Digital Transformation of Non-Financial Enterprises and Shadow Banking Business: Intensification or Mitigation

Zhengyang Zhang

School of Materials Science and Engineering, Tianjin University, Tianjin 300350, China

zhangzhengyang@tju.edu.cn

Abstract. As a new driving force for the high-quality development of China's economy, digital transformation is crucial to the development of multi-dimensional businesses of enterprises. This paper selects the A-share listed companies in Shanghai and Shenzhen from 2006 to 2020 as a sample, and examines the impact and mechanism of non-financial enterprises' digital transformation on shadow banking business from both theoretical and empirical perspectives. The study found that the digital transformation of non-financial enterprises can intensify the shadow banking business. The mechanism analysis shows that the digital transformation of enterprises intensifies the shadow banking business by enhancing the information advantage and inhibiting the regulatory level. Heterogeneity analysis found that digital transformation has a more obvious effect on shadow banking in enterprises with weak internal control and high-risk uncertainty. This article not only provides an implementation path for enterprises to better enjoy the dividends of digital transformation, but also provides more important experience and enlightenment for the government to help enterprises in digital transformation and guard against the development of shadow banking business.

Keywords: Digital Transformation; Shadow Banking; Information Advantages; Financing Constraints; Financial Regulation.

1. Introduction

The Fourteenth Five-Year Plan for the National Economic and Social Development of the People's Republic of China and the Outline of the Long-term Goals for 2035 list "Accelerating the Digital Development and Building a Digital China" as a separate chapter, put forward the idea of "driving the transformation of production, lifestyle and governance by digital transformation as a whole". From the perspective of specific data, the White Paper on China's Digital Transformation (2021) The report shows that in 2020, the penetration rate of digital R&D and design tools among enterprises in key fields of China's manufacturing industry will exceed 70%, and the application of big data technology will cover many fields such as government affairs, finance, medical care and energy. In 2021, the scale of China's digital economy will reach 45.5 trillion-yuan, accounting for 39.8% of GDP. It will play an increasingly important role in the stability and support of the national economy and promote the development of China's economy to a higher level. According to the report of Digital Transformation Index of Chinese Enterprises in 2021 released by Accenture, the average score of the digital transformation index of Chinese enterprises has risen from 37 points in 2018 to 54 points in 2021, and the overall transformation process has been more than half completed. It can be seen that the digital transformation has become the trend of the times and has been widely discussed by the academic, political and business circles.

The existing literature has deeply studied the specific economic consequences of digital transformation, mainly focusing on the impact on enterprise division of labor, innovation and risk response. For example, Wu Fei et al. (2021) found that the digital transformation of listed companies can significantly improve stock liquidity by investigating the performance of listed companies in the capital market. Yuan Chun et al. Li Yuan and Xue Yulian (2022) found that digital transformation can significantly enhance the ability of sustainable development of enterprises. Yang Jie et al. (2022) showed that digital transformation can significantly enhance enterprise innovation. Wang Huijuan and others found that digital transformation can significantly improve the level of enterprise risk taking. Wang Rongji et al. (2022) found that the digital transformation of enterprises may enhance

market power by reducing transaction costs, improving production efficiency and easing financing constraints. Liu Mengsha et al. (2022) found that corporate digital transformation can significantly reduce the cost of corporate debt financing. The higher the degree of corporate digital transformation, the lower the cost of corporate debt financing. Ye and Tong (2022) pointed out that digital transformation can promote the overall improvement of the main business performance of enterprises by improving the internal management level and innovation ability of enterprises. Zeng and Lei (2021) found that the digital transformation of enterprises can improve total factor productivity by improving enterprise management efficiency and technology level.

However, it is noteworthy that there are few articles discussing the impact of digital transformation on the shadow banking of non-financial enterprises. Due to its systemic risk characteristics, the negative consequences of shadow banking business were once very serious in China and became the focus of financial stability. With regard to the factors affecting shadow banking, the existing research findings can be discussed from the perspectives of financing constraints (Chen et al., 2018), bank deferred executive compensation (Wang Yanyan et al., 2020), regulatory arbitrage (Xiao, 2020), compensation for competition losses (Ahn and Breton, 2014) and opportunism (Si Dengkui et al., 2021). According to the structure hole theory, non-financial enterprises with information advantages play a role in connecting the structure hole between enterprises in need of funds and financial institutions, making shadow banking business "popular" (Yan Endian and Xie Jiajia, 2021). On the one hand, digital transformation can improve production efficiency, improve the ability of enterprises to collect and use information (Yang Jie et al., 2022), increase supervision and audit costs, and promote the development of shadow banking. On the other hand, digital transformation can significantly alleviate financing constraints and financial mismatches, improve the ability of enterprises to cope with risks, strengthen internal governance, reduce opportunistic behavior (Chen Haidong and Wu Zhijun, 2022), and inhibit the development of shadow banking. Therefore, the research on the impact of digital transformation on the shadow banking of non-financial enterprises is of great significance.

The possible research contributions of this paper are as follows: (1) Expand the relevant research on the impact of digital transformation on the economic and financial fields. Unlike the existing literature, which mostly studies the progress from the perspective of the impact of digital transformation on the growth and development of enterprises (Li Yuan and Xue Yulian, 2022), this paper, based on the background of the vigorous development of digital transformation, integrates digital transformation and shadow banking of non-financial enterprises into the same research framework, which forms a useful supplement to the existing literature. (2) Due to the different characteristics of enterprise risk level and internal control quality, the impact of digital transformation on shadow banking of non-financial enterprises may have different characteristics. Therefore, based on the dimensions of enterprise risk level and internal control quality, this paper carries out group regression on the relationship between digital transformation and shadow banking of non-financial enterprises, further revealing the heterogeneous impact of digital transformation under different conditions. (3) This paper further discusses the specific ways of digital transformation to promote the shadow banking of non-financial enterprises, and provides some guidance for practice. Through regression analysis, it verifies the two ways of digital transformation to promote the shadow banking of non-financial enterprises by promoting the information advantage of enterprises and inhibiting the level of supervision.

2. Theoretical Analysis and Research Assumptions

The shadow banking of non-financial enterprises is an important way to alleviate the capital problem under the background of corporate credit mismatch. Due to the existence of financing constraints, regulatory arbitrage and opportunism, the problem of shadow banking has become increasingly prominent in recent years. On the one hand, digital transformation can promote enterprises to grasp information advantages and restrain supervision, thus promoting shadow banking;

On the other hand, digital transformation can alleviate financing constraints and financial mismatches, strengthen internal control and internal governance, and then curb shadow banking. Due to the dual nature of the impact of digital transformation on the shadow banking of non-financial enterprises, when analyzing the relationship between the two, this paper proposes research hypotheses from the positive and negative effects, as follows:

2.1 Digital Transformation Intensifies the Shadow Banking of Non-financial Enterprises

On the one hand, digital transformation promotes the shadow banking of non-financial enterprises by promoting the information advantages of enterprises. According to the "structural hole" theory, in the case of information inequality between the internal and external capital demanders and the financial institutions on the conventional capital supply side of the enterprise, non-financial enterprises with significantly enhanced information advantages play the role of "structural hole" (Burt, 1992; Chen Yunsen, 2015). They tend to use the information in their hands to connect financial institutions and capital demanders, two individuals who have no direct connection (Liu Lin and Wang Jinfeng, 2022), and use the funds in their hands to extend credit to obtain a higher rate of return, ultimately promoting the development of the scale of shadow banks (Yan Endian and Xie Jiajia, 2021). Further, through digital transformation, enterprises use big data, internet, artificial intelligence, 5G, cloud computing, blockchain and other technologies to timely obtain and feedback information about the whole process of production and operation (Yang Jie et al., 2022), and enhance their ability to obtain, store and analyze data in the whole process of production and operation. Thus, it can promote the transformation of the internal operation mode and the optimization of the management system of the enterprise, promote the internal governance of the enterprise to be more intelligent (Huang Xinggang et al., 2022), and make the internal cross-department information advantage of the enterprise more significant. On this basis, enterprises have a more accurate and accurate grasp of the whole process information, and the information advantages of cross-department, cross-upstream and downstream, cross-industry grasp have been significantly enhanced. In addition, digitalization accelerates the continuous generation of new data and new knowledge in the enterprise's intelligent closed-loop structure and market (Chen Haidong and Wu Zhijun, 2022), and the transmission and sharing of information inside and outside the enterprise (Wang Rongji et al., 2022) will help enterprises establish a convenient information exchange platform (Shen Minghao et al., 2022), improve the use efficiency of data elements (Huang Xinggang et al.,2022). Cross-industry collaborative innovation capability makes enterprises more efficient and convenient to grasp various kinds of external information. Therefore, digital transformation enhances the ability of non-financial enterprises to obtain information across sectors, upstream and downstream, and across industries through different supply chains (Zhang Min, 2012). Then it is inclined to make full use of the information advantage to play a more significant role in extending internal and external credit of enterprises and intensifying the shadow banking of enterprises (Yan Endian and Xie Jiajia, 2020). When receiving the paper, we assume that the corresponding authors grant us the copyright to use.

On the other hand, digital transformation can promote the shadow banking of non-financial enterprises by inhibiting regulation. In the enterprise, the data monopoly caused by the digital transformation will make it difficult for the management to make unified decisions, resulting in the failure of supervision over the management (Sun Zeyu and Qi Baolei, 2021). At the same time, senior executives use the information advantage of digital technology to transmit misleading information to shareholders with different interests or give private benefits to win over some shareholders (Cheng M, 2015), thus weakening the internal regulatory power of the enterprise, It will provide a hotbed for the relevant opportunistic behaviors of the management, and urge them to engage in the shadow banking business to achieve the pursuit of post promotion and high profits (Si Dengkui et al., 2021). Secondly, after the digital transformation, the ability of enterprises to use big data, internet and other high-tech to evade regulation has been significantly enhanced, and they are engaged in various cross-market and cross-industry "shadow" banking businesses with excess profits (Dou Wei et al., 2022). Therefore, the digital transformation of enterprises can enhance the ability of enterprises to obtain

information, form the information gap between different internal links and between enterprises and external links, and create information monopoly groups with information advantages. At the same time, it will also improve the ability of digital technology and data operation, and further improve the level of information "packaging" and "whitewashing", so as to bypass the conventional regulatory system and enter into high profits, High-yielding activities are conducive to the development of shadow banking.

Therefore, based on the above analysis, the following assumptions are proposed:

H1a: Digital transformation can intensify the shadow banking business of non-financial enterprises.

2.2 Digital Transformation Inhibits the Shadow Banking of Non-financial Enterprises

On the one hand, digital transformation can alleviate financing constraints and financial mismatches, thus inhibiting the shadow banking of non-financial enterprises. Non-financial enterprises with strong demand for shadow banking generally have high financing constraints. Non-financial enterprises with large financing constraints and small market power tend to obtain capital through informal financial channels (Si Dengkui et al., 2022). However, due to the existence of long-term credit discrimination, China's small and private enterprises generally face the problem of "financing is difficult and expensive" (Sun Zhihong, Liu Bingrong, 2022), Make financing constraints become an important driving force for the development of shadow banks. Digital transformation can significantly reduce financing costs, broaden enterprise financing channels, and reduce financial mismatch (Han Xun and Li Jianjun, 2020) to ease financing constraints, thus inhibiting the development of shadow banking. First of all, the widespread use of digital technology has lowered the threshold and cost of financial services and effectively eased the financing constraints of enterprises (Huang Yiping and Huang Zhuo, 2018). Secondly, in order to avoid the financial crisis caused by the increase of capital demand in the process of digitalization, enterprises will prepare more cash based on the prevention motivation, reduce the scale of external financing required, and ease the external financing constraints (Tan Zhidong et al., 2022). In addition, enterprises will carry out digital transformation in accordance with national policies and development strategies, so it is easier to obtain special support from local governments and enjoy more preferential policies, The expenditure of business tax of enterprises will be reduced accordingly to ease the financing constraints of enterprises (Wang Rongji et al., 2022). Finally, after the digital transformation, the enterprise will send a positive signal to the society, improve the reputation and image of the enterprise (Wu Fei et al., 2021; Li Yuan and Xue Yulian, 2022), improve the investment confidence of investors, enrich external financing channels, and reduce financing constraints (Wang Bingnan et al., 2022).

On the other hand, digital transformation can strengthen internal control and internal governance, and inhibit the shadow banking of non-financial enterprises. With the strengthening of the internal governance mechanism (Yi Luxia et al., 2021), the quality of control has been improved, while the strength of external supervision has been strengthened, the opportunistic behavior of the management or shareholders seeking high profits has been restrained (Si Dengkui et al., 2021), and the regulatory arbitrage that bypasses the supervision system has hit the shadow banks. It is noteworthy that digital transformation can strengthen internal governance and internal control. First of all, through digital transformation, enterprises can improve the accuracy and effectiveness of risk assessment, risk response and monitoring (Lin Chuan et al., 2022), form a "hidden supervision" of the management, help to make reasonable investment decisions, prevent the prevalence of speculation (Zhao Xi and Xu Ningning, 2013), and curb the shadow banking of non-financial enterprises (Si Dengkui et al., 2022). Secondly, the external supervision mainly focuses on the attention of analysts, institutional investors (Hu Jinyan and Zhang Xiaofan, 2022) and government supervision agencies. After the digital transformation, it will send a positive signal to the society, attract the attention of analysts and institutional investors, strengthen the external market supervision (Wang Shouhai et al., 2022), and then inhibit the shadow banking of non-financial enterprises.

Therefore, based on the above analysis, the following assumptions are proposed:

H1b: Digital transformation can inhibit the shadow banking business of non-financial enterprises.

3. Research Design

3.1 Data Source and Sample Selection

This paper selects the A-share listed companies in Shanghai and Shenzhen from 2006 to 2020 as the initial sample, and carries out the following screening on the data: (1) eliminate the ST and * ST enterprise samples; (2) Eliminate the sample of financial enterprises; (3) Delete samples with missing variable observations; (4) All continuous variables are subject to 1% tail reduction (Winsorise). After the above screening, a total of 19232 samples were obtained. The main data of this paper comes from CSMAR and Wind databases.

3.2 Data Source and Sample Selection

3.2.1 Shadow Banking of Non-financial Enterprises (Shbank)

Based on the research of Li Jianjun, Han Xun (2019), and Stenkui et al. The entrusted loan data is obtained by manually identifying and sorting out the entrusted loan announcements and notes to the accounting statements of the sample companies; The entrusted financial management data is obtained by querying the sub-database of China's foreign investment in CSMAR; Private lending is measured by using the "other accounts receivable" in the balance sheet of listed companies in the CSMAR database as the proxy variable.t the end of the contribution under a heading References, see our example below.

3.2.2 Enterprise Digitalization Degree (Digit)

Based on the research of Wu Fei et al. (2021), this paper uses the frequency of key words related to digital transformation in the annual report of listed companies to construct digital transformation indicators. Determine the key words related to artificial intelligence technology, blockchain technology, cloud computing technology, big data technology, and digital technology application in the sample annual report (as shown in Table 1), and add the word frequency and take the logarithm to get the enterprise digital degree measurement index (*Digit*).

Table 1. Keyword thesaurus of enterprise digital transformation

(1)	(2)
Artificial intelligence technology	AI, business intelligence, image understanding, investment decision support system, intelligent data analysis, intelligent robot, machine learning, deep learning, semantic search, biometric technology, face recognition, voice recognition, identity verification, automatic driving, natural language processing
Big data technology	Big data, data mining, text mining, data visualization, heterogeneous data, credit reporting, augmented reality, hybrid reality, virtual reality
Cloud computing technology	Cloud computing, stream computing, graph computing, in-memory computing, multi-party security computing, brain-like computing, green computing, cognitive computing, fusion architecture, billion level concurrency, EB level storage, Internet of Things, information physics system
Blockchain technology	Blockchain, digital currency, distributed computing, differential privacy technology, smart financial contract
Application of digital technology	Mobile internet, industrial internet, mobile internet, internet healthcare, e-commerce, mobile payment, third-party payment, NFC payment, smart energy, B2B, B2C, C2B, C2C, 020, Internet connection, smart wear, smart agriculture, smart transportation, smart medical care, smart customer service, smart home, smart investment consulting, smart culture and tourism, smart environmental protection, smart grid, smart marketing, digital marketing, unmanned retail, internet finance Digital finance, Fintech, financial technology, quantitative finance, open bank

3.2.3 Control Variable

In order to control other economic characteristic indicators that affect the shadow banking of non-financial enterprises, this paper introduces a series of control variables. See Table 2 for details.

Table 2. Control variable definition table

Variable symbol	Variable name	Meaning
Size	Enterprise size	ln(Total assets+1)
Roa	Return on assets	Total net profit/assets
Lev	Asset-liability ratio	Total liabilities/total assets
Age	Age of the enterprise	the current year - the year of registration
Growth	Enterprise growth	(Current operating income - previous operating income)/previous operating income
Dual	Two functions in one	The CEO and the chairman of the board of directors are one. If yes, it is 1, otherwise it is 0
Mngmhld	Management shareholding ratio	Number of shares held by the management/total number of shares of the enterprise
Insthold	Institutional shareholding ratio	Shares held by institutional investors/total shares of enterprises
GDPg	Economic growth rate	(GDP of the current period/GDP of the previous period) - 1

3.3 Data Source and Sample Selection

$$Shbank = \beta_0 + \beta_1 Digit + \beta_2 Size + \beta_3 Roa + \beta_4 Lev + \beta_5 Age + \beta_6 Growth + \beta_7 Dual + \beta_8 Mngmhld + \beta_9 Insthold + \beta_{10} GDPg + \sum Year + \sum Industry + \varepsilon \quad (1)$$

In the model, the explained variable is *Shbank*, which means the shadow banking of non-financial enterprises. The core explanatory variable is *Digit*, which represents the degree of digital transformation of enterprises. The coefficient reflects the impact of the degree of digitalization of enterprises on the shadow banking of non-financial enterprises. It is the focus of this paper. If it is positive, it indicates that digital transformation can intensify the shadow banking business of non-financial enterprises. In order to absorb the impact of unobservable factors at the industry and time levels on the shadow banking of non-financial enterprises, this paper adds the fixed effects at the year and industry levels as the residual item.

4. Analysis of Empirical Results

4.1 Descriptive Statistics

Table 3 shows the descriptive statistical results. The average value of Shbank is 17.236, indicating that the average value of enterprises in the sample carrying out shadow banking business is 17.236, reflecting the increasingly prominent problem of non-financial enterprises engaging in shadow banking business in recent years. The maximum value is 22.273, the minimum value is 12.611, and the standard deviation is 1.877, reflecting that the scale of shadow banking business of different enterprises varies greatly. The maximum value of Digit is 4.718, and the minimum value is 0.000, indicating that the degree of digital transformation of enterprises in the sample is quite different.

Table 3. Descriptive statistics of main variables

Variable	Mean	Standard deviation	Median	Minimum	Maximum
Shbank	17.236	1.877	17.188	12.611	22.273
Digit	1.002	1.267	0.693	0.000	4.718
Size	22.134	1.285	21.965	19.687	26.061
Age	17.246	5.206	17.000	7.000	32.000
Roa	0.040	0.054	0.036	-0.188	0.197
Lev	0.439	0.208	0.436	0.053	0.905
Growth	0.194	0.455	0.116	-0.541	3.043
Mngmhld	0.113	0.189	0.001	0.000	0.674
Insthold	0.397	0.232	0.405	0.002	0.882
GDPg	0.110	0.035	0.104	0.070	0.184

4.2 Descriptive Statistics

Table 4 reports the regression results of corporate digital transformation to the shadow banking of non-financial enterprises. Model (1) is a regression result with only core explanatory variables, and the Digit regression coefficient is significantly positive at the level of 1%. The control variable is added to the model (2), and the Digit regression coefficient is still significantly positive at the 1% level. The industry-year fixed effect is added in the model (3), and the Digit regression coefficient is still significantly positive at the 1% level. The above results show that the deepening of enterprise digitalization will significantly improve the degree of shadow banking of non-financial enterprises in both economic and statistical sense.

Table 4. The impact of digital transformation on the shadow banking of non-financial enterprises

	(1)	(2)	(3)
	Shbank	*Shbank*	*Shbank*
Digit	0.222***	0.218***	0.156***
	(22.802)	(32.783)	(18.045)
Size		0.893***	0.959***
		(96.986)	(99.080)
Roa		-0.700***	-1.515***
		(-3.274)	(-7.284)
Lev		1.859***	1.647***
		(30.346)	(26.083)
Age		0.008***	0.012***

		(4.268)	(6.137)
Growth		0.018	0.020
		(0.853)	(0.947)
Dual		-0.049**	-0.050***
		(-2.282)	(-2.409)
Mngmhld		-0.109*	-0.051
		(-1.902)	(-0.887)
Insthold		-0.264***	-0.266***
		(-5.443)	(-5.647)
GDPg		1.768***	5.396***
		(6.405)	(7.918)
Fixed year effect	No	No	Yes
Fixed Industry effect	No	No	Yes
_cons	17.014***	-3.747***	-4.710***
	(978.379)	(-19.406)	(-18.591)
N	19232	19232	19232
adj.R²	0.022	0.558	0.608

Note: ***, ** and * are significant at the level of 1%, 5% and 10% respectively.The same will be said later.

4.3 Robustness Check

Table 5. Robustness check

	Replace explanatory variable	Introduction of missing variables	Excluding samples before 2008
	(1)	(2)	(3)
	Shbank	*Shbank*	*Shbank*
Digit		0.129***	0.155***
		(14.923)	(17.539)
Digit1	91.792***		
	(11.075)		
Control variables	Yes	Yes	Yes
Fixed year effect	Yes	Yes	Yes
Fixed Industry effect	Yes	Yes	Yes
_cons	-4.677***	-4.378***	-4.535***
	(-18.377)	(-17.330)	(-17.001)
N	19232	19232	17431
adj.R²	0.604	0.617	0.617

First, according to Yuan Chun et al. The corresponding regression results are reported in column (1) of Table 5. It can be seen that after changing the explanatory variables, the research conclusion is basically consistent with Table 4.

Second, considering that there may be missing variables, this paper introduces the operating cash flow ratio (*CFO*) and the tangible asset ratio (*Tang)* in the model (1). *CFO* is expressed by dividing the net cash flow from operating activities by the total assets at the end of the period; *Tang* is expressed as the sum of fixed assets and inventories divided by total assets. The corresponding regression results are reported in column (2) of Table 5. It can be seen that after the introduction of missing variables, the research conclusion is consistent with Table 4.

Third, considering the impact of the global financial crisis in 2008, it will have an abnormal impact on major economic indicators. This may affect the robustness of the above regression results. In this paper, the observed values before 2008 are removed and the regression is carried out again. The corresponding regression results are reported in column (3) of Table 5. It can be seen that after removing the samples before 2008, the research conclusion is consistent with Table 4.

Based on the above analysis, this paper assumes that H1a is tenable.

5. Mechanism Analysis

According to the previous analysis, digital transformation may promote non-financial enterprises to engage in shadow banking business by promoting enterprise information advantages and inhibiting internal and external supervision. The specific model is as follows:

$$Asy = \beta_0 + \beta_1 Digit + \beta_2 Size + \beta_3 Roa + \beta_4 Lev + \beta_5 Age + \beta_6 Growth + \beta_7 Dual + \beta_8 Mngmhld + \beta_9 Insthold + \beta_{10} GDPg + \sum Year + \sum Industry + \varepsilon \quad (2)$$

$$Supv = \beta_0 + \beta_1 Digit + \beta_2 Size + \beta_3 Roa + \beta_4 Lev + \beta_5 Age + \beta_6 Growth + \beta_7 Dual + \beta_8 Mngmhld + \beta_9 Insthold + \beta_{10} GDPg + \sum Year + \sum Industry + \varepsilon \quad (3)$$

Among them, there are two mechanism variables: *Asy* and *Supv*. *Asy* is the variable to test the intermediary mechanism of information superiority, and *Supv* is the variable to test the internal and external supervision mechanism. Other variable definitions are consistent with model (1).

5.1 Digital Transformation→Enhancement of Information Advantages→Promotion of Shadow Banking

Through digital transformation, enterprises use big data, internet, artificial intelligence, 5G, cloud computing, blockchain and other technologies to timely obtain and feedback information about the whole process of production and operation (Yang Jie et al., 2022), so as to enable enterprises undergoing digital transformation to gain information advantages. Based on the research of Yi Luxia et al. (2021), this paper uses the analyst's attention intensity to reflect the enterprise's information superiority (*Asy*). Table 6 reports the information superiority mechanism test. It can be seen from column (1) of table 6 that digitalization can significantly improve the degree of information superiority of enterprises. This empirical result is consistent with the previous theoretical analysis, which shows that digital transformation can significantly improve the shadow banking level of non-financial enterprises by improving the degree of information superiority of enterprises and promoting enterprises to use information to extend internal and external credit.

5.2 Digital Transformation→Restrain Regulation→Promotion of Shadow Banking

In this paper, the audit cost is used as the proxy variable of supervision difficulty, and the total audit cost (Supv) in the audit opinion sub-base of financial report of CSMAR database is used as the indicator of supervision level. Table 6 reports the mechanism inspection of internal control quality. From column (2) of table 6, it can be seen that digital transformation can significantly increase audit costs, indicating that digital transformation can significantly improve the difficulty of supervision and the ability of enterprises to evade supervision, thus inhibiting supervision. This empirical result is consistent with the previous theoretical analysis, which shows that digital transformation can significantly improve the participation of non-financial enterprises in shadow banking by restraining internal and external supervision.

Table 6. Mechanism test results

	Information superiority mechanism	Evasion of supervision mechanism
	(1)	(2)
	Asy	*Supv*
Digit	0.080***	0.016***
	(11.919)	(5.102)
Control variables	Yes	Yes
Fixed year effect	Yes	Yes
Fixed Industry effect	Yes	Yes
_cons	-10.480***	4.913***
	(-59.818)	(48.568)
N	19232	19915
adj.R²	0.455	0.655

6. Heterogeneity Analysis

6.1 Based on Internal Control Level

Table 7. Heterogeneity caused by the degree of internal control

	Shbank	*Shbank*
	Strong internal control	Weak internal control
Digital	0.142***	0.169***
	(11.635)	(13.731)
Control variables	Yes	Yes
Fixed year effect	Yes	Yes
Fixed Industry effect	Yes	Yes
_cons	-5.219***	-4.576***
	(-15.196)	(-11.744)
N	9732	9500
adj.R²	0.644	0.566

Existing research has found that enterprises with weak internal control are more difficult to deal with various risks and capital problems when conducting digital transformation (Chen Haidong and Wu Zhijun, 2016), thus providing a hotbed for the "popularity" of high-margin shadow banking business. Based on the research of Zhou Weihua et al. (2022), this paper measures the quality of internal control according to the internal control index issued by Shenzhen Dibo Big Data Research Center. In this paper, the internal control index obtained is converted into a dummy variable, and the listed companies are divided into two groups according to this. Based on this, the regression analysis is carried out. The regression results are shown in Table 7. Column (1) is the estimated result of enterprises with strong internal control. The coefficient of Digit is 0.142, which is significant at the level of 1%, indicating that the digital transformation of enterprises can significantly promote the

shadow banking business. Column (2) is the estimated result of the weak degree of internal control. The coefficient of Digit is 0.169, which is significant at the level of 1%, indicating that the digital transformation of enterprises can significantly promote shadow banking, and the improvement effect is stronger than that of enterprises with strong internal control. The possible reason is that, on the one hand, when the internal supervision of enterprises cannot effectively supervise and supervise the management, opportunistic behavior will prevail. Enterprises with low internal control level are more likely to have opportunistic behavior when they conduct digital transformation (Zhao Xi and Xu Ningning, 2013), which shows that the digital transformation of enterprises with weak internal control will promote the shadow banking business more significantly; On the other hand, enterprises with strong internal control tend to be more abundant in technology level, total capital, human resources and other elements (Tian Kunru and Han Fei, 2017). Rich resources can better avoid capital problems and various risks in the process of enterprise digital transformation. Therefore, compared with enterprises with strong internal control, digitalization of enterprises with weak internal control has a significantly stronger role in promoting shadow banking.

6.2 Based on the Level of Risk and Uncertainty

Table 8. Heterogeneity caused by risk and uncertainty

	Shbank	*Shbank*
	High risk and uncertainty	Low risk and uncertainty
Digit	0.159***	0.154***
	(13.079)	(12.453)
Control variables	Yes	Yes
Fixed year effect	Yes	Yes
Fixed Industry effect	Yes	Yes
_cons	-4.840***	-4.513***
	(-13.957)	(-12.029)
N	10087	9145
adj.R²	0.615	0.601

The promotion of enterprise digital transformation to the shadow banking of non-financial enterprises is affected by risks and uncertainties. Referring to the method of Nie Huihua (2020) and the policy uncertainty perception index extracted from the enterprise annual report text, this paper converts the obtained uncertainty index into a dummy variable, and divides listed companies into two groups, one group is enterprises with high risk and uncertainty, and the other group is enterprises with low risk and uncertainty. Compare the impact of digitalization on shadow banking business of enterprises with different risk uncertainties by grouping regression. See Table 8 for the regression results. Columns (1) - (2) are estimated by grouping according to the level of risk and uncertainty. The regression coefficients of Digit are 0.159 and 0.154 respectively, which are positive and significant at the level of 1%. Through the comparison of the absolute values of the coefficients, it can be found that when the level of risk uncertainty is high, the promotion effect of enterprise digital transformation on shadow banking is more significant. The possible reason is that, on the one hand, the digital transformation of enterprises means additional costs and high learning costs, and the increase of capital investment will not necessarily lead to output growth (Liu Shuchun et al., 2021), so the uncertainty of enterprises themselves caused by the soaring costs is significantly increased, leading to the tendency of banks and others to lend to state-owned enterprises or large enterprises, making these enterprises have more capital idle (Huang, et al., 2008). Therefore, the increased risk and uncertainty of enterprises will significantly enhance the financing mismatch, which will make the capital flow of state-owned enterprises and other enterprises with financing advantages more

abundant, and can significantly promote their participation in shadow banking activities. On the other hand, state-owned enterprises in the early stage of transformation, with the increase of risk and uncertainty, in order to maintain the performance and steady development of enterprises, managers' opportunistic behavior has increased significantly. At the same time, state-owned enterprises have the characteristics of principal-agent system, which has increased the level of information asymmetry between managers and principals to a certain extent, making managers' opportunistic behavior further improved (Chen Haidong and Wu Zhijun, 2022), Shadow banking is a highly profitable opportunistic business, so when risks and uncertainties increase, the role of digital transformation in promoting shadow banking will increase significantly.

7. Conclusion and Policy Recommendations

7.1 Conclusion

Digital transformation has become an important link in the development of non-financial enterprises, and is the general trend of national policies. The impact of digital transformation on the development of shadow banking of non-financial enterprises is also a very noteworthy issue. In view of this, this paper selects the A-share main board listed enterprises from 2006 to 2020 as a sample to test the impact and mechanism of non-financial enterprises' digital transformation on shadow banking business from both theoretical and empirical perspectives. The research found that the digital transformation of non-financial enterprises can intensify the shadow banking business. This conclusion is still valid after the robustness tests such as changing the measurement method of variables, adding control variables and removing samples. The mechanism analysis shows that the digital transformation of non-financial enterprises intensifies the shadow banking business by enhancing the information advantage and inhibiting the regulatory level. Heterogeneity analysis found that digital transformation has a stronger effect on shadow banking in enterprises with weak internal control and high-risk uncertainty.

7.2 Policy Recommendations

Based on the above research conclusions, this paper puts forward the following policy recommendations:

First, non-financial enterprises should strengthen their internal governance and internal control level, improve their risk response level, promote the digital transformation to play a greater positive role, avoid falling into the "financing trap", and become the "free rider" of shadow banking business. First of all, enterprises should promote the innovation and reform of the organizational structure, optimize the operation mode and management mechanism of enterprises, ensure the effective supervision and management of all levels of enterprises, avoid the short-sighted and speculative behavior of the management, and become the "hotbed" of shadow banks. Secondly, enterprises should collect, sort out and analyze the information of each link through artificial intelligence, blockchain, cloud computing, big data and other technologies, break the communication barriers between enterprises and upstream and downstream, make full use of information exchange channels, and achieve product lifecycle management, thus reducing operating costs and improving management efficiency. Finally, enterprises should optimize the operation process of financial resources, improve the efficiency of capital use and financial stability, and actively use the advantages of digital transformation to transmit positive information to the capital market, open up financing channels, and stabilize the capital operation process, so as to improve the level of enterprise risk bearing, and then curb shadow banking.

Second, while increasing the efforts to promote digital transformation, the government should also establish and improve the corresponding supervision and supervision system, appropriately increase the audit efforts, better promote the effective allocation of financing and financial capital, and curb the further expansion of shadow banking. First of all, the government should guide enterprises to make information transparent and open, reduce the negative impact of information

asymmetry, establish a more transparent and effective market environment, and avoid the information advantage caused by digitalization from aggravating shadow banking. Secondly, we should actively improve the relevant laws and regulations and supervision and management mechanism, fill the blind area of supervision, give full play to the positive role of digital finance, and prevent the occurrence of systemic financial risks. And focus on the shadow banking business scale of non-state-owned enterprises. Finally, give full play to the independence, professionalism and legality of the national audit supervision, and play a strengthening role in the process of digital transformation, and better restrain the shadow banking business.

Third, alleviate the loan discrimination of private enterprises in the process of digital transformation from the top policy tool design level, break the financing constraints, and ensure the healthy development of the economy and society. First, strengthen the inclusive nature of financial reform and effectively improve the credit discrimination and financing constraints faced by different enterprises. Secondly, the Ministry of Finance, the Securities Regulatory Commission and other regulatory authorities should strengthen the disclosure requirements and supervision of listed non-financial enterprises on their growth and operating conditions. At the same time, they should establish a management mechanism with controllable risk, effective supervision and strong binding force, implement classified supervision and penetrating supervision on various forms of shadow banking business, and establish a fair and efficient financing supervision service platform. Finally, it is recommended that the government introduce incentive policies to promote the digital transformation of enterprises, such as financial subsidies, tax incentives and the establishment of special financial support, so as to avoid enterprises engaged in digital transformation from falling into the "shadow bank" trap due to capital turnover and financing problems, so as to better enjoy the dividends of digital transformation.

References

[1] Chen Haidong, Wu Zhijun. Empirical test of the relationship between digitalization of state-owned enterprises and market competitiveness [J]. Statistics and Decision, 2022,38 (23): 184-188.

[2] Dou Wei, Zhang Shumin, Zheng Xinyi Can "structural" deleveraging restrain the "shadow" banking business of enterprises? [J] Journal of Nanjing University of Finance and Economics, 2022, No.234 (2): 34-45.

[3] Chen Yunsen. Social Network and Enterprise Efficiency: Evidence Based on the Location of Structural Holes [J] Accounting Research, 2015, (1): 48-55.

[4] Han Xun, Li Jianjun. Financial Mismatch, Shadow Banking of Non-financial Enterprises and Economic "Moving from Reality to Fiction" [J]. Financial Research, 2020, No.482 (8): 93-111.

[5] Hu Jinyan, Zhang Xiaofan. Executive financial background, external supervision and shadow banking of non-financial enterprises [J]. Journal of Jinan University (Social Science Edition), 2022,32 (1): 101-116+176.

[6] Huang Xinggang, Hou Baosheng, Ye Sijian, Li Yingshuai. Research on the relationship between digital transformation and enterprise total factor productivity -- a test based on the perspective of resource allocation [J]. Price Theory and Practice, 2022, No.461 (11): 107-111.

[7] Li Jianjun, Han Xun. Shadow banking and operational risk of non-financial enterprises [J]. Economic Research, 2019, 54 (8): 21-35.

[8] Li Yuan, Xue Yulian. Digital transformation and enterprise sustainable development [J]. Enterprise economy 2022,41 (12): 61-68.

[9] Lin Chuan. Digital transformation and risk of stock price collapse [J]. Securities Market Guide, 2022, (6): 47-57.

[10] Liu Lin, Wang Jinfeng. Social capital and shadow banking of non-financial enterprises [J]. Journal of Nanjing Audit University, 2022,19 (2): 80-90.

[11] Liu Mengsha, Shao Qi, Ruan Qingsong. Research on the impact of digital transformation on corporate debt financing costs [J/OL]. Research on financial issues: 1-9.

[12] Nie Huihua, Ruan Rui, Shen Ji. Corporate uncertainty perception, investment decision-making and financial asset allocation [J]. World Economy, 2020,43 (6): 77-98.

[13] Stenkui, Li Xiaolin, Zhao Zhongkuang. The shadow banking of non-financial enterprises and the risk of stock price collapse [J]. China Industrial Economy, 2021, No.399 (6): 174-192.

[14] Stenkui, Li Yingjia, Li Xiaolin. China's banking competition and shadow banking of non-financial enterprises [J]. Financial Research, 2022, No.506 (8): 171-188.

[15] Shen Minghao, Tan Weijie. Digital and enterprise green innovation performance - recognition of dual effects based on increment and quality improvement [J]. Southern Economy, 2022, No.396 (9): 118-138.

[16] Sun Zeyu, Qi Baolei. The coexistence of multiple major shareholders and the auditor's pricing decision [J]. Audit and Economic Research, 2021 (9): 1-10.

[17] Tan Zhidong, Zhao Xun, Pan Jun, etc. The value of digital transformation: based on the perspective of corporate cash holdings [J]. Financial Research, 2022,48 (3): 64-78.

[18] Tian Kunru, Han Fei. Internal control, institutional investors and real earnings management - based on the division of central enterprises, local state-owned enterprises and other enterprises [J]. East China Economic Management, 2017,31 (4).

[19] Wang Binan, Guo Jingxian, Lu Ying, Wang Zhongsong. Research on the impact of institutional ownership on corporate financial distress - the regulatory role of corporate digital transformation [J/OL]. Management Modernization, 2022 (6): 22-29.

[20] Wang Shouhai, Xu Xiaotong, Liu Yewei. Will the digital transformation of enterprises reduce the risk of debt default? [J]. Securities Market Herald, 2022, (4): 45-56.

[21] Wang Rongji, Wang Jue, Bai Dongbei. Digital transformation and enterprise market power - theoretical mechanism and empirical identification [J]. Modern Management Science, 2022, No.337 (6): 157-166.

[22] Wu Fei, Hu Huizhi, Lin Huiyan, Ren Xiaoyi. Digital transformation of enterprises and capital market performance - empirical evidence from stock liquidity [J]. Management World, 2021,37 (7): 130-144+10.

[23] Yan Endian, Xie Jiajia. Supply chain relations, information advantages and shadow banking business - based on empirical evidence of listed non-financial enterprises [J]. Management Review, 2021,33 (1): 291-300+329.

[24] Yang Jie, Ma Congwen, Liu Yuncai. The impact of digital transformation on enterprise innovation [J]. Statistics and Decision, 2022,38 (23): 180-184.

[25] Yi Luxia, Wu Fei, Xu Siyang. Research on the performance-driven effect of enterprise digital transformation [J]. Securities Market Herald, 2021, (8): 15-25+69.

[26] Yuan Chun, Xiao Tusheng, Geng Chunxiao, Sheng Yu. Digital transformation and enterprise division of labor: specialization or vertical integration [J]. China Industrial Economy, 2021, No.402 (9): 137-155.

[27] Zhao Xi, Xu Ningning. Information disclosure of management power, opportunistic motivation and internal control defects [J]. Audit Research, 2013, (4).

[28] Zhang Min. Supplier-client relationship and auditor selection [J] Accounting Research, 2012, (12): 81-86.

[29] Zhou Weihua, Liu Yilin. Management ability, enterprise digitalization and internal control quality [J]. Economic and Management Research, 2022,43 (5): 110-127.

[30] Ahn,J.H.,and R.Breton,2014, “Securitization, Competition and Monitoring”, Journal of Banking & Finance, 40(3):195~210..

[31] Allen, F., Y. Qian, G. Tu, and F. Yu,2019. “Entrusted Loans: A Close Look at China’s Shadow Banking System”, Journal of Financial Economics, 133(1):18~41.

[32] Burt R.S. Structural Holes: The Social Structure of Competition[M] USA: Harvard.

[33] Chang, C., Z. Liu, M. Spiegel, and J. Zhang,2019. “Reserve Requirements and Optimal Chinese Stabilization Policy”, Journal of Monetary Economics, 103(5).33~51.

[34] Cheng M, Lin B, Wei M. Executive compensation in family firms: The effect of multiple family members[J].Journal of Corporate Finance,2015,32:238-257. Business School,1992.

[35] Liu Y, J Dong, L Mei, R Shen. Digital innovation and performance of manufacturing firms: An affordance perspective [J/OL]. Technovation, 2022.

[36] Peng Y, Tao C. Can digital transformation promote enterprise performance? From the perspective of public policy and innovation [EB/OL]. Journal of Innovation & Knowledge, 2022.

[37] Reddy S K, Reinartz W. Digital Transformation and Value Creation: Sea Change Ahead [J]. GFK Marketing Intelligence Review,2017,9(1). Li J, Han X. The Macroeconomic Effect of Shadow Credit Market Financing[J]. Applied Economics & Finance,2016,3 (3):158-170.

[38] Zheng Ye, Yongjia Tong. Discrete Dynamics in Nature and Society: The Influence of Digital Transformation of Foreign Trade Enterprises on Their Business Performance [J],2022.