

Research on the Impact of Digital Mergers and Acquisitions on Stock Market Risk: Based on the Perspective of Stock Price Crash Risk

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Abstract

Digital Mergers and Acquisitions (DMA) represent a strategic approach for enterprises to acquire digital assets and capabilities. Existing research primarily focuses on the impact of DMA on innovation and financial performance, with insufficient exploration of its effects on capital market risk, particularly stock price crash risk. This study aims to investigate whether and how DMA can mitigate the risk of stock price crashes in firms. Using a sample of A-share listed companies in China from 2012 to 2023 and employing a multi-period Difference-in-Differences (DID) model, this paper empirically examines the impact of DMA on stock price crash risk and its underlying mechanisms. The results show that: (1) Compared to firms conducting non-digital M&A, firms implementing DMA significantly reduce their future stock price crash risk. This conclusion remains robust after a series of endogeneity controls and robustness tests. (2) Mechanism analysis reveals that DMA mitigates stock price crash risk by alleviating corporate financing constraints. (3) Heterogeneity analysis indicates that the risk-reducing effect of DMA is more pronounced in state-owned enterprises and firms located in the eastern region of China. This study enriches the literature on the economic consequences of DMA and provides empirical evidence for corporate digital transformation strategies and market risk regulation.

Keywords

Digital Mergers and Acquisitions; Digitalization; Stock Price Crash Risk; Financing Constraints

1. Introduction

The report of the 20th National Congress of the Communist Party of China emphasized that "digitalization presents a rare historical opportunity for the Chinese nation," highlighting the core position of digital technology in the new development stage. Subsequently, the Third Plenary Session of the 20th CPC Central Committee systematically deployed the strategic path of "promoting the deep

integration of the digital economy and the real economy." Against this national strategic backdrop, digital transformation has become a crucial direction for macro-economic development and a practical issue that various market entities must address. Digital Mergers and Acquisitions (DMA), as external strategic investment behaviors for enterprises to rapidly acquire key digital technologies, service capabilities, innovative talent, and data resources, have increasingly become a key pathway for many enterprises to achieve digital transformation.

As DMA activities become more frequent, an important question arises: Can digital mergers and acquisitions effectively reduce the stock price crash risk of participating firms after completion? The exploration of this issue is not only related to micro-level corporate investment decisions and value realization but also holds significant policy implications for macro-level efforts to promote the integration of digital technology with the real economy and accelerate the construction of a Digital China. Existing literature on DMA has mostly focused on its impact on corporate innovation and financial performance, with insufficient systematic and in-depth exploration of its specific impact mechanisms on stock market performance, particularly regarding its potential risk-governance function in suppressing stock price crash risk.

Therefore, based on existing theoretical findings and actual data from A-share listed companies, this paper aims to deeply analyze whether and how DMA affects corporate stock price crash risk and further reveal its internal transmission mechanisms, with the goal of providing empirical references and decision-making basis for enterprises and policymakers.

2. Literature Review and Theoretical Analysis

2.1. Literature Review on Digital M&A and Stock Price Crash Risk

Research on the factors influencing stock price crash risk has consistently been a focus in academia. Jin and Myers (2006) first confirmed firm-level stock price crash risk, attributing its root cause to agency problems and information asymmetry. Management tends to hide bad news due to various motivations. When accumulated negative information reaches a threshold and is released abruptly, it triggers a cliff-like drop in stock prices, leading to a crash. In the context of M&A, mainstream research suggests that factors such as high goodwill from overpayment, performance commitments, and stock payment methods in M&A transactions can exacerbate stock price crash risk (Yang et al., 2018; Wang et al., 2017; Li, 2020).

On the other hand, studies indicate that digital technology can effectively reduce stock price crash risk by improving information transparency, enhancing internal control, and optimizing corporate governance (Zong et al., 2023; Dong, 2022). Since DMA is a crucial pathway for enterprises to achieve digital transformation, it may also have an impact on stock price crash risk. However, existing research has not yet formed a systematic analytical framework focusing specifically on "digital" M&A;

discussions are scattered across two relatively independent research veins: traditional M&A and digital transformation. There is a lack of direct and systematic empirical examination of the impact of DMA itself on stock price crash risk. This study aims to fill this gap by examining DMA as an integrated strategic action and empirically testing its overall effect on stock price crash risk.

2.2. Theoretical Analysis and Hypothesis Development

Based on signaling theory and resource-based theory, DMA may influence stock price crash risk through the following channels:

Firstly, DMA directly improves the corporate information environment and inhibits the motivation and ability to hide bad news. Integrated digital technologies such as big data analytics and artificial intelligence enhance the timeliness and traceability of operational data, thereby strengthening financial and business information transparency (Dong et al., 2022). This increases the cost and risk for management to conceal bad news, constraining opportunistic behavior, and allows negative information to be detected and digested by market participants earlier and more gradually, avoiding concentrated exposure.

Secondly, DMA enhances the fundamental operational aspects and risk resilience of enterprises, reducing the source of bad news. The integration of digital technology with core business aims to improve efficiency and reduce costs through process automation and intelligent decision-making, thereby strengthening operational resilience and the sustainability of profitability. A more efficient and flexible digitally transformed enterprise has a lower probability of encountering major operational setbacks or sharp performance deterioration.

Therefore, this paper proposes Hypothesis H1:

H1: Digital mergers and acquisitions can significantly reduce a firm's stock price crash risk.

Furthermore, financing constraints, a state where the cost of external financing exceeds that of internal financing, often exacerbate operational risk and incentivize management to delay the disclosure of bad news. DMA may alleviate corporate financing constraints by enhancing information transparency and optimizing asset structure, thereby improving creditworthiness and reducing the cost of external financing. The alleviation of financing constraints can reduce management's motivation to hide bad news due to capital pressure and enhance the firm's ability to withstand market shocks, thereby lowering the probability of stock price crashes. Therefore, this paper proposes Hypothesis H2:

H2: Digital mergers and acquisitions can reduce stock price crash risk by alleviating corporate financing constraints.

3. Research Design

3.1. Sample and Data

This study takes M&A events completed by Chinese A-share listed companies from 2012 to 2023 as the initial sample. To enhance the standardization and reliability of the research, ST and PT companies, financial industry firms, and M&A cases where the target is registered in a "tax haven" are excluded. The main source of financial data is the CSMAR database. To avoid confounding interference from multiple M&As by the same company, this study retains only the largest M&A transaction by each company during the sample period. After processing, a total of 4,919 M&A events announced and completed by listed companies between January 1, 2012, and December 31, 2023, are ultimately obtained. All continuous variables are winsorized at the 1% and 99% levels.

3.2. Variable Definitions

1. Dependent Variable: Stock Price Crash Risk (NCS, DU). Following Xu et al. (2013) and Yang et al. (2018), this paper uses the negative skewness coefficient of firm-specific weekly returns (NCSKEW, abbreviated as NCS) and the up-to-down volatility ratio of returns (DUVOL, abbreviated as DU) for year $t+1$ to measure stock price crash risk. Larger values indicate higher crash risk.

2. Explanatory Variable: Digital M&A (DMA). Using text analysis, this paper constructs a keyword lexicon for digital transformation with reference to Wu et al. (2021) and national digital economy policy texts. An M&A event is defined as a DMA if the target company's business scope description contains digital keywords. The variable DMA is a dummy variable that equals 1 if the firm conducts DMA in year t , and 0 otherwise. In the multi-period DID model, it is constructed as the interaction term of the treatment group dummy and the post-event time dummy.

3. Mediating Variable: Financing Constraints (FC). Following Hadlock and Pierce (2009) and domestic research practices, the SA index is constructed using firm size and age, and a logit model is estimated to fit the annual probability of financing constraints, which is defined as the financing constraint index FC. A larger FC indicates more severe financing constraints.

4. Control Variables. This study controls for a series of firm-level characteristics that may affect stock price crash risk, including: Cash Flow (Cashflow), Asset-Liability Ratio (Lev), Firm Age (FirmAge), Return on Equity (Roe), Book-to-Market Ratio (Bm), Tobin's Q (TobinQ), Revenue Growth Rate (Growth), and CEO Duality (Dual). Additionally, firm and year fixed effects are controlled in the regression models.

Table 1. Variable Definitions and Descriptions

Variable Name	Variable Symbol	Description
Negative Skewness Coefficient	$NCS_{i,t+1}$	Negative skewness coefficient of firm-specific weekly returns for firm i in year $t+1$.

Up-Down Volatility Ratio	DUI,t+1	Up-to-down volatility ratio of returns for firm i in year t+1.
Digital M&A	DMAi,t	Dummy variable, equals 1 if firm i conducts digital M&A in year t, otherwise 0.
Financing Constraints	FCi,t	Financing constraint index for firm i in year t. Higher value indicates greater constraints.
Cash Flow	Cashflowi,t	Net cash flow from operating activities divided by total assets.
Asset-Liability Ratio	Levi,t	Total liabilities / Total assets.
Firm Age	FirmAgei,t	Ln (Current year - Establishment year + 1).
Return on Equity	Roei,t	Net profit / Average shareholders' equity.
Book-to-Market Ratio	Bmi,t	Book value / Market value.
Tobin's Q	TobinQi,t	(Market value of tradable shares + Number of non-tradable shares × Net assets per share + Book value of liabilities) / Total assets.
Revenue Growth Rate	Growthi,t	(Current operating revenue - Prior operating revenue) / Prior operating revenue.
CEO Duality	Duali,t	Dummy variable, equals 1 if the Chairman and CEO are the same person, otherwise 0.

3.3. Model Specification

To address the issue of different firms conducting DMA at different times, a multi-period Difference-in-Differences (DID) model is constructed to estimate the treatment effect. The baseline regression model is set as follows:

$$\text{Crash}_{i,t} = \alpha_0 + \alpha_1 \text{DMA}_{i,t} + \sum \beta \text{Controls}_{i,t} + \text{FE}_i + \text{YE}_t + \varepsilon_{i,t} \quad (1)$$

Where $\text{Crash}_{i,t}$ represents the stock price crash risk indicators (NCS or DU) for firm i in year t. $\text{DMA}_{i,t}$ is the core explanatory variable. $\text{Controls}_{i,t}$ is the set of control variables. FE_i and YE_t represent firm and year fixed effects, respectively. $\varepsilon_{i,t}$ is the error term. Clustered standard errors at the firm level are used.

To test the mediating effect of financing constraints, a stepwise regression approach is adopted, building on Model (1):

$$FC_{i,t} = \gamma_0 + \gamma_1 DMA_{i,t} + \sum \delta Controls_{i,t} + FE_i + YE_t + \mu_{i,t} \quad (2)$$

$$Crash_{i,t} = \lambda_0 + \lambda_1 DMA_{i,t} + \lambda_2 FC_{i,t} + \sum \varphi Controls_{i,t} + FE_i + YE_t + v_{i,t} \quad (3)$$

4. Empirical Results and Analysis

4.1. Descriptive Statistics and Correlation Analysis

The descriptive statistics of the main variables are shown in Table 2. The mean of DMA is 0.63, indicating that approximately 63% of the observations in the sample belong to the treatment group. The mean values of the stock price crash risk indicators, NCS and DU, are -0.396 and -0.281, respectively. The mean of the financing constraint index FC is 0.463, suggesting that the sample firms face a moderate level of financing constraints on average. The correlation analysis shows a significant negative correlation between DMA and the two crash risk indicators (NCS and DU) at the 1% level, providing preliminary support for Hypothesis H1.

Table 2. Descriptive Statistics of Main Variables

Variable	N	Mean	Std. Dev.	Min	Max
DMA	4919	0.630	0.376	0	1
NCS	4919	-0.396	0.652	-4.248	2.277
DU	4919	-0.281	0.417	-2.369	1.031
FC	4919	0.463	0.267	0.001	0.981
Cashflow	4919	0.054	0.060	-0.199	0.266
Lev	4919	0.399	0.176	0.035	0.925

4.2. Baseline Regression Results

Table 3 presents the baseline regression results for the impact of DMA on stock price crash risk. Columns (1) and (2) show the regression results with NCS and DU as dependent variables, respectively. The coefficients of DMA are -0.227 and -0.131, both significant at the 1% level. This indicates that after controlling for other factors, firms implementing DMA experience a significant reduction in their stock price crash risk compared to firms that do not conduct DMA or conduct non-digital M&A. Hypothesis H1 is thus validated.

Table 3. Baseline Regression Results: The Impact of DMA on Stock Price Crash Risk

Variables	(1) NCS	(2) DU
DMA	-0.227***	-0.131***
	(0.033)	(0.024)

Cashflow	0.053	-0.025
	(0.199)	(0.135)
Lev	-0.256**	-0.167**
	(0.105)	(0.074)
Controls	YES	YES
Firm FE	YES	YES
Year FE	YES	YES
Observations	4,919	4,919
Adjusted R ²	0.080	0.062

Note: ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors clustered at the firm level are in parentheses.

4.3. Robustness Tests

To ensure the reliability of the conclusions, this study conducts a series of robustness tests: (1) **Parallel Trend Test**: The estimated coefficients for the pre-treatment periods are not significantly different from zero, satisfying the parallel trends assumption. (2) **Replacement of Dependent Variables**: Recalculating crash risk indicators using the total market capitalization-weighted average method yields consistent conclusions. (3) **Propensity Score Matching (PSM)**: Using the nearest neighbor matching method to construct a comparable sample, the results remain robust. (4) **Placebo Test**: Randomly assigning the timing of the "DMA" treatment 500 times shows that the estimated coefficients are concentrated around zero, indicating that the baseline results are unlikely to be driven by other unobserved factors. (5) **Exclusion of Abnormal Years**: Excluding data from the pandemic years (2020-2023), the core conclusions remain unchanged. These tests collectively confirm the robustness of the finding that DMA inhibits stock price crash risk.

4.4. Mediating Effect Test: Financing Constraints

Table 4 reports the results of the mediating effect test for financing constraints. Column (1) shows the result of regressing the mediating variable FC on DMA. The coefficient of DMA is significantly negative (-0.129), indicating that DMA helps alleviate corporate financing constraints. Column (2) adds the mediating variable FC to the baseline model. The coefficient of DMA remains significantly negative, while the coefficient of FC is significantly positive. This suggests that financing constraints partially mediate the relationship between DMA and the reduction in stock price crash risk. Hypothesis H2 is supported.

Table 4. Mediating Effect Test: Financing Constraints

Variables	(1) FC	(2) NCS
DMA	-0.129*	-0.218***
	(0.074)	(0.033)
FC		0.072***
		(0.021)
Controls	YES	YES
Firm FE	YES	YES
Year FE	YES	YES
Observations	4,919	4,919
Adjusted R ²	0.822	0.084

Note: ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors clustered at the firm level are in parentheses.

4.5. Heterogeneity Analysis

Further analysis reveals that the risk-reducing effect of DMA varies across different contexts. (1) **Nature of Property Rights:** The inhibitory effect of DMA on stock price crash risk is more pronounced in state-owned enterprises (SOEs) than in non-SOEs. This may be attributed to the stricter internal control systems and political-social constraints inherent in SOEs, which synergize with the information transparency brought by digitalization. (2) **Geographical Region:** The effect shows a gradient pattern of "leading in the East, following in the Central, and lagging in the West." This is closely related to the varying levels of digital infrastructure, financial market development, and information efficiency across regions.

5. Conclusions and Implications

5.1. Research Conclusions

Using a sample of A-share listed companies in China from 2012 to 2023 and a multi-period DID model, this paper systematically examines the impact of DMA on stock price crash risk and its internal mechanisms. The main findings are as follows: First, compared to non-digital M&A, DMA can significantly reduce a firm's future stock price crash risk, and this conclusion remains robust after a series of tests. Second, mechanism analysis shows that DMA reduces stock price crash risk by alleviating corporate financing constraints. Third, heterogeneity analysis indicates that the risk-reducing effect of DMA is more pronounced in state-owned enterprises and firms located in the eastern region.

5.2. Implications

For Enterprises: Firms should integrate DMA into their overall digital transformation strategy, utilizing it not only as a capital operation but as a core strategic lever to build long-term digital capabilities. Emphasis should be placed on post-merger integration to internalize digital assets and enhance information transparency and governance, thereby mitigating risks.

For Government and Regulatory Bodies: Efforts should be made to build an institutional environment that supports substantive DMA, including improving the multi-level policy support system, deepening capital market reforms to facilitate financing and exit channels for DMA, and implementing differentiated guidance strategies across regions and types of enterprises to promote coordinated development.

For Investors and Intermediaries: Investors should enhance their ability to understand digital technology and business models, focusing on the long-term value creation of DMA rather than short-term speculation. Intermediary institutions should strengthen their professional capabilities to provide high-quality valuation, due diligence, and advisory services for DMA, promoting a rational and healthy market ecosystem.

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