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Original Paper

Financial Technology and Digital Transformation of Enterprises—A Perspective of Financing Constraints and Credit Rationing

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Abstract

With the rapid development of the Digital economy, the Digital transformation of enterprises has become a new trend, and the effective promotion of the Digitalization of the enterprise is the key to the high-quality development of China's economy. Through web crawler crawling data of Shanghai and Shenzhen A-share listed companies from 2011 to 2019 to investigate the role of regional FinTech in Digital transformation of enterprises, using text mining methods. The empirical results show that FinTech has a significant positive effect on Digital transformation of enterprises. After robustness tests such as reducing endogenous problems and replacing samples, the conclusions are still robust; Fintech reduces the information asymmetry between financial institutions and enterprises, alleviates the financing constraints of enterprises, and improves the efficiency of credit allocation by accelerating credit approval, thus promoting the Digital transformation of enterprises; In small and medium-sized private enterprises, FinTech has a more obvious effect on promoting enterprises' Digital transformation; In the more economically backward Middle West, FinTech can also play its role.

Keywords

FinTech, Enterprise Digital Transformation, Alleviate Financing Constraints, Improve the Efficiency of Credit Rationing

1. Introduction

In the context of Digitization, the Digital economy is both an engine that drives the world economy and an indispensable force that leads the country's high-quality development. The report of the 20th Party Congress states that "we should accelerate the development of the Digital economy, promote the

in-depth integration of the Digital economy and the real economy, and create internationally competitive Digital industry clusters". Taking real enterprises as the main body, cross-border integration as the orientation, and cost reduction, efficiency improvement and innovation as the driving force have become the consensus of major developed countries, whose experience is exemplary in guiding and promoting the Digital transformation of enterprises in China. 2022's China Digital Economy Development Report states that "in 2021, the scale of China's Digital economy reached 45.5 trillion yuan, with a In 2021, the scale of China's Digital economy will reach 45.5 trillion yuan, accounting for 39.8% of GDP, an increase of 9.6 percentage points compared with the early stage of the 13th Five-Year Plan. As the core engine of the macro-economy, the Digital economy will become the backbone of steady growth.

Against the backdrop of domestic epidemics, international economic uncertainty, and the complexity of the international situation, China's economic development has been severely challenged, and according to the Accenture China Enterprise Digital Transformation Index 2022, "In 2022, the country's major economic indicators, such as consumption, employment, investment, and other major economic indicators, fell significantly from January to March". Facing a highly uncertain industry environment highlights the pivotal role of Digitalization more and more, and the willingness of enterprises to realize Digital transformation gradually increases. The Fourteenth Five-Year Plan for National Economic and Social Development of the People's Republic of China and Vision 2035 clearly states that "we should embrace the Digital era, accelerate the construction of a Digital economy, a Digital society and a Digital government, and drive the transformation of production, life and governance with Digital transformation as a whole". Therefore, promoting the Digital transformation of enterprises is the core engine to lead the high-quality development of the Digital economy, and to tap the potential of the data dividend to empower the high-speed development of the real economy. In summary, promoting enterprise Digital transformation is of vital importance to driving the high-quality development of the Digital economy.

When traditional finance is facing the dilemma of stagnation, FinTech effectively meets the demand (Yanbo et al., 2022). Firstly, through emerging Digital technologies, FinTech breaks the boundaries of geographic space by utilizing its almost zero marginal cost to provide external financial support for the Digital transformation of enterprises; secondly, FinTech, as a technology-driven financial innovation, has a common "technology zone" between its underlying technology and the Digital technology that supports the Digital transformation of enterprises, so it can provide technological spillover advantages. Therefore, it can provide technological spillover advantages (Zhang, 2020) and deepen the supply-side structural reform; finally, fintech improves the business credit value of enterprises by improving the transparency of enterprise information, identifying enterprises with innovation potential, improving the enterprise industry environment and alleviating financing constraints.

In order to accelerate fintech and promote the Digital transformation of financial institutions, the People's Bank of China released the Financial Technology Plan (2022-2025) in late 2021. Can FinTech

drive the Digital transformation of enterprises? And what is its mechanism of action? In the critical period of China's economic transformation, it is strategically important to study the connection between the two in order to walk out of the road of financial Digitalization with Chinese characteristics, to help the economy run into a new era of Digitalization and to promote the steady development of China's economy.

The following are the possible contributions of this paper: firstly, this paper integrates fintech into the analytical framework of enterprise Digital transformation, and comprehensively reveals the mechanism of fintech-enabled enterprise Digital transformation. This not only portrays the internal logic of fintech and Digital transformation, but also digs out the micro evidence of the impact of fintech on the real economy, further expanding the understanding of the factors affecting enterprise Digital transformation. The current domestic research on enterprise Digital transformation mainly focuses on effect and measurement, ignoring the impact of emerging Digital technologies on enterprise Digital transformation. Second, from the perspective of financing constraints and credit rationing, we discuss the role path of fintech in promoting enterprise Digital transformation based on different perspectives, which complements the relevant research on enterprise Digital transformation, provides new ideas for releasing the potential of data elements, and broadens the research perspectives of the Digital economy. Finally, the heterogeneous role of fintech on enterprise Digital transformation is examined from the dual perspectives of enterprises and regions, and the possible impact between the two is systematically studied. In a practical sense, the findings of this paper provide a rich theoretical reference for solving the information asymmetry problem between banks and enterprises and the supply shortage problem that occurs in traditional finance, so as to improve the efficiency of resource allocation to boost the Digital transformation of enterprises, and efficiently promote the deep integration of fintech and the real economy.

2. Literature Review and Research Hypotheses

To summarize the definitions of Digital transformation from different perspectives, this paper defines it as the ability of enterprises to enhance their dynamic dual innovation by strengthening the level of Digital construction, access, application, and platform construction, to promote the reorganization and change of business processes and strategies from the enterprise level and the industrial level, to promote the transformation and upgrading of business models, and to ultimately improve the innovation and operational performance of the enterprise and enhance the core competitiveness of the enterprise (Yan et al., 2022).

The Digital transformation of enterprises is affected by different factors. The existing literature has mainly studied the path dependence of Digital transformation (Zhang, 2020), organizational change perspective (Hu, 2020), financial expenditure (Wu et al., 2021), business model perspective (Wang et al., 2020), mechanisms, paths, and countermeasures (Li & Liang, 2020), innovation of management theories (Chen, 2019), cross-system transformation of enterprises (Xiao, 2020), and challenges of

Digitalization to existing strategic management theories (Chen, 2020). The above analyses on different dimensions of Digital transformation mainly focus on enterprise Digital transformation capabilities and Digital transformation maturity assessment models, specific industries, specific directions, and lack of research on the relationship between fintech and enterprise Digital transformation.

In an environment where the development of Digital economy has become the core driver of the current high-quality development of China's economy, Digital transformation has become an inevitable law (Yanbo et al., 2022), but the unfriendly business environment, high investment risks and lopsided financing methods (Li, 2020) have forced enterprises to struggle to carry out Digital innovation. In order to solve the above challenges, a benign Digital economy ecosystem should be built for SMEs, free from financing constraints, and provide high-quality financial resources, while fintech, as a "technology-driven financial innovation", forces the optimization and upgrading of financial structure (Hsu et al., 2014), eases the mismatch of credit resources, and attracts financial resources to enterprises with potential for development (Hsu et al., 2014). It eases the mismatch of credit resources, attracts financial resources for enterprises with development potential, and promotes the Digital transformation of enterprises.

Fintech mainly affects the Digital transformation of enterprises in two ways: Fintech strengthens the stability of the real economy. By utilizing emerging technologies such as big data and blockchain, fintech can improve the resource allocation efficiency of financing institutions, enhance risk management capabilities, and reduce the cost of enterprise financing (Chen & Zhu, 2016); fintech improves the efficiency of enterprise innovation transformation. Under the environment of "mass innovation, mass innovation", through the aggregation of financial resources, it promotes benign communication among consumers, enterprises and investors (Xu & Dong, 2021; Zhang, 2019), facilitates the innovation of fintech, and further promotes the enterprises to improve the efficiency of innovation. Combined with the above analysis, this paper proposes:

Hypothesis 1: Fintech can effectively promote enterprise Digital transformation.

For enterprises, Digital transformation requires a large amount of capital and cost investment, occupying most of the enterprise's cash flow, at the same time, in the process of transformation to generate a large number of derived management, equipment maintenance costs, innovation performance-driven effect will be seriously weakened, and in the long-term process of enterprises need to adapt to the technological impact, in addition to the technology is still changing, the impact of Digital technology will be a long term process (Qi et al., 2020). Bank credit is the main financing method for Chinese enterprises, but banks favor state-owned enterprises and discriminate against private enterprises when lending, which is called "financial discrimination" (Fang, 2007). Enterprise Digital transformation is a process of continuous optimization from shallow to deep (Teece, 2007), so it relies more on financing. The existence of financing constraints causes enterprises to deviate from the optimal investment level (Greenwald et al., 1984; Myers & Majluf, 1984) and restricts the export of private enterprises (Sun & Li, 2012). As Digital technology penetrates the financial market, the

Corporate financing constraints can alleviate corporate financial difficulties (Li et al., 2019). The development of financial technology can alleviate the financing constraints of enterprises by reducing the information asymmetry between banks and enterprises, and promote the Digital transformation of enterprises. In a study on financial technology improving total factor productivity of enterprises, Song Min (2020) used Shanghai and Shenzhen A-share data from 2011 to 2018 and found that Amount Technology used emerging technologies such as big data and blockchain to mine more comprehensive enterprise information. It diverts financial resources to small and medium-sized enterprises, improves the quality of financial services, and further promotes the integration of Digital economy and traditional finance. Based on the above analysis, this article proposes:

Hypothesis 2: Fintech can alleviate financing constraints and promote Digital transformation of enterprises.

Under normal operation, innovation project funding tends to rank at the end of the firm's regular projects, and when firms' profitability deteriorates, firms prioritize cutting back on R&D and innovation funding (Brown & Petersen, 2009). The importance of external credit rationing for firms' innovation investment becomes more and more obvious when internal financing cannot support the funding of innovation projects. However, for SMEs, it is often difficult for innovation projects to obtain credit rationing through financial markets. A large number of studies, as well as failed enterprise innovation projects, have shown that inefficiency and distortion of credit rationing (Hsieh & Klenow, 2009; Song & Wu, 2015) is a key factor leading to the low degree of Digital transformation of enterprises, and that the mismatch of external credit resources can result in a reduction of 20% in the efficiency of production (Song & Wu, 2015), and that if the efficiency of credit rationing in the country were to reach the level of the United States, domestic productivity would rise by 30%-50% (Hsieh & Klenow, 2009).

Fintech also facilitates credit resources to benefit high-quality SMEs. Enterprises need huge cash flow to support Digital transformation, and at the same time incur a large amount of derived management and equipment maintenance costs, and the innovation performance-driving effect will be seriously weakened (Xiao et al., 2021), with a more serious impact on SMEs. In a study on fintech, science and technology finance and regional R&D innovation, Hou and Song (2020) found that fintech utilizes the mediating effect of financial resource allocation efficiency to positively regulate the R&D innovation of enterprises, promote the credit supply of SMEs, and further correct the distorted resource allocation. Based on the above analysis, this paper proposes:

Hypothesis 3: Fintech can effectively improve the efficiency of credit allocation and promote the Digital transformation of enterprises.

3. Research Design

3.1 Sample and Data Sources

The research sample is selected from Chinese A-share listed companies in Shanghai and Shenzhen

from 2011 to 2019. The basic characteristics, financial data, and industry classification data of listed companies are obtained from CSMAR database, and the core explanatory variables enterprise Digital transformation indicators are obtained from the annual reports of Shanghai and Shenzhen A-share companies through text analysis as proxy indicators. The core explanatory variable fintech indicator uses the usage depth index in China Digital Inclusive Finance Index as a proxy indicator. The data are processed as follows: exclude ST and delisted during the period samples; exclude financial industry and information transmission industry samples; and delete missing data samples. In addition, considering the effect of outliers, this paper does two-sided 1% quantile shrinkage on all continuous variables. As a result, 19,732 observations from 2924 companies are obtained.

3.2 Model Construction and Variable Definition

In order to study the connection between fintech and enterprise Digital transformation, this paper sets the following model:

$$Digit_{it} = \alpha_0 + \alpha_1 Fintech_{mt} + \gamma X_{it} + Ind + \varepsilon_{it} \quad (1)$$

included among these，$Digit_{it}$ is the degree of Digital transformation of firm i in year t, $Fintech_{mt}$ denotes the level of fintech in region m in year t, X_{it} is a control variable, and the model also controls for industry fixed effects. This paper focuses on the coefficient of the core explanatory variable $Fintech_m$. If α_1 is significantly positive, it means that regional fintech can significantly promote the Digital transformation of enterprises.

3.2.1 Enterprise Digital Transformation (Digit)

Digital transformation is an important symbol for companies to construct a Digital economy community, and this paper measures Digital transformation through quantitative measures. The annual reports of Shanghai and Shenzhen A-share companies are counted to quantify the degree of Digital transformation. The specific processing methods are as follows: firstly, based on Python crawler to collect and organize the annual reports of Shanghai and Shenzhen A-share listed companies; secondly, drawing on the practice of Tang (2022) and Wu (2021), this paper divides Digital transformation into “underlying technology” and “technology practice”, from “underlying technology” to “technology practice”, and from “Digital transformation” to “technology practice”. “From the perspective of “underlying technology”, it is subdivided into artificial intelligence technology, big data technology, cloud computing technology, and blockchain technology, and from the perspective of “technology practice”, it focuses on specific Digital application scenarios, and it can be summarized through the following keywords. Once again, on the basis of the existing keyword dictionary, this paper draws on the “2022 White Paper on Digital Transformation of Chinese Enterprises”, “2022 Digital Transformation Trend Report”, as well as the core policy texts and research results of the “Government Work Report” in recent years, to further expand the keyword dictionary of Digital transformation; and finally, we use Jieba’s Chinese participles to analyze the statistics and high-frequency words related to Digital transformation in the annual report, and to identify the most common words related to Digital

transformation. Digital transformation-related high-frequency words, calculate the disclosure frequency of keywords, get the indicators of enterprise Digital transformation, and do logarithmic processing after adding 1.

3.2.2 Financial Technology (Fintech)

According to the definition of the Global Financial Stability Board (FSB), fintech is "technology-led financial innovation". Li (2016) and other scholars believe that the essence of fintech is the technology that combines Digital technology with traditional finance, utilizing emerging technologies such as big data, blockchain, cloud computing, artificial intelligence, etc., to improve the efficiency of the traditional financial industry and effectively reduce operating costs. Han (2016) has a deeper understanding of fintech as: fintech is simply the combination of finance and internet technology. Li (2016) has a different view of fintech: the integration of Digital technology with the traditional financial industry makes it more efficient, and the existence of Digital technology injects vitality and energy into finance, making it high-quality development. The deep penetration of emerging Internet technologies in the financial industry benefits the Digital economy, and the connection between the financial industry and its customers is benignly reshaped to promote the growth of the Digital economy, constituting a major element in the in-depth implementation of the innovation-driven development strategy (Xie et al., 2021; Li et al., 2021).

This paper uses China's Digital Inclusive Finance Index (DIFI) compiled by the Digital Finance Research Center of Peking University and Ant Financial Services (Guo et al., 2021). The group utilizes the data stability and representativeness of Ant Group containing Digital economy, which is authoritative in the research about Digital finance (Qiu et al., 2021). The total index includes: Digital finance coverage index, Digital finance usage depth index, and inclusive finance Digitization index. Among them, the depth of use index includes payment, money fund, credit, insurance, investment, credit and other indexes. The depth of use index of Digital finance has become an important engine for the growth of Digital financial inclusion index, and the future development of Digital finance will mainly rely on the growth of the depth of use space. This paper specifically uses the depth index to measure the degree of fintech at the city level.

3.2.3 Control Variable Set

Enterprise size (Size, total assets taken as a logarithm): relative to SMEs, large-scale enterprises tend to have greater information transparency, a higher degree of access to external financing, and a stronger production capacity to increase the degree of Digital transformation of the enterprise through fintech and other means.

Enterprise age (AGE, the age at which the enterprise is listed is taken as logarithmic): the older the enterprise is, the more resources it has accumulated in the industry and the lower the financing constraints, while the enterprise may have low productivity due to inefficient innovation or outdated production equipment (Sun, 2014). Therefore, the effect of firm age on firms' Digital transformation capability cannot be fully determined.

Gearing ratio (LEV, total liabilities/total assets): the gearing ratio reflects a firm's capital structure and ability to raise debt to operate. When the leverage level of a firm is low, it is able to ensure continuous investment in R&D and further expand the knowledge base by expanding production scale, etc. (Brien, 2003), and thus the firm's Digital transformation capability is stronger.

Return on Assets (ROA, Net Profit/Total Assets): Return on Assets indicates an enterprise's ability to earn profits, reflecting the enterprise's inputs and outputs and the efficiency of asset utilization. The higher the indicator, the more efficient the capital operation of the enterprise, and the more it can promote the Digital transformation of the enterprise.

Tangible Asset Ratio (Tangibi, Fixed Assets/Total Assets): The higher the tangible asset ratio, the more advanced the production equipment and the higher the profitability of the enterprise. Tangible assets as collateral improve the ability of enterprises to obtain credit resources and provide financial liquidity for enterprise Digital transformation (He & Tian, 2016). Therefore, the greater the proportion of tangible assets in the enterprise, the stronger the enterprise's Digital transformation ability.

The nature of property rights

(Soe, state-owned enterprises take 1, private enterprises take 0). The specific definition is shown in Table 1.

Table 1. Definition of Variables

Variable	Variable Description
Digit	Enterprise Digital transformation, add 1 to the number of keyword disclosures and take the natural logarithm
Deep	Fintech level, using the depth index to take the natural logarithm
Size	Firm size, total assets at the end of the year taking the natural logarithm
LEV	Gearing ratio, total liabilities to total assets at year-end
ROA	Return on assets, year-end net profit to year-end total assets
Tangibi	Tangible assets ratio, fixed assets at the end of the year to the total assets at the end of the year of the value of money
Age	Age of the firm, natural logarithm of the number of years the firm has been on the market

3.3 Descriptive Statistics

Table 2. Descriptive Statistics

Variable	Sample	Mean	Std.Dev.	Min	Med	Max
Digit	19732	5.9123	0.5406	2.3979	5.9661	7.7630
Deep	19732	5.3776	0.5317	1.9110	5.4922	6.0866

Size	19732	23.6522	1.4563	20.3228	23.5006	28.5513
Roa	19732	0.0491	0.0664	-0.1644	0.0411	0.3024
Age	19732	1.9726	0.9343	0.0000	2.1972	3.3673
Lev	19732	0.5695	0.5772	0.0561	0.4458	3.4890
Tangibi	19732	0.2782	0.3223	0.0022	0.1977	2.0590

Table 2 reports the descriptive statistics of the main variables in this paper. The mean value of firms' annual Digital transformation is 5.9123, indicating that the overall level of Digital transformation is high. The mean value of depth of use is 5.4922, and the maximum and minimum values are 6.0866 and 1.9110, respectively, indicating that the level of fintech varies widely across regions.

4. Analysis of Empirical Results

4.1 Regression to Basics

Table 3 reports the regressions of FinTech on firms' Digital transformation in the two sets of models. Model (2) controls for industry fixed effects only, and model (1) adds the set of control variables to it. the regression coefficients of Deep are significantly positive in both sets of models, but the coefficient of Deep decreases in model (1), which may be that the relevant effects are drawn by the set of control variables to some extent. The above results show that the development of fintech can indeed help the Digital transformation of enterprises, which verifies the hypothesis of this paper.1 The comprehensive regression results show that the penetration of fintech in the traditional financial industry, the information asymmetry between banks and enterprises has been eased, which reduces the financing constraints of enterprises, improves the efficiency of favorable capital allocation, and further promotes the Digital transformation of enterprises.

The coefficient of Size is significantly positive, proving that the larger the enterprise size, the greater the Digital reform, because the closer the relationship between the bank and the enterprise, the more unaffected the enterprise investment-cash flow (Shen & Wang, 2005), thus reducing the financing constraints of the private enterprises; the coefficient of Tangibi is significantly positive, indicating that the enterprise reasonable financialization and industrial investment, the greater the degree of enterprise Digital transformation, because the foundation of the country is the real economy, Digital technology penetration of the real economy in order to promote the quality and efficiency of manufacturing enterprises (Li et al., 2022).

Table 3. Base Regression Results

	(1)	(2)
	Digit	Digit
Deep	0.1246***	0.1485***

	(7.6140)	(16.6304)
Size	0.0866***	
	(9.2657)	
Lev	-0.0889***	
	(6.9047)	
Roa	0.1101	
	(1.2469)	
Tangibi	0.0854***	
	(4.1001)	
Age	0.0166	
	(1.3062)	
_cons	3.0820***	5.1142***
	(15.0665)	(106.3963)
Industry	Control	Control
Sample	19732	19732
Adjusted R2	0.0352	0.0217

Note. ***, **, and * represent 1%, 5%, and 10% significance levels; t-values for two-sided tests corresponding to robust standard errors for industry clustering are in parentheses. The following tables are identical.

4.2 Endogenous Issues

Although this paper goes to control for relevant factors affecting FinTech, it may still generate endogeneity problems due to omitted variables and measurement errors on indicators. This paper utilizes an instrumental variable approach to reduce the effect of endogeneity. Drawing on Tang et al. (2022), this paper utilizes the number of listed firms in the province (Pro) as an instrumental variable. On the one hand, benign fintech cannot be separated from high-quality listed firms, which satisfies the correlation condition; on the other hand, there is no significant link between the number of firms and Digital transformation decisions, which satisfies the exclusivity condition.

Table 4 reports the regression results of the instrumental variables, and the coefficient of FinTech is significantly positive on the regression, proving that after reducing the endogenous effects, it is consistent with the previous empirical results, i.e., the penetration of FinTech boosts the Digital transformation of enterprises.

Table 4. Instrumental Variables Approach

	(1)	(2)
	Digit	Digit

pro	0.0221***	
	(4.2637)	
Deep		0.1303***
		(4.3015)
Control Variables	Control	Control
Industry	Control	Control
Sample	19732	19732

4.3 Robustness Check

4.3.1 Replacement of Fintech Level Metrics

Referring to Cai et al. (2021), Digital finance is used to replace FinTech using Depth (Deep). After replacing the measure, the results are shown in Table 5 and the conclusions of this paper remain robust.

Table 5. Replacement of Fintech Level Indicators

	Digit
Cover	0.0892***
	(6.7830)
Control Variables	Control
Industry	Control
Sample	19732
Adjusted R2	0.0350

4.3.2 Deletion of Specific Samples

(1) Due to the strong economic power and large population size of municipalities directly under the central government, there may be a more serious bidirectional causality of well-developed Digital firms for Fintech. Referring to the practice of Luo (2016), this paper excludes the municipality directly under the central government from the sample, and the results are shown in Table 6. (2) Given that the sample of listed companies in this paper can be divided into limited liability companies and joint-stock limited companies, and the former are usually small and medium-sized enterprises (SMEs) due to their simple establishment, flexible institutions, and small capital scale relative to joint-stock limited companies, they tend to be subjected to financial discrimination and credit financing is biased in favor of Fintechs. credit financing has the inertia of favoring the limited liability company. Therefore, this paper in accordance with the limited liability company registered capital order, in order to retain the first 30%, 20%, 10% of the sample, the results are shown in Table 7. Replacement of measurement indicators, the conclusions of this paper are still robust.

Table 6. Exclusion of Municipalities

	Digit
Deep	0.1246***
	(7.6140)
Control Variables	Control
Industry	Control
Sample	19732
Adjusted R2	0.0352

Table 7. Exclusion of Some Limited Company Samples

	(1)	(2)	(3)
	Digit	Digit	Digit
30%	0.0462***		
	(3.2374)		
20%		0.0290**	
		(1.5803)	
10%			0.0080**
			(0.3989)
Control Variables	Control	Control	Control
Industry	Control	Control	Control
Sample	19732	19732	19732
Adjusted R2	0.0328	0.0325	0.0323

5. Mechanism Analysis

5.1 Based on Corporate Finance Constraints

The existence of financing constraints can stagnate the Digital transformation of enterprises (Hopenhayn, 2014), and FinTech utilizes emerging Digital technologies to allow investors to effectively capture the Digital dividends of enterprises, thereby moderating information asymmetry and allowing credit resources to flow to enterprises in an effective and timely manner, further reducing the financing constraints of enterprises. Referring to Hadlock and Piere (2010), by calculating the equation *-0.737×Size+0.043×Size2-0.04×Age*, The SA index of the firms in the measurement year is used to measure the financing constraints of the firms. The SA index is taken to be negative, if the absolute value is larger, it indicates that the financing constraints are more severe.

Table 8 reports the results of the mediation effect test on financing constraints. The results in the first column show that the coefficient of Deep is significantly negative on the regression, indicating that FinTech significantly reduces firms' financing constraints. The results in the second column show that the coefficient of SA is significantly negative on the regression, indicating that financing constraints do

inhibit firms' Digital transformation; the coefficient of Deep is significantly positive on the regression and the value is significantly lower than that of Table 3 (0.1246), indicating that after controlling for the financing constraints, the role of FinTechs in fueling the firms' Digital transformation has been reduced, which verifies the hypothesis of this paper. 2 FinTechs utilize the emerging Digital technologies to get rid of geospatial constraints, reduce the information asymmetry between financing institutions and enterprises, ease the financing constraints of enterprises, and facilitate enterprises' access to financial support to further boost their Digital transformation.

Table 8. FinTech, Financing Constraints and Corporate Digital Transformation

	(1)	(2)
	SA	Digit
Deep	-0.1648***	0.1032***
	(-25.1633)	(6.0694)
SA		-0.1227***
		(-2.9923)
Control Variables	Control	Control
Industry	Control	Control
Sample	19732	19732
Adjusted R2	0.9915	0.0356

5.2 Based on the Efficiency of Corporate Credit Rationing

Fintech, with the help of big data, artificial intelligence and other Digital technologies, allows enterprises to fully disclose their financial information, comprehensively explores their potential profit projects, and allows credit resources to benefit small and medium-sized enterprises (SMEs). Drawing on Song Min's (2020) study on total factor productivity, this paper constructs the following model to test the impact of fintech on credit rationing efficiency:

$$Loan_{it} = \beta_0 + \beta_1 Performance + \beta_2 Deep_{mt-1} + \beta_3 Deep_{mt-1} \times Performance + \beta_4 X_{it-1} + Ind + \varepsilon_{it} \quad (2)$$

$$Digit_{it} = \beta_0 + \beta_1 Deep_{mt-1} + \beta_2 Loan_{it} + \beta_3 X_{it-1} + Ind + \varepsilon_{it} \quad (3)$$

In model (2), $Loan_{it}$ is the net change in the firm's bank loan in the year, *Performance* is the firm's performance, and the firm's current and future profitability is measured using *ROA* and ROA_{t+1}, with all other variables held constant. This paper focuses on the coefficient β_3 of the interaction term of $Deep_{mt-1} \times Performance$ in model (2) and the coefficient β_4 of Loan in model (3). If β_3 and β_4 are both significantly positive, it proves that FinTech can significantly increase the sensitivity of new credit to

enterprise productivity, i.e., FinTech can significantly enhance the credit resource allocation to SMEs by external investment institutions and further promote enterprise Digital Transformation.

Table 9 reports the regression results. The results in the first column show that the coefficient on the *Deep×ROA* interaction term is significantly positive, demonstrating that new credit is more sensitive to firm performance after controlling for fintech, i.e., fintech diverts financial capital to high-productivity firms. The results in the second column show that the $Deep \times ROA_{t+1}$ interaction term coefficient is significantly positive, i.e., controlling for FinTech, it is easier for external investment organizations to identify SMEs with future profit potential. In the third column, the coefficient of Loan is significantly positive on the regression, indicating that the more efficient credit rationing is, the more it promotes the Digital transformation of enterprises. Taken together, the development of fintech boosts the credit rationing of investment institutions to SMEs, creates a benign market environment for enterprises, reduces investment risks and enriches financing channels, and further promotes the Digital transformation of enterprises. The hypothesis of this paper is verified 3.

Table 9. Fintech, Credit Rationing Efficiency and Corporate Digital Transformation

	(1)	(2)	(3)
	loan	loan	Digit
loan			0.0220***
			(4.2560)
Deep	-0.0201	-0.0131	0.1359***
	(-0.6768)	(-0.4433)	(7.0614)
Deep×ROA	0.6958***		
	(2.7285)		
ROA	-2.5857*		
	(-1.9545)		
$Deep \times ROA_{t+1}$		0.5613***	
		(2.7659)	
ROA_{t+1}		-3.1094***	
		(-2.8229)	
Control Variables	Control	Control	Control
Industry	Control	Control	Control
Sample	15161	15161	15161
Adjusted R2	0.0179	0.0144	0.0322

6. Heterogeneity Analysis

6.1 Heterogeneity Analysis Based on Firm Ownership and Size

State-owned enterprises (SOEs) have strong credit profitability by virtue of their political connections

(Yu, & Pan, 2008), while small and medium-sized private enterprises (SMEs) face "financial discrimination", which further strengthens their financing constraints. Therefore, in order to deeply study the corporate differences in the impact of fintech on the Digital transformation of enterprises. Property Ownership of Enterprises (*POE*) and Size of Enterprises (*Size*) are used as interactive explanatory variables for FinTech.

The regression results in Table 10 show that the coefficients of *Deep×Size* and *Deep×POE* are both significantly negative, indicating that fintech is more capable of promoting the Digital transformation of small and medium-sized private enterprises relative to large SOEs. By virtue of fintech innovation informatization, it boosts the information asymmetry mitigation between investment institutions and SMEs (Hou & Song, 2020), promotes enterprises' profitable projects to obtain reasonable credit support, and further facilitates the Digital transformation of enterprises.

Table 10. Fintech and the Digital Transformation of Companies with Business Ownership and Business Size

	(1)	(2)
	Digit	Digit
Deep	0.1353***	0.6619***
	(8.2926)	(6.4031)
Deep×POE	-0.0585***	
	(-3.4881)	
Size	0.0888***	0.2075***
	(9.3518)	(8.7442)
Deep×Size		-2.8012***
		(-5.2908)
Control Variables	Control	Control
Industry	Control	Control
Sample	19732	19732
Adjusted R2	0.0358	0.0369

6.2 Area-Based Sub-Sample Study

There is a considerable gap between the economic levels of different regions in China, and there are significant differences in the market environment and institutional policies between different regions. However, with the application of emerging technologies such as big data, the immediacy and convenience of traditional finance combined with Digital technology can break down the barriers of physical space, allowing the industry's sales market to gradually expand and further narrowing the gap between the development of various regions. Therefore, in this paper, in order to study the regional differences in the Digital transformation of enterprises by fintech, the full sample is divided into the

eastern region and the central and western regions according to the domestic provinces.

The regression results in Table 11 show that the regression coefficients of FinTech in the eastern region as well as in the central and western regions are significantly positive, which indicates that FinTech can indeed play a role in assisting the Digital transformation of enterprises in different regions, and Digitization is actively promoting the realization of financial policy universality, market downward mobility, and scenario line upward in various industries (Hou & Song, 2020; Zhou et al., 2020).

Table 11. FinTech and Digital Transformation of Enterprises in Different Regions

	(1) Eastern	(2) Central and Western
Deep	0.1286***	0.1272***
	(6.0054)	(4.8078)
Control Variables	Control	Control
Industry	Control	Control
Sample	12913	6819
Adjusted R2	0.0368	0.0321

7. Conclusions and Implications

7.1 Main Findings

The development of the real economy is crucial to the construction of a modernized industrial system, and Digital transformation has become an important engine to drive high-quality economic growth. Based on the two-dimensional perspective of enterprise financing constraints and credit rationing, this paper studies the impact mechanism of fintech on enterprise Digital transformation. Firstly, it is empirically concluded that fintech can significantly promote the Digital transformation of enterprises. Second, further revealing its potential mechanism from different dimensions, it is concluded that fintech mainly reduces the information asymmetry between banks and enterprises by integrating with the traditional financial industry to reduce the financing constraints; and further boosts the Digital transformation of enterprises by accelerating credit approval and improving the efficiency of credit rationing. Finally, through the heterogeneity analysis, it is found that FinTech is more significant in promoting the Digital transformation of SMEs, and for both the central and western regions as well as the eastern region, there is a significant facilitating effect, probably because FinTech gives full play to its characteristics of zero marginal cost and freedom from geographic and spatial constraints to promote the economic development of the central and western regions, and to reduce the gap between the central and western regions and the eastern regions at the absolute level. The research in this paper provides new perspectives and evidence for a better understanding of the multidimensional impact of the integration of fintech and the real economy on the Digital transformation of enterprises.

7.2 Policy Implications

First, the data dividend is deeply explored through financial technology to comprehensively portray Digital strength. Due to information asymmetry between banks and enterprises, enterprises are plagued by financing constraints and inefficient resource allocation. By virtue of "data + technology" to achieve a Digital workforce, comprehensively shaping the core competitiveness of enterprises in the big data environment, opening up the supply chain and industrial chain information interoperability, and further assisting in the "last mile" of the transformation of innovative theories into real results. Deeply recognize the competitive potential of data elements, clarify the development strategy of enterprises, and actively promote the transformation of enterprises into data decision-making direction. Through market orientation and realistic demand, we will comprehensively explore the scope of data synthesis and application, contribute to the potential of data and technology, and actively serve the real economy and drive the Digital transformation of enterprises.

Second, accelerate the all-round application of regulatory technology, and build a financial and technological risk firewall. Fintech is a "double-sided blade", and when integrating with the traditional financial industry to promote the development of the Digital economy, it may cause financial risks due to improper use of methods and approaches. Actively using Digital compliance tools to penetrate various scenarios containing data, while reducing costs and improving the efficiency of financial supervision; at the enterprise level, strengthening the supervision of fintech innovation behavior, making fintech innovation activities transparent, and weaving a dense "protective net" for the transmission of Digital technology risks to the financial industry, so as to stifle the potential risks of fintech from the source, and protect consumers' rights and interests. Thirdly, the focus of enterprise Digital transformation is to protect the legitimate rights and interests of consumers and maintain market order.

Third, the center of gravity of enterprise Digital transformation should not deviate from the real economy, and the phenomenon of financialization of enterprises should be prevented from intensifying. The real economy is an important foundation for the country's economic development, and only by combining emerging Digital technologies with the real economy can they truly give full play to their technological advantages and become the core engine that empowers enterprises' core competitive advantages, drives their Digital transformation and enhances quality and efficiency, and drives economic growth. In the process of promoting the Digital transformation of enterprises, the government should always be vigilant against the profit-seeking nature of capital in the over-pursuit of financial assets under the attribute of zero marginal cost of Digital technology, leading to the gradual separation of enterprises from the real economy to the direction of financialization, and deteriorating the industry environment of enterprises.

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