Digital Transformation and Corporate Risk-taking from the Perspective of Resilience

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Abstract. Promoting the enterprise digital transformation is a key measure for enterprises to deal with the impact of external risks, improving the resilience and safety level of enterprises has become an eager concern of all circles. From the perspective of enterprise resilience, we regarded the "digital China" strategy as a quasi-natural experiment, and constructed the continuous DID model, aiming to test the effect and mechanism of digital transformation on enterprise risk-taking ability. The results show that digital transformation has a significant promoting effect on enterprise risk-taking. Digital transformation can improve the enterprise risk-taking ability by leveraging the "shock absorption" effect, "energy dissipation" effect, and "regeneration development" effect. This study further enriches the research connotation of digital transformation and enterprise resilience.

Keywords: Digital transformation; Enterprise risk-taking; Continuous DID; "Digital China" strategy

1 Introduction

Under the complex and changing internal and external situation, the risks and uncertainties faced by enterprises are soaring, threatening their stable development. As a disruptive innovation change, digital transformation reconstructs the enterprise technical process, management system, and governance architecture. While causing uncertainty, it provides new feasible solutions for enterprise risk prevention and crisis governance and obtains the joint promotion of enterprises and the nation.

Much research about digital transformation focuses on the impact on improving quality and efficiency and optimizing the process of enterprises relying on "digital dividend", but the explanatory power of the effects on enterprise risk prevention and defense are relatively weak (Dmitry & Henrik, 2023)[3]. Resilience under the stress framework is a classic perspective to explore enterprise risk-taking (Conz & Magnani, 2020)[2]. How digital transformation affects enterprise resilience and promotes risk-taking has become an urgent question to be answered. The impact mechanism of digital transformation on enterprise risk-taking still needs to be explored in a personalized way.

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2 Theoretical Background and Development of Hypotheses

Since IBM first proposed the concept of enterprise digital transformation in 2012, it has been supported and followed by many enterprises. The digital economy has become the focus of promoting economic transformation, and the enterprise digital transformation has become its core. China has included it in the government work report for six consecutive years. In 2018, it proposed the construction of "Digital China" for the first time. Starting in 2021, China has begun to emphasize accelerating the digital transformation of traditional industries and small and medium-sized enterprises, which means that the enterprise digital transformation has begun to rise from the organizational willingness to the national strategy. Therefore, we viewed the "Digital China" strategy as a quasi-natural experiment to drive corporate digital transformation.

Previous studies focused on the positive impact of digital transformation on enterprise business, and the enterprises are placed in a stable and safe development environment to explore the empowering effect and quality improvement effect of digital transformation on enterprises. At present, the VUCA and BANI characteristics of the external environment of enterprises are increasing, and ambiguity and disorder have become the norm. The mechanism of improving quality and efficiency and the mechanism of optimizing and empowering under the previous linear change cannot effectively explain the effect mechanism of digital transformation on enterprise risk-taking.

Enterprise resilience based on the ability view can explain how enterprises respond to risk shocks in the context of countertrend, and resilience can help enterprises to achieve "rebound" and "reverse" (Anas et al., 2021)[1]. To realize the "rebound" means to meet the survival needs, restore the state before the risk shock, and improve the enterprise risk-taking ability. To achieve "reverse" is to meet the development needs, grasp the opportunities derived from the crisis, and realize the new development.

Digital transformation is conducive to improving enterprise resilience and thereby promoting the improvement of enterprise risk-taking ability. From the perspective of realizing "rebound", digital transformation is conducive to enhancing enterprise risk-taking through shock absorption and energy dissipation. On the one hand, digital transformation promotes the flow of information and improves communication efficiency, which is conducive to promoting the connection between enterprises and the upstream and downstream of the supply chain, realizing stable operation. On the other hand, digital transformation realizes the integration of digital technology and production process, improves the supervision level on the whole process, reduces production loss, reduces the occupation of idle resources and transaction costs, and then improves enterprise risk-taking. In terms of "reverse", digital transformation enhances enterprise risk-taking ability through the regenerative development effect. Digital transformation is conducive to improving enterprise information collection and processing capabilities, promoting enterprises to sensitively grasp development opportunities, improving long-term investment and innovation levels, and further improving risk-taking ability. Based on the analysis, we propose the following hypothesis:

Hypothesis 1: Digital transformation actively promotes enterprise risk-taking.

3 Research Design

3.1 Model Design

Before the digital economy has become a national strategy, some enterprises have carried out different degrees of digital practice. Therefore, the dummy variable setting of the traditional DID model cannot accurately measure the changes in enterprise digital transformation. Drawing on the empirical operations of Xu et al. (2020)[4], the "Digital China" strategy is regarded as a quasi-natural experiment, and the continuous DID method is used for empirical testing. The model setting is as follows:

$$Res_{i,t} = \alpha_0 + \alpha_1 \times digtr_{i,t} + \gamma \sum Controls_{i,t} + \mu_i + \lambda_t + \upsilon_j + \varepsilon_{i,t} \quad (1)$$

Among them, $Res_{i,t}$ is the dependent variable, which represents the risk-taking of enterprise i of year t. The *digtr* represents digital transformation. Controls are a series of control variables. the α_0 is a constant. The μ_i is the firm fixed effect. The λ_t is year fixed effect. The υ_j is the industry fixed effect. The $\varepsilon_{i,t}$ is residual. The α_1 is the coefficient of the core independent, which reflects the relationship between digital transformation and enterprise risk-taking ability.

3.2 Variable Declaration and Data Source

We used the data of Chinese listed companies from 2011 to 2022 as a research sample, which is processed as follows: (1) excluding firms belonging to the financial and real estate industries; (2) excluding those with missing financial data; (3) excluding those with special treatment (ST, ST* and PT); (4) excluding insolvent firms. To avoid the influence of outliers, we take the winsorization for the core continuous variables at the 1% and 99% levels and finally obtain 25929 firm-year observations.

The enterprise risk-taking (Res), which is the dependent variable, is expressed by earnings volatility, and the three-year volatility of ROA minus net profit is measured. The specific operation process is to take every three years (years t-2 to t) as an observation period, and rolling calculates the standard deviation of ROA minus net profit.

The digital transformation (*digtr*), which is the core independent variable, consists of the interaction terms *dig* × *Post*. The Post indicates whether or not to propose the "Digital China" strategy, which is set to be 1 after 2018 and 0 otherwise. The *dig* represents the mean value of the level of digital transformation in 2016 and 2017, whose construction is carried out according to the following process: Firstly, referring to Wu et al. (2021)[5], we constructed a word set of digital transformation based on natural language processing technology (NLP), which consists of digital strategy, digital technology, and digital technology application. Secondly, we counted the frequency of keywords by text analysis based on the word set. Finally, the proportion of digitization-related word frequency in the total word frequency is used to measure the *dig*.

To eliminate the influence of other potential variables on enterprise risk-taking, we further include a series of control variables, including enterprise property rights, enterprise age, enterprise size, Tobin Q, cash flow, asset structure, short-term debt ratio,

separating extent of ownership and controlling right, ownership concentration, total asset turnover ratio, asset-liability ratio and return on equity. Due to space limitations, the detailed measures of control variables are reserved for review.

The digital transformation is obtained by text analysis of the MD&A in the annual reports of listed companies. The policy dummy variables are manually processed and set. The employee-related data are from the Wind database, and other financial data and R&D data are from the CSMAR database.

4 Empirical Results and Discussion

4.1 Baseline Regression Results

The baseline regression results are shown in columns (1) to (4) of Table 1. We used the stepwise regression method to test the effect of digital transformation on enterprise risk-taking, and the control variables and fixed effects are included in turn. The results show that the estimated coefficient of digital transformation is significantly positive at the 1% level. After the inclusion of control variables and fixed effects, the value of the estimated coefficient is slightly smaller, and there is no substantial change. This means that digital transformation significantly improves the enterprise risk-taking ability, and Hypothesis 1 is initially verified.

4.2 Robustness Test

To test the applicability of the DID model, we further conducted the parallel trend test. By constructing the intersection multiplication term of the year dummy variable and digital transformation, and then eliminating the data of the period before the policy occurred, the trend chart of event analysis was drawn, as shown in Fig. 1. The results show that before the policy occurrence, the coefficients of the interaction term are not significant, and there is no significant difference between different groups; after the policy occurrence, the coefficients of the interaction term start to be significant, which mean pass the parallel trend test. The coefficient of the interaction term is not significant in the current policy period, which means that the positive impact of digital transformation on enterprise risk-taking has a certain lag.

Table 1. Baseline results and robustness test.

	(1) *Res*	(2) *Res*	(3) *Res*	(4) *Res*	(5) *Res2*	(6) *Res*	(7) *Res*	(8) *Res*
digtr	1.708***	1.131***	1.451***	0.954***	0.994***	0.975***	1.134***	1.141***
	(0.2200)	(0.2920)	(0.2290)	(0.2920)	(0.2700)	(0.3100)	(0.3450)	(0.3420)
digtr-2						-0.0611		0.176
						(0.3160)		(0.3260)
digtr-1							-0.286	-0.391
							(0.3000)	(0.3000)

Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.0267***	0.0274***	0.113***	0.249***	0.244***	0.249***	0.249***	0.249***
	(0.0004)	(0.0003)	(0.0087)	(0.0286)	(0.0268)	(0.0292)	(0.0288)	(0.0292)
Fixed Effects	No	Yes	No	Yes	Yes	Yes	Yes	Yes
N	25929	25901	22314	22256	22256	20667	21493	20667
R^2	0.0128	0.00321	0.0949	0.0889	0.0933	0.0896	0.0891	0.0897

*Notes: Robust standard errors clustered at the firm level are in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01; the same below. Table Source: Author's homemade.*

We carried out the robustness test by changing the variable measure, and *Res2* is obtained by annual industry adjustment of *Res* and substituted into equation (1), which is shown in column (5) of Table 1. The coefficient of digital transformation is significantly positive at the 1% level, which means that digital transformation significantly improves the enterprise risk-taking ability. Next, we further carried out the robustness test by removing the expectation effect. To avoid the expected effect of the policy, we proposed the policy one and two years earlier, generated $digtr_{-2}$ and $digtr_{-1}$, and then substituted them together into equation (1), whose results are shown in columns (6) to (8) of Table 1. Only the interaction term in the policy current period is significantly positive, which verifies the robustness of Hypothesis 1.

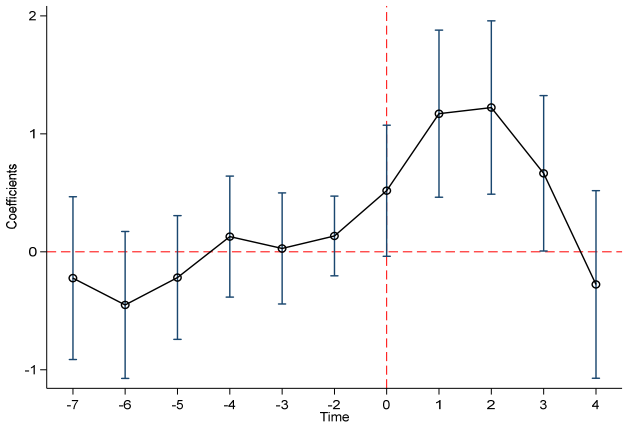

Fig. 1. Parallel trends tests. (*Figure Source: Author's homemade.)*

5 Conclusions

Based on the perspective of enterprise resilience, we considered the proposal of the "Digital China" strategy as a quasi-natural experiment to promote the enterprise digital transformation and built a continuous DID model to test whether digital transformation

can improve the enterprise risk-taking ability. The results show that digital transformation has a significant role in promoting enterprise risk-taking, and this conclusion is tested in a series of robustness tests. Digital transformation can improve the enterprise risk-taking ability by exerting the "shock absorption" effect, "energy dissipation" effect, and "regenerative development" effect.

For the government, it is necessary to further implement the "digital China" strategy, vigorously promote the enterprise digital transformation, improve the digital emergency response, digital rescue, and digital regeneration systems, and improve the institutional basis for digital technology to support risk management. For enterprises, it is necessary to further promote the enterprise digital transformation, focus on improving the enterprise digital maturity, formulate the digital transformation implementation plan and digital governance plan, give play to the positive role of digital technology in enterprise risk management, and coordinate the relationship between stakeholders.

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