Value	5.13***	3.77***	1.82*	-1.64	-0.83	3.64***	2.27**	6.09***	3.91***	0.15	-0.35
Patell Test Value	5.70***	4.33***	2.71***	-1.44	-0.89	9.21***	5.42***	10.32***	6.25***	1.69*	1.18
Generalized Sign Test Value	2.57**	1.89**	0.87	-0.84	-0.49	1.89*	2.57**	1.89*	2.23**	-0.15	-1.52
Other industries											
Obs.	38	38	38	38	38	38	38	38	38	38	38
Mean	-0.12%	0.52%	0.31%	0.29%	0.35%	1.35%	1.11%	0.71%	0.83%	0.59%	0.95%
T-Test Value	-0.28	1.24	0.74	0.69	0.85	1.41	1.50	0.96	1.37	0.98	1.28
Patell Test Value	-0.22	1.35	2.46**	1.53	1.22	3.47***	3.97***	2.16**	3.09***	3.55***	4.25***
Generalized Sign Test Value	0.30	1.93	1.27	0.62	0.30	0.95	1.60	1.60	1.93	1.60	0.95
*, **, *** statistically significant at the 0.10, 0.05, and 0.01 levels.											

Table 3. Subsampling analysis

Hypothesis 3 indicates that abnormal stock returns of blockchain announcements are positively associated with the existence of a CIO (or CTO) in the announcing firm. Panel B in Table 3 depicts our analysis of two subsamples containing firms with and without a CIO (or CTO). On event day 0, we can observe a significant sizeable abnormal return of 2.06% in firms with a CIO (or CTO), which is higher than the firms without a CIO (or CTO) (AAR=0.22%). What's more, the overall effect measured by the cumulative stock return is 2.22% and significant in both the parametric and non-parametric test over the event window [-1;1], which is higher than the stock return (CAR=0.26%) of firms without a CIO (or CTO). Overall, H3 is supported.

Event Day/ Window	Obs.	Mean	T-Test Value	Patell Test Value	GST Value	Obs.	Mean	T-Test Value	Patell Test Value	GST Value
Panel B	**Existence of a CIO (or CTO)**					**No existence of a CIO (or CTO)**				
-2	15	-0.43%	-0.44	-0.66	0.11	123	0.82%	3.82***	4.47***	1.81*
-1	15	0.48%	0.49	1.57	0.63	123	0.46%	2.15**	3.18***	1.81*
0	15	2.06%	2.10**	3.75***	2.70***	123	0.22%	1.04	14.22***	0.91
1	15	-0.32%	-0.33	-0.40	-0.41	123	-0.43%	-2.02**	10.43**	-1.09
2	15	-0.35%	-0.36	-0.88	-0.41	123	-0.29%	-1.35	2.56**	0.00
[-2;2]	15	1.44%	0.63	2.02**	0.63	123	0.79%	1.60	21.29***	-0.18
[-1;1]	15	2.22%	1.27	2.61***	1.14	123	0.26%	0.67	19.25***	1.63
[-2;0]	15	2.10%	1.20	3.99***	2.18**	123	1.51%	3.97***	14.92***	1.45
[-1;0]	15	2.54%	1.78*	4.22***	1.66*	123	0.69%	2.22**	13.23***	1.99**
[0;1]	15	1.74%	1.22	3.47***	1.14	123	-0.21%	-0.67	21.59***	-0.36
[0;2]	15	1.39%	0.79	2.96***	-0.41	123	-0.49%	-1.30	23.07***	-0.36
Panel C: The percentage of Executives with an R&D background										

	high					low				
-2	69	1.40%	4.71***	5.85***	2.01**	69	-0.03%	-0.11	-0.19	0.46
-1	69	0.92%	3.08***	4.97***	2.01**	69	0.01%	0.04	0.01	0.70
0	69	0.83%	2.79***	19.49***	1.28	69	0.02%	0.06	1.26	1.18
1	69	-0.84%	-2.83***	13.73***	-1.87*	69	0.00%	0.00	0.01	0.22
2	69	-0.56%	-1.89*	2.88***	-0.42	69	-0.03%	-0.08	0.13	0.22
[-2;2]	69	1.74%	2.57**	28.77***	0.07	69	-0.03%	-0.03	0.61	-0.02
[-1;1]	69	0.90%	1.72*	26.67***	1.76*	69	0.03%	0.06	0.90	1.43
[-2;0]	69	3.14%	5.99***	20.62***	2.01**	69	0.00%	0.00	0.54	0.46
[-1;0]	69	1.75%	4.08***	18.75***	2.73***	69	0.03%	0.07	0.90	0.70
[0;1]	69	-0.01%	-0.03	29.20***	-0.66	69	0.02%	0.04	1.27	0.70
[0;2]	69	-0.57%	-1.10	30.86***	-0.90	69	-0.01%	-0.01	1.34	0.22

*, **, *** statistically significant at the 0.10, 0.05, and 0.01 levels.
GST = Generalized Sign Test

Table 3. Subsampling analysis

Hypothesis 4 suggests that abnormal stock returns of blockchain announcements are positively associated with a high proportion of executives with an R&D background in the announcing firm. The subsample analysis concerning this hypothesis is depicted in Panel C in Table 3. We find that investors show no reaction to blockchain announcements when the firm has a low ratio of executives with an R&D background. Thus, abnormal stock returns are close to zero. The overall effect measured by the cumulative stock return is close to zero and insignificant in both the parametric and non-parametric tests. In contrast, the stock market reaction to blockchain announcements is positive and considerable in size when the firm has a high ratio of executives with an R&D background. Abnormal returns on the two days before event day 0 are 1.40% (significant) and 0.92% (significant), and the abnormal return on event day 0 is also significantly positive (AAR=0.83%). This results in significant cumulative abnormal returns in different event windows [-2;2] and [-1;1]. Overall, H4 is supported.

Effects of National Policy on Investors' Reactions

Hypothesis 5 indicates that abnormal stock returns of blockchain announcements are positively associated with the supportive national policy for blockchain technology. In this analysis, we identify the difference in the event day of announcing the adoption of blockchain technology in our observation period. As we mentioned above, on October 24, 2019, Xi Jinping, general secretary of the Communist Party of China (CPC) Central Committee, underscored the critical role of blockchain technology in the new round of technological innovation and industrial transformation, urging more efforts to quicken development in the sector when presiding over a group study session of the CPC Central Committee Political Bureau on the development and trend of blockchain technology. Thus, we choose that day as the separation point to split our sample into two groups. Table 4 depicts the subsampling analysis. The analysis illustrates that positive stock market reactions are more obvious for later announcements. We can identify significantly higher abnormal returns from the event day -2 to day 0 and cumulative abnormal returns over different event windows (both [-2;2] and [-1;1]). Overall, we can conclude that the national policy had an impact on the investor's positive reaction to the blockchain announcement, and investors reacted more strongly after this event.

Event Day / Window	Obs.	Mean	T-Test Value	Patell Test Value	GST Value	Obs.	Mean	T-Test Value	Patell Test Value	GST Value
	Time period: 20161.1-2019.10.24					Time period: 2019.10.25-2021.6.31				
-2	91	0.46%	1.79*	2.77***	0.97	47	1.11%	2.74***	3.00***	1.62
-1	91	0.38%	1.49	2.23**	2.02**	47	0.62%	1.54	2.92***	0.45
0	91	0.11%	0.43	1.44	0.97	47	1.03%	2.53**	23.12***	1.62

1	91	-0.21%	-0.82	-0.95	-1.35	47	-0.83%	-2.04**	17.98***	-0.14
2	91	-0.14%	-0.56	-0.55	0.76	47	-0.59%	-1.45	4.42***	-1.32
[-2;2]	91	0.60%	1.02	4.46***	-0.92	47	1.35%	1.45	29.38***	1.33
[-1;1]	91	0.29%	0.63	2.70**	1.39	47	0.83%	1.15	29.65***	1.92*
[-2;0]	91	0.95%	2.09**	5.18***	0.55	47	2.77%	3.86***	18.41***	2.21**
[-1;0]	91	0.49%	1.33	3.25***	1.18	47	1.65%	2.83***	19.27***	2.51**
[0;1]	91	-0.10%	-0.26	0.77	-0.71	47	0.20%	0.34	35.83***	1.04
[0;2]	91	-0.24%	-0.53	0.45	-1.15	47	-0.39%	-0.54	38.38***	0.15

*, **, *** statistically significant at the 0.10, 0.05, and 0.01 levels.
GST = Generalized Sign Test

Table 4. Effects of National Policy on Investors' Reactions

Robustness Checks

In order to ensure the robustness and generalizability of our results, we conducted several additional robustness tests. First, we conducted a complementary analysis to explore the differences in average and cumulative abnormal stock returns between our sample's single announcements and multiple announcements. Table 5 depicts the subsampling analyses. The analysis illustrates that positive stock market reactions are more evident for multiple announcements. We can identify significantly higher abnormal returns from the event day -2 to day 0 and cumulative abnormal returns over different event windows (both [-2;2] and [-1;1]). Therefore, we can conclude that multiple blockchain announcements issued by companies enhance the investor's positive reaction.

Event Day / Window	Obs.	Mean	T-Test Value	Patell Test Value	GST Value	Obs.	Mean	T-Test Value	Patell Test Value	GST Value
	Single Announcement					Multiple Announcements				
-2	138	0.68%	3.13***	4.00***	1.75*	22	2.34%	4.36***	4.02***	1.05
-1	138	0.47%	2.12**	3.52***	1.92*	22	0.90%	1.68*	1.65*	0.19
0	138	0.42%	1.93***	14.66***	1.75*	22	1.07%	2.00**	2.06**	1.05
1	138	-0.42%	-1.92*	9.71***	-1.16	22	-1.35%	-2.52**	-2.79***	-0.67
2	138	-0.29%	-1.35	2.13**	-0.14	22	-1.20%	-2.24**	-2.44**	-2.39**
[-2;2]	138	0.86%	1.72*	20.76***	0.04	22	1.76%	1.43	3.88***	0.19
[-1;1]	138	0.47%	1.22	19.49***	2.26**	22	0.62%	0.65	1.49	0.62
[-2;0]	138	1.57%	4.08***	14.95***	1.75*	22	4.31%	4.54***	6.37***	1.05
[-1;0]	138	0.89%	2.83***	13.88***	2.43**	22	1.98%	2.54**	3.10***	1.05
[0;1]	138	0.00%	0.01	21.53***	0.04	22	-0.28%	-0.36	0.08	0.62
[0;2]	138	-0.29%	-0.75	22.76***	-0.48	22	-1.48%	-1.56	-1.33	-1.10

*, **, *** statistically significant at the 0.10, 0.05, and 0.01 levels.
GST = Generalized Sign Test

Table 5. The Multiple Effects of Blockchain Announcements

Additionally, we conducted a sub-sample analysis to examine the effect of national regulatory policy. After China's central bank ordered a complete halt on Initial Coin Offerings (ICOs) on September 4, 2019, Chinese regulators took steps to shut down the country's cryptocurrency exchanges and ban digital cryptocurrency trading from reining in financial risks[4]. Given this unique policy in China, we chose

[4] http://europe.chinadaily.com.cn/business/2017-09/19/content_32206127.htm

September 4, 2019, as the separation point and divided our sample into two groups. Table 6 depicts the subsampling analysis. The analysis illustrates that positive stock market reactions are more obvious for announcements announced after September 4, 2019. We can identify a significant cumulative abnormal stock return for the time-period 2017-2021 in the event window [-2;2] and [-1;1], while the stock market reaction for the time-period 2016-2017 is negative (not significant). Thus, our analysis shows that the national regulatory policy also positively impacted the investor's reaction to the blockchain announcement. Chinese regulators' ban on cryptocurrency exchanges is a timely response to the risks of tech finance but not a repudiation of blockchain technology innovation. Such regulatory policies distinguish blockchain from cryptocurrencies, allowing for a more regulated and professional development of blockchain. In general, supportive and regulatory national policies for blockchain technology have enhanced the stock market's positive reaction to blockchain announcements.

Event Day / Window	Obs.	Mean	T-Test Value	Patell Test Value	GST Value	Obs.	Mean	T-Test Value	Patell Test Value	GST Value
	Time period: 20161.1-2017.9.4					**Time period: 2017.9.5-2021.6.31**				
-2	14	0.32%	0.43	0.83	0.96	124	0.72%	3.16***	3.94***	1.52
-1	14	0.39%	0.54	0.95	1.50	124	0.47%	2.06**	3.39***	1.52
0	14	-0.44%	-0.61	-1.02	0.42	124	0.52%	2.27**	15.82***	1.70*
1	14	-0.21%	-0.30	-0.36	-0.65	124	-0.44%	-1.94*	10.38***	-1.00
2	14	0.39%	0.54	0.48	2.04**	124	-0.37%	-1.63	2.09**	0.82
[-2;2]	14	0.44%	0.26	0.95	0.42	124	0.90%	1.73*	21.59***	-0.10
[-1;1]	14	-0.26%	-0.20	0.01	0.42	124	1.72%	4.26***	15.47***	1.89*
[-2;0]	14	0.27%	0.20	0.91	-0.12	124	0.55%	1.37	20.57***	2.25**
[-1;0]	14	-0.05%	-0.05	0.22	0.42	124	1.00%	3.02***	14.58***	2.43
[0;1]	14	-0.66%	-0.61	-1.28	-0.65	124	0.08%	0.24	23.15***	0.26
[0;2]	14	-0.27%	-0.20	-1.00	-0.12	124	-0.29%	-0.73	24.36***	-0.46

*, **, *** statistically significant at the 0.10, 0.05, and 0.01 levels.
GST = Generalized Sign Test

Table 6. Effects of National Regulatory Policy on Investors' Reactions

Discussion

Our study examines the value relevance of firms releasing blockchain announcements and identifies the conditions that lead stock investors to react positively to blockchain announcements. Previously, literature has examined the U.S. stock market and developed markets and found that blockchain announcements can generate firm value (Cheng et al. 2019; Klöckner et al. 2022). Liu et al. (2022) studied the Chinese stock market based on resource-based theory and found that blockchain announcements elicit a significant positive market reaction on the release date. Similarly, we find that companies have significant average abnormal positive returns on the announcement date as well as on the two days before the announcement date in the Chinese stock market. Furthermore, we explore the effects of firm-level factors and national policies on the stock market's reactions. In this section, we discuss these findings.

First, our analysis suggests that abnormal stock returns of blockchain announcements are positively associated with IT industry companies. Investors may recognize that the IT industry companies have a relevant technology base to research and implement specific applications of blockchain technology, so they could benefit from it. In contrast, blockchain announcements by manufacturing industry companies may send less noticeable or harmful signals. Our results suggest that manufacturing companies exhibit significant and negative cumulative abnormal returns (CAR=-0.78%) in the event window [-2;2]. Since blockchain technology is a complex and emerging technology, investors may not be optimistic that manufacturing companies can effectively integrate and benefit from blockchain technology. Second, we found that companies with senior executives in charge of IT-related matters when issuing blockchain

announcements had positive stock returns. The presence of a CIO or CTO may send a positive signal to investors since these two types of managers are responsible for developing the company's information technology strategy. Third, the stock market's reaction to blockchain technology is positive for companies with a high ratio of executives with an R&D background. Investors may believe that top executive teams with a high percentage of R&D background may have a better understanding of how to measure the benefits and costs of blockchain technology. Therefore, companies are more likely to benefit from adopting blockchain technology. In addition, this study shows that abnormal returns are higher for blockchain announcements issued after September 4, 2019, and October 24, 2019. This result provides evidence of the impact of national policies on stock market reactions. The company's blockchain announcements indicate that the company is actively responding to supportive and regulatory national policies, which may send a positive strategic signal to investors. As a result, investors reacted more strongly to the company's blockchain announcement in the market.

Throughout the analysis, we observe that investor reaction to blockchain announcements is a significant positive reaction on the two days before the event day 0 and a negative reaction (mostly significant) on the two days after the event day 0. We conjecture that information about the firm's blockchain announcement may be leaked, and investors react positively in advance, as observed by Cahill et al. (2020). Afterward, investors regain their composure and no longer react strongly to blockchain announcements. Moreover, although it has been recognized that companies can benefit from blockchain technology, it is still unclear how companies adopt blockchain technology and integrate it into their existing business. So, investors' reactions to the blockchain announcement are even negative in the two days after the event day 0.

Theoretical Contributions

Overall, our study makes the following contributions at the theoretical level by linking to existing research. Firstly, our findings provide experimental support for many of the theoretical discussions concerning the use of blockchains (e.g., Babich and Hilary 2020; Olsen and Tomlin 2020). Compared with Liu et al. (2022) and Klöckner et al. (2022), we demonstrate that our sample companies have significant average abnormal positive returns on the announcement date and two days before the announcement date in the Chinese stock market. Our study provides richer evidence for the conclusion that blockchain technology initiatives can increase the short-term stock value of firms (Cheng et al. 2019; Klöckner et al. 2022; Liu et al. 2022).

Second, we extend the previous literature by identifying the interaction effect between blockchain announcements and abnormal stock returns. Specifically, our results show that investors react positively to blockchain announcements from the IT industry companies, while they react negatively to blockchain announcements from the manufacturing industry companies. In contrast to existing research (Klöckner et al. 2022; Liu et al. 2022), we demonstrate that organizational factors, including the presence of a CIO (or CTO) and a high percentage of executives with an R&D background, positively influence investors' reactions to blockchain announcements. Our findings add to the information systems and operations management literature on IT initiatives (e.g., Bose and Leung 2019; Boyd et al. 2019; Hendricks et al. 2007) about the value of blockchain initiatives and the influencing factors of firm characteristics.

Third, we demonstrate that supportive and regulatory national policies for blockchain technology enhance positive stock market reactions to blockchain announcements. We highlight the importance of national policies in determining how financial markets perceive corporate adoption of blockchain technology. To the best of our knowledge, this study should be the first event study to focus on the impact of national policies influencing the value of blockchain announcements, which provides a reference for different countries to formulate their attitudes towards blockchain technologies. As a whole, our study contributes to the literature on strategic signals associated with blockchain announcements relating to technology adoption.

Practical Implications

Our findings also provide insights into companies' blockchain-related business decisions. Our research identifies conditions under which blockchain announcements may lead to stronger positive investors' reactions and increase the equity value of a company. We point out that blockchain announcements issued by companies with the presence of a CIO (or CTO) and a high percentage of executive teams with an R&D background can send a solid signal to shareholders about technological innovation. At the same time, we also point out that investors are cautious about adopting blockchain technology, and there are risks if

companies simply follow the trend of issuing blockchain announcements. Therefore, we encourage organizations to pay more attention to the organizational structure before making blockchain announcements if they want to benefit from it.

Limitations and Implications to Future Research

We readily acknowledge that there are several limitations to the study. First, we acknowledge that our sample size is relatively small, which may limit our inferences. To address this issue, we refer to the existing literature (Drechsler et al. 2019) and use a combination of parametric tests (t-test and the Patell Test) and nonparametric tests (the Generalized Sign Test) to circumvent the problems associated with sample size. Of course, future studies could increase the sample size for further research.

Furthermore, we only considered companies that made announcements about blockchain technology in our sample, and the generalizability of the results may be limited. First, we only searched for announcements about blockchain technology from January 1, 2016, to June 31, 2021, which may have missed some announcements. Second, we filtered periodic reports such as annual and quarterly reports. However, not all companies make announcements about blockchain technology.

Although our research findings should be interpreted with an awareness of these limitations, the study offers several opportunities for future research. First, due to the limitations of the event study methodology, we can only demonstrate that blockchain announcements are positively associated with abnormal stock returns. It is unclear whether blockchain announcements would cause a stock price increase. Future studies could use more rigorous research methods, such as PSM or DID. Second, we only focus on the impact of blockchain announcements on short-term stock price returns. Future research could examine the mechanisms behind how blockchain announcements influence organizational performance. At last, we do not cover how blockchain technology can be integrated with business. Future research could explore how blockchain technology can empower businesses to create firms value.

Conclusion

This study reveals the impact of blockchain announcements on the short-term stock market value of Chinese A-share listed companies through an event study method. Specifically, we find that blockchain announcements positively impact firms' short-term stock prices, which is consistent with the findings of existing studies on blockchain announcements. The difference is that we find that the positive impact of blockchain announcements on firm stock prices is affected by industry classification, national policies, and corporate governance structure, including the existence of a senior manager CIO or CTO responsible for information technology and the proportion of executives with an R&D background in top management teams. Further, we found that supportive and regulatory national policies for blockchain technology enhance market reactions to blockchain announcements, which provides a reference for different countries to formulate their attitudes towards blockchain technologies. In addition, the findings of this study can also guide business practices. That is, managers should elevate the deployment of blockchain in the enterprise to the strategic level and focus on staffing CIOs, CTOs, and top management teams with relevant R&D backgrounds to better enhance the enterprise's market value. We hope our research will inspire future studies exploring the role of blockchain technology in enhancing enterprise market value and organizational performance.

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