Digital Finance May Dampen Corporate Trade Credit: Evidence from China's Prefecture-level Cities

Yinghan Liu[1,a], Fat Iam Lam[2,b*], Leongwong Lei[2,c]

[a]Email: liuyinghan_lynn@163.com; [b]Email: p2209642@mpu.edu.mo;
[c]Emai: macau1314@hotmail.com

[1]Macau Polytechnic University, Chongqing College of Electronic Engineering.
Address:Faculty of Humanities and Social Sciences,Macao Polytechnic University R. de Luís Gonzaga Gomes, Macao, China
[2]Macao Polytechnic University, Macao,China
Address:Faculty of Humanities and Social Sciences,Macao Polytechnic University R. de Luís Gonzaga Gomes, Macao, China

Abstract. China's 14th Five-Year Plan prioritizes the acceleration of the development of the digital economy and its integration with the real economy. In conjunction with this plan, this study examines the impact of China's digital finance development on corporate trade credit. This study matches a sample of Chinese A-share non-financial listed companies with corresponding prefecture-level cities from 2011 to 2021, and empirically examines the relationship between digital finance and corporate trade credit using multiple regression analysis. The regression results indicate that the development of digital finance in China may have an inhibitory effect on business credit, each one-point increase in the level of digital finance in the prefecture-level city will result in an average 0.1 percentage point decrease in business credit for businesses in the prefecture-level city, which remains robust after a series of robustness tests. Heterogeneity analysis reveals that the development of digital finance has a more obvious inhibitory effect on the business credit of private firms, asset-heavy firms, and firms with high financial leverage. By analyzing the mechanism of action, it is found that digital financial development affects business credit through the change of financing constraints.

Keywords: Digital Finance; Corporate Trade Credit; China's Prefecture-level Cities; Financing constraints

1 Introduction

In China's 14th Five-Year Plan, China expressed the importance of digitalizing China and policies were proposed to accelerate the integration of digital finance and organizations. Xi Jinping, China's premier, has emphasized on developing the digital finance and economy [1]. During Xi Jinping's work in Fujian, he had started to propose the development of "Digital Fujian"; subsequently, he proposed "Digital Zhejiang." Following these two pioneer initiatives, China has been focused on developing digital finance as a national development strategy. In 2022, Zhou Xiaochuan (Vice Chairman, Bo Ao Asia Forum) made a vital speech at Beijing Digitial Finance Forum in support of digital finance and pointed out the integral role of digital finance in digital economization and its role in the development of the modern financial industry. In recent years, China's provincial governments at all levels have been pushing the

development of digital finance. Organizations are able to eliminate the use of the middleman and reduce business costs as digital finance is able to utilize digital platforms and 'big data' to process, transmit and communicate data; theoretically, digital financialization could also reduce corporate financing costs and facilitate advanced integration of digital finance and organizations so as to enable organizational transformation. The potential of digital finance in organizational development is immense and has attracted scholarly attention in terms of the implications of digital finance on the economy (macro-scale) and on the individual (micro-scale). Based on this background, this paper aims to study the impact of digital finance on corporate business credit and its mechanism.

2 Literature review

In the literature review, regarding macro-level research, Guo et al. [2] compiled a large amount of organizational data and compiled a comprehensive indicator of the digital finance sector in China. Ding [3] also considered the impact and influence of digital finance on carbon emissions, private organizations, regional innovation, regional economy and shared prosperity.

At the micro level, Xie et al. [4] analyzed the impact of digital finance on overall entrepreneurship as well as entrepreneurship of migrants, farmers and local residents. Tang et al. [5] studied the relationship between digital finance and organizational innovation. Zhang and Sun [6], Tu et al. [7] conducted an empirical study on digital finance and corporate finance, while Yu et al. [8], Zhai et al. [9], Lv and Shi [10] studied debt default risk and digital finance.

Amiti and Weinstein [11] argue that corporate credit is a corporate strategy to retain corporate funds by deferring payments. Brennan et al. [12] argue it is considered as a strategic tool for organizational development and financial management, as well as a strategic negotiation tool to achieve organizational goals; Giannetti et al. [13] and Liu et al. [14] suggested that corporate credit has an incentive effect on organizations that have difficulty in financing because it alleviates their financial constraints. Meltzer et al. [15] studied the relevance of monetary policy and economic policy uncertainty on trade credit. At the meso level, Zhang et al. [16] studied the impact of market position and supplier concentration on trade credit. At the micro level, the relationship between factors such as financialization of organizational firms, internal control, corporate finance, corporate operations, corporate strategy and accounting on trade credit has also been discussed [17-22].

Research findings on the micro, meso, and macro levels have been insightful in advancing the existing knowledge on trade credit; however, few studies have considered the impact of digital finance on trade credit, especially in China and at the prefecture level. Although Zhong et al. [23] considered the impact of digital finance on the sub-allocation of corporate credit, and although there have been detailed studies on the impact of digital finance at the macro and micro scales, however, there is a research gap in the relationship between digital finance and trade credit.

To fill this research gap, this paper attempts to analyze whether digital financialization adversely affects firms' trade credit using data from Chinese prefecture-level cities? If so, how does it arise? Does the severity of these impacts vary by organization? This study finds that

digital financialization severely damages trade credit. This finding has been rigorously tested and the results remain valid. It is found that digital finance affects corporate trade credit by changing the financing constraints of organizations. Finally, through statistical heterogeneity analysis, the results show that digital finance has a more significant adverse effect on non-state organizations, organizations with higher financial leverage, and asset-intensive organizations.

As an indispensable part of organizational management, trade credit is financially vital and has unique financial attributes. Corporate trade credit is fundamentally an informal financing method between organizations and may be substituted with other financing methods. Organizations will typically provide differentiated trade credit to downstream customers with better business performance with the objectives of increasing sales revenue and market share.

How does the above financial arrangement implicate trade credit?

Hypothesis 1:

Digital finance will have adverse implications on trade credit. Liao et al. [24] postulated that as a large number of financial platforms enter the market, the capital supply is increased significantly, thereby reducing the financial constraints of organizations.

Hypothesis 2

Digital finance affects trade credit through corporate financing as a meditating effect.

In order to answer the research question of whether different organizations suffer different implications, this paper also puts forth the following hypotheses.

Hypothesis 3:

Compared with state-owned listed organizations, digital finance has a more significant effect on the trade credit of non-state-owned listed organizations.

Hypothesis 4:

Compared with low-leverage enterprises, the impact of digital finance on the trade credit of high-leverage organizations is more significant.

Hypothesis 5:

Digital finance has a more significant impact on asset-heavy organizations' trade credit compared to asset-light organizations.

3 Methods

3.1 Data collection

Data were collected from China's A-share Shanghai and Shenzhen mainboards and second-board listed companies as research samples for the period of 2011 to 2021. Financial organizations (i.e., ST, *ST and PT-type organizations) were eliminated from the data collection. Given that this paper's focus is on prefecture-level cities, companies in Beijing, Shanghai, Tianjin and Chongqing (the four municipalities) were excluded from the data set. Data from 2,459 listed organizations were used in the study, including 15,548 observed values

distributed in 242 prefecture-level cities in China. All the financial data in this paper were adopted from the CSMAR (China Stock Market & Accounting Research) database. To avoid the outlier effect of extreme values, all the continuous variables in the model were winsorized by 1% and 99% percentile, respectively. Figure 1 illustrates the number of sampled companies by year.
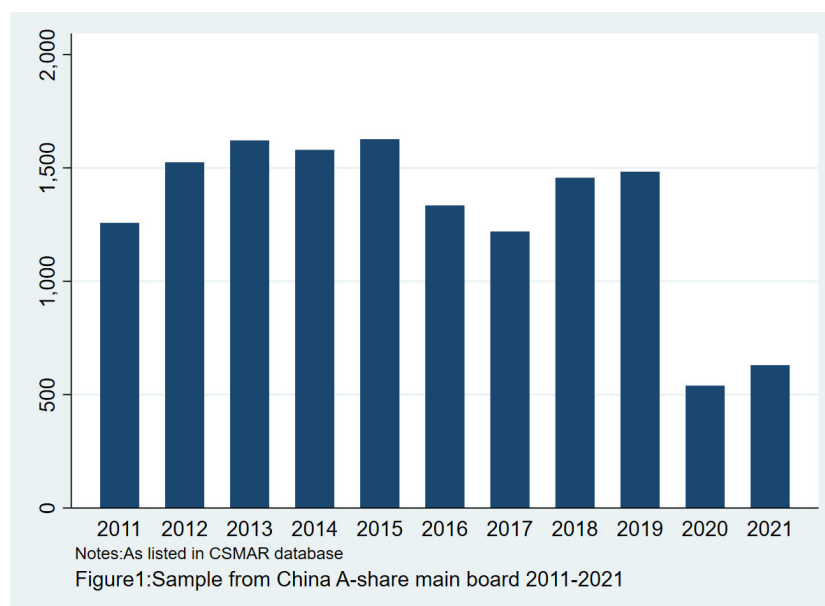

Notes:As listed in CSMAR database
Figure1:Sample from China A-share main board 2011-2021

Fig. 1. Source: China's A-listed main-board companies (2011-2021)

3.2 Definition of variables

This section provides an overview of the variables used in the study. focusing on the explanatory variables, explained Variables and Control Variables.

3.2.1 Explanatory variables: digital finance

Data were collected from the fourth issue of the Peking University Digital Financial Inclusion Index of China (2011-2021) compiled by the specialized team in charge of 'Peking University Digital Financial Inclusion Index of China.'

For comparison purposes, the city's comprehensive index is matched with the prefecture-level data of the listed companies. This paper divided the index by 100 to derive the percentage in order to ensure all data were measured on the same level of magnitude.

Figure 2 shows the digital financial index of China's prefecture-level cities from 2011 to 2022. Moreover, the curve has moved progressively to the right, reflecting the growing inclusion of digital finance.
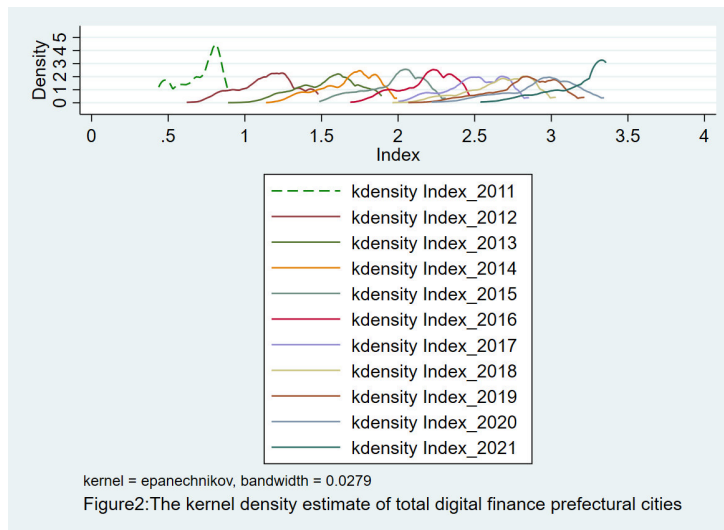
Figure2:The kernel density estimate of total digital finance prefectural cities

Fig. 2. Kernel density estimation of digital finance in China's prefecture-level cities

3.2.2 Explained variables: trade credit

This study adopts Fang et al. [25] research and applies assets and liabilities statements (accounts payable + notes payable + pre-paid accounts/ total liabilities) to calculate corporate trade credit. Figure 3 illustrates the kernel density estimation of the sample organizations' trade credit from 2011 to 2021. It can be seen that their trade credit has not changed significantly over time.
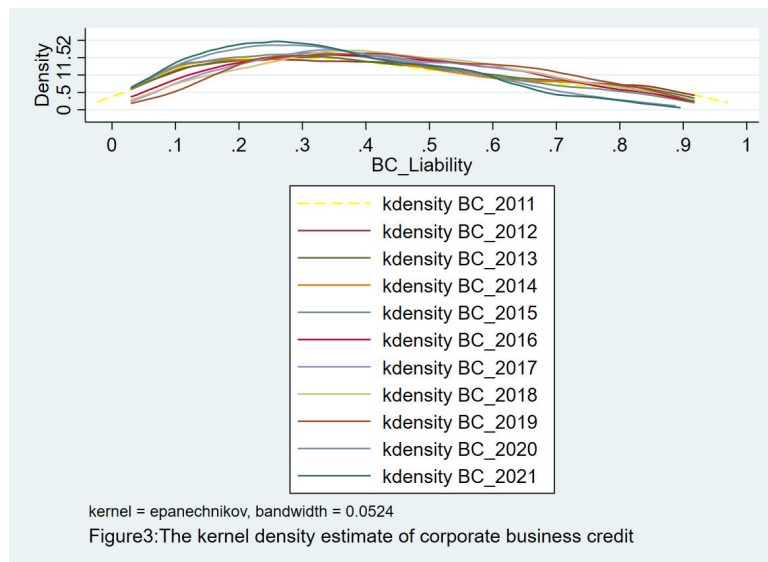

Figure3:The kernel density estimate of corporate business credit

Fig. 3. Kernel destiny estimate of corporate trade credit

3.2.3 Control variables

Referencing Yu and Pan [26], this paper controls for the following variables related to corporate trade credit. City-level controlled variables include organizational structure, city economic development, and foreign direct investments. Organizational-level controlled variables include organizational size, fixed asset ratio, financial leverage, operating cash flow, profitability, growth and development, equity concentration and types of equity. Also, the corporate roles of Chairman and General Manager are combined as one role under one person. See Table 1 for details.

Table 1. Variable definitions

Variable	Symbol	Definition
Digital Finance	Index	Peking University Digital Financial Inclusion Index of China /100
Corporate Trade Credit	BC_Liability	(Accounts Payable+ Notes Payable+ Accounts Payable) / liabilities
Organizational Size	Size	Natural Logarithm of organization's total assets
Fixed Asset Ratio	PPER	Fixed Assets/Total Assets
Financial Leverage	Lev	Total Liabilities/ Total Assets
Cash Flow	CFO	Net cash flow/ Total Assets
Return on Assets	ROA	Net Profits/ Total Assets
Corporate Growth Rate	Growth	Revenue Growth Rate
Ownership concentration	Top1	Ratio of biggest shareholder's shares ownership
Chairman and General Manager as same role	Dual	Chariman and General Manager as same role, Dual=1 otherwise, Dual=0
Corporate Equity	SOE	Sate-owned entreprise，SOE=1 otherwise SOE=0
Industrial Structure	Second	Ratio of secondary industry to regional GDP in the city where the organization is located
Economic Development	ln_Gdp	Per-capital GDP
Foreign Investment	Open	Ratio of foreign capital inflow to regional GDP in the city where the organization is location

3.3 Model design

This paper proposes the following empirical model:

$$BC\_Liability_{i,j,t} = \alpha_0 + \alpha_1 Index_{j,t} + \alpha_2 Control_{i,j,t} + \delta_j + \mu_t + \varepsilon_{i,j,t} \qquad (1)$$

I, j and t represent individual, city and year; control _ (i, j, t) represents the control variables at the organization level and the prefecture-level city level (Size, PPER, Lev, CFO, ROA, Growth, Top1, Dual, SOE, Second, ln _ Gdp, Open); δ _ j and μ _ t are fixed as the effect of prefecture-level cities and years. ε _ (i, j, t) represent random error term. Also, standard errors are clustered to individuals in this paper.

4 Results

After the completion of the research design, this section will involve descriptive statistics of the variables, regression analysis of Equation (1) with subsequent discussions, and robustness tests of the regression results.

4.1 Descriptive statistics

Table 2 shows that the mean value of corporate trade credit (BC _ Liability) is 0.427, the median is 0.405, with the minimum value at 0.030, and the maximum at 0.918, indicating that corporate trade credit accounts for a relatively high proportion of total corporate liabilities. Also, the statistical differences between different organizations are significant. Therefore, this study's findings have great theoretical significance and applicability. The digital finance index's mean value is 1.996; the median is 2.023; the minimum value is 0.466 and the maximum value is 3.357, suggesting uneven development of digital finance in China's prefecture-level cities.

Table 2. Descriptive statistics

Variable	Sample Size	Mean Value	Median	Standard Deviation	Minimum Value	Maximum Value
Index	15548	1.996	2.023	0.732	0.466	3.357
BC_Liability	15548	0.427	0.405	0.229	0.03	0.918
Size	15548	22.14	21.99	1.233	19.88	25.7
Lev	15548	0.435	0.426	0.205	0.056	0.901
PPER	15548	0.221	0.191	0.157	0.003	0.698
ROA	15548	0.036	0.036	0.056	-0.228	0.183
Growth	15495	0.332	0.126	0.842	-0.689	5.797
CFO	15548	0.043	0.043	0.067	-0.155	0.226
Dual	15548	0.272	0	0.445	0	1
SOE	15287	0.351	0	0.477	0	1
TOP1	15548	34.47	32.49	14.69	8.99	73.7
ln_Gdp	9561	11.36	11.3	1.119	9.091	21.04
Second	13568	0.459	0.464	0.083	0.165	0.88
Open	13550	0.028	0.025	0.019	0	0.131

4.2 Basic regression results and analysis

Table 3, Column (1)-(3) shows the basic regression results.

Table 3 Basic regression results

Variable	Corporate Trade Credit (BC_Liability)		
	(1)	(2)	(3)
Index	-0.1146848***	-0.0887863***	-0.1044454***
	(0.03193)	(0.029575)	(0.03893)

Control Variables	NO	YES	YES
City (Fixed)	YES	YES	YES
Year (Fixed)	YES	YES	YES
N	15548	15234	7790
R^2	0.0712	0.215	0.2051

Note: ( ) represents the standard error after clustering adjustment (clustering to individuals); * * *, * * and * are considered significant at 1 %, 5 % and 10 % levels, respectively.

Table 3 reveals that digital finance is significantly negatively correlated to corporate trade credit, each one-point increase in the level of digital finance in the prefecture-level city will result in an average 0.1 percentage point decrease in trade credit for corporates in the prefecture-level city, illustrating that the development of digital finance is detrimental to corporate trade. Hypothesis 1 is thereby verified.

4.3 Robustness tests

In this section, robustness tests are conducted to verify the stability of the findings. Specifically:

4.3.1 Replacement of explanatory variables

Given that digital finance is considered a regional variable while organizational operation is micro-level, there may be a time-lag effect regarding the impact between them. This paper uses digital finance (l.Index, l2.Index) as the main explanatory variable and concurrently controls for the time-delay effect in terms of the control variables (ln _ Gdp, Second, Open) at the city level. *Table* 4 (Column 1 and 2) shows the basic regression results.

This paper also adopts the higher-level provincial digital financial index (Pro_Index) as the explanatory variable with the regression results shown in *Table* 4 (Column 3). This step is performed to avoid any errors resulting from using different methods to measure the explanatory variables

Whether the financial indicators are rooted at the prefecture-level or provincial level, results support Hypothesis 1: the development of digital finance dampens corporate trade credit.

4.3.2 Replacement of explained variables

This paper calculated the sum of the accounts payable, notes payable and accounts receivable in the corporate balance sheet and replaced the explained variables using logarithms to conduct an empirical test to assess Hypothesis 1 (see Fig. 4). This step was performed to avoid any errors resulting from the different measurement methods of the explained variables. *Table* 4 (Column 4) illustrates the validity of Hypothesis 1 in that digital finance will still dampen corporate trade credit significantly (10% significance level).
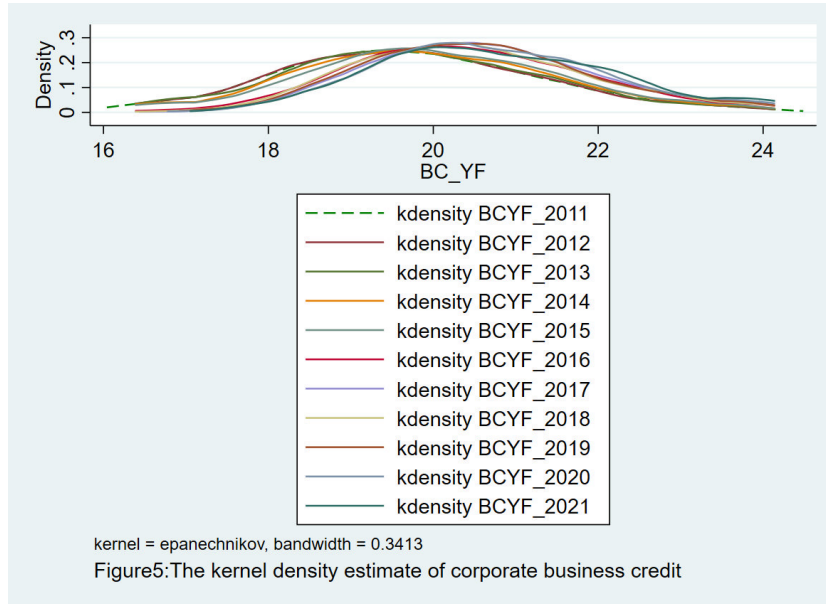
Figure5:The kernel density estimate of corporate business credit

Fig. 4. Kernel density estimation of enterprise trade credit after replacement of explained variables

4.3.3 Test based on fixed effects model

To eliminate any bias caused by missing variables, a two-way fixed effects model is used to test robustness. Table 4 (Column 5) shows the robustness of the test results (5% significance level), further confirming the validity of Hypothesis 1.

Table 4 Regression results and robustness

Variable	Trade Credit Requirements				
	(1)	(2)	(3)	(4)	(5)
	BC_Liability	BC_Liability	BC_Liability	ln_BCYF	BC_Liability
Index				-0.16653*	-0.08426**
				(t=-1.95)	(t=-2.14)
l.Index	-0.09756***				
	(t=-3.24)				
l2.Index		-0.0927 ***			
		(t=-2.91)			
Pro_Index			-0.0122 ***		
			(t=-7.81)		
Control variables	YES	YES	YES	YES	YES
City (fixed)	YES	YES	/	YES	YES
Year (fixed)	YES	YES	YES	YES	YES
Sample Size	6554	5664	15234	7790	7145
R^2	0.2035	0.1933	0.198	0.7496	0.2028

4.4 Discussion

After a series of robustness tests, this paper still concludes that the negative correlation between the development of digital finance and corporate business credit is presented, i.e., the development of digital finance may inhibit corporate trade credit. On average, a one percentage point increase in the level of local digital finance would lead to an average reduction of 0.1 percentage points in trade credit for corporates. Similar to the results of Zhong et al. [23], his study finds that digital finance helps to reduce the secondary allocation of trade credit and effectively reduces the behavior of enterprises using trade credit to make secondary allocation of long-term borrowing funds, and the inhibiting effect is more obvious for enterprises with stronger external financing ability. Next, this paper will further analyze the mechanism of digital finance affecting trade credit and its heterogeneity.

To further analyze the mechanism of the impact of digital financial development on corporate trade credit, this section will conduct a mediation analysis and heterogeneity analysis. The results of the mediation analysis indicate that the development of digital finance leads to an increase in financing constraints for real-ntity enterprises, resulting in heightened difficulty in securing financing and consequently harming corporate trade credit. The heterogeneity analysis further reveals that the influence of digital financial development on trade credit varies across enterprises of different natures.

4.4.1 Mediation analysis

As previously mentioned, digital finance reduces corporate trade credit via financing restrictions. This paper also designs a mediating effect model to clarify the impact pathway of Hypothesis 1 further.

$$\text{KZ}_{i,j,t} = \beta_0 + \beta_1 \text{Index}_{j,t} + \beta_2 Control_{i,j,t} + \delta_j + \mu_t + \varepsilon_{i,j,t} \tag{2}$$

$$\text{BC\_Liability}_{i,j,t} = \gamma_0 + \gamma_1 \text{Index}_{j,t} + \gamma_2 \text{KZ}_{i,j,t} + \gamma_3 Control_{i,j,t} + \delta_j + \mu_t + \varepsilon_{i,j,t} \tag{3}$$

Using Wen and Ye's [27] research, Model (1) is used to test the impact of digital finance on corporate trade credit; Model (2) is used to test the impact of digital finance on corporate financing constraints (KZ)[1]; Model (3) is used to test for the mediating effect in financing constraints (KZ). In Model (1), α_1 represents the total effect of digital finance on corporate trade credit. On the premise that coefficient α_1 is significant, Model 2's β_1 and Model 3's γ_2 are then tested. If both β_1 and γ_2 are significant, Model (3) 's γ_1 is checked. If γ_1 is significant (insignificant), this result shows that the impact of digital finance on corporate trade credit is partially (totally) impacted by the influence of financing constraints (KZ). *Table* 5 shows the corresponding results.

---

[1] Data on financing constraints (KZ) is derived from the CSMAR database and defined as follows. ST, * ST and PT stocks, companies listed for less than 1 year, delisted or suspended, and listed companies on the Beijing Stock Exchange were excluded.

Table 5 Regression results of meditating effects

	(1)	(2)	(3)
Variable	BC_Liability	KZ	BC_Liability
Index	-0.0842649 ***	0.9042705***	-0.0817897***
KZ			-0.0027372 *
Control Variable	YES	YES	YES
City (fixed)	YES	YES	YES
Year (fixed)	YES	YES	YES
N	7145	7145	7145
R^2	0.2028	0.6311	0.2033

Table 5 (Columns 1, 2, 3) shows the regression results of Formulas (1), (2) and (3), respectively; α_1 is at 1% significance, thereby re-validating Hypothesis 1; β_1 is at 1% significance; γ_1 is at 1% significance; and γ_2 is at 10% significance. Results show that digital finance impacts corporate trade credit through corporate financing constraints as a meditating effect; Hypothesis 2 is established.

To further assess the reliability of the mediating effect results, this paper also conducted a sobel test and bootstrap test on KZ; all the test results passed the validity tests[2].

4.4.2 Heterogeneity analysis

In this section, a heterogeneity analysis is conducted on factors including ownership, corporate financial leverage ratio, and fixed asset ratio to verify the validity of the hypothesis.

(1) Organizational Equity

The samples in this study are categorized based on corporate equity (ownership). Private (non-state-owned) organizations account for 37.5%, while state-owned organizations account for 62.95%. Table 6 (Column 1 and Column 2) presents the regression results. The findings indicate that digital finance has a more significant impact on private organizations compared to state-owned organizations, thereby confirming Hypothesis 3. A possible explanation for this observation is that the information confidentiality and asymmetry of private organizations progressively decrease with the advancement of digital financialization. This, in turn, leads to an increase in avenues for private organizations to secure formal financing and a reduction in their reliance on commercial credit.

Table 6 Regression results of heterogeneity analysis

Variable	Trade Credit Requirements					
	(1)	(2)	(3)	(4)	(5)	(6)
	Equity (Ownership)		Financial Leverage Rato		Fixed Asset Ratio	

---

[2] Due to limited space, this paper does not show the full test results. Interested readers may contact the corresponding author for a copy of the full test results.

	State-Owned Organization	Private Organization	High	Low	High	Low
Index	-0.0517*	-0.0781	-0.1190***	-0.01599	-0.0846**	-0.0277
Inclusion of Control Variable(s)	YES	YES	YES	YES	YES	YES
Inclusion of City-Level Effect	YES	YES	YES	YES	YES	YES
Inclusion of Year Effect	YES	YES	YES	YES		
N	2644	4501	3597	3548	3707	3438
R^2	0.1098	0.2770	0.0873	0.2588	0.227	0.2147

(2) Financial leverage ratio

Based on the median value of 0.426 for the financial leverage ratio of the sampled organizations (Lev), this study divides the samples into two groups: high/low financial leverage ratio. Table 6 (Column 3 and Column 4) displays the regression results. It becomes evident that the impact of digital finance on the trade credit of organizations with low financial leverage is not significant, whereas the impact is quite substantial (1%) for organizations with high financial leverage.

(3) Fixed asset ratio

All sampled organizations are classified and grouped based on the median value (0.191) of the fixed asset ratio (PPER). Table 6 (Column 5 and Column 6) presents the regression results. The influence of digital finance on the trade credit of organizations with a high fixed asset ratio is significantly greater than that on organizations with a low fixed asset ratio. Thus, Hypothesis 5 is validated.

5 Conclusions

The main objective of this article is to test the relationship between digital financial development and corporate business credit and its mechanism of action, as well as how different types of firms behave differently in the face of digital financial development. After empirical analysis as well as robustness test, mediation effect analysis and heterogeneity analysis discussion, the article draws the following conclusions.First, digital finance is observed to have an inhibitory effect on corporate trade credit, each one-point increase in the level of digital finance in the prefecture-level city will result in an average 0.1 percentage point decrease in business credit for businesses in the prefecture-level city,a conclusion that holds true even after conducting robustness tests. Second, the mechanism analysis reveals that digital finance prompts organizations to reduce trade credit by altering their financing constraints. Third, the impact of digital finance on trade credit is more pronounced for private organizations compared to state-owned counterparts. Fourth, the influence of digital finance on organizations' trade credit is more substantial for those with high financial leverage than

those with low financial leverage. Fifth, asset-heavy organizations experience a more significant impact on trade credit from digital finance compared to asset-light organizations.

Combined with the above conclusions, this paper puts forward the following recommendations: First, governments and regions should pay attention to the trade credit suppression effect that occurs in the development of digital finance, and in particular, they need to focus on the difficulties faced by private enterprises, highly financially leveraged enterprises and asset-heavy enterprises in the wake of this suppression effect. Second, the development of digital finance will inhibit trade credit by changing the financing constraints of enterprises, so this inhibition can be mitigated by easing the financing constraints of enterprises, while financial institutions in each region should take the initiative to assume corporate responsibility and promote the deep integration of finance and digital technology, so as to alleviate the financing constraints of enterprises.Finally, mitigating security risks and enhancing regulatory oversight in the digital economy, along with advancing the legalization of organizations, becomes a crucial imperative. China's digital economy, evolving from the foundations of agricultural and industrial economies, will witness rapid technology and business model advancements. While digital finance and internet finance represent only a fraction of the digital economy, its distinctive attributes of data sharing, integration, intelligence, globalization, and networking necessitate robust security measures. This paper advocates for enhancing the digital economy's "early warning" security system, bolstering human resources, constructing robust security risk prevention mechanisms, and enhancing the legal framework for organizations.

References

[1] Xi, J. P. (2023).Holding high the great banner of socialism with Chinese characteristics and uniting struggles for the comprehensive construction of a modern socialist country - Excerpts from Comrade Xi Jinping's report to the General Assembly on behalf of the 19th Central Committee. Available online: http://politics.people.com.cn/ (accessed: 2023, March 2).

[2] Guo, F., Wang, J. Y., Wang, F., Kong, T., Zhang, X., & Cheng, Z. Y. (2020). Cedu zhongguo shuzi puhui jinrong fazhan: Zhishu bianzhi yu kongjian tezheng [Measuring China's digital financial inclusion: Index compilation and spatial characteristics]. *Jingji xue*, 19(4), 1401-1418. Available at: https://i.cnki.net/.

[3] Ding, F. (2022). Zhongguo shuzi puhui jinrong dui tanqiangdu de yingxiang [Effects of inclusive digital finance on carbon intensity of China]. *Wuhan daxue xuebao*, 75(6), 110-120. Available at: https://i.cnki.net/.

[4] Xie, H. L., Shen, Y., Zhang, H. X., & Guo, F. (2018). Shuzi jinrong neng cujin chuangye ma?Laizi zhongguo de zhengju [Can digital finance promote entrepreneurship? Evidence from China]. *Jingji xue*, 17(4), 1157-1180. Available at: https://i.cnki.net/.

[5] Tang, S., Wu, X. C., & Zhu, J. (2020). Shuzi jinrong yu qiye jishu chuangxin:Jiegou tezheng, jizhi shibie yu jinrong jianguan xia de xiaoying chayi [Digital finance and enterprise technology innovation: Structural feature, mechanism identification and effect difference under financial supervision]. *Guanli shijie*, 36(5), 52-66. Available at: https://i.cnki.net/.

[6] Zhang, A. L., & Sun, X. Y. (2022). Shuzijinrong, yinhang zhudong fengxian chengdan yu qiye rongzi yuesu [Digital finance, banks' active risk-taking and corporate financing constraints]. *Diaoyan shijie*, (10), 58-65. Available at: https://i.cnki.net/.

[7] Tu, Y. M., Wu, J., & Li, M. J. (2022). Shuzi jinrong dui qiye rongzi chengben yingxiang de shizheng[Empirical evidence on the impact of digital finance on the cost of corporate finance]. *Tongji yu juece*, 38(19), 140-145. Available at: https://i.cnki.net/.

[8] Yu, M. M., Ma, W. Y., & Qian, J. E. (2022). Shuzi jinrong dui qiye zhaiwu weiyue fengxian de yingxiang [The impact of digital financial development on corporate debt default risk]. *Jinrong yu jingji*, (3), 39-47. Available at: https://i.cnki.net/.

[9] Zhai, S. P., Han, X., Zhang, X. L., & Chen, X. (2022). Shuzi jinrong neng jiangdi qiye zhaiwu weiyue fengxian ma? [Can digital finance reduce the risk of corporate debt default?]. *Kuaiji yanjiu*, (2), 117-131. Available at: https://i.cnki.net/.

[10] Lv, J., & Shi, J. (2022). Shuzi puhui jinrong ,rongzi yuesu yu qiye zhaiwu fengxian [Digital finance inclusivity, financing constraints and corporate debt default risk]. *Wuhan jinrong*, (9), 41-49. Available at: https://i.cnki.net/.

[11] Amiti, M., & Weinstein, D. E. (2011). Exports and financial shocks. *The Quarterly Journal of Economics*, 126(4), 1841-1877. Available at: https://doi.org/10.1093/qje/qjr033.

[12] Brennan, M. J., Maksimovic, V., & Zechner, J. (1988). Vendor financing. *The Journal of Finance*, 43(5), 1127-1141. Available at:https://doi.org/10.1111/j.1540-6261.1988.tb03960.x.

[13] Giannetti, M., Burkart, M., & Ellingsen, T. (2011). What you sell is what you lend? Explaining trade credit contracts. *The Review of Financial Studies*, 24(4), 1261-1298. Available at: https://doi.org/10.1093/rfs/hhn096.

[14] Liu, M., Xu, Z., & Zhao, Y. (2004).Shangye xinyong yanjiu zongshu [Trade credit: A literature review]. *Shijie jingji*, (1), 66-77. Available at: https://i.cnki.net/.

[15] Meltzer, A. H. (1960). Mercantile credit, monetary policy, and size of firms. *The Review of Economics and Statistics*, 42(4), 429-437. Available at: https://doi.org/10.2307/1925692.

[16] Zhang, X. M., Wang, Y., & Zhu, J. G. (2012). Shichang diwei ,shangye xinyong yu qiye jingyingxing rongzi [Market power, trade credit and business financing]. *Kuaiji yanjiu*, 8(4), 58-65. Available at: https://i.cnki.net/.

[17] Zheng, J., Lin, Z. G., & Peng, L. (2013). Gao zhiliang de neibu kongzhi neng zengjia shangye xinyong rongzi ma?Jiyu huobi zhengce biangeng shijiao de jianyan [Can higher quality of internal control increase trade credit financing? Evidence from monetary policy changes]. *Kuaiji yanjiu*, (6), 62-68. Available at: https://i.cnki.net/.

[18] Sun, P. Y., Li, F. Y., & Gu, L. J. (2014). Shangye xinyong nengfou chengwei qiye youxiao de rongzi qudao: Jiyu touzi shijiao de fenxi [Whether trade credit can be an efficient finance channel for firms: From the investment perspective]. *Jingji xue*, 13, 1637-1652. Available at: https://i.cnki.net/.

[19] Wang, Z. Q., Wang, Z. J., & Li, J. (2017). Jingying fengxian yu yingyun zijin rongzi juece [Business risks and operating fund financing decisions]. *Kuaiji yanjiu*, 5, 62-69. Available at: https://i.cnki.net/.

[20] Fang, H. X., & Chu, Y. W. (2019). Gongsi zhanlue yu xinyong rongzi [Corporate strategy and trade credit financing]. *Nankai jingji pinglun*, 22(5), 142-154. Available at: https://i.cnki.net/.

[21] Xiu, Z. F., Liu, R., & Ying, J. W. (2021). Caiwu wubi, gongyinglian jizhongdu, yu qiye shangye xinyong rongzi [Financial fraud, supply chain concentration, and corporate trade credit financing]. *Kuaiji yanjiu*, (1), 82-99. Available at: https://i.cnki.net/.

[22] Bai, X. L., He, M., & Zhang, J. R. (2022). Qiye jinronghua sunhai shangye xinyong le ma? Laizi zhongguo A gu shichang de jingyang zhengju [Does corporate financialization affect trade credits?

Empirical evidence from China's A-share market]. *Guoji jinrong yanjiu*, (9), 87-96. Available at: https://i.cnki.net/.

[23] Zhong, K., Liang, P., Dong, X. D., & Wang, X. L. (2022). Shuzi puhui jinrong yu shangye xinyong erci peizhi [Digital financial inclusion and secondary allocation of commercial credit]. *Zhongguo gongye jingji*, (1), 170-188, 2022. Available at: https://i.cnki.net/.

[24] Liao, J., Hu, Y., & Xiang, H. (2020). Shuzi puhui jinrong fazhan huanjie le qiye rongzi yuesu ma? Jiyu qiye shehui zeren de tiaojie xiaoying [Could digital financial inclusion reduce the financing constraints of enterprises? The regulating effect of corporate social responsibility]. *Yunnan caijing daxue xuebao*, 36(9), 73-87. Available at: https://i.cnki.net/.

[25] Fang, M. Y. (2014). Shichang jingzheng ,caiwu yuesu he shangye xinyong :Jiyu zhongguo zhizaoye qiye de shizheng fenxi [Market competition, financial constraints, and trade credit: Evidence from China's manufacturing firms]. *Jinrong yanjiu*, (2), 111-124. Available at: https://i.cnki.net/.

[26] Yu, M. G., & Pan, H. B. (2010). Suoyouquan xingzhi, shangye xinyong yu xindai ziyuan peizhi xiaolv [Ownership, trade credit, and the allocation efficiency of credit resources]. *Jingji guanli*, 8(9), 106-117. Available at: https://i.cnki.net/.

[27] Wen, Z. L., & Ye, B. J. (2014). Zhongjie xiaoying fenxi:Fangfa he moxing fazhan [Analyses of mediating effects: The development of methods and models]. *Xinli kexue jinzhan*, 22(5), 731-745. Available at: https://i.cnki.net/.