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The impact of digital transformation on corporate financing constraints: Based on the analysis of internal and external dual paths

Ying Li, Fang Gao*

Glorious Sun School of Business and Management, Donghua University, Shanghai, 200051, China
15173588844@163.com
**Corresponding author*

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Abstract: Financing constraints are an inevitable problem in the long-term development of enterprises. Under the background of the rapid development of digital technology, it is of great significance to explore whether digital transformation can alleviate capital constraints through technology empowerment. This paper selects Shanghai and Shenzhen A-share listed companies from 2018 to 2022 as the research object, and explores the impact of enterprise digital transformation on financing constraints. The study found that digital transformation can significantly alleviate financing constraints. Mechanism analysis shows that digital transformation can reduce the level of financing constraints by improving the quality of internal control and media attention. This paper enriches the research perspective of the impact of digital transformation on financial constraints, and brings some enlightenment for enterprises to promote digital transformation in practice.

1. Introduction

With the development of digital economy, the digital transformation of enterprises has become one of the key strategies to enhance competitiveness. Digital transformation has fundamentally reshaped the business models, operational processes, and management practices of companies by integrating advanced information technologies like cloud computing, big data, the Internet of things, and artificial intelligence. This transformation not only improves the operational efficiency and market competitiveness of enterprises, but also has a profound impact on the financing constraints of enterprises. Scholars have noted that, amidst the thriving digital economy, digital transformation is a critical strategy for businesses to overcome technological R&D constraints and to alleviate financing challenges and high costs associated with capital[1]. Digital transformation boosts information transparency and narrows the gap of information asymmetry, allowing financial institutions to more precisely evaluate the creditworthiness and solvency of businesses. This, in turn, mitigates the risks and costs associated with financing. Furthermore, as digital transformation involves a shift in the production process, business models, and internal organizational structures[2], it can enhance the efficiency of information gathering and dissemination. This not only aligns with the demands of the

digital age but also assists enterprises in identifying new avenues for profit growth. Amid growing uncertainty in global economic development and mounting economic pressures, Chinese enterprises must seize opportunities, quicken the pace of digital transformation, actively engage in the digital economy's progress, and overcome bottlenecks to fuel innovation and growth.

In this context, this paper examines prior research on enterprise digital transformation and financing constraints. It focuses on Shanghai and Shenzhen A-share listed companies from 2018 to 2022 as the subject of study, investigating the effects of digital transformation on financing constraints and the mechanisms through which these effects occur, as well as any variations among different characteristic sub-samples. Theoretically, the paper broadens the scope of research on how enterprise digital transformation influences financing constraints. Practically, it offers insights for businesses to address financial limitations and provides guidance for companies looking to advance their digital transformation efforts.

2. Theoretical analysis and hypothesis.

2.1 Digital transformation and financing constraints

From the perspective of information asymmetry, digital transformation can improve the quality of information disclosure from the aspects of information quality and information disclosure willingness, so as to alleviate financing constraints. Digital transformation enterprises outpace traditional ones in their capacity to gather, process, and analyze information. The resulting output is more organized and standardized, enhancing the overall use of information. In addition, due to the positive impact of digital transformation on the improvement of production efficiency and enterprise value [3], digital transformation enterprises will be more concerned by investors in the capital market. Therefore, digital transformation enterprises have a stronger willingness to disclose, in order to reduce the degree of information asymmetry between enterprises and external fund providers, so that financing constraints can be effectively alleviated.

Starting from the agency theory, digital transformation can help improve the construction of the internal control system of enterprises, weaken the opportunistic operation space of management, so as to alleviate the agency problem and reduce the financing constraints of enterprises. Specifically, digital transformation and upgrading can promote the optimization of organizational structure and management mode, thus reducing the opportunistic behaviors of management and improving the efficiency of communication and decision-making in daily management. Then digitization can also penetrate into all aspects of the daily operation of enterprises, improve the transparency of business, and help managers find problems in time. At the same time, stakeholders can also use digital technology to integrate their own demands into the internal control process of enterprises and play an active role. For investors, creditors and other information disadvantaged groups, the effectiveness of internal control is an important indicator of their investment decisions. A good internal control system can not only reasonably ensure the authenticity and reliability of corporate financial reports, but also convey the signal that the current risk of enterprises is low[4], and the problem of financing constraints has been alleviated.

According to the theory of signal transmission, enterprises will actively disclose positive information such as the implementation of digital transformation strategy, which makes it easier for the market to have positive expectations, so as to attract the attention of important information intermediaries in the capital market such as news media[5]. It encourages the media to delve deeper into uncovering non-public information of enterprises. This not only alleviates the problem of information asymmetry, but also forms a strong social supervision force. At the same time, because the state has promulgated many corresponding subsidy policies to encourage enterprises to carry out digital transformation, on the one hand, government subsidies can improve the solvency of enterprises

and curb the negative impact of financing constraints ; on the other hand, government subsidies will produce a certification effect, release positive signals, and enable enterprises to obtain more external financing, thereby resolving the financing constraints of enterprises[6]. Based on this, the following hypothesis is proposed:

H1: Digital transformation can alleviate financing constraints.

2.2 Internal control quality, enterprise digital transformation and financing constraints

Effective internal control is pivotal to corporate governance. It not only curbs self-interested and opportunistic behaviors by management but also enables the timely detection and prevention of controlling shareholders' attempts to transfer private interests and encroach upon corporate resources. This helps to curb unwarranted related-party transactions, thereby reducing the additional risk premium demanded by capital providers and easing financing constraints. It's clear that enhancing the effectiveness of internal controls is a crucial strategy for easing financing constraints.

Digital transformation gives enterprises the possibility to improve the quality of internal control. To be specific, digital transformation can improve the quality of internal control of enterprises through the following three aspects. First of all, digital transformation can enhance the transparency and accuracy of enterprise information [7]. Through the digital system, enterprises can obtain various business data and information in real time, reduce information asymmetry and human intervention, so as to better grasp business risks and problems. Secondly, digital transformation can optimize business processes and organizational structures[8]. The digital system can help enterprises to realize the automation and standardization of business processes, improve work efficiency and quality, and also adjust and optimize the organizational structure, reduce the internal redundancy level of enterprises, and improve the overall operation efficiency of enterprises. Finally, digital transformation can introduce advanced internal control tools and means. For example, digital systems can provide real-time monitoring, risk warning and other functions to help enterprises better identify, assess and control risks and improve the level of internal control. Based on this, the following hypothesis is proposed:

H2: The digital transformation of enterprises can alleviate financing constraints by improving the quality of internal control.

2.3 Media attention, enterprise digital transformation and financing constraints

Media attention primarily mitigates corporate financing constraints in two key ways. Firstly, given that external investors have limited capacity to obtain and discern corporate information, news media often serve as a vital source for additional corporate insights. As corporate media attention increases, investors gain access to more comprehensive and higher-quality information, thereby reducing the information asymmetry between them and the enterprises. Secondly, media reports have the function of exposing, which can prompt intervention from government regulatory bodies and public scrutiny [9]. With heightened media attention on corporations, the role of media oversight and deterrence is amplified, effectively mitigating post-credit moral hazard issues and encouraging the acquisition of more external financing by businesses.

With the advent of new technologies, digital transformation has become a critical strategy for businesses to maintain a competitive edge and adapt to market shifts. Consequently, when companies announce initiatives like their digital transformation strategies, they draw the interest of key information intermediaries, including the news media. These media reports not only supply investors with valuable information to reduce information asymmetry but also send positive signals about the company's digital transformation efforts, effectively easing financing constraints. Moreover, increased media scrutiny enhances the media's ability to uncover non-public information about digital

transformation companies, creating a robust force of social oversight. Simultaneously, the deployment of digital technology has expanded the avenues for supervision[10], compelling management to exercise restraint under the heightened external scrutiny [11], and curbing managerial opportunism. Based on this, the following hypothesis is proposed:

H3: The digital transformation of enterprises can alleviate financing constraints by increasing media attention.

3. Research design

3.1 Sample selection and data sources

This paper selects Shanghai and Shenzhen A-share listed companies from 2018 to 2022 as primary research samples. In order to reduce the impact of special samples and ensure the accuracy of research results, the samples are screened as follows: (1) Excluding companies that have been ST or * ST, delisted or suspended during the sample period; (2) Excluding listed companies with missing key research data; (3) Excluding companies with asset-liability ratio greater than 1. (4) Excluding listed companies in the financial and insurance industries to avoid the impact of the particularity of such industries on the overall results. Finally, 16980 sample data were obtained. The empirical research data of this paper are mainly from CSMAR database, Internal control related data comes from the DIB database, and the relevant data of media reports are from China Research Data Service Platform (CNRDS).

3.2 Variable definition

(1) Explained variables

Financing constraints (KZ). In the past, scholars have various ways to measure financing constraints, including single index, comprehensive index, sensitivity coefficient and so on. It is too one-sided to use a single enterprise characteristic to measure the financing constraints faced by enterprises. Compared with the comprehensive index, it is more objective and comprehensive, and the effectiveness of the sensitivity coefficient measurement method depends on whether the specific conditions are established. This paper finally refers to Wang (2022) and uses the comprehensive index KZ index to measure the level of financing constraints of enterprises. The larger the KZ value, the higher the degree of financing constraints faced by enterprises.

(2) Explanatory variables

Digital transformation (DT). Because it is difficult to directly measure the level of digitization, most of the literature is based on the research of Wu and Hu (2021) [12], and uses text analysis to analyze the text of the annual report of listed companies. The "Digital Economy Research Database" in the CSMAR refers to Wu (2021)[12], and divides the digital transformation of enterprises into two levels: " underlying technology " and " practical application. " Among them, "underlying technology" includes artificial intelligence, blockchain, cloud computing, and big data technology. Four categories, "practical application" refers to the application of digital technology by enterprises, in order to construct a lexicon to perform word frequency statistics on the company's annual report. Referring to Li et al. (2023)[13], this paper summarizes the frequency of five kinds of index words and adds 1 to take the natural logarithm, and the final value is taken as the measurement index of enterprise digital transformation

(3) Mediator variable

Internal control quality (IC). This paper uses the ' internal control index ' disclosed by the DIB database to measure the quality of internal control of enterprises. Referring to Zhang (2022)[8], the internal control index is divided by 100, that is, IC= internal control index /100. The larger the value

of the index, the higher the quality of internal control.

Media attention (Media). Referring to Huang (2020)[14], the total number of news reported by the media each year is measured, including the number of reports of online media and the number of reports of newspaper media. Whether the content of the report mentions the enterprise is the criterion, and the sum of the number of news reports of the two types of media plus the logarithm of 1 is taken as the measurement index.

(4) Control variables

The design of control variables in this paper comprehensively considers the basic situation of the enterprise, solvency, profitability, growth ability, operation ability, and ownership structure, etc., and selects enterprise scale (SIZE), asset-liability ratio (LEV), cash flow level (CFO), return on assets (ROA), enterprise value (TobinQ), operating income growth rate (Growth), total asset turnover rate (TAT), listing years (AGE), two positions in one (DUAL). In addition, the dummy variable year (YEAR) and industry (Industry) are introduced to control the impact of year and industry on the regression results. The definitions of all variables are listed in Table 1.

Table 1: Variable definition table

Type	Name	Symbol	Variable declaration
Explained variables	Financing constraints	KZ	KZ index is used to measure financing constraints.
Explanatory variables	Digital transformation	DT	The sum of the word frequencies of all keywords related to digital transformation in the annual report plus 1 takes the natural logarithm.
Mediator variable	Internal control quality	IC	IC = internal control index / 100
	Media attention	MEDIA	The sum of the number of news reports about the company in the network news and newspaper financial news plus 1 natural logarithm.
Control variables	Enterprise scale	SIZE	Natural logarithm of year-end total assets
	Asset-liability ratio	LEV	Total liabilities / total assets
	Cash flow level	CFO	Net cash flow from operating activities / total assets
	Return on assets	ROA	Net profit / average total assets
	Enterprise value	TobinQ	Market value / total assets
	Operating income growth rate	Growth	(current year operating income-last year operating income) / last year operating income
	Total asset turnover rate	TAT	Operating income / total assets
	Years on the market	AGE	The natural logarithm of the listed years of enterprises
	Two positions in one	DUAL	Dual chairmanship and general manager，1 for yes, 0 for no
	Year	YEAR	Year dummy variable
	Industry	IND	Industry dummy variable

3.3 Model construction

In order to investigate the impact of digital transformation (DT) on corporate financing constraints (FC), referring to the research of Wu et al. (2021), Model 1 is constructed to test Hypothesis H1:

$$KZ = \alpha_0 + \alpha_1 DT + \alpha_2 SIZE + \alpha_3 LEV + \alpha_4 CATA + \alpha_5 ROA + \alpha_6 TobinQ + \alpha_7 Growth + \alpha_8 TAT + \alpha_9 AGE + \alpha_{10} Dual + \alpha_{11} Top1 + \sum YEAR + \sum IND \quad (1)$$

This paper intends to use the three-step method of the intermediary effect model to test the mechanism of H2 and H3. Firstly, the financing constraint (KZ) is used to regress the mediator variable (Mediator), and then the financing constraint (KZ) is used to regress the degree of digital transformation (DT) and the mediator variable (Mediator). The specific model is as follows:

$$Mediator = \mu_0 + \mu_1 DT + \sum Controls + \sum YEAR + \sum IND \quad (2)$$

$$KZ = \varphi_0 + \varphi_1 DT + \varphi_2 Mediator + \sum Controls + \sum YEAR + \sum IND \quad (3)$$

4. Empirical Results and Analysis

4.1 Descriptive statistical analysis

In order to preliminarily understand the basic characteristics of the sample data, descriptive statistics are carried out on the sample as a whole, and the results are shown in Table 2. The minimum value of the KZ index is-5.943, and the maximum value is 6.230. It can be seen that the degree of financing constraints faced by individual companies varies greatly. The average is 0.902, and the median is 1.173, indicating that most companies are facing financing constraints. In a state of above average, therefore, the research on financing constraints has great practical significance in alleviating corporate financing constraints. The minimum value of enterprise digital transformation (DT) is 0, the maximum value is 6.301, and the median is 1.609. It shows that although most of the listed companies in Shanghai and Shenzhen have gradually entered the stage of digital transformation, there are still some enterprises that have never been involved in digital transformation, and on the whole, the digital transformation of Chinese enterprises is still at a low level.

Table 2: Descriptive Statistics

Variable	N	mean	min	p25	p50	p75	max	sd
KZ	17529	0.902	-5.943	-0.517	1.173	2.538	6.230	2.380
DT	17529	1.784	0.000	0.693	1.609	2.773	6.301	1.417
IC	17529	6.268	0.000	6.107	6.550	6.890	8.078	1.323
MEDIA	17529	4.677	0.000	4.234	4.745	5.357	11.842	1.472
SIZE	17529	22.370	19.936	21.423	22.172	23.112	26.344	1.310
LEV	17529	0.420	0.058	0.267	0.414	0.560	0.886	0.195
CFO	17529	0.746	0.023	0.195	0.389	0.821	7.574	1.063
ROA	17529	0.036	-0.229	0.012	0.038	0.071	0.218	0.071
TobinQ	17529	1.938	0.837	1.181	1.533	2.166	8.804	1.283
Growth	17529	0.308	-0.725	-0.043	0.109	0.369	6.421	0.845
TAT	17529	0.599	0.070	0.349	0.518	0.736	2.426	0.393
AGE	17529	2.106	0.104	1.458	2.262	2.922	3.342	0.901
Dual	17529	0.311	0.000	0.000	0.000	1.000	1.000	0.463

4.2 Main effect analysis

Firstly, in order to verify the hypothesis H1, the regression analysis of model 1 is carried out, and the regression results are shown in Table 3. It can be seen that before and after controlling the financial characteristics and governance characteristics of enterprises, the regression coefficients of enterprise digital transformation (DT) are significantly negative. The DT coefficient in column (2) is-0.052, and through the significance test of 0.01 level, it shows that the higher the digital transformation index of enterprises, the lower the level of financing constraints of enterprises, that is, the digital transformation of enterprises can significantly alleviate the financing constraints of enterprises, hypothesis H4 is verified. Among the control variables, the coefficients of enterprise scale (SIZE), cash flow level (CFO), return on assets (ROA) and growth rate of operating income (GROWTH) are significantly negative. It can be seen that enterprises with larger scale, higher profitability, operation ability and growth ability usually face lower financing constraints. Secondly, young enterprises with low asset-liability ratio may be regarded as promising by the capital market, and asset-liability ratio (LEV) and listing years (AGE) are negatively correlated with corporate financing constraints. The above regression results are basically in line with expectations, and the conclusions are reliable.

Table 3: Main effect regression results

Variables	KZ	KZ
	(1)	(2)
DT	-0.041***	-0.052***
	(0.015)	(0.007)
SIZE		-0.102***
		(0.009)
LEV		6.727***
		(0.057)
CFO		-16.537***
		(0.146)
ROA		-7.255***
		(0.152)
TobinQ		0.444***
		(0.007)
GROWTH		-0.026**
		(0.011)
TAT		-0.016
		(0.024)
AGE		0.306***
		(0.011)
DUAL		-0.035*
		(0.019)
_cons	1.777***	0.462**
	(0.178)	(0.202)
YEAR	Yes	Yes
IND	Yes	Yes
r2_a	0.082	0.787
N	17529.000	17529.000

Note: The standard error of regression coefficient is in parentheses, * p < 0.1, * * p < 0.05, * * * p < 0.01.

4.3 Mediating effect analysis

The internal control quality (IC) and media attention (MEDIA) are introduced into the mediator variable (Mediator) in Model (2) and Model (3), and the mediating effect of the two is tested by the three-step model. The results are shown in Table 4.

In the intermediary mechanism test results of internal control quality, the coefficient of enterprise digital transformation (DT) in column (1) is 0.023, which is significantly positive at the 1% level, indicating that enterprise digital transformation can significantly improve the quality of internal control. The coefficient of internal control quality (IC) in column (2) is-0.018, which is significantly negative at the 1 % level, indicating that the improvement of internal control quality can significantly reduce the level of corporate financing constraints. Since the coefficient of DT in Column (2) is also significantly negative, the above results show that the quality of internal control plays a partial mediating role in the impact of enterprise and digital transformation on financing constraints. In addition, the Sobel test statistic is Z= -2.71, P < 0.01, which once again verified the existence of the mediating effect of internal control quality. That is, the digital transformation of enterprises can alleviate financing constraints by improving the quality of internal control, hypothesis H4 is verified.

In the test results of the intermediary mechanism of media attention, the coefficient of DT in Column (3) is significantly positive at the 1 % level, indicating that the digital transformation of enterprises can significantly improve the media attention. The coefficient of media attention (MEDIA) in Column (4) is − 0.015, which is significantly negative at the 0.05 level, that is, the improvement of media attention has a significant mitigation effect on corporate financing constraints. At the same time, the coefficient of DT in column (4) is significantly negative, which shows that media attention plays a partial intermediary role in the impact of enterprise and digital transformation on financing constraints. The result of Sobel test is Z = -2.556, P < 0.01, which verifies the robustness of the result again. The above results show that the digital transformation of enterprises can reduce the level of financing constraints by increasing media attention, hypothesis H4 is verified.

Table 4: Regression results of mediating effect

Variables	Internal Control Quality		Media Attention	
	IC	KZ	MEDIA	KZ
	(1)	(2)	(3)	(4)
DT	0.023***	-0.051***	0.068***	-0.051***
	(0.008)	(0.007)	(0.008)	(0.007)
IC		-0.018***		
		(0.007)		
MEDIA				-0.015**
				(0.007)
Control variables	Yes	Yes	Yes	Yes
_cons	1.966***	0.522**	-8.168***	0.339
	(0.221)	(0.203)	(0.234)	(0.208)
YEAR	Yes	Yes	Yes	Yes
IND	Yes	Yes	Yes	Yes
Adj.R2	0.183	0.787	0.252	0.787
N	17529.000	17529.000	17529.000	17529.000
Sobel Z	-2.710		-2.556	

4.4 Robustness test

(1) Replace key variables

Replace the measurement of the level of financing constraints. At present, the evaluation methods of financing constraints are diverse, and the indicators constructed by scholars based on their respective research perspectives are also different. In order to test the robustness of the results, this paper uses the FC index to replace the KZ index to verify the results. The results are shown in Column (1) of Table 4-4. The coefficient of DT is still significantly negative at the 1 % level, which is consistent with the previous conclusions, and the results are robust.

Replace the measurement of enterprise digital transformation. Most of the existing articles use text analysis to measure digital transformation. However, some scholars believe that the expression of digital transformation vocabulary in the annual report is more to show the enterprise's awareness of digital transformation and future planning, and lacks the reflection of the current digital transformation behavior and status of the enterprise. Therefore, this paper replaces the measurement method of the degree of digital transformation of enterprises, and uses the enterprise digital transformation index (DTindex) in CSMAR ' China listed company digital transformation research database ' as the substitution variable. The index is composed of six aspects: strategic guidance, organizational empowerment, technology-driven, enterprise digital achievements and applications, and environmental support at the medium and macro levels, which can comprehensively measure the level of enterprise digital transformation. The regression results are shown in Column (2) of Table 5. The coefficient of DTindex is significantly negative at the 1 % level, which again shows that the digital transformation of enterprises has a mitigating effect on financing constraints, which is consistent with the previous conclusions.

Table 5: Regression results of replacing key variables

Variables	FC	KZ
	(1)	(2)
DT	-0.002***	
	(0.001)	
DTindex		-0.004***
		(0.001)
Control variables	Yes	Yes
_cons	4.814***	0.585***
	(0.021)	(0.201)
YEAR	Yes	Yes
IND	Yes	Yes
Adj.R2	0.844	0.787
N	17412	17529

(2) Lag explanatory variables

The previous article has proved that the digital transformation of enterprises can alleviate financing constraints by reducing corporate transparency. However, when enterprises have sufficient sources of funds, they are also motivated to increase their investment in digital transformation, thereby improving the level of digital transformation of enterprises. In order to reduce the interference of the reverse causality between the independent variable and the dependent variable, this paper extends the time window of the impact of enterprise digital transformation (DT) on financing constraints (KZ), and processes the explanatory variable DT with a lag of 1 to 2 periods. The results are as shown in Table 6. The results of the first and second lag periods are consistent with the previous benchmark regression and the regression results after adding the adjustment effect, and the research results are

robust.

Table 6: Regression results of lagged explanatory variables

Variables	DT lagged one period	DT lagged two periods
	KZ	KZ
	(1)	(2)
L.DT	-0.051***	
	(0.008)	
L2.DT		-0.046***
		(0.009)
Control variables	Yes	Yes
_cons	-0.239	-0.402
	(0.223)	(0.252)
YEAR	Yes	Yes
IND	Yes	Yes
Adj.R2	0.797	0.803
N	12986	9220

(3) Instrumental variable method

This paper draws on Xiao et al. (2021)[15] to use the mean value (IV) of the degree of digital transformation of enterprises in the same industry and region in the same year without the enterprise as a tool variable, and uses the two-stage least squares method for regression to control the endogenous problems between the research variables. The investment and construction of digital transformation of enterprises are usually affected by the external environment. Therefore, the level of digital transformation of enterprises in the same industry and region usually has a certain correlation, while the industry average and regional average of digital transformation are not directly related to the financing constraints faced by individual enterprises. It can be seen that IV initially meets the conditions as an instrumental variable.

Table 7: Regression results of instrumental variable method

Variables	the first stage	the second stage
	DT	KZ
	(1)	(2)
DT		-0.1578**
		(-2.28)
IV	0.2825***	
	(12.93)	
Control variables	Yes	Yes
_cons	-2.0874***	-1.8094***
	(-9.52)	(-7.08)
YEAR	Yes	Yes
Industry	Yes	Yes
Observations	16998	16998
R-squared	0.331	0.776
Kleibergen-Paap rk LM	178.05(P=0.000)	
Cragg-Donald Wald F	186.48(>16.38)	

Table 7 reports the regression results of 2SLS. The first stage regression results show that the instrumental variable (IV) is positively correlated with the enterprise digital transformation (DT) at

the 1 % level, and the coefficient of DT in the second stage regression results is significantly negative at the 5 % level, which is basically consistent with the main hypothesis regression results. Among them, the Kleibergen-Paap rk LM statistic was 178.05 (P = 0.000), and it means the instrumental variables passed the unrecognized test; the statistic of Cragg-Donald Wald F is 186.48, which is much larger than 16.38. The instrumental variable passes the weak correlation test, indicating that the instrumental variable is reasonable and reliable.

5. Research conclusions and implications

This paper takes Shanghai and Shenzhen A-share listed companies from 2018 to 2022 as research samples, and combines information asymmetry theory, principal-agent theory and signal transmission theory to explore the impact of enterprise digital transformation on financing constraints. The research conclusions are as follows: (1) Enterprise digital transformation can alleviate corporate financing constraints. (2) Internal control and external media attention play a partial mediating role in the relationship between the two, that is, the digital transformation of enterprises can alleviate financing constraints by improving the quality of internal control and media attention.

Based on the above conclusions, the practical implications are as follows: Firstly, at the strategic level, businesses should integrate digital transformation into their long-term development plans. Digitization is essential for keeping pace with the times and for easing financing constraints, which in turn supports sustainable business growth. Secondly, in terms of corporate governance, companies should leverage digital technology to enhance internal control quality, innovate and refine their internal control mechanisms, and reduce operational risks to earn investor trust and adapt to market changes. Thirdly, as key information intermediaries in the capital market, media outlets should ensure a robust information dissemination environment, safeguarding the authenticity of information sources and the accuracy of transmission to effectively monitor corporate actions. They should also guide investors in understanding digital transformation, aiding such enterprises in easing financing constraints. Lastly, government departments and regulatory bodies should align with the digital economy's evolution, actively develop and refine laws and regulations to foster enterprise digital transformation and upgrading. They should encourage digital initiatives, providing robust legal protections and financial support to businesses.

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