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Digital Transformation of Enterprises and Debt Maturity Structure

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Abstract

This article empirically tests the impact of corporate digital transformation on debt maturity structure based on financial data of listed companies and corporate digital transformation from 2016 to 2020. Firstly, digital transformation of enterprises can significantly optimize their debt maturity structure. Secondly, digital transformation of enterprises can optimize debt maturity structure by alleviating financing constraints, increasing media attention, and reducing information asymmetry. After robustness testing and alleviating endogeneity issues, this conclusion still holds. Further analysis reveals that the optimization effect of corporate digital transformation on debt maturity structure is more significant in state-owned enterprises, non high-tech enterprises, and enterprises in the eastern and western regions. The research in this article helps to enrich the research framework on the impact of digital transformation and enrich literature on the impact mechanism of corporate debt maturity structure.

Keywords

Digital Transformation; Debt Maturity Structure; Financing Constraints.

1. Introduction

Digital transformation has become a key means for enterprises to adapt to the market demands of the new era and enhance their competitiveness. Digital transformation refers to the use of new generation information technology by enterprises, such as cloud computing, big data, the Internet of Things, artificial intelligence, and blockchain, to stimulate the innovative driving potential of digital elements, create and enhance the survival and development capabilities of the information age, accelerate business optimization, upgrading, and innovation transformation, transform and enhance traditional driving forces, cultivate new driving forces for development, create, transmit, and acquire new value, The process of achieving transformation, upgrading, and innovative development. Digital transformation can help enterprises adapt to market changes in the digital economy environment, optimize business processes, improve production and operation efficiency, innovate business models, reshape core competitiveness of enterprises, and achieve business success and growth. Digital transformation involves three levels of transformation, integration, and reconstruction, covering changes in multiple aspects such as enterprise strategic systems, business models, business processes, production operations, and organizational structures. In the process of digital transformation, enterprises need to pay attention to the application of digital technology, data security and privacy protection, the cultivation of digital talents, and organizational change.At the same time, digital transformation also requires the joint participation and efforts of the leadership, management, and employee levels of the enterprise to achieve comprehensive upgrading and transformation. In short, digital transformation is an important challenge and opportunity faced by enterprises in the digital economy era. Through digital transformation, enterprises can better adapt to market changes, improve competitiveness, and achieve sustainable development. For enterprises, a reasonable debt maturity structure is very important. However, there is no research on digital transformation and debt maturity structure

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of enterprises in existing literature. So, how will the digital transformation of enterprises affect the debt maturity structure?

This article explores the impact of enterprise digital transformation on debt maturity structure from the perspective of the degree of enterprise digital transformation. Firstly, digital transformation of enterprises can optimize their debt maturity structure by alleviating financing constraints. Secondly, digital transformation of enterprises can increase media attention. When the reputation and image of the enterprise are improved, creditors will trust the enterprise more and be willing to provide longer term loans, thereby optimizing the debt maturity structure of the enterprise. Finally, digital transformation of enterprises can reduce the degree of information asymmetry and optimize the debt maturity structure. Based on the above, through digital transformation, enterprises can better manage financial and operational risks, improve reputation and image, reduce information asymmetry, optimize debt maturity structure, and reduce financing costs.

This article uses digital transformation and financial data of Chinese A-share listed companies in Shanghai and Shenzhen from 2016 to 2020 to empirically test the impact of corporate digital transformation on debt maturity structure. The following conclusion is drawn: corporate digital transformation can significantly optimize debt maturity structure. The channel mechanism test found that digital transformation of enterprises can optimize their debt maturity structure by alleviating financing constraints, increasing media attention, and reducing information asymmetry. Analysis of heterogeneity at the enterprise level found that digital transformation of enterprises has a more significant optimization effect on the debt maturity structure of state-owned enterprises, non high-tech enterprises, and enterprises in the eastern and western regions.

After theoretical analysis and empirical proof, the conclusion of this article has important theoretical value and contribution. On the one hand, the research framework on the impact of digital transformation on enterprises has been expanded. In existing literature, more attention is paid to the impact of digital transformation on enterprise innovation, information quality, and the risk of stock price collapse. However, there is little research on the term structure of corporate debt, and this article will help enrich the research framework of digital transformation on corporate debt term structure. On the other hand, it enriches the literature on the impact mechanism of corporate debt maturity structure. In the past, when exploring the influencing factors of debt maturity structure, more research was conducted from aspects such as corporate governance and the degree of external marketization of enterprises. However, empirical research on debt maturity structure from the perspective of digital transformation of enterprises is still rare. Therefore, based on existing literature, this article enriches the research on the impact of digital transformation on enterprises and the driving factors of debt maturity structure.

2. Literature Review

2.1. The Consequences of Digital Transformation Economy

Digital transformation has gradually become an important trend in the development of various industries worldwide, and many enterprises are actively exploring the process of digital transformation to enhance their competitiveness and adapt to the rapidly changing market environment. However, digital transformation is a complex and resource intensive process, and its economic consequences have always been a focus of attention for scholars and businesses. This article will provide a literature review on the economic consequences of digital transformation, elaborating in detail from three perspectives: economic benefits, competitiveness, and corporate performance.

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In terms of economic benefits. Firstly, digital transformation can reduce the operational costs of enterprises by optimizing business processes, reducing labor costs, and improving production efficiency. For example, by introducing automated production lines and intelligent manufacturing technology, enterprises can reduce labor and production costs. Secondly, digital transformation can increase a company's revenue by providing new products and services, expanding sales channels, and enhancing brand influence. For example, by conducting e-commerce on the internet, companies can expand their sales range and attract more consumers. Finally, digital transformation can improve resource utilization efficiency through data analysis and optimization of resource allocation. For example, through data analysis, enterprises can better understand market demand and consumer behavior, thereby better allocating resources and optimizing products.

In terms of competitiveness. Firstly, digital transformation can drive enterprise product innovation to meet market demand and enhance competitiveness. For example, by introducing artificial intelligence technology, enterprises can develop products with higher added value and innovation. Secondly, digital transformation can drive enterprises to innovate their business models to adapt to market changes and enhance competitiveness. For example, through internet platforms and the sharing economy model, enterprises can provide products and services that are different from traditional models. Finally, digital transformation can enhance the competitiveness of enterprises by enhancing brand image and visibility. For example, by establishing a good brand and corporate image on social media, companies can attract more consumers and increase brand loyalty.

In terms of corporate performance. Firstly, digital transformation can improve the financial performance of enterprises by reducing costs and increasing revenue. For example, by introducing automated production lines and intelligent manufacturing technology, enterprises can reduce production costs and improve production efficiency, thereby improving profitability. Secondly, digital transformation can enhance non-financial performance of enterprises by improving customer satisfaction and service quality. For example, by conducting e-commerce on the internet, companies can expand their sales range and attract more consumers, thereby improving customer satisfaction and market share. Finally, digital transformation can enhance the sustainable development capabilities of enterprises through efficient resource utilization, environmental protection, and other means. For example, by introducing green manufacturing technology, enterprises can reduce energy consumption and environmental pollution, thereby enhancing their social responsibility and sustainable development capabilities.

In summary, for enterprises undergoing digital transformation, it is necessary to fully consider the economic consequences of digital transformation and develop corresponding strategic planning and management measures to ensure the expected economic benefits and competitiveness improvement.

2.2. Factors Influencing Debt Maturity Structure

The debt maturity structure is one of the important decisions in corporate debt financing, which determines the maturity time and repayment pressure of corporate debt. The choice of debt maturity structure is influenced by various factors, including internal factors, external environmental factors, and organizational factors. This article will review the influencing factors of debt maturity structure from three perspectives: internal factors, external environmental factors, and organizational factors.

In terms of internal factors of the enterprise. Enterprise size is one of the important factors affecting the debt maturity structure. Usually, larger enterprises have more resources and capabilities to withstand the pressure of short-term debt, so they are more likely to choose long-term debt. Smaller enterprises are more inclined to choose short-term debt to avoid excessive debt repayment pressure. The profitability of a company also has a significant impact

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on its debt maturity structure. Usually, companies with strong profitability have more cash flow to repay their debts, so they are more likely to choose long-term debt. Enterprises with weaker profitability are more inclined to choose short-term debt to avoid excessive debt repayment pressure. The type of assets of a company also affects its debt maturity structure. For example, companies with heavy asset types are more likely to choose long-term debt to leverage the characteristics of assets to increase cash flow. Enterprises with light asset types tend to choose short-term debt to avoid asset constraints and reduce operational risks.

In terms of external environmental factors of the enterprise. Changes in the macroeconomic environment can affect the debt maturity structure of enterprises. For example, during periods of economic expansion, companies are more likely to choose long-term debt to take advantage of economic growth opportunities. During economic downturns, companies are more likely to choose short-term debt to reduce financial and operational risks. The debt maturity structure of different industries also varies. For example, companies in mature industries are more likely to choose long-term debt to stabilize cash flow and reduce financial risk. Enterprises in emerging industries tend to choose short-term debt to flexibly respond to market changes and uncertainties. Changes in the policy environment can also affect the debt maturity structure of enterprises. For example, changes in tax policies, monetary policies, and regulatory policies may affect a company's cash flow and financial risk, thereby affecting the choice of debt maturity structure.

In terms of organizational factors of the enterprise. The corporate governance structure will affect the debt maturity structure of a company. For example, differences in factors such as board structure, management incentives, and shareholder protection can lead to differences in the choice of debt maturity structure for enterprises. The risk preference of managers can also affect the debt maturity structure of a company. Managers with higher risk preferences are more likely to choose long-term debt in pursuit of higher returns, while managers with lower risk preferences are more inclined to choose short-term debt to reduce financial risk. Corporate culture can also affect a company's debt maturity structure. A positive corporate culture can encourage companies to manage financial risks more robustly and choose a more suitable debt maturity structure.

Enterprises need to develop reasonable debt maturity structure strategies based on comprehensive consideration of various factors to support their long-term development and stable operation. Meanwhile, with the continuous changes in market environment and organizational structure, enterprises also need to continuously adjust and optimize their debt maturity structure to adapt to market changes and reduce financial risks.

2.3. Comment

In summary, on the one hand, existing literature mainly focuses on the economic consequences of digital transformation of enterprises in terms of competitiveness and performance, while on the other hand, the driving factors of debt maturity structure mainly focus on tax policies, monetary policies, and other aspects. However, there is little literature exploring the debt maturity structure of enterprises from the perspective of digital transformation. The conclusion of this article can enrich the research on the impact of digital transformation on enterprises and the driving factors of debt maturity structure.

3. Theoretical Analysis and Hypothesis Formulation

Firstly, digital transformation can alleviate financial constraints by reducing information asymmetry. Information asymmetry is a common problem in financial markets, which increases the financing costs and difficulties for enterprises. Digital transformation can standardize the processing of massive data, transform non-standardized non-financial

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information into processable information, and output it to information users through digital platforms and other channels, so that both sides of the financing can grasp specific multi-dimensional information including non-standardized non-financial information, thereby reducing the information cost for investors to identify enterprises. This can not only reduce the information asymmetry between enterprises and investors, but also enhance market investors' expectations, making it easier for enterprises to obtain exogenous financing.

Secondly, digital transformation of enterprises can also optimize debt maturity structure by increasing media attention. Media attention refers to the frequency and level of media coverage of a company, which has a significant impact on the reputation and image of the company. Digital transformation can increase the media attention of enterprises through online marketing, social media, search engine optimization, and other methods, thereby enhancing their reputation and image. When the reputation and image of a company are improved, creditors will trust the company more and be willing to provide longer term loans, thereby reducing the short-term debt ratio of the company. At the same time, digital transformation can also detect market changes and risks in a timely manner through data analysis and monitoring, helping enterprises better manage financial and operational risks, thereby reducing the risk premium and short-term debt ratio of enterprises.

Finally, digital transformation of enterprises can reduce information asymmetry and optimize debt maturity structure. In the financial market, information asymmetry can increase the financing cost and difficulty of enterprises. Digital transformation can obtain more information about enterprises through data mining and analysis, such as sales, inventory, order status, etc., and integrate this information into the enterprise's information system. This information can not only provide support for internal decision-making within the enterprise, but also provide more information about the enterprise to external investors, thereby reducing the degree of information asymmetry. When creditors can better assess the credit risk of a company, they will lower their requirements for risk premium, thereby reducing the short-term debt ratio of the company.

In summary, through digital transformation, enterprises can better manage financial and operational risks, improve reputation and image, reduce information asymmetry, optimize debt maturity structure, and reduce financing costs. Based on the above analysis, we propose the main hypothesis of this article:

4. Research Design

4.1. Sample Selection and Data Sources

0To test the hypothesis of this article, this article selects Chinese A-share listed companies in Shanghai and Shenzhen as research samples, and the years of digital transformation and financial data of enterprises are from 2016 to 2020. Following the following standards for sample processing: Firstly, considering the particularity of financial listed companies, financial companies were excluded; Secondly, samples of ST and * ST companies were excluded; Finally, to avoid the impact of outliers, all continuous variables were subjected to a 1% Winorize tail reduction treatment, resulting in 8348 sample observations. The digital transformation data in this article is sourced from the WinGo database, and the financial data is sourced from the Guotai An database.

4.2. Variable Settings

The dependent variable (DMS) is the term structure of corporate debt. Referring to the research by Zhong Kai et al. (2016), this article defines the debt maturity structure as the ratio of long-term borrowing to total borrowing. The higher the value, the higher the proportion of long-term borrowing of a company, and the longer the debt maturity structure.

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Explanatory variable (DCG): Enterprise digital transformation. This article refers to Wu Fei (2021) and utilizes word frequency and computing digital transformation level from five aspects: artificial intelligence technology, big data technology, cloud computing technology, blockchain technology, and digital technology application.

Control variables: This article draws inspiration from existing literature and controls enterprise size (natural logarithm of total assets), asset liability ratio (total liabilities/total assets), and inventory proportion (inventory value/total asset value), respectively × 100%), Growth rate of operating revenue ((current operating revenue - operating revenue of the same period last year)/operating revenue of the same period last year × The impact of major variable indicators such as 100% equity concentration (number of shares held by the largest shareholder/total number of shares), Tobin Q value (TP-TN)/(TP+TN+FP+FN), equity nature (state-owned enterprise value is 1; non-state-owned enterprise value is 0), and enterprise age (natural logarithm of enterprise establishment years). The specific names and definitions of variables are shown in Table 1:

Table 1. Definition of main variables

Variable category	Variable	Variable Symbol	Variable Definition
Explained Variable	Debt maturity structure	DMS	Long term loans/total loans
Explanatory Variable	Digital transformation	DCG	Utilize word frequency and computing digital transformation level from five aspects: artificial intelligence technology, big data technology, cloud computing technology, blockchain technology, and digital technology application
Controlled Variable	Size	Size	Take the natural logarithm of total assets
	Asset liability ratio	Lev	Total liabilities/total assets
	Inventory proportion	INV	Inventory value/total asset value × 100%
	Operating revenue growth rate	Growth	(Current operating revenue - operating revenue from the same period last year)/operating revenue from the same period last year × 100%
	Ownership concentration	Top1	Number of shares held by the largest shareholder/total number of shares
	Tobin Q value	TobinQ	(TP-TN)/(TP+TN+FP+FN)
	Nature of equity	SOE	The value of state-owned enterprises is 1; The value for non-state-owned enterprises is 0
	enterprise age	ListAge	The natural logarithm of the establishment period of the enterprise
externalities	Year	Year	The sample range studied in this article is from 2016 to 2020
	Industry	Industry	Based on Wind data statistics, the Wind industry

4.3. Modeling

In order to explore the impact of corporate digital transformation on debt maturity structure, this article constructs the following regression model (1) to test the research hypothesis:

$$\mathrm{DMS}_{i,t} = \beta_0 + \beta_1 DCG_{i,t} + \sum \beta_j Controls_{i,t} + \sum Industry + \sum Year + \varepsilon_{i,t} \quad (1)$$

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Among them, the dependent variable in the regression is corporate debt maturity structure (DMS), the core explanatory variable is corporate digital transformation (DCG), and Controls is the aforementioned control variable; ε Is the random error term of the model. At the same time, this article controls the dummy variables of time (Year) and industry (Industry) to eliminate the influence of fixed factors of time and industry.

5. Empirical Results and Testing Analysis

5.1. Descriptive Statistics

As shown in Table 2, the maximum and minimum values of corporate debt maturity structure (DMS) are 1.000 and 0.000, with a standard deviation of 0.289, indicating significant differences in debt maturity structure among different enterprises; The average value of Enterprise Digital Transformation (DCG) is 1.450, with a median of 1.099; The mean of SOE in the control variable is 0.368, less than 0.500, and the median is 0.000, indicating that our sample is mainly composed of non-state-owned enterprises; The statistical results of other control variables also basically met expectations.

Table 2. Descriptive Statistics

Variable	N	Mean	SD	Min	p50	Max
DMS	8348	0.381	0.289	0.000	0.316	1.000
DCG	8348	1.450	1.478	0.000	1.099	6.265
Size	8348	22.860	1.307	19.730	22.690	26.400
Lev	8348	0.510	0.173	0.056	0.510	0.906
INV	8348	0.141	0.134	0.000	0.108	0.657
Growth	8348	0.183	0.435	-0.660	0.107	4.310
Top1	8348	0.333	0.146	0.083	0.310	0.732
TobinQ	8348	1.661	0.952	0.802	1.375	11.460
SOE	8348	0.368	0.482	0.000	0.000	1.000
ListAge	8348	2.298	0.825	0.000	2.398	3.332

5.2. Correlation Analysis

Table 3. Correlation Analysis

	DMS	DCG	Size	Lev	INV	Growth	Top1	TobinQ	SOE	ListAge
DMS	1	-0.073***	0.202***	0.084***	-0.125***	0.028**	0.122***	-0.138***	0.149***	0.103***
DCG	-0.079***	1	0.046***	-0.006	-0.010	0.025**	-0.103***	0.072***	-0.148***	-0.042***
Size	0.243***	0.020*	1	0.456***	-0.019*	0.010	0.216***	-0.578***	0.377***	0.437***
Lev	0.083***	-0.029***	0.455***	1	0.159***	-0.033***	0.096***	-0.374***	0.231***	0.271***
INV	0.068***	-0.064***	0.118***	0.272***	1	0.055***	-0.003	0.023**	-0.034***	0.042***
Growth	0.037***	0.023**	0.023**	-0.007	0.043***	1	0.012	0.125***	-0.092***	-0.170***
Top1	0.146***	-0.119***	0.250***	0.093***	0.038***	0.009	1	-0.151***	0.282***	-0.016
TobinQ	-0.056***	0.064***	-0.390***	-0.291***	-0.064***	0.047***	-0.107***	1	-0.323***	-0.292***
SOE	0.159***	-0.154***	0.373***	0.230***	0.038***	-0.074***	0.287***	-0.195***	1	0.428***
ListAge	0.083***	-0.030***	0.406***	0.265***	0.122***	-0.079***	-0.051***	-0.116***	0.386***	1

Note: * * *, * * and * respectively indicate significant levels at 1%, 5%, and 10%, the same below.

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Table 3 presents the correlation analysis results of the main variables in this article. Among them, the upper half is the Spearman coefficient, and the lower half is the Pearson coefficient. Through analysis, it was found that: firstly, there is a significant negative correlation between corporate digital transformation and debt maturity structure, which to some extent supports the main hypothesis of this article; Secondly, the relationship between control variables and corporate debt maturity structure is consistent with existing literature conclusions.

5.3. Analysis of Benchmark Regression Results

Table 4PanelA reports the regression results of model (1), where Table (1) shows that the DCG coefficient is -0.010 when only controlling for industries and years, which is significant at the 1% level, to some extent verifying the main hypothesis of this article. Subsequently, control variables such as enterprise size were added, and the regression results are shown in column (2), GP_ The coefficient of IF is -0.015, which is significant at the 1% level, indicating a significant negative correlation between corporate digital transformation and debt maturity structure under established conditions. At this point, the main hypothesis of this article has been verified.

Table 4. Principal regression and robustness testing

PanelA: Principal Regression

	DMS	**DMS**
	(1)	**(2)**
DCG	-0.010***	-0.015***
	(-4.07)	(-6.11)
Size		0.045***
		(15.59)
Lev		-0.122***
		(-6.22)
INV		-0.158***
		(-5.37)
Growth		0.025***
		(3.72)
Top1		0.059***
		(2.75)
TobinQ		0.021***
		(6.14)
SOE		0.026***
		(3.69)
ListAge		-0.020***
		(-4.79)
Industry	Controlled	Controlled
Year	Controlled	Controlled
Constant	0.645***	-0.379***
	(45.15)	(-5.85)
N	8348	8348
Adj. R^2	0.174	0.211

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PanelB: Robust Test

	DMS	DMS	DMS2
	(1)Replace x	(2)Replace y	(3)Corporate level clustering
DCG		-0.002***	-0.015***
		(-3.26)	(-4.19)
DCG2	-0.020***		0.045***
	(-7.18)		(8.99)
Size	0.047***	0.032***	-0.122***
	(15.91)	(34.92)	(-4.10)
Lev	-0.125***	0.068***	-0.158***
	(-6.38)	(12.62)	(-3.03)
INV	-0.157***	-0.042***	0.025***
	(-5.35)	(-4.63)	(3.37)
Growth	0.025***	-0.006***	0.059*
	(3.79)	(-3.01)	(1.72)
Top1	0.061***	-0.023***	0.021***
	(2.84)	(-3.54)	(4.24)
TobinQ	0.021***	0.001	0.026**
	(6.08)	(1.12)	(2.36)
SOE	0.027***	-0.001	-0.020***
	(3.83)	(-0.37)	(-3.18)
ListAge	-0.022***	-0.008***	-0.015***
	(-5.23)	(-6.79)	(-4.19)
Industry	Controlled	Controlled	Controlled
Year	Controlled	Controlled	Controlled
Constant	-0.369***	-0.564***	-0.379***
	(-5.72)	(-27.50)	(-3.34)
N	8348	8348	8348
Adj. R^2	0.213	0.255	0.211

5.4. Robust Test

5.4.1. Replace Explanatory Variables

This article refers to the approach of Zhao Chenyu (2021), using word frequency and computational digital transformation level (DCG2) to replace explanatory variables and reshape the model from four dimensions: digital technology application, internet business model, intelligent manufacturing, and modern information systems (1). According to the results in column (1) of Table 4PanelB, the regression coefficient of DCG2 is -0.020, which is significant at the 1% level. The main hypothesis of this article has been verified.

5.4.2. Replace the Dependent Variable

This article changes the measurement method of debt maturity structure variables to (long-term loans+bonds payable)/total liabilities, and reshapes the model (1). According to the results in column (2) of Table 4PanelB, the regression coefficient of DCG is -0.002, which is significant at the 1% level. The main hypothesis of this article has been validated.

5.4.3. Corporate Level Clustering Adjustment

To alleviate the potential heteroscedasticity issues in model design, we conducted clustering adjustments at the company level based on robust standard error regression. The regression results are shown in column (3) of Table 4PanelB, and the DCG coefficient remains consistent with (2) of Table 4PanelA and is significant at the 1% level. The results indicate that after

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mitigating the possible heteroscedasticity issues in the model, our results are still robust, indicating a significant negative correlation between corporate digital transformation and debt maturity structure.

5.5. Endogeneity Testing

5.5.1. Instrumental Variable Method

To alleviate potential endogeneity issues caused by mutual causality and missing variables, we used instrumental variable method (IV) for testing. This article uses the mean of digital transformation within the region, industry, and year (DCG_IV) of the enterprise as the instrumental variable for digital transformation, and uses the two-stage least squares method to regress again. The results are shown in column (1) of Table 5 PanelA, DCG_ The coefficient of IV is 0.974, which is significant at the 1% level, indicating that our instrumental variable has a good explanatory effect on the explanatory variable (DCG) in model (1). Meanwhile, the results in column (2) show a coefficient of -0.033 for DCG, which is significant at the 1% level, indicating a significant negative correlation between corporate digital transformation and debt maturity structure. Therefore, after using instrumental variables to overcome potential endogeneity issues, the main hypothesis still holds.

5.5.2. PSM

Table 5. Endogeneity testing

	PanelA: Tool Variable Method		PanelB: PSM
	First	**Second**	
	DCG	**DMS**	**DMS**
	(1)	**(2)**	**(3)**
DCG		-0.033***	-0.015***
		(-6.82)	(-6.10)
DCG_IV	0.974***		
	(52.02)		
Size	0.119***	0.049***	0.045***
	(10.21)	(16.16)	(15.41)
Lev	0.004	-0.124***	-0.114***
	(0.05)	(-6.32)	(-5.76)
INV	-0.632***	-0.173***	-0.170***
	(-5.39)	(-5.84)	(-5.72)
Growth	0.082***	0.026***	0.026***
	(3.07)	(3.89)	(3.86)
Top1	-0.048	0.055**	0.056***
	(-0.56)	(2.56)	(2.59)
TobinQ	0.021	0.022***	0.021***
	(1.51)	(6.31)	(6.05)
SOE	-0.294***	0.020***	0.026***
	(-10.41)	(2.70)	(3.68)
ListAge	0.069***	-0.019***	-0.019***
	(4.14)	(-4.64)	(-4.65)
Industry	Controlled	Controlled	Controlled
Year	Controlled	Controlled	Controlled
Constant	-2.710***	-0.637***	-0.376***
	(-9.02)	(-8.49)	(-5.76)
N	8348	8348	8348
Adj. R^2	0.518	0.209	0.212

Note: The Kleibergen Paap rk Wald F statistic value for instrumental variable testing is 17.902, Kleibergen Paap rk LM statistic value is 17.902 * *, and Hansen J statistic value is 0.000.

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This article further adopts the method of propensity score matching (PSM) to alleviate the potential self selection problem in the samples and enhance the randomness characteristics of the samples. The specific process is as follows: Firstly, we used samples with lower levels of digital transformation as the control group, and samples with higher levels of digital transformation as the experimental group. Secondly, we used a logistic model to select the control variables in Table 1 as the matching covariates, while controlling for factors such as industry and year, and ultimately matched 4137 control companies and 4137 control companies. We used a 1:1 nearest neighbor matching method to match experimental and control groups with similar scores. Finally, we conducted regression analysis on the matched samples in model (1) after balance testing. The regression results are provided in column (3) of Table 5PanelB, indicating that there is still a significant negative impact between corporate digital transformation (DCG) and debt maturity structure (DMS), supporting the main conclusion of this article.

6. Further Analysis

6.1. Mechanism Verification

6.1.1. Financing Constraints

The behavior of enterprise digital transformation can transmit positive information to the outside world, win stable cash flow and resources for enterprises, alleviate financial pressure, alleviate resource scarcity, and alleviate financing constraints. This article replaces the dependent variable in model (1) with the financing constraint measurement indicator. This article uses the financing constraint SA index to reshape the model (1), and the results are shown in column (1) of Table 6PanelA. The DCG coefficient is -0.006, which is significant at the 1% level. This indicates that the higher the degree of digital transformation of enterprises, the more long-term financial support they can obtain, thereby reducing their financing constraints.

6.1.2. Smedia Attention

In terms of media attention. This article takes the natural logarithm of the number of times a company appears in newspaper and media headlines and content that year, and sets it as the media attention variable Media_ Title and Media_ Cont, replace the dependent variable in model (1) with media attention (Media_title and Media_cont), and the regression results are shown in columns (2) and (3) of Table 6PanelB. The coefficients of DCG are 0.967 and 15.142, respectively, which are significant at the 1% level. This indicates that the higher the degree of digital transformation of enterprises, the higher the media attention they receive. This indicates that the degree of digital transformation can significantly increase media attention and release positive signals to the capital market.

6.1.3. Asymmetry

In terms of information asymmetry. The digital transformation of enterprises can improve the problem of information asymmetry, enabling creditors to more accurately evaluate the solvency of enterprises. This reduces creditors' concerns about the debt maturity of the enterprise, thereby lowering the debt maturity. This article uses analyst tracking to measure the degree of information asymmetry. This article replaces the dependent variable in model (1) with AnaAttention and reshapes model (1). The results are shown in column (4) of Table 6PanelC, with a DCG coefficient of 0.026, which is significant at the 5% level. This indicates that the higher the degree of digital transformation of enterprises, the higher the attention of analysts, which can effectively reduce information asymmetry.

The above results all indicate that digital transformation of enterprises can release positive signals, reduce financing constraints and information asymmetry, gain media attention, and be beneficial for optimizing the debt maturity structure of enterprises.

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Table 6. Mechanism verification

	PanelA:Financing Constraints	PanelB: Media attention		PanelC:Analyst attention
	SA	**Media_title**	**Media_cont**	**AnaAttention**
	(1)	**(2)**	**(3)**	**(4)**
DCG	-0.006***	0.967***	15.142***	0.026**
	(-3.08)	(4.32)	(4.53)	(2.29)
Size	0.113***	6.336***	90.787***	0.898***
	(47.12)	(23.12)	(22.14)	(65.24)
Lev	-0.059***	-1.374	-49.300*	-1.756***
	(-3.66)	(-0.74)	(-1.78)	(-18.92)
INV	0.079***	0.702	0.781	0.366***
	(3.42)	(0.26)	(0.02)	(2.64)
Growth	-0.016***	-1.644***	-30.976***	0.300***
	(-2.86)	(-2.63)	(-3.31)	(9.48)
Top1	0.063***	1.101	-11.353	-0.215**
	(3.53)	(0.55)	(-0.38)	(-2.11)
TobinQ	0.033***	2.097***	26.615***	0.495***
	(11.45)	(6.47)	(5.49)	(30.33)
SOE	-0.003	-1.918***	-10.972	-0.423***
	(-0.54)	(-2.87)	(-1.10)	(-12.63)
ListAge	-0.172***	-1.993***	-22.919***	-0.226***
	(-50.18)	(-4.97)	(-3.82)	(-11.52)
Industry	Controlled	Controlled	Controlled	Controlled
Year	Controlled	Controlled	Controlled	Controlled
Constant	-5.996***	-138.236***	-2017.606***	-18.404***
	(-114.55)	(-22.76)	(-22.20)	(-60.13)
N	8348	8157	8157	8348
Adj. R2	0.365	0.097	0.089	0.405

6.2. Exploring Heterogeneity at the Enterprise Level

6.2.1. Property Heterogeneity Testing

Due to the heterogeneity of property rights, there are differences in resource acquisition and management levels between state-owned and non-state-owned enterprises. Therefore, it is necessary to determine whether the degree of digital transformation of state-owned or non-state-owned enterprises has a greater impact on the debt maturity structure of enterprises. Based on this, we divided the sample into state-owned (SOE=1) and non-state-owned (SOE=0) samples according to the property rights of enterprises (SOE) in Table 1 control variables, and conducted group regression. The results are shown in the (1) and (2) columns of Table 7PanelA, with DCG coefficients of -0.029 and -0.007, respectively. Through inter group difference test, the DCG coefficient in the state-owned enterprise sample is significant at the 1% level, and the DCG coefficient in the non-state-owned enterprise sample is significant at the 10% level. This indicates that the degree of digital transformation of enterprises has a more significant impact on the debt maturity structure in state-owned enterprises.

6.2.2. Industry Heterogeneity Testing

High tech enterprises often have better conditions for digital transformation due to their relatively high technological capabilities. The impact of digital transformation on the debt maturity structure of enterprises may have heterogeneity at the enterprise level. The results of

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industry heterogeneity testing are reported in columns (3) and (4) of Table 7PanelB. It can be seen that compared to high-tech enterprises, digital transformation has a significant effect on reducing the debt maturity structure of non high-tech enterprises. The possible reason is that non high-tech enterprises have a weak digital technology foundation, and digital transformation is more conducive to enhancing the innovation and competitiveness of non high-tech enterprises in difficult situations.

6.2.3. Regional Heterogeneity Testing

There are significant differences in the degree of digital transformation, market perfection, and enterprise development among different regions, and the impact of digital transformation on the debt maturity structure of enterprises may have regional heterogeneity. This article divides the sample enterprises into two groups for regression: the eastern and western regions and the central regions. The results of regional heterogeneity testing are reported in columns (5) and (6) of Table 7PanelC, with DCG coefficients of -0.017 and 0.002, respectively. It is not difficult to see that compared to the central region, digital transformation has a significant effect on optimizing the debt maturity structure of enterprises in the eastern and western regions.

Table 7. Further analysis

	PanelA:Heterogeneity of Property Rights		PanelB:Industry Heterogeneity		PanelC:Regional heterogeneity	
	DMS	**DMS**	**DMS**	**DMS**	**DMS**	**DMS**
	state-owned	**Non-state**	**High tech enterprises**	**Non high-tech enterprises**	**eastern and western regions**	**Central region**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
DCG	-0.029***	-0.007*	-0.004	-0.026***	-0.017***	0.002
	(-4.44)	(-1.66)	(-1.32)	(-6.88)	(-6.64)	(0.35)
Size	0.053***	0.034***	0.030***	0.057***	0.045***	0.053***
	(6.48)	(5.24)	(7.38)	(13.57)	(14.33)	(6.41)
Lev	-0.134**	-0.102***	-0.171***	-0.069**	-0.124***	-0.115**
	(-2.56)	(-2.86)	(-6.46)	(-2.32)	(-5.70)	(-2.42)
INV	-0.027	-0.231***	-0.369***	-0.071*	-0.142***	-0.269***
	(-0.31)	(-3.88)	(-7.69)	(-1.85)	(-4.41)	(-3.64)
Growth	0.017	0.033***	0.030***	0.022**	0.022***	0.038**
	(1.19)	(3.66)	(3.30)	(2.26)	(2.91)	(2.38)
Top1	0.066	0.039	0.029	0.085***	0.070***	0.013
	(1.16)	(0.93)	(0.98)	(2.67)	(2.96)	(0.25)
TobinQ	0.010	0.023***	0.018***	0.029***	0.021***	0.025***
	(1.08)	(4.12)	(4.18)	(4.95)	(5.27)	(3.33)
SOE	-	-	0.032***	0.027***	0.027***	0.023
	-	-	(3.19)	(2.68)	(3.37)	(1.36)
ListAge	-0.036***	-0.012	-0.018***	-0.016***	-0.018***	-0.035***
	(-2.99)	(-1.63)	(-3.14)	(-2.61)	(-4.04)	(-3.01)
Industry	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Year	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Constant	-0.440**	-0.229	0.005	-0.700***	-0.381***	-0.475***
	(-2.32)	(-1.60)	(0.04)	(-7.50)	(-5.43)	(-2.67)
N	3068	5280	4282	4066	6963	1385
Adj. R^2	0.285	0.150	0.061	0.282	0.213	0.224

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7. Conclusion

Based on the data of A-share listed companies in Shanghai and Shenzhen from 2016 to 2020, this article examines the impact of digital transformation on the debt maturity structure of enterprises and draws some conclusions. Firstly, digital transformation of enterprises can significantly reduce their debt maturity structure. Secondly, mechanism testing indicates that alleviating financing constraints, increasing media attention, and reducing information asymmetry are three important paths for optimizing the debt maturity structure of enterprises through digital transformation. Thirdly, further heterogeneity analysis indicates that compared to non-state-owned enterprises, digital transformation has a stronger effect on optimizing the debt maturity structure of state-owned enterprises; Compared to high-tech enterprises, digital transformation has a stronger effect on optimizing the debt maturity structure of non high-tech enterprises; Compared to the central region, digital transformation has a stronger impact on optimizing the debt maturity structure of enterprises in the eastern and western regions. The research conclusion of this article helps to enrich the research on the impact of digital transformation on enterprises, and also helps to further improve the literature on the impact mechanism of corporate debt maturity structure.

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