

The Impact of Digital Financial Inclusion on the Financing Costs of Small and Medium-Sized Enterprises: Theoretical Mechanisms and Empirical Evidence

Hanwen He

School of Business Administration, Southwestern University of Finance and Economics, Chengdu, China
3279633393@qq.com

Abstract. This study examines whether digital financial inclusion reduces the financing costs of small and medium-sized enterprises in China. The analysis combines the Peking University Digital Financial Inclusion Index with an unbalanced panel of A-share listed firms from 2011 to 2023 and estimates firm and year two-way fixed-effects models. Financing cost is measured as the logarithm of financial expenses divided by average interest-bearing debt. The baseline estimate for digital financial inclusion is -0.0743 and is statistically significant at the 5% level, indicating that improvements in regional digital financial inclusion are associated with lower corporate financing costs. Mechanism tests show that digital financial inclusion significantly increases analyst coverage and the number of analyst reports, supporting an external information environment channel. The negative association is more pronounced among firms located in central and western China and among privately owned enterprises, where conventional financial services and implicit credit support are relatively weaker. The results remain robust after lagging the core explanatory variable, adopting an alternative financing-cost measure, and changing the definition of small and medium-sized enterprises. These findings highlight the role of digital data, technology-enabled risk assessment, and information production in improving financing conditions for underserved firms.

Keywords: digital financial inclusion, financing cost, small and medium-sized enterprises, information asymmetry, analyst coverage

1. Introduction

Small and medium-sized enterprises play a central role in employment creation, technological innovation, supply-chain resilience, and structural transformation. Nevertheless, their financing conditions are typically weaker than those of large firms. Limited collateral, short credit histories, less standardized accounting information, and relatively high due-diligence costs make it difficult for lenders to distinguish high-quality firms from risky borrowers. Under information asymmetry, financial institutions may protect themselves by charging higher interest rates, shortening loan

maturities, requiring additional guarantees, or rationing credit. These responses translate the problem of limited information into persistently high financing costs.

Digital financial inclusion integrates mobile payments, big data, cloud computing, and automated risk assessment into financial intermediation. Transaction records, tax information, logistics data, and supply-chain relationships can supplement conventional financial statements and create a more timely operating profile of a firm. Digital delivery also lowers the dependence of financial services on physical branches and may increase competition for previously underserved clients. The Peking University Digital Financial Inclusion Index, which measures coverage breadth, usage depth, and the degree of digitalization, provides a consistent regional measure for evaluating these effects [1].

Existing studies generally show that digital financial inclusion improves access to financial services, alleviates financing constraints, and promotes investment and innovation [2-8]. However, financing constraints and financing costs are conceptually distinct. Constraint indices mainly describe the difficulty of obtaining external funds, whereas financing cost measures the price actually paid for capital. A direct examination of financing cost therefore provides sharper evidence on whether digital technology changes credit risk pricing. In addition, the external information-production channel has received less attention than the expansion of credit supply. Analyst coverage and analyst reports provide observable measures of information collection, processing, and dissemination in capital markets.

This study links the regional digital financial inclusion index to firm-level data for Chinese A-share listed small and medium-sized enterprises from 2011 to 2023. Firm and year fixed effects are used to estimate the relationship between digital financial inclusion and financing cost. Analyst coverage and report production are examined as mechanism variables, while regional and ownership subsamples are used to evaluate heterogeneous effects. The main contribution is threefold. First, the study focuses on the actual price of financing rather than a constraint index. Second, it provides firm-level evidence for an external information environment channel. Third, it distinguishes within-group statistical significance from genuine differences in coefficient magnitudes and interprets the heterogeneity results cautiously.

The remainder of the paper is organized as follows. Section 2 reviews the literature and develops the hypotheses. Section 3 presents the data, variables, and empirical model. Section 4 reports the baseline, mechanism, heterogeneity, and robustness results. Section 5 discusses the findings, policy implications, and limitations. Section 6 concludes.

2. Literature review and hypothesis development

2.1. Digital financial inclusion and financing cost

The literature on digital financial inclusion and firm behavior can be grouped into three strands. The first examines financing constraints and finds that digital financial services expand access, reduce credit rationing, and generate larger benefits for private firms and firms in financially underdeveloped areas [2-4]. The second studies investment, innovation, and operating performance, emphasizing lower transaction costs, broader financing channels, and improved allocation of capital [3, 5, 7]. The third directly considers debt, equity, or composite financing costs and suggests that digital finance can reduce the price of external funds and improve financing structures [6, 8].

The underlying mechanism is closely related to information asymmetry. Conventional lenders rely heavily on audited financial statements, collateral, and repeated face-to-face interactions. These information sources are relatively limited for small firms, leading to costly screening and monitoring. Financial development can relax such financing frictions [9], while higher-quality

information improves debt contracting by allowing lenders to price borrower risk more accurately [10].

Digital financial inclusion can reduce these frictions through both data expansion and process automation. Digital payment flows, online sales, tax records, and supply-chain transactions provide high-frequency and verifiable signals of operating activity. Machine-learning-based credit assessment and automated post-loan monitoring can lower the marginal cost of processing small loans. Meanwhile, online service delivery weakens geographical barriers and may increase competition among financial providers. When screening costs, monitoring costs, and market markups decline, the risk premium embedded in corporate financing prices should also decline.

H1. A higher level of regional digital financial inclusion is associated with a lower financing cost for small and medium-sized enterprises.

2.2. External information environment mechanism

Digital financial activities generate traceable operating data and strengthen the connection between firms and external information users. When data become more available and timely, analysts face lower costs in collecting information, detecting performance changes, and producing earnings forecasts. More analysts may therefore initiate coverage, while incumbent analysts may issue more reports. Expanded analyst coverage can accelerate price discovery, reduce disagreement among market participants, and discipline corporate disclosure.

Greater external information production also assists banks and other capital providers. Independent assessments of cash flow, profitability, and operating risk can improve borrower screening and reduce the need to rely mechanically on firm size, ownership status, or collateral. As risk classification becomes more precise, high-quality firms are less likely to bear an average premium created by information opacity. Accordingly, analyst coverage and the volume of analyst reports are used as observable indicators of an improved external information environment. These tests identify a key link in the proposed mechanism, although they do not by themselves constitute a complete causal mediation analysis.

H2. Digital financial inclusion improves the external information environment of small and medium-sized enterprises, as reflected in greater analyst coverage and more analyst reports.

2.3. Regional and ownership heterogeneity

The marginal value of digital financial inclusion should depend on the initial availability of conventional financial services. Central and western China generally have lower densities of financial institutions and fewer specialized financial products than the eastern region. Because digital finance depends less on physical branches, its ability to fill gaps in service coverage may be stronger in these areas. Ownership may also matter. State-owned enterprises often benefit from stable bank relationships, stronger credit recognition, and perceived implicit support. Private enterprises depend more heavily on market-based credit assessment and may therefore respond more strongly to improvements in verifiable information.

H3. The reduction in financing cost associated with digital financial inclusion is more pronounced for firms in central and western China and for privately owned enterprises.

3. Research design

3.1. Data and sample construction

Firm-level financial, governance, and analyst data are obtained from the WIND and CSMAR databases. Regional digital financial inclusion is measured using the Peking University Digital Financial Inclusion Index. The sample period is 2011-2023. Starting from Chinese A-share listed small and medium-sized enterprises, the sample excludes financial firms, firms designated as ST or *ST, and observations with missing values for key variables. Small and medium-sized enterprises are identified according to the firm-size criterion used in the source dataset. All continuous variables are winsorized at the 1st and 99th percentiles. The baseline regression contains 28,003 firm-year observations.

3.2. Variable definitions

Table 1. Variable definitions

Variable	Definition	Measurement
ln_FinCost	Financing cost	Natural logarithm of financial expenses divided by average interest-bearing debt
DIF_index	Digital financial inclusion	Overall digital financial inclusion index for the province of firm registration
ln_Analyst	Analyst coverage	$\ln(1 + \text{number of analysts following the firm})$
ln_Report	Analyst reports	$\ln(1 + \text{number of analyst reports issued during the year})$
Size	Firm size	Natural logarithm of total assets
Lev	Leverage	Total liabilities divided by total assets
ROA	Profitability	Net income divided by total assets
Growth	Sales growth	Annual growth rate of operating revenue
Age	Firm age	Natural logarithm of years since listing

Notes: Average interest-bearing debt is the mean of beginning- and end-of-year interest-bearing debt. Interest-bearing debt includes short-term loans, long-term loans, and bonds payable.

The financing-cost variable is constructed as follows:

$$FinCost_{it} = FinanceExpense_{it} / [(InterestDebt_{it} + InterestDebt_{i,t-1}) / 2] \quad (1)$$

where financial expenses capture the accounting cost of external finance and average interest-bearing debt scales this expense by the stock of debt that bears explicit financing costs.

3.3. Empirical model

The baseline two-way fixed-effects model is specified as:

$$\ln(FinCost_{it}) = \alpha + \beta DIF_{p(i),t} + \gamma' X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (2)$$

where i indexes firms, t indexes years, and $p(i)$ denotes the province in which firm i is registered. DIF is the regional digital financial inclusion index, X is the vector of firm-level controls, μ_i denotes

firm fixed effects, and λ_t denotes year fixed effects. Standard errors are clustered at the firm level. A significantly negative β supports H1. For the mechanism tests, $\ln_Analyst$ and $\ln_Report$ are used as dependent variables. Heterogeneity is assessed by estimating the same specification for eastern versus central-western firms and for state-owned versus private firms. Robustness checks lag the core explanatory variable by one year, replace the financing-cost measure, and apply an alternative definition of small and medium-sized enterprises.

4. Empirical results

4.1. Baseline regression

Table 2. Digital financial inclusion and financing cost: baseline regression

Variable	(1) $\ln_FinCost$
DIF_index	-0.0743**(0.0364)
Size	-0.0260**(0.0112)
Lev	3.0215*** (0.0610)
ROA	-0.7683*** (0.1074)
Growth	0.0066(0.0140)
Age	0.0221(0.0141)
Firm fixed effects	Yes
Year fixed effects	Yes
Observations	28,003
R ² / Adjusted R ²	0.3343 / 0.3321

Notes: Firm-clustered standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 2 reports the baseline estimate. The coefficient on DIF_index is -0.0743 and is significant at the 5% level. After controlling for observable firm characteristics, time-invariant firm heterogeneity, and common annual shocks, a higher level of digital financial inclusion is associated with a lower financing cost. This result supports H1. Because the dependent variable is logarithmic and the economic interpretation of a one-unit change in the index depends on the index scaling, the coefficient is interpreted primarily through its sign, statistical significance, and stability across specifications rather than as a mechanical percentage-point change.

The control variables are broadly consistent with standard credit-pricing arguments. Size is negative and significant, suggesting that larger firms obtain lower financing prices because they possess more stable cash flows, more collateral, or stronger disclosure. Leverage is positive and highly significant, indicating that greater debt burdens increase default risk and required compensation. ROA is negative, consistent with profitable firms having stronger internal cash flows and repayment capacity. Growth and Age are not statistically significant once firm fixed effects are included.

Firm fixed effects absorb persistent differences in corporate culture, governance quality, and industry position, while year fixed effects absorb macroeconomic, monetary-policy, and capital-market shocks common to all firms. Nevertheless, the regional index may still move together with

local economic development or financial-supply improvements. The robustness tests therefore evaluate whether the result survives alternative timing, measurement, and sample definitions.

4.2. External information environment tests

Table 3. Digital financial inclusion and external information production

Variable	(1) ln_Analyst	(2) ln_Report
DIF_index	0.0934**(0.0386)	0.1323*** (0.0481)
Size	0.3839*** (0.0112)	0.4786*** (0.0140)
Lev	-0.4949*** (0.0657)	-0.5593*** (0.0825)
ROA	3.3846*** (0.1719)	4.4856*** (0.2231)
Growth	0.0426*** (0.0144)	0.0901*** (0.0194)
Age	-0.1796*** (0.0151)	-0.2152*** (0.0190)
Firm/year fixed effects	Yes	Yes
Observations	17,105	17,127
R ² / Adjusted R ²	0.3023 / 0.2985	0.3024 / 0.2986

Notes: ln_Analyst and ln_Report are the natural logarithms of one plus analyst coverage and one plus the annual number of analyst reports, respectively. Other notes are the same as in Table 2.

Table 3 shows that DIF_index has a coefficient of 0.0934 for analyst coverage and 0.1323 for analyst reports, significant at the 5% and 1% levels, respectively. The estimates indicate that stronger regional digital financial inclusion is accompanied by broader analyst coverage and more intensive report production. This evidence supports H2 and is consistent with the proposition that digital operating data lower the cost of external information collection and processing.

The result has two economic implications. First, independent analyst assessments can improve the speed of information discovery and reduce differences in information sets across investors and creditors. Second, a greater supply of reports broadens the dissemination of evaluations concerning profitability, cash flow, and risk. Better external information allows capital providers to distinguish borrowers more accurately, reducing the excess premium that transparent, high-quality firms might otherwise pay because of pooled risk assessment.

4.3. Regional and ownership heterogeneity

The regional estimates show a negative but statistically insignificant coefficient in eastern China (-0.0587) and a larger negative coefficient in central and western China (-0.0797), significant at the 10% level. The pattern is consistent with a service-gap-filling effect. Firms in eastern China operate within a more developed conventional financial system and may already have multiple financing channels. In central and western areas, digital customer acquisition, remote approval, and data-based risk assessment are more likely to generate incremental improvements in financing conditions.

Table 4. Regional and ownership heterogeneity

Variable	(1) Eastern	(2) Central-western	(3) State-owned	(4) Private
DIF_index	-0.0587(0.0635)	-0.0797*(0.0451)	-0.0073(0.0486)	-0.1109** (0.0487)
Size	-0.0493*** (0.0178)	0.0073(0.0152)	0.1415*** (0.0238)	-0.1101*** (0.0171)

Table 4. (continued)

Lev	3.0079*** (0.1150)	3.0877*** (0.0742)	3.2189*** (0.0730)	2.7523*** (0.0967)
ROA	-1.0574*** (0.2440)	-0.6141*** (0.1222)	-0.4735*** (0.1230)	-1.8912*** (0.2002)
Growth	0.0651*** (0.0208)	-0.0371** (0.0181)	-0.0428** (0.0195)	0.0624*** (0.0193)
Age	0.0337 (0.0296)	0.0652*** (0.0179)	0.0138 (0.0170)	0.0114 (0.0217)
Observations	9,696	17,598	14,024	13,979

Notes: All columns include firm fixed effects, year fixed effects, and the control variables reported in the table. The R^2 values for columns (1)–(4) are 0.3758, 0.3255, 0.3371, and 0.3486, respectively. Other notes are the same as in Table 2.

The ownership results are more pronounced. The coefficient is close to zero and insignificant for state-owned enterprises, whereas it is -0.1109 and significant at the 5% level for private firms. State-owned enterprises commonly have stable banking relationships and stronger perceived credit support. Private firms lack these advantages and rely more heavily on market-based verification of operating quality. The findings are therefore consistent with H3. However, a formal cross-group coefficient test would be required before concluding that the coefficients are statistically different from one another; the present evidence primarily establishes that the estimated association is concentrated in the theoretically more constrained subsamples.

4.4. Robustness tests

Table 5. Robustness tests

Variable	(1) One-year lag	(2) Alternative cost	(3) Alternative SME definition
L_DIF_index	-0.0753** (0.0373)		
DIF_index		-0.0749** (0.0355)	-0.1894* (0.1113)
Size	-0.0260** (0.0112)	-0.0286*** (0.0109)	-0.0248** (0.0115)
Lev	3.0217*** (0.0610)	0.9009*** (0.0591)	3.0228*** (0.0615)
ROA	-0.7692*** (0.1075)	-1.3251*** (0.1031)	-0.7592*** (0.1076)
Growth	0.0067 (0.0140)	0.0249* (0.0134)	0.0060 (0.0139)
Age	0.0222 (0.0141)	-0.0028 (0.0138)	0.0210 (0.0142)
Observations	28,003	28,003	28,003
R^2	0.3343	0.1517	0.3372

Notes: Column (2) uses the alternative dependent variable $\ln_FinCost_liab$. Column (3) applies an alternative definition of small and medium-sized enterprises. Other notes are the same as in Table 2.

The coefficient on the one-year lag of digital financial inclusion is -0.0753 and remains significant at the 5% level, suggesting that the baseline result is not entirely driven by contemporaneous reverse association. Using the alternative financing-cost measure yields a coefficient of -0.0749, also significant at the 5% level. Applying the alternative enterprise-size definition produces a coefficient of -0.1894, significant at the 10% level. The consistently negative estimates show that the central finding is robust to changes in timing, measurement, and sample classification.

5. Discussion

5.1. Interpretation and contribution

The findings support an information-based interpretation of digital financial inclusion. Digital finance does not merely expand the number of available channels; it changes the quantity, frequency, and verifiability of information used in financing decisions. Regional digital infrastructure can convert operating records into signals that are easier for analysts and financial institutions to process. The positive effects on analyst coverage and report production are consistent with this interpretation and help connect regional digital development to firm-level financing prices.

The heterogeneity results further indicate that the value of digital finance is conditional on the initial financial environment. The association is stronger in central and western China, where branch-based services and specialized products are relatively limited, and among private firms, which receive less ownership-based credit support. This pattern is economically important because it suggests that digital financial inclusion can narrow financing disparities rather than simply improve conditions for firms that already have strong access to conventional finance.

Methodologically, the study complements research that relies on SA, KZ, or other financing-constraint indices. Those measures are useful for identifying restricted access to external capital, but they do not directly observe the price paid for financing. By examining financial expenses relative to interest-bearing debt, the analysis provides evidence on risk pricing. The mechanism tests also move beyond a generic credit-supply explanation by documenting a measurable response in external information production.

5.2. Policy implications

Several policy implications follow. First, subject to data security, authorization, and privacy protection, interoperability among payment, tax, supply-chain, logistics, and credit-information systems should be improved. Better data portability can help financial institutions construct reliable digital credit profiles for small firms and reduce screening costs. Second, investment in digital infrastructure and inclusive financial-service capacity should be strengthened in central and western regions, where the marginal return to overcoming physical service gaps appears larger.

Third, financial institutions should design digital credit products that are linked to verified operating scenarios of private small and medium-sized enterprises rather than relying mechanically on collateral or ownership. Fourth, digital expansion should be accompanied by algorithmic governance. Transparent model validation, auditable data authorization, complaint channels, and safeguards against discriminatory pricing are necessary to ensure that lower information-processing costs do not create new forms of exclusion.

5.3. Limitations

The analysis has three limitations. First, the digital financial inclusion index is measured at the regional level and cannot fully capture the intensity with which an individual firm uses digital financial services. Second, analyst coverage and report production mainly reflect capital-market information and do not capture the soft information accumulated within banks. Third, firm and year fixed effects and lagged regressors alleviate only part of the endogeneity concern. Future research could exploit policy pilots, instrumental variables, or other quasi-natural experiments to strengthen

causal identification. Formal coefficient-equality tests and a full mediation design would also provide more rigorous evidence on heterogeneity and mechanisms.

6. Conclusion

Using panel data for Chinese A-share listed small and medium-sized enterprises from 2011 to 2023, this study examines the relationship between regional digital financial inclusion and corporate financing cost. The results indicate that digital financial inclusion is significantly associated with lower financing cost. It also increases analyst coverage and the production of analyst reports, providing evidence for an improved external information environment. The negative association is concentrated in central and western China and among private enterprises, where conventional financial services and credit support are relatively weaker. The conclusion remains stable when the digital financial inclusion index is lagged, the financing-cost measure is replaced, and the sample definition is changed.

Overall, digital financial inclusion appears to improve financing conditions by combining broader service coverage with data-enabled information production and more accurate risk assessment. Its contribution is therefore not limited to greater access to finance; it also concerns the pricing of finance and the distribution of information across market participants. Policies that expand digital infrastructure while strengthening data governance can help translate these advantages into sustainable reductions in the financing burden of underserved firms.

References

- [1] Guo, F., Wang, J. Y., Wang, F., et al. (2020). Measuring China's digital financial inclusion: Index compilation and spatial characteristics. *China Economic Quarterly*, 19(4), 1401-1418.
- [2] Song, C., & Shi, Y. (2025). The effect of digital financial inclusion on corporate financing constraints and its mechanisms. *Caijing Zongheng*, 24, 153-158.
- [3] Fang, X. M., & Liu, Y. E. (2024). Digital financial inclusion, suppression of resource misallocation, and the prosperity of small and medium-sized enterprises. *Economic Theory and Business Management*, 1.
- [4] Wen, G. R., & Chen, H. Z. (2024). Digital financial inclusion and financing constraints of small and micro enterprises. *Financial Theory and Teaching*, 42(5), 14-25.
- [5] Liu, J. (2025). Digital financial inclusion, social networks, and green innovation of small and medium-sized enterprises. *Statistics & Decision*, 9.
- [6] Can digital financial inclusion reduce the cost of equity financing for small and medium-sized enterprises? (2023). *North China Finance*, 8.
- [7] Digital financial inclusion and innovation in small and medium-sized enterprises: Evidence from the SME Board. (2023). *Modern Marketing*, 12.
- [8] Digital financial inclusion, debt financing, and financing constraints of small and medium-sized enterprises. (2023). *Communication of Finance and Accounting*, 1.
- [9] Love, I. (2003). Financial development and financing constraints: International evidence from the structural investment model. *The Review of Financial Studies*, 16(3), 765-791. <https://doi.org/10.1093/rfs/hhg013>
- [10] Bharath, S. T., Sunder, J., & Sunder, S. V. (2008). Accounting quality and debt contracting. *The Accounting Review*, 83(1), 1-28. <https://doi.org/10.2308/accr.2008.83.1.1>