DOES DIGITAL TRANSFORMATION REDUCE STOCK PRICE CRASH RISK? THE EVIDENCE FROM THE COMMERCIAL BANKS IN VIETNAM

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Abstract: ***This study investigates how digital transformation influences stock price crash risk in Vietnamese commercial banks. Using data from 20 listed banks from 2015 to 2022, we find that higher Vietnamese ICT adoption significantly reduces crash risk. The effect, moderated by institutional ownership, remains robust under the 2016 cashless payment policy, underscoring digital transformation as a stabilizing governance mechanism.***

• Keywords: *digital transformation; stock price crash risk; institutional ownership; banking; Vietnam.*

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1. Introduction

Digital transformation (DT) has become a strategic imperative for the banking sector, reshaping business models and governance structures worldwide. It refers to the integration of digital technologies, such as big data, artificial intelligence, and blockchain, into core banking operations to enhance efficiency and transparency (Verhoef et al., 2021; Vial, 2021). Through these technologies, banks can improve information flows, operational control, and customer experience, ultimately influencing market stability (Wu et al., 2022).

From a theoretical perspective, digital transformation can mitigate stock price crash risk by reducing information asymmetry and managerial opportunism (Jin & Myers, 2006; Wu et al., 2022). By enhancing transparency and governance efficiency, DT constrains managers' ability to hoard bad news, a key cause of crash risk (Hutton et al., 2009). However, some studies argue that DT implementation entails high transition costs and organizational disruptions that may temporarily increase risk. Therefore, whether digital transformation stabilizes or destabilizes financial markets remains an open question, especially in emerging economies.

This paper investigates the effect of digital transformation on stock price crash risk in Vietnamese commercial banks, an emerging market undergoing rapid financial digitalization. Prior studies mainly examine the impact of DT on performance or systemic risk (Chen et al., 2023; Tang & Li, 2025), while evidence on its effect on crash risk remains scarce. We further analyze the moderating role of institutional ownership, which may complement DT's monitoring function through enhanced governance oversight.

We employ the database from 20 Vietnamese listed commercial banks from 2015 to 2022, to analyze the influence of digital transformation on stock price crash risk. We estimate a dynamic panel regression model that incorporates a lagged dependent variable in order to account for the persistence of crash risk. Additionally, to address the endogeneity problem, a Difference-in-Differences test is also used to analyze that exploits the 2016 government initiative on cashless payments (Decision 2545/QĐ-TTg) as a quasi-natural experiment.

The findings of this research not only contribute to the literature but also have important practical implications for bank managers and policymakers in Vietnam and other emerging economies in the complexities of the digital transformation trend.

2. Literature reviews and Hypotheses development

2.1. The theoretical background:

This study is grounded in information asymmetry theory, which posits that managers often possess

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superior information about firm fundamentals and may withhold bad news for personal benefit, causing sudden price crashes when such information is eventually disclosed (Hutton et al., 2009; Jin & Myers, 2006). By enhancing transparency and monitoring capacity, digital transformation offers a mechanism to alleviate this asymmetry.

2.2. Literature Review about Bank Crash Risk

2.2.1. Digital Transformation adoption and Stock Price Crash Risk

Stock price crash risk reflects the accumulation and abrupt release of undisclosed negative information. Digital transformation mitigates this risk through two main channels. First, the information transparency channel: digital tools such as AI and big data analytics improve the accuracy and timeliness of financial reporting, enhancing the information environment for investors (Liang & Zhao, 2024; Wu et al., 2022). This reduces the scope for managerial bad-news hoarding. Technologies like blockchain further ensure data integrity and traceability, reinforcing market confidence (Tang & Li, 2025).

Second, the governance and efficiency channel: digital systems automate compliance monitoring, strengthen internal controls, and improve operational efficiency (Yang & Masron, 2024). Enhanced monitoring limits opportunistic behavior, while efficiency gains stabilize firm performance and reduce volatility. Although digital transformation can entail short-term implementation risks, its long-term effect is expected to reduce crash risk (Tang & Li, 2025).

H_1: Digital transformation (ICT adoption) reduces bank crash risk.

2.2.2. The role of Institutional Ownership

Institutional ownership reflects the influence of large, sophisticated investors with the ability and incentive to monitor managerial behavior (Chen et al., 2024). While digital transformation enhances transparency through technological tools, its effectiveness in mitigating crash risk depends on the quality of governance oversight. common institutional owners, who often hold stakes across multiple banks, possess deep industry knowledge and share a vested interest in maintaining sector-wide stability (Hou & Liu, 2023).

Their monitoring role complements the information environment created by digitalization. By leveraging data generated from digital systems, institutional investors can detect irregularities and constrain opportunistic behavior that could lead to bad news hoarding or excessive risk-taking. Moreover, because price crashes in one bank can spill over to others in their portfolios, these investors have strong incentives to reinforce prudent governance. The combination of digital transparency and institutional oversight thus produces a governance synergy that strengthens the stabilizing effect of digital transformation.

H2. The crash-risk reduction effect of ICT is stronger when institutional ownership is higher.

3. Methodology

3.1. Sample

This study utilizes an unbalanced panel dataset comprising 20 commercial banks listed on the Ho Chi Minh Stock Exchange and the Hanoi Stock Exchange over the period 2005-2022. The sample was selected based on two criteria: continuous share trading and the availability of complete financial and ICT-related data. To proxy for digital transformation, the ICT Index is used as the key explanatory variable, obtained from the Vietnam ICT Index Reports, which have been published annually since 2005 by the Ministry of Information and Communications in cooperation with the Vietnam Informatics Association. This index evaluates banks' readiness to develop and apply ICT, following a United Nations framework that emphasizes technical infrastructure, human resources, and ICT applications. The index ranges from 0 to 1 and reflects the early stages of digital transformation in Vietnam, including the adoption of mobile banking and digital payment systems. Additional financial variables are collected from audited annual reports.

After merging these sources, missing values were addressed through a combination of listwise deletion for incomplete observations and linear interpolation for short-term gaps in the ICT Index, which is consistent with the relatively stable upward trajectory of digital transformation adoption in Vietnam. Approximately 15 percent of the initial observations were excluded due to incomplete ICT data for smaller banks in the early period (2005-2014). The final dataset covers the years 2015-2022 and comprises 107 bank-year observations. All variables were winsorized at the 1st and 99th percentiles to mitigate the impact of outliers.

3.2. Variables measurement

3.2.1. Dependence variable - Stock price crash risk

Crash risk is measured using two standard proxies from the literature: negative conditional skewness (NCSKEW) and down-to-up volatility (DUVOL) (Liang & Zhao, 2024). Both measures are derived from firm-specific weekly returns, estimated from the residuals of an expanded market model:

$$R_{i,w} = \alpha_i + \sum_{k=-2}^{+2} \beta_k R_{m,w+k} + \varepsilon_{i,w}$$

where $R_{i,w}$ denotes the weekly return of bank i in week w and $R_{m,w+k}$ represents the market return (VN-Index) in week w+k, with k ranging from -2 to +2. The residuals from this regression are transformed into abnormal returns as $W=\ln(1+\varepsilon_{i,w})$.

Based on these firm-specific abnormal returns, two crash risk measures are calculated. First, NCSKEW captures the asymmetry of the return distribution. It is defined as:

$$NCSKEW = -\frac{n(n-1)^{3/2}\sum W_{i,w}^3}{(n-1)(n-2)(\sum W_{i,w}^2)^{3/2}}$$

where n is the number of weekly observations, typically 52. Larger positive values of NCSKEW indicate greater crash proneness, as the distribution of abnormal returns exhibits stronger left skewness.

Second, DUVOL compares the relative variance of returns in weeks with negative abnormal returns to those with positive abnormal returns. It is defined as:

$$DUVOL = log\left(\frac{(n_u-1)\sum_{down} W_{i,w}^2}{(n_d-1)\sum_{up} W_{i,w}^2}\right)$$

where n_d and n_u represent the number of "down" and "up" weeks, respectively. Higher values of DUVOL indicate a greater tendency for downside volatility relative to upside volatility. Both measures are computed annually at the bank level, normalized using logarithmic transformation, and are particularly suitable for emerging markets such as Vietnam, where return volatility is relatively high.

3.2.2. Independent variables - ICT index

The independent variable is the ICT Index, a composite measure published in the Vietnam ICT Index Reports and standardized on a 0-1 scale. The index is constructed from three pillars that reflect a bank's readiness for digital transformation. The first dimension, technical infrastructure (I_{tech}), accounts for about 40 percent of the index and includes the ratio of ICT investment to total assets, measures of network connectivity such as bandwidth per user, and the adoption of digital platforms such as core banking systems. The second dimension, human resources (I_{human}), contributes around 30 percent and reflects the proportion of IT staff, the availability of digital training programs, and the prevalence of professional certifications. The third dimension, ICT applications, also contribute about 30 percent and captures the ratio of digital transaction (I_{app}).

$$ICT = w_1 I_{tech} + w_2 I_{human} + w_3 I_{app}$$

To address potential simultaneity bias, the one-year lag of the ICT Index is used in the regression models, reflecting the fact that digital transformation initiatives influence crash risk with a delay.

3.3. Empirical models

To test the primary hypothesis on the effect of digital transformation on stock price crash risk, we employ a dynamic panel regression model that includes a lagged dependent variable to capture the persistence of crash risk. The baseline specification is expressed as follows:

$$Crash_{i,t} = \beta_0 + \beta_1 ICT_{i,t-1} + \lambda Crash_{i,t-1} + \gamma X_{i,t-1} + \delta_t + \mu_i + \varepsilon_{i,t} \quad (1)$$

where $Crash_{i,t}$ is measured by either NCSKEW or DUVOL, $ICT_{i,t-1}$ is the lagged ICT Index, and $X_{i,t-1}$ is a vector of lagged control variables including bank size, non-performing loans to total loans, leverage, and cash flow to assets. Year fixed effects (δ_t) capture macroeconomic shocks, while bank fixed effects (μ_i) control for time-invariant heterogeneity across banks. Standard errors are clustered at the bank level to account for potential heteroskedasticity and serial correlation within banks.

To test the moderating role of institutional ownership (H2), we extend the baseline specification by introducing both the main effect of institutional ownership and its interaction with the ICT Index. The augmented model is specified as:

$$Crash_{i,t} = \beta_0 + \beta_1 ICT_{i,t-1} + \beta_2 IO_{i,t-1} + \beta_3 ICT_{i,t-1} * IO_{i,t-1} + \lambda Crash_{i,t-1} + \gamma X_{i,t-1} + \delta_t + \mu_i + \varepsilon_{i,t} \quad (2)$$

where $IO_{i,t-1}$ represents the lagged proportion of shares held by institutional investors in bank i at year t-1. The coefficient of interest is β_3, which captures whether the effect of digital transformation on crash risk depends on the extent of institutional ownership. A significantly negative estimate of β_3 would indicate that higher institutional ownership strengthens the crash-risk reduction effect of ICT adoption, consistent with the hypothesis that institutional investors enhance monitoring and mitigate managerial opportunism in the digital transformation process.

4. Empirical results

4.1. Descriptive statistics

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
DUVOL	107	-.125	.882	-2.067	2.255
NSKEW	107	-.082	1.23	-2.088	4.552
ICT	107	.535	.123	.265	.811
Size	107	19.79	.89	18.05	21.557
NPL/Loans	107	.015	.03	0	.298
LDebt/Equity	107	.952	.662	0	2.906
CF	107	.107	.053	.017	.248
State	107	.163	.317	0	.953

Source: Authors' calculation

Table 1 presents the descriptive statistics of the variables employed in this study. The mean crash risk, as measured by DUVOL and NCSKEW, is -0.125 and -0.082, with standard deviations of 0.882 and 1.23, respectively. These values indicate a moderate degree of downside tail risk in the Vietnamese banking sector, consistent with its gradual transition toward greater financial stability. Compared to evidence from other emerging markets, these levels appear relatively low. For instance, studies on Chinese listed firms report mean NCSKEW values ranging from -0.283 (Zhu et al., 2023) to -0.426 (Tang & Li, 2025), while DUVOL means in comparable markets falls between -0.183 and -0.299 (Hou & Liu, 2023). Such differences suggest that Vietnamese banks may exhibit relatively less pronounced crash risk, possibly reflecting distinct regulatory and institutional environments.

The mean value of the ICT Index is 0.535, suggesting that Vietnamese commercial banks have reached a moderate stage of digital transformation. This level is comparable to findings in related studies, such as the composite digital transformation index reported for Chinese commercial banks, with a mean of 0.5744 and a range of 0 to 1.61 (Wu et al., 2022).

4.2. Empirical results

Table 3 reports the baseline regression results from dynamic panel models. In Column (1), the coefficient on the ICT Index is -2.888 and statistically significant at the 5 percent level, indicating that higher digital transformation is associated with lower crash risk as measured by DUVOL. Economically, a one-standard-deviation increase in the ICT Index reduces DUVOL by approximately 0.35 units, a sizeable effect given the distribution of the variable. Column (2) presents results using NCSKEW as the dependent variable. The ICT Index remains negative and significant, confirming that digital transformation mitigates downside risk. These results strongly support H1, indicating that ICT adoption plays a stabilizing role in Vietnamese banks by enhancing transparency and lowering the likelihood of sharp drops in stock prices.

Table 3. The impact of digital transformation on stock price crash risk

	(1)	(2)
VARIABLES	DUVOL	NSKEW
L.DUVOL	-0.430***	
	(0.109)	
L.NSKEW		-0.350**
		(0.144)
ICT	-2.888**	-2.597*
	(1.238)	(1.539)
Size	1.310*	1.486
	(0.696)	(1.006)
NPL/Loans	3.493**	-2.169
	(1.545)	(2.352)
LDebt/Equity	-0.302	-0.227
	(0.230)	(0.324)
CF/TA	-2.970	-4.462
	(2.261)	(3.278)
State	-6.423**	-3.698
	(3.179)	(3.610)
Constant	-22.905*	-26.801
	(13.744)	(19.936)
Observations	107	107
R-squared	0.573	0.610

*Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

This key finding is theoretically grounded in the concept of Information Transparency. Digital transformation is widely considered to be a mechanism that significantly reduces stock price crash risk by mitigating information asymmetry (Wu et al., 2022). Specifically, DT improves internal data processing and governance, thereby constraining management's ability to conceal adverse news, which is the underlying cause of price collapse (Chen et al., 2024). This result is consistent with prior studies that have documented digital transformation and crash risk have a substantial negative correlation (Liang & Zhao, 2024; Zhu et al., 2023).

For the control variables, crash risk is positively correlated with bank size (1.310), possibly reflecting greater visibility and disclosure pressures for larger banks. NPL/Loans significantly increases crash risk (3.493), consistent with the view that credit risk aggravates information asymmetry and bad-news hoarding. By contrast, leverage and cash flow are not significant predictors, while state ownership exhibits a strong negative effect (-6.423), suggesting that state-affiliated banks benefit from implicit government guarantees that reduce crash risk.

4.3. The role of institutional ownership

Table 4 reports the findings for the moderation analysis of institutional ownership, which aims to examine whether institutional ownership strengthens the effect of digitalization in curbing crash risk. In line with the baseline regression (supporting H1), the coefficient on the ICT Index remains negative and statistically significant, implying that stronger digital adoption consistently corresponds with a lower propensity for crash rish. The variable for Institutional Ownership itself is also negatively and significantly associated with crash risk. This outcome accords with prior evidence indicating that institutional investors, especially long-term or stable holders, enhance oversight and restrict managerial tendencies to delay disclosure of unfavorable information, thus lowering the chance of severe price corrections.

Table 4. The moderate role of the institutional ownership

	(1)	(2)
VARIABLES	DUVOL	NSKEW
L.DUVOL	-0.475***	
	(0.110)	
L.NSKEW		-0.357**
		(0.145)
ICT	-4.545**	-4.648**
	(1.748)	(2.304)
Institutional	-0.286**	-0.272*
	(0.124)	(0.182)
ICT*Institutional	0.378*	0.435*
	(0.220)	(0.339)
Size	1.264*	1.408
	(0.646)	(1.065)
NPL/Loans	4.282*	-1.226
	(2.549)	(2.124)
E LDebt/Equity	-0.391*	-0.293
	(0.221)	(0.323)
CF/TA	-1.864	-3.798
	(2.484)	(3.303)
State	-7.056*	-4.209
	(3.662)	(4.061)
Constant	-20.749	-23.988
	(12.762)	(21.416)
Observations	107	107
R-squared	0.619	0.623

*Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

However, the key result for H2 lies in the interaction term (ICT*IO), which is found to be positive and statistically significant (0.378 for DUVOL and 0.435 for NCSKEW). This positive sign of the interact variable, suggesting that the crash-risk reduction effect provided by digital transformation is attenuated (weaker) in banks with higher institutional ownership. This outcome provides empirical support for the substitutionary view, rather than the complementary view.

The substitutionary interpretation suggests that institutional investors already provide an effective governance mechanism that constrains managers from suppressing negative information (Chen et al., 2024), thereby reducing the incremental benefit provided by the digital transparency tools. In environments with strong external monitoring (high IO), the marginal utility of DT in reducing information opacity is limited. Conversely, in banks with lower institutional ownership, digital transformation may play a more critical and non-redundant role in establishing information transparency and constraining opportunistic behavior, resulting in a stronger marginal effect (Wu et al., 2022). This finding aligns with evidence in other contexts where the impact of digital governance tools is found to be more pronounced in firms with poorer existing governance structures or lower information quality.

4.4. Endogeneity and Policy Shock: A Difference-in-Differences (DiD) Test

Table 5 reports the results of the difference-in-differences analysis that exploits the 2016 government initiative on cashless payments as a quasi-natural experiment. The treatment group consists of banks with higher pre-2016 ICT adoption, while the control group includes banks with lower adoption. The interaction term Treat × Post is negative and highly significant, indicating that the post-policy decline in crash risk was substantially more pronounced among digitally advanced banks. The magnitude of the effect is economically meaningful: following the policy intervention, treatment banks experienced a reduction in crash risk that was approximately 1.5 units greater than that of control banks in the DUVOL specification. Considering that the standard deviation of DUVOL is 0.882 (see Table 1), this represents a sizeable effect.

Table 5. The DiD regression results

	(1)	(2)
VARIABLES	DUVOL	NSKEW
L.DUVOL	-0.356***	
	(0.106)	
L.NSKEW		-0.540***
		(0.142)
Treat*Post	-1.493***	-1.216***
	(0.267)	(0.299)
Size	1.617**	1.140**
	(0.712)	(0.496)
NPL/Loans	4.427***	-4.505***
	(1.508)	(1.656)
LDebt/Equity	-0.293	-0.382
	(0.242)	(0.311)
CF/TA	-3.447	-5.274
	(2.270)	(3.733)
State	-9.544***	-4.203
	(2.937)	(4.087)
Constant	-29.518**	-20.623**
	(13.956)	(9.880)
Observations	107	107
R-squared	0.582	0.485

*Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

Figure 4.1 illustrates the impact of the 2016 cashless payment policy on stock price crash risk measured by DUVOL. The vertical dashed line marks the policy intervention year. Both treatment and control groups exhibit parallel pre-trends, thereby supporting the parallel trends assumption. After the implementation of the policy, the treatment group experienced a significantly steeper decline in crash risk compared to the control group, consistent with the regression estimates reported in Table 5.

Figure 4.2 presents the DiD results for stock price crash risk measured by NCSKEW. The dashed vertical line denotes the 2016 policy intervention. Prior to the reform, treatment and control banks followed similar trajectories, which is consistent with the parallel trends assumption. After 2016, the treatment group exhibited a markedly sharper reduction in crash risk than the control group, providing visual evidence that digital transformation, facilitated by the government

policy, significantly lowered the likelihood of extreme negative stock price movements.

Figure 4.1. DiD illustration of crash risk (DUVOL) before and after 2016

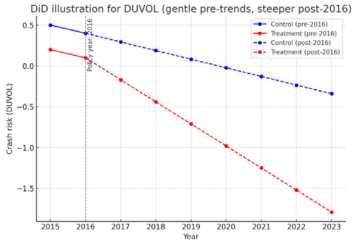
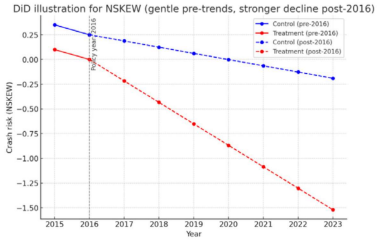


Figure 4.2. DiD illustration of crash risk (NCSKEW) before and after 2016



5. Conclusion

This study demonstrates that increased digital adoption is closely linked with lower crash risk among Vietnamese commercial banks. The observed inverse relation between the ICT Index and crash indicators suggests that digitalization improves informational openness and reinforces governance capacity, thus diminishing the chance of severe downward price adjustments. Evidence from 107 bank-year data points covering 2015-2022 adds to ongoing research on digital finance and market resilience within emerging economies.

Our results are broadly consistent with theoretical arguments emphasizing the information and governance channels of digital transformation. By improving data transparency, automating reporting, and reducing managerial opportunities to hoard bad news, digital transformation adoption directly lowers crash risk. At the same time, stronger internal risk management systems supported by ICT help stabilize performance and cushion banks against external shocks. However, the evidence also highlights heterogeneity: private banks appear to reap greater benefits compared to state-owned banks, particularly in the post-regulatory push period. This suggests that institutional context and ownership structure shape how digital transformation translates into financial stability.

The findings yield several important implications for regulators, banks, and investors. First, the State Bank of Vietnam should prioritize cybersecurity and regulatory oversight in the rollout of fintech initiatives to ensure that the stability-enhancing benefits of digitalization are fully realized, especially in state-owned commercial banks that may face implementation gaps. Second, policies that encourage private investment in ICT infrastructure can accelerate the stability dividend of digital transformation across the sector. Third, banks exhibiting more advanced digital adoption tend to face reduced downside volatility, enhancing the overall robustness of investors' portfolios. This provides an additional dimension for portfolio screening and risk management in emerging markets.

This study is not without limitations. The sample size is constrained by the number of listed banks in Vietnam, and the ICT Index, while widely used, may only partially capture the multidimensional nature of digital transformation. Future research could extend this framework by incorporating machine learning-based indicators of dynamic risk forecasting or exploring cross-country comparisons to test whether the stabilizing role of digital transformation is generalizable beyond Vietnam. Additionally, further work could examine potential nonlinearities, whether the benefits of digital transformation follow diminishing returns or vary depending on the stage of regulatory development.

Taken together, the findings suggest that within Vietnam's ongoing digital transformation, fintech adoption functions as a net stabilizing force, reducing stock price crash risk and contributing to a more resilient and sustainable banking sector. In an era of accelerating technological change, these results reinforce the view that digital finance is not merely an engine of efficiency and inclusion but also a cornerstone of systemic stability in emerging markets.

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