Original Research Article

The Influence of Digital Financial Inclusion on Corporate Finance Limitations - An Examination through Empirical Evidence from China's A-Share Listed Firms

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Abstract: As digital inclusive finance continues to progress, it will increasingly have a greater financial influence on businesses. This is because digital inclusive finance is essential to the growth of businesses. In order to verify the influence of digital inclusive finance on enterprise financing constraints, this paper builds an empirical analysis model using data from A-share listed enterprises over a 10-year period, from 2012 to 2021. It also analyzes the impact of digital inclusive finance on enterprise financing constraints from a financial perspective. The findings demonstrate that corporate funding limitations can be successfully reduced via digital inclusive finance, with this effect being more pronounced in non-state-owned businesses.

Keywords: Digital financial inclusion; Financing constraints; Empirical analysis

1. Introduction

The emergence of digital inclusive finance can be attributed to the expansion of service scope through digital technology, improved accessibility, and increased commercial sustainability. It offers comprehensive and convenient financial products to a diverse range of enterprises and special groups. Digital inclusive finance is crucial for modernizing and transforming the economy and fostering business growth. Digital inclusive finance may be an effective solution to the funding challenges that Chinese businesses typically encounter.

In order to investigate how digital inclusive finance may ease the burden of corporate financing and serve as a resource for corporate decision-making and policy-making, this study will research data from A-share listed businesses. In-depth analysis of the connection between them and the mechanisms underlying their functions will be done in this study, which is essential for advancing inclusive digital finance and superior economic development.

2. Theoretical analysis and research hypothesis

2.1. Digital financial inclusion reduces the cost of corporate finance

The following samples show how digital financial inclusion significantly affects corporate finance costs:

First, big data, artificial intelligence, and other technologies have lowered the cost of information asymmetry. This lowers the significant audit costs and time associated with information asymmetry in traditional lending, resulting in more affordable and convenient corporate funding. Simultaneously, these technologies-based credit evaluation models offer businesses more precise financing services.

Second, the credit risk of businesses is appropriately evaluated by digital inclusive finance, which lowers the cost of credit risk and lessens the financing load on them. This evaluation forecasts future developments in addition to reflecting the companies' existing credit standing.

Lastly, by removing the need for conventional middlemen and realizing direct docking between businesses and financing institutions via the Internet platform, digital inclusive finance successfully lowers the costs associated with financing intermediaries. When combined, these benefits dramatically lower the cost of funding for businesses.

2.2. Digital Inclusive Finance Expands Corporate Financing Channels

The funding channels available to businesses have been greatly increased by digital inclusive finance. By creating an online platform and enabling direct docking between businesses and financial institutions, it has, among other things, decreased the funding threshold. The efficiency and accuracy of financing have increased thanks to the application of big data analysis in the exact assessment of company credit and provision of financing services. Furthermore, it collaborates with supply chain businesses, incorporates funding sources, and offers enterprises practical and affordable supply chain finance solutions, therefore broadening the financial landscape. When considered as a whole, these programs provide businesses—particularly medium-sized businesses—a wider range of easier-to-access funding choices that significantly assist in their growth. When it comes to cost, accessibility, and efficiency, digitally inclusive financing has proven to be clearly superior to traditional funding techniques. Second, digital inclusive finance lowers the financing threshold and offers more convenient financing services to A-share listed firms and other enterprises by properly assessing corporate credit via the use of big data analysis and other technologies. Enterprise development is impeded by the hefty collateral guarantees required by traditional finance institutions. On the other hand, the digital inclusive finance platform may effectively lower the barrier of enterprise financing, decrease the requirement for collateral, and better comprehend the financial, operational, and risk condition of businesses.

2.3. Digital financial inclusion increases the efficiency of corporate finance

There are clear benefits to the digital inclusive finance platform in terms of financing efficiency. The platform leverages Internet technologies to quickly acquire company information, drastically reduce review times, and provide quick funding. Furthermore, its credit evaluation technique may save financing costs and evaluate firm credit effectively. By filling out simple information, businesses may swiftly complete the audit and credit assessment procedure and gain financial support through the digital inclusive finance platform, which is less time-consuming than the laborious process of traditional financial institutions. This helps businesses achieve quick development and increase operational efficiency in addition to financial efficiency. Simultaneously, positive credit assessment outcomes might offer businesses better terms for upcoming funding, thereby enhancing the effectiveness of capital use.

This study puts out the following research hypothesis in light of the previously mentioned:

Hypothesis H1: Digital financial inclusion can effectively reduce the financing constraint problem of enterprises.

2.4. Differential impact of digital financial inclusion on corporate finance constraints

The harsh financing conditions imposed by traditional financial institutions on non-state enterprises have made financing difficult and costly. Digital inclusive financial platforms, which improve financing efficiency and reduce financing costs through credit assessment models, are particularly beneficial to non-state-owned enterprises and can help them enhance the efficiency of capital utilization. In contrast, SOEs, which enjoy stronger policy support and a stable market position, may see a weaker, albeit beneficial, impact from improved

financing efficiency on digital inclusive finance platforms.

As a result, the following hypotheses are proposed in this paper:

Hypothesis H2: Financing constraints of non-state-owned firms are more significantly affected by digital financial inclusion compared to state-owned firms.

3. Empirical analysis

3.1. Sample data selection and data sources

This paper chooses to take the data of A-share listed companies in the consecutive ten-year period from 2012-2021 as the sample data, and does the following treatments to the data: (1) excludes the samples of ST and *ST enterprises; (2) excludes the financial industry; (3) excludes the samples that the variables are missing in the sample period; and (4) does the closing treatment of 1-99% for the continuous variables. The enterprise-level data in this paper comes from the Cathay Pacific database, and the digital financial inclusion data comes from the Digital Financial Inclusion Research Center of Peking University.

3.2. Definition of variables

3.2.1. Explained Variables

The explanatory variable in this paper is corporate financing constraints, and in the selection and construction of indicators of financing constraints, with reference to the research of scholars from Hadlock and Pierce (2009), Fang Xuewen et al. (2010), Zhang Yumei et al. (2017), Gu Leilei et al. (2020), and Chen Jun et al. (2020), we choose to use the FC index as a method of calculating corporate financing constraints indexes, with the specific formula is as follows:

$$P(QUFC = 1 \text{ 或 } 0 | Z_{i,t}) = \frac{e^{Z_{i,t}}}{1 + e^{Z_{i,t}}}$$

Style:

$$Z_{i,t} = \alpha_0 + \alpha_1 size_{i,t} + \alpha_2 lev_{i,t} + \alpha_3 \left(\frac{CashDiv}{ta}\right)_{i,t} + \alpha_4 MB_{i,t} + \alpha_5 \left(\frac{NWC}{ta}\right)_{i,t}$$
$$+ \alpha_6 \left(\frac{EBIT}{ta}\right)_{i,t}$$

Style:

Size: Represents the magnitude of a company's assets, calculated as the natural logarithm of its total assets.

Leverage (Lev): Signifies the financial gearing of a firm, computed as the ratio of total liabilities to total assets.

Cash Dividends (CashDiv): The amount of cash distributed by the company to its shareholders over the course of a year.

Market-to-Book Ratio (MB): Reflects the valuation of a business in the market relative to its book value, determined by dividing the market value by the book value.

Net Working Capital (NWC): Represents the difference between a company's current assets and current liabilities, excluding cash and short-term investments. It is computed as Working Capital minus Money Funds minus Short-Term Investments.

Earnings Before Interest and Taxes (EBIT): Indicates a company's profitability by showing the earnings

generated before deducting interest and tax expenses.

Total Assets (ta): The overall value of all the assets owned by a company.

A higher FC index value signifies a more significant degree of constraints on corporate financing.

3.2.2. Explanatory variables

In this paper, the explanatory variable is the digital financial inclusion index. Since Peking University's Digital Financial Inclusion Research Center stands as one of the foremost authoritative institutions for digital financial inclusion in China, this study opts to adopt its Digital Financial Inclusion Index. This decision is informed by referencing the methodologies utilized by several scholars in defining digital financial inclusion indicators, including Zhao Mingyue (2023), Liu Jingyu and colleagues (2023), as well as Xia Ruilian and co-authors (2023).

3.2.3. Control variables

In terms of control variables, this paper chooses to use firm size, asset-liability ratio, proportion of fixed assets, firm growth, whether it is loss-making, board size, proportion of independent directors, and shareholding concentration as control variables, respectively.

All the variables selected for this paper are defined as shown in Table 3-1.

Table 3-1. Variable Definition Table

Variable type	variable name	variable symbol	Variable Definition
explanatory variable	Financing constraints	FC	Based on the FC index measurement formula, we get
explanatory variable	Digital Inclusive Finance	lndig	The NU Digital Financial Inclusion Index takes logarithms
control variable	Enterprise size	Size	Logarithmic total assets of the enterprise
	Fixed assets as a percentage	FIXED	Fixed assets/total assets
	Is there a loss	Loss	Loss = 1; otherwise = 0
	Board size	Board	Logarithmic number of board members
	Percentage of independent directors	Indep	Number of independent directors/total number of board members
	shareholding concentration	Top10	Shareholding ratio of top ten shareholders
grouping variable	Nature of shareholding	SOE	State-owned enterprises = 1; non-state-owned enterprises = 0

3.3. Model construction

Based on the research content of this paper, the empirical analysis model is constructed as follows:

$$FC_{i,t} = \alpha_0 + \alpha_1 lndig_{i,t} + \alpha_2 Size_{i,t} + \alpha_3 FIXED_{i,t} + \alpha_4 Loss_{i,t} + \alpha_5 Board_{i,t}$$

$$+ \alpha_6 Indep_{i,t} + \alpha_7 Top10_{i,t} + \mu_i + year_t + i.Ind + \varepsilon_{i,t}$$

The document margins must be the following:

where i,t is the data for firm t in year i, and α_0 is the intercept, α_1- α_7 is the coefficient of each variable, μ_i is the individual fixed effect, $i.Ind$ is the industry fixed effect, $year_t$ is the time fixed effect, $\varepsilon_{i,t}$ is the random perturbation term.

3.4. Regression analysis

3.4.1. Descriptive statistical analysis

Descriptive statistics were first analyzed for the variables selected for this paper, and the results are shown in Table 3-2.

Table 3-2. Descriptive Statistical Analysis.

Variable	Obs	Mean	Std. dev.	Min	Max.
fc	27,390	0.486	0.282	0.002	0.963
lndig	27,390	5.802	0.341	4.683	6.138
Size	27,390	22.278	1.294	19.570	26.452
Lev	27,390	0.428	0.205	0.035	0.927
FIXED	27,390	0.209	0.159	0.002	0.725
Loss	27,390	0.115	0.320	0	1
Board	27,390	2.121	0.198	1.609	2.708
Indep	27,390	0.377	0.054	0.286	0.600
Top10	27,390	0.580	0.150	0.217	0.910

Table 3-2 illustrates that the listed companies have an average financing constraint level (fc) of 0.486, accompanied by a relatively narrow standard deviation of 0.282. This signifies minimal discretization and slight overall variations. However, a substantial range between the extreme values of 0.002 and 0.963 indicates a noticeable imbalance in the levels of constraints. Meanwhile, the mean value for digital financial inclusion stands at 5.802, paired with a similarly low standard deviation of 0.341. The minimal disparity among extreme values denotes a relatively even progression across diverse provinces, coupled with minor overall dispersion and variability.

3.4.2. Basic regression analysis

Based on the empirical analysis model constructed in this paper, the regression analysis is launched and the results are shown in Table 3-3.

Table 3-3. Regression Results.

	(1) Fc	(2) Fc
lndig	-0.106***	-0.057***
	(-6.78)	(-4.72)
Size		-0.161***
		(-87.08)
Lev		-0.393***
		(-54.81)
FIXED		-0.053***
		(-5.41)
Loss		-0.042***
		(-18.48)
Board		0.006
		(0.75)
Indep		0.044*
		(1.91)
Top10		0.114***
		(12.07)
Ind	Yes	Yes
Year	Yes	Yes
Stkcd	Yes	Yes
_cons	1.064***	4.401***

	(12.82)	(57.53)
N	27390	27390
R^2	0.097	0.469
adj. R^2	-0.057	0.378
F	86.967	574.391
p	0.000	0.000

Columns (1) and (2) of Tables 3-5 demonstrate the regression results with and without control variables, both of which show that digital financial inclusion significantly and negatively affects the fc index of corporate financing constraints, proving that the model is robust. In column (2), the coefficient of digital financial inclusion on corporate financing constraints is -0.057, which is significant at the 1% level, indicating that a 1-unit increase in the level of digital financial inclusion reduces corporate financing constraints by 0.057 units, which verifies research hypothesis H1.

3.4.3. Robustness Tests

In the robustness test section, this paper uses heteroskedasticity-corrected clustering robust standard errors, two-stage GMM test, and reduced sample period for robustness test, respectively.

Firstly, considering that this paper uses panel data of listed companies for empirical analysis, the problem of heteroskedasticity may have a more obvious impact on the results of the empirical analysis of this paper, so the clustering of robust standard errors is used for the correction of heteroskedasticity.

Secondly, considering the influence of endogeneity factors, we choose to use lag 1 and lag 2 of digital financial inclusion as instrumental variables and use the GMM two-step method to correct for endogeneity.

Thirdly, given the impact of bias from the choice of sample period, the sample period is reduced and the analysis is conducted using data from 2017-2021 to further validate robustness.

Table 3-4. Robustness Tests.

	Clustering Robust Criterion Error	GMM2S	Reduction of sample period
	Fc	Fc	Fc
lndig	-0.057***	-0.052**	-0.079**
	(-2.99)	(-1.98)	(-2.31)
Size	-0.161***	-0.164***	-0.181***
	(-38.22)	(-63.75)	(-57.69)
Lev	-0.393***	-0.296***	-0.192***
	(-25.58)	(-32.46)	(-17.59)
FIXED	-0.053***	-0.019	-0.049***
	(-2.75)	(-1.49)	(-3.17)
Loss	-0.042***	-0.046***	-0.051***
	(-13.75)	(-18.48)	(-19.24)
Board	0.006	-0.007	0.001
	(0.55)	(-0.72)	(0.10)
Indep	0.044	0.006	0.030
	(1.40)	(0.23)	(0.92)
Top10	0.114***	0.004	-0.011
	(7.56)	(0.29)	(-0.69)
Ind	Yes	Yes	Yes
Year	Yes	Yes	Yes
Stkcd	Yes	Yes	Yes
_cons	4.401***		5.181***
	(32.29)		(23.18)

N	27390	18351	16346
R^2	0.469	0.410	0.312
adj. R^2	0.469	0.283	0.089
F	196.941	308.762	180.347
p	0.000	.	0.000

Drawing from the outcomes of the robustness test, it is evident that across all three sets of results, the influence of digital inclusive finance on corporate financing constraints consistently exhibits a significantly negative effect. This underscores the strong robustness of the model presented in this paper and underscores the high reliability of the regression findings.

3.4.4. Heterogeneity analysis

Taking into account the diverse nature of enterprises, a heterogeneity analysis was conducted by segmenting them into state-owned and non-state-owned categories. The findings of this analysis are presented in Table 3-5.

Table 3-5. Heterogeneity Analysis.

	nationalized business	non-state enterprise
	Fc	Fc
lndig	-0.030	-0.063**
	(-1.06)	(-2.47)
Size	-0.141***	-0.169***
	(-22.23)	(-31.53)
Lev	-0.420***	-0.371***
	(-16.66)	(-19.24)
FIXED	-0.020	-0.058**
	(-0.63)	(-2.53)
Loss	-0.037***	-0.043***
	(-8.23)	(-10.89)
Board	-0.003	0.016
	(-0.16)	(1.16)
Indep	-0.029	0.076*
	(-0.68)	(1.73)
Top10	0.011	0.112***
	(0.42)	(5.22)
_cons	3.748***	4.613***
	(17.88)	(26.88)
N	9351	18039
R^2	0.416	0.492
adj. R^2	0.414	0.491
F	58.943	159.127
p	0.000	0.000

Examining the heterogeneity analysis outcomes presented in Table 3-7, it becomes apparent that in the regression analysis of state-owned enterprises, the influence of digital financial inclusion on corporate financing

constraints is insignificant. Conversely, in non-state-owned enterprises, the impact remains notably negative, suggesting that the restraining effect of digital financial inclusion on financing constraints is more evident in the latter group. This finding serves to validate the second hypothesis, H2, proposed in this study.

4. Conclusions and recommendations

4.1. Conclusions of the study

Based on the data of China's A-share listed companies from 2012 to 2021, this paper constructs an empirical analysis model to analyze and study the relationship between digital inclusive finance and corporate financing constraints, and draws the following conclusions:

First, it is concluded through theoretical analysis that the impact of digital inclusive finance on corporate financing constraints is mainly generated through reducing financing costs, broadening financing channels and increasing financing efficiency.

Second, through empirical analysis, it is concluded that the development of digital inclusive finance can effectively reduce the level of enterprise financing constraints, while this effect is more significant in non-state-owned enterprises and small and medium-sized enterprises.

4.2. Recommendations for countermeasures

Based on the research in this paper, the following countermeasures are proposed:

Firstly, the development of digital inclusive finance should be supported. The Government should promote relevant policies to encourage financial institutions to provide more credit support to MSMEs through digital inclusive finance platforms, with a view to lowering their financing costs, broadening their financing channels and improving their financing efficiency.

Secondly, the empirical analysis concludes that the development of digital inclusive finance can effectively reduce the level of corporate financing constraints, while this effect is more significant among non-state-owned enterprises.

Thirdly, digital inclusive finance platforms should be committed to improving service quality, including strengthening risk management, optimizing user experience and enhancing user trust. At the same time, regulators should standardize market order and protect investors' rights and interests to ensure the healthy development of the digital inclusive finance market.

Fourth, it emphasizes the close integration of digital inclusive finance with the real economy. Platforms should provide risk pricing, risk management and other financing consulting services to help SMEs reduce financing costs and improve financing efficiency, thereby realizing sound development.

Funding support

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