The Impact of the Development of Digital Finance on the Risk of Corporate Debt Financing

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Abstract. This investigation evaluates the association between the evolution of digital finance and the risk associated with corporate debt financing among Chinese A-share listed companies from 2012 to 2022. The research identifies a significant reduction in debt financing costs as a consequence of advancements in digital finance, although these benefits are not uniformly distributed geographically. The study provides a nuanced perspective on how digital finance development can be strategically leveraged to alleviate financing issues faced by SMEs. Highlighting the influence of regional economic disparities, the paper offers actionable insights for policymakers and stakeholders in the digital finance ecosystem, advocating for the enhancement of digital finance as a catalyst for economic development and SME support.

Keywords: Digital finance, Debt financing costs, Fixed effects model.

1. Introduction

In the era of globalization's swift transformation, the significance of small and medium-sized enterprises (SMEs) in fostering national progress cannot be overstated. These entities serve as the backbone of the domestic economy, acting as key catalysts for worldwide economic expansion. They are pivotal in augmenting job opportunities, enhancing livelihoods, and stimulating entrepreneurial and innovative endeavors. According to data from the World Bank in 2020, small and medium-sized enterprises (SMEs) play a pivotal role in the economies of countries such as the United States, the European Union, France, and Japan. These SMEs make up more than 98% of all businesses, employ between 65% to 80% of the workforce, and are responsible for creating over half of all jobs. Economically, they account for 40% to 60% of the Gross Domestic Product (GDP) and contribute 50% to 65% of the total output value, marking a substantial impact on the creation of national wealth.

Nonetheless, SMEs often grapple with inherent weaknesses such as unpredictability in growth, information disparities, and limitations in economies of scale, which expose them to elevated borrowing risks. Consequently, financial accessibility issues are a prevalent challenge that SMEs encounter across both advanced and emerging economies. Analogously, in China, SMEs have been instrumental in driving economic growth, boosting employment, and preserving societal stability. As per the "China Statistical Summary" published by the Chinese National Bureau of Statistics, SMEs represent 95.6% of the overall enterprise count, with primary business income contributing 65%, total profits accounting for 52.2%, and employment comprising 79.4% of the workforce.

Confronted with intricate circumstances, the administration has implemented diverse strategies to assist companies in overcoming hardships. On December 29, 2021, the State Council released a directive emphasizing the enhancement of credit information sharing for facilitating SME financing. By publishing a shared list, the aim is to support enterprises in overcoming difficulties. The high financing cost reveals how enterprises can develop and obtain sufficient funds on a healthy and orderly track, which is an urgent issue for both enterprises and governments [1]. As Internet technology advances, digital finance, blending digital technologies with financial services, has introduced novel prospects and hurdles to societal progression. By effectively harnessing digital finance, the issue of information imbalance can be mitigated, thereby offering tailored remedies for both capital providers and seekers.[2].

The progression of digital technology, coupled with the evolution of financial innovation, has catalyzed the exponential growth of digital finance, an amalgamation of these two domains. Unlike

conventional finance, digital finance exhibits an expansive reach, effectively fostering extensive and profound information exchange. It significantly mitigates information disparities and diminishes transaction expenses among diverse entities [3]. The proliferation of digital finance has broadened corporate debt financing avenues and introduced the potential for decreasing the associated costs [4]. Despite its prevalent application in easing corporate debt financing issues, theoretical investigations are scarce. The study explores the critical issue of the extent to which digital financial advancements shape corporate debt funding hazards, aiming to pinpoint the exact connection between digital finance and these risks.

Consequently, it centers on the data from Chinese A-share listed enterprises spanning 2012 to 2022 to examine the effect of digital finance on corporate borrowing costs. Results indicate a substantial reduction in companies' debt financing expenses due to the growth of digital finance. Notably, this impact varies regionally, and there is also a sector-specific difference observable in this connection.

Presently, a substantial number of researchers have delved into the connection between digital finance and the expenses associated with corporate debt financing. The focus of studies on digital finance lies primarily in its definition, quantification, and inclusive worth. Conversely, examinations of corporate debt financing costs center on firm-specific attributes, internal control mechanisms, and macroeconomic influences. This body of work indirectly implies the scarcity of research bridging digital finance and these costs. Moreover, this paper aims to delve deeper into how the advancement of digital finance affects corporate financing costs, considering potential regional disparities and industry variations, and it intends to do so by integrating relevant theoretical frameworks.

2. Theoretical Analysis and Research Hypotheses

2.1. Theoretical Analysis

The expenses associated with conventional financial operations are substantial. Digital inclusive finance necessitates cost efficiency, a condition facilitated by the constant evolution of digital technologies. These technologies have fostered the growth of digital inclusive finance, ensuring its sustainability. It offers equitable, efficient, all-encompassing, convenient, and sustainable financial solutions to all societal segments, particularly underbanked special groups and micro and small enterprises, in an affordable and responsible manner. For corporate funding, digital inclusion streamlines costs through digital processes, encompassing both temporal and monetary expenses, while broadening financial service accessibility. As digital inclusive finance evolves and platforms become more structured, competition with traditional informal lending intensifies, potentially displacing aspects of the conventional financial system. This rivalry enhances corporate debt financing efficiency.

Digital tools enable specialized roles for financial service providers in digital inclusive finance, catering to firms' online lending requirements and mitigating the information asymmetry-induced issues of adverse selection and moral hazard between banks and corporations. Technological spillovers' stimulative impact directly influences the banking sector's competitiveness, instigating a " Catfish effect " and decreasing "transaction costs." Furthermore, leveraging advanced IT and intelligent big data networks transcends geographical and temporal boundaries, enabling online transactions that significantly cut corporate debt financing costs. Digital inclusive finance redirects financial resources towards entities like SMEs and farmers, easing credit constraints and fostering the high-quality growth of the real economy.

Accordingly, this research posits the following hypotheses:

2.2. Research Hypotheses

2.2.1. H1: Digital finance can reduce the cost of corporate debt financing.

Innovative utilization of digital technology within the realm of inclusive finance has emerged as a beacon of hope for small and medium-sized enterprises to overcome financial hurdles [5][6]. In this new era, the unaddressed financing challenges faced by businesses necessitate the intervention of digital tools [7][8]. Internet technology, along with other nascent technologies, have revolutionized corporate financing prospects, offering advantages that surpass conventional direct and indirect funding avenues [9]. Digital inclusive finance not only encompasses inclusivity but specifically targets SMEs [10]. By leveraging "digital" technologies, it mitigates information asymmetry between financial institutions and SMEs, enhancing the ease of access to financial resources [11][12] while concurrently reducing the associated costs [13][14].

2.2.2. H2: There are regional differences in the impact of digital finance on corporate debt costs.

China exhibits marked disparities in regional economic progress, with a pronounced pattern of prosperity in the eastern regions and relative poverty in the western areas. These varying degrees of economic advancement imply dissimilar distributions of economic factors, which in turn give rise to disparities in the effectiveness and caliber of fiscal allocation across distinct regions [15][16]. Empirical studies have revealed substantial regional variations in the growth of digital finance within China. Crucially, factors such as economic development, income levels, technological advancement, financial literacy, and others exert a profound influence - indeed, an even more pronounced one - on the evolution of digital finance. In economically less developed regions, small and medium-sized enterprises (SMEs) confront considerable obstacles in securing funding. On one front, SMEs in these regions experience low financing efficiency. Financial institutions operating in these regions often face difficulties with allocating resources, navigating complex procedures, and delivering financial services effectively [17]. At the same time, while digital technology has been adopted in economically less privileged areas, it tends to deplete local resources, and its role in improving loan processes for small and medium-sized enterprises (SMEs) seems to be minimal. Furthermore, financial services in these less prosperous areas remain immature. Economically backward regions lack the capacity to offer comprehensive financial services, with an unstable foundation in the financial sector. The extent of digitalization falls short of enabling effective support for SME lending, thereby hindering the mitigation of corporate debt financing risks [18].

3. Research Design

3.1. Participant Selection

The study employs data from Chinese A-share listed corporations spanning the years 2012 to 2022 as its initial dataset. This dataset undergoes the following refinement steps: (1) elimination of ST designated firms; (2) exclusion of financial sector entries; (3) removal of records with incomplete information. Consequently, a total of 22,784 valid observations are derived. The primary sources of these data encompass the EPS, Wind, and CSMAR databases.

3.2. Variable Specification

3.2.1. Dependent Variable

The Interest Expense Ratio is utilized here, representing the proportion of financial cost expenditures relative to total expenses within a given period. Financial costs predominantly include interest expenses, which are incurred due to corporate debt obligations, thereby measuring the firm's debt financing load.

3.2.2. Independent Variable

The study employs the Urban Digital Financial Inclusion Index sourced from Peking University's Digital Finance Research Center, covering data from 2012 to 2022. To comprehensively evaluate the advancements in digital inclusive finance, additional data across three different dimensions have been incorporated into the analysis.

The Coverage Depth (cov) traditionally measures the reach of financial institutions and service personnel count. For digital inclusive finance, it is redefined as the extent of integration between third-party payment accounts and bank cards, indicating user inclusiveness.

Usage, conversely, demonstrates the practical application of digital inclusive finance services. This encompasses aggregate usage indicators and activity-focused metrics, incorporating diverse business aspects.

The Digitization Factor (digt) signifies the accessibility of digital inclusive finance. It is measured through parameters such as availability, affordability, dependability, and user-friendliness.

3.2.3. Control variable

The research incorporates a range of control variables to delineate the specific effects being studied. These include the size of the enterprise (SIZE), how long the enterprise has been established (AGE), the rate of sales increase (GROWTH), liquidity status as indicated by cash flows (CASH), the ratio of capital to labor within the company (CAPINT), effectiveness of asset use reflected in return on assets (ROA), and the level of ownership concentration (EQUITY). To ensure a comprehensive analysis, year-to-year (YEAR) and industry-specific (IND) fixed effects are also included. Table 1 provides a detailed description of these variables for further reference.

Table 1. Table of variable specifications.

Variable category	Variable label	Variable notation	Explanation
Response variable	Debt financing expense	***Debt***	Expressed as the proportion of total expenses using financial cost charges
Explanatory variable	Digital Financial Inclusion Index	***Ind***	Peking University Digital Financial Inclusion Index, divided by 100
	Scope of access	***cov***	Access scope index, normalized by 100
	Utilization intensity	***usage***	Utilization intensity index, normalized by 100
	Degree of digitization	***digt***	Digitization index/100
Control variable	Firm size	***size***	Logarithmic representation of total assets
	Business age	***age***	Logarithm of the company's operational years
	Growth in sales	***growth***	Sales growth rate
	Cash flow magnitude	***cash***	Operating cash flow represented logarithmically
	Enterprise capital intensity	***deb***	Operating income to total assets ratio
	Asset turnover	***roa***	Net profit to end-of-period total assets ratio
	Shareholding concentration	***share***	Largest shareholder's equity percentage

3.3. Model Building

To investigate the interconnection between digital finance and the expenses associated with corporate debt funding, a conceptual framework is formulated as follows:

$$Debt_t = \beta_0 + \beta_1 Index_{i,t} + \beta Control_{i,t} + \sum Ind + \sum Year + \varepsilon_{i,t+i}$$

4. Empirical Analysis

4.1. Descriptive Statistics

Descriptive statistical analysis, as shown in Table 2 [19], demonstrates a wide range in the debt ratio of corporations, with the highest recorded ratio at 5.238 and the lowest at -2.517. The average ratio is calculated to be 0.011, with a standard deviation of 0.093, signifying a diverse span of corporate debt financing costs. The mean score for the financial inclusion index (Ind) stands at 2.045, with a range extending from 0.563 to 3.116, reflecting a varied degree of financial inclusion across different regions for the surveyed firms.

Table 2. Analysis of descriptive statistics [19].

	N	Mean	Std	Min	Max
Ind	21,673	2.045	0.678	0.563	3.116
Debt	21,673	0.011	0.093	-2.517	5.238
usage	21,673	2.015	0.726	0.573	3.275
Cov	21,673	2.013	0.638	0.546	3.108
Size	21,673	7.618	1.012	5.306	12.752
digt	21,673	2.076	0.824	2.216	3.358
growth	21,673	0.752	14.213	-3.116	13.246
Age	21,673	3.061	0.542	0.758	4.064
deb	21,673	0.052	0.067	-0.204	0.309
cash	21,673	2.106	0.215	1.418	2.706
share	21,673	37.326	15.281	3.117	99.00
roa	21,673	0.035	1.105	-6.714	94.39

4.2. Main Test Regression Results

Beginning with a Hausman test to determine the appropriate model, the panel data analysis proceeded with a fixed effects model, as expounded in Table 3. The analysis reveals that the composite index of digital financial inclusion (Ind), along with its sub-indices (cov, usage, and digt), are statistically significant at the 1% level. 'Cov' shows the most pronounced effect on the levels of corporate debt, with 'usage' and 'digt' following in influence. The widespread adoption of digital financial services is notably reshaping the debt landscape, with a broader reach across the country. Significantly, there is a reverse correlation between the progress in digital finance and corporate debt financing costs, endorsing Hypothesis H1. This suggests that the progression in digital finance is associated with the availability of more cost-effective debt financing for companies.

Table 3. Outcomes of primary regression examination.

	Debt			
digt				-0.325*** (-9.95)
usage			-0.216*** (-8.93)	
cov		-0.409*** (-11.26)		
Ind	-0.306*** (-8.46)			
share	-0.027* (1.75)	-0.031* (1.73)	-0.026* (1.69)	-0.022* (1.73)
roa	0.001 (0.79)	0.000 (0.59)	0.003 (0.66)	0.001 (0.89)
deb	0.032*** (7.84)	0.037*** (9.66)	0.039*** (6.57)	0.035*** (8.74)
Cons	-1.729*** (-5.96)	-1.617*** (-5.76)	-1.807*** (-5.65)	-1.629*** (-4.47)
growth	0.001** (2.16)	0.003** (2.29)	0.002* (1.71)	0.002** (2.26)
age	-0.217*** (-3.63)	-0.227*** (-5.41)	0.025 (0.89)	-0.117*** (-4.57)
size	-0.135*** (-7.94)	-0.207*** (-6.78)	-0.215*** (-7.93)	-0.309*** (-8.76)
N	21,673	21,673	21,673	21,673
Year	Yes	Yes	Yes	Yes
cash	-0.087* (-1.75)	-0.126** (-2.21)	-0.074 (-0.95)	-0.116* (-1.74)
Ind	Yes	Yes	Yes	Yes
Adj.R^2	0.226	0.239	0.285	0.307

4.3. Endogeneity

During the empirical research phase, the potential for endogeneity was acknowledged and addressed. The investigation adjusted for this by incorporating the lagged values of corporate debt financing costs (L.Debt) from the preceding term as an explanatory variable. A two-step generalized method of moments (GMM) approach was employed to rectify possible biases due to omitted variables and to mitigate endogeneity concerns. The regression results, specified in Table 4, columns (1) and (2), show statistical significance in the first-difference autoregression AR (1) but not in AR (2), with the Sargan test confirming the robustness of the model. The research further accounted for endogeneity by delaying the explanatory variables, as indicated in the third column of Table 4. These additional tests uphold a consistent negative link between the digital financial inclusion index and the cost of corporate debt, reinforcing the main argument of the research with solid empirical evidence.

Table 4. Investigation of endogeneity [19].

	FE **Debt(1)**	**GMM** **Debt(2)**		**FE** **Debt(3)**
size	-0.028*** (-7.42)	-0.046*** (-5.25)	L.size	-0.053*** (7.08)
Ind	-0.216*** (-8.24)	-0.178 (-1.16)	L.Ind	-0.128*** (-5.62)
growth	0.002* (1.58)	0.002 (0.46)	L.growth	0.001 (0.55)
age	-0.076*** (-3.64)	0.036 (0.52)	L.age	-0.184*** (-4.04)
share	0.309* (1.72)	0.162 (0.35)	L.share	-0.156 (-0.57)
roa	-0.026*** (-3.76)	0.006 (0.64)	L.roa	0.003 (0.68)
deb	0.007*** (12.64)	0.046*** (7.57)	L.deb	0.005*** (5.36)
cash	-0.303*** (-6.72)	0.018*** (4.09)	L.cash	0.104* (1.78)
cons	-0.463*** (-3.68)	-1.884*** (-3.72)		
L.*Debt*		-0.204*** (-8.18)	cons	-1.772*** (-6.64)
Obs	22,784	21,875	obs	19,756
Adj.R^2	0.213		Adj.R2	0.189
AR(1)		0.003		
AR(2)		0.015		
Sargan text		0.017		

4.4. Heterogeneity Analysis

Adopting the methodology of Hedges and Vevea (1998), this research employs a fixed effects model when effect sizes display homogeneity, otherwise opting for a random effects model. The development of digital finance varies across China's regions, influenced by disparities in economic progress, resource allocation, and business conditions. Consequently, the influence of digital finance on corporate debt financing might differ regionally. Hence, investigating regional disparities in digital finance's impact on corporate debt financing costs holds both practical importance and serves as a steppingstone towards fostering balanced digital finance growth nationwide. Table 5 exhibits the regression results that account for regional disparities. The data indicates that in the eastern region, a higher level of digital finance advancement is associated with reduced costs for corporate debt financing. However, the connection is found to be less pronounced in both the central and western regions when juxtaposed with the eastern region. This disparity could stem from the eastern region's economically advanced status and more sophisticated digital finance industry, which provide companies with a wider range of funding options, subsequently leading to substantial decreases in their financing costs. In contrast, the western region, due to aspects like economic maturity, industrial structure, and demographic composition, yields insignificant results, supporting H2.

Table 5. Exploration of heterogeneity.

	Debt		
	Eastern	**Central**	**Western**
Ind	-0.218***	-0.064***	-0.042
	(-8.52)	(-4.26)	(-0.64)
control	Yes	Yes	Yes
Cons	-0.067***	-0.073	-0.193***
	(-4.38)	(-0.85)	(-3.74)
Ind	Yes	Yes	Yes
Year	Yes	Yes	Yes
N	13,273	6975	2536
Adj.R^2	0.215	0.307	0.319

5. Conclusion

The study focuses on Chinese A-share listed firms between 2012 and 2022, investigating the influence of digital finance on corporate debt financing costs. It reveals that digital finance expansion notably decreases these costs; however, its effects exhibit regional disparities. Drawing upon these results, the article suggests policy implications for leveraging digital inclusive finance to effectively address financing constraints faced by small and medium-sized enterprises not only in China but also globally.

Primarily, regulatory bodies ought to intensify their oversight in managing risks and augment their regulatory competencies alongside service efficacy. While digital inclusive finance significantly aids in mitigating funding challenges for SMEs and supports the real economy, it also poses latent hazards. These authorities must leverage digital technology's potential to detect, anticipate, and address diverse financial risks effectively, fostering an environment conducive to the growth of digital inclusive finance. Furthermore, reinforcing supervision against abusive arbitrage practices is pivotal in steering the orderly progression of digital inclusive finance and enhancing corporate access to financial resources.

Secondly, technology companies should utilize their technological prowess to provide sophisticated solutions. In the domain of digital financial inclusion, these entities are crucial in generating cutting-edge technological responses. As financial regulations strengthen and risk management becomes more paramount, it is essential for tech corporations to focus on implementing and nurturing technological capabilities. By employing key innovations like ABCD, they can create advanced services for regulatory authorities, traditional financiers, and other participants, significantly boosting the effectiveness of digital financial inclusion.

Thirdly, financial institutions need to accelerate their digital transition to ensure equitable resource allocation within the financial sector. Hastening this digital transformation guarantees a fair dispersion of financial resources and promotes a synergistic relationship between financial institutions and SMEs. This process reduces operational expenses, while instituting a credit monitoring mechanism facilitates targeted financing and safeguards against potential adverse selection issues.

Fourthly, embracing digital transformation is crucial for the financial stability of small and medium-sized enterprises (SMEs). They ought to acknowledge their weakness and optimize the utilization of digital inclusive finance. This involves reinforcing corporate governance, enhancing creditworthiness, securing their market position, promptly mitigating economic uncertainties, and proactively engaging in the innovation of financial service approaches.

There are still areas that have not been considered in this study. For example, digital finance will definitely bring some new forms of risk, such as the reliance on cash flow in big technology credit, which may form new financial instability mechanisms.

References

[1] Cao S, Nie L, Sun H, Sun W, Taghizadeh-Hesary F. Digital finance, green technological innovation and energy-environmental performance: Evidence from China's regional economies. Journal of Cleaner Production, 2021.

[2] Li X, Shao X, Chang T, Albu L. Does digital finance promote the green innovation of China's listed companies?. Energy Economics, 2022.

[3] Lin B, Ma R. How does digital finance influence green technology innovation in China? Evidence from the financing constraints perspective. Journal of environmental management, 2022.

[4] Liu Y, Luan L, Wu W, Zhang Z, Hsu Y. Can digital financial inclusion promote China's economic growth?. International Review of Financial Analysis, 2021, 78:101889.

[5] Dippel C, Ferrara A, Heblich S. Causal mediation analysis in instrumental-variables regressions. The Stata Journal, 2020, 20(3):613-26.

[6] Naeem K, Li MC. Corporate investment efficiency: The role of financial development in firms with financing constraints and agency issues in OECD non-financial firms. International Review of Financial Analysis, 2019, 62:53-68.

[7] Demertzis M, Merler S, Wolff GB. Capital markets union and the fintech opportunity. Journal of financial regulation, 2018, 4(1):157-65

[8] Hall BH, Moncada-Paternò-Castello P, Montresor S, Vezzani A. Financing constraints, R&D investments and innovative performances: new empirical evidence at the firm level for Europe. Economics of Innovation and New Technology, 2016, 25(3):183-96.

[9] Shahrokhi M. E-finance: status, innovations, resources and future challenges. Managerial Finance, 2008, 34(6):365-98.

[10] Liang B, Zhang JH. Does China's Inclusive Finance Innovation Ease Financing Constraints of Small and Medium-Sized Enterprise. InForum Sci. Tech, 2018.

[11] Huang Y, Lin C, Sheng Z, Wei L. FinTech credit and service quality. Geneva Financial Research Institute, Working Papers, Geneva, 2018.

[12] Xun Z, Guanghua W, Jiajia Z, Zongyue H. Digital economy, financial inclusion and inclusive growth. China Economist, 2020, 15(3):92-105.

[13] Fuster A, Plosser M, Schnabl P, Vickery J. The role of technology in mortgage lending. The Review of Financial Studies, 2019, 32(5):1854-99.

[14] Guo F, Wang J, Wang F, Kong T, Zhang X, Cheng Z. Measuring China's digital financial inclusion: Index compilation and spatial characteristics. China Economic Quarterly, 2020, 19(4):1401-18.

[15] Jie Li, Yu Wu, Jing Jian Xiao,The impact of digital finance on household consumption: Evidence from China. Economic Modelling, 2020, 86:317-326.

[16] Luo Y, Peng Y, Zeng L. Digital financial capability and entrepreneurial performance. International Review of Economics & Finance, 2021, 76:55-74.

[17] Wen HX. The Theoretical Logic and Practical Path of Digital Inclusive Finance Relieving the Financing Plight for Small and Medium-sized Enterprises. Econ. Res, 2021, 12:103-11.

[18] Khurana IK, Martin X, Pereira R. Financial development and the cash flow sensitivity of cash. Journal of Financial and Quantitative Analysis, 2006, 41(4):787-808.

[19] Tang Y, Geng B. Digital finance development level and corporate debt financing cost. Finance Research Letters, 2024, 60:104825.