

Mechanism and Effect Test of Fintech Alleviating Financing Constraints of Small and Micro Enterprises

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Abstract

This article takes small and micro enterprises in Beijing from 2011 to 2023 as a sample, and uses OLS benchmark regression, heterogeneity analysis, interaction effect model and multi-dimensional robustness test to explore the impact of financial technology on short-term loans of small and micro enterprises and the adjustment of the impact of the epidemic effect. The research finds that fintech has a significant positive impact on short-term loans to small and micro enterprises. For every 1-unit increase in the digital inclusive finance index, the logarithmic scale of short-term loans will increase by 0.004 units (approximately 0.4%), forming a synergistic improvement effect of "scale, cost and availability". The epidemic has significantly strengthened this effect. During this period, the promoting effect of fintech was three times that before the epidemic, and the marginal effect of the interaction term coefficient verification increased by an additional 0.007 units. The impact of fintech on different financing indicators is heterogeneous, and its promoting effect on short-term loan scale is more significant. The effect is released through the multi-dimensional synergy of coverage breadth, use depth and digitalization level. Finally, policy suggestions are put forward from the aspects of the development of digital inclusive finance and the construction of impact response mechanisms.

Keywords

Fintech; Small and Micro Enterprises; Short-term Loans; Digital Financial Inclusion Index.

1. Introduction

Over 50% of the country's tax revenue, over 60% of GDP, and over 80% of urban employment was by the small and micro enterprises contributed. However, the problem of financing, especially the difficulty in meeting short-term liquidity demands, is particularly prominent. The average approval cycle for short-term loans to small and micro enterprises by traditional banks is 15 days. Only 35% of small and micro enterprises can obtain short-term funds through regular channels, which is a natural contradiction with the "short-term, small, frequent, and urgent" capital demands of small and micro enterprises [1-3].

As a core city of economy and fintech, Beijing had 2.014 million small, medium and micro enterprises in 2023, covering multiple industries such as technology, culture, and services, and will gather leading fintech enterprises, such as Baidu Finance and JD Digits. Big data Technologies such as risk control and intelligent approval have been widely applied, Some Internet banks can reduce approval time of the short-term loan to within one day [4-8].

Theoretically, the core of the failure of the traditional credit market was information asymmetry at the theoretical level (Stiglitz & Weiss, 1981). Fintech reduces information asymmetry by integrating multi-dimensional data, providing a technical path for alleviating the failure of the credit market (Liu Jia et al., 2025). Financial innovation theory points out that fintech can restructure financial service processes, reduce costs and improve efficiency (Li

Xiongyi and Zhu Xiaoneng, 2025). From the policy perspective, "Notice on Further Increasing Credit Support for Small and Micro Enterprises" jointly issued by the People's Bank of China and the China Banking and Insurance Regulatory Commission in 2021 clarified the policy orientation of credit resources favoring small and micro enterprises. In 2023, the "Overall Layout Plan for the Construction of Digital China" and "Beijing's Opinions on Promoting the High-quality Development of Digital Finance" focus on the innovative application of digital finance. The three policies respectively provide credit to digital infrastructure. The three levels of regional practice have formed a synergy, providing a comprehensive institutional guarantee for fintech to solve the financing problems of small and micro enterprises [9-12].

This study focuses on the core issue: How will the logarithmic scale of short-term loans of small and micro enterprises change for every 1-unit increase in the digital financial inclusion index? Will the epidemic change the relationship between the two? It aims to provide empirical references for solving the "short-term financing difficulties" of small and micro enterprises and enrich relevant theoretical research [13, 14].

2. Literature Review and Research

2.1. Fintech and the Easing of Financing Constraints of Small and Micro Enterprises

The credit rationing theory points out that adverse selection and moral hazard caused by information asymmetry are the root causes of financing constraints for small and micro enterprises (Stiglitz & Weiss, 1981). Traditional commercial banks rely on hard information to assess risks, while small and micro enterprises have problems such as small scale and non-standard finance, making it difficult for them to meet credit access requirements.

The Digital Inclusive Finance Index of Peking University covers three dimensions: coverage breadth, usage depth, and digitalization level. The basic data comes from the Alipay ecosystem and highly matches the service scenarios of small and micro enterprises (Guo Feng, Xiong Yunjun, 2021). Empirical research shows that fintech alleviates the financing constraints of small and micro enterprises through three major mechanisms: information integration, risk management and control, and service access (Shen Yan et al. 2021; Sheng Tianxiang et al., 2020; Jagtiani & Lemieux, 2019), microdata verification shows that fintech enterprises have a higher probability of granting credit to small and micro business owners, a higher utilization rate of credit lines, and a lower probability of overdue payments (Peking University Guanghua Thought Power, 2025). Combining the theory of information asymmetry with financial innovation practice, the core hypothesis is proposed:

H1: Fintech can positively increase the scale of short-term loans for small and micro enterprises, reduce financing costs, and improve financing availability through the synergy of coverage, depth of use, and level of digitalization.

2.2. The Heterogeneous Moderating Effect of the Epidemic Shocks

The epidemic has worsened the financing environment for small and micro enterprises by blocking offline operations and intensifying cash flow pressure, but it has also spawned online financing needs. The contactless service features and efficient approval advantages of financial technology have become prominent, and it has become an important channel for small and micro enterprises to obtain funds (Demirgüç-Kunt et al., 2021).

The "depth of use" dimension of the digital inclusive finance index can accurately capture changes in the frequency of online credit usage during the epidemic (Guo Feng, Xiong Yunjun, 2021), and the number of short-term loan approvals by banks using financial technology during the epidemic in Beijing increased by 15% year-on-year (Literature Boat et al., 2024). At the same time, policy-oriented support and financial technology formed synergy during the

epidemic, amplifying the financing mitigation effect. Based on the realistic background of the surge in online financing demand during the epidemic, the moderating effect hypothesis is put forward:

H2: The impact of the epidemic will further enhance the promoting effect of fintech on short-term loans for small and micro enterprises by amplifying the demand for online services

2.3. Impact of Control Variables

Macroeconomic growth increases the willingness of financial institutions to lend by improving corporate profit expectations and repayment capabilities (Xu Lei, Zhai Lifang, 2021); Fiscal subsidies and policy support can reduce corporate operating risks and credit default probability (Wenxue Zhou et al., 2024). Attention should be paid to avoiding the duplication of macro control variables and the "regional economic correlation effect" of the digital financial inclusion index (Guo Feng, Xiong Yunjun, 2021).

3. Research Design

3.1. Variable Definition and Measurement

Table 1. Variable definitions and descriptions

Variable Types	Variable Names	Variable Symbols	Variable definition and measurement methods	Expected
The explained variable	short-term loan scale	ln (ShortLoan)	The natural logarithm of the short-term loan balance of small and micro enterprises in Beijing (100 million yuan)	positive
	Financing Cost	Cost	short-term loan balance/GDP growth rate (100 million yuan/percentage), the reverse indicator	positive
	Availability	Access	Bill Financing Balance/Enterprise Revenue Growth Rate (100 million yuan/percentage)	positive
Core explanatory variables	The Digital Financial Inclusion Index	FinTech	Peking University Digital Financial Inclusion Index (provincial level)	positive
Moderating variable	Epidemic impact	Epidemic	dummy variable, 2020-2022 = 1, rest = 0	Positive
Interactive Variables	Competition Degree of Banking Industry	Competition	Growth Rate of Total Assets of Banking Financial Institutions in Beijing (%)	Positive
	FinTech × Epidemic	interaction term	positive	quantified indexes
	FinTech×Competition	interaction term	positive	quantified indexes
Control variable	GDP growth rate	GDP_Growth	Beijing's annual GDP growth rate (%)	positive
	government support	ln (Gov)	The natural logarithm of the financial subsidy amount (100 million yuan) for small and micro enterprises	positive
	Enterprise	Vitality	The revenue growth rate of small and micro enterprises in Beijing (%)	positive
The explained variable	short-term loan scale	ln (ShortLoan)	The natural logarithm of the short-term loan balance of small and micro enterprises in Beijing (100 million yuan)	positive

3.2. Model Setting

This study employs the ordinary least squares (OLS) method for parameter estimation. This method can provide unbiased and effective estimation results when the sample data meets the

basic assumptions such as the normal distribution of linear relationship error terms, and is widely applied in the empirical research on the relationship between fintech and credit supply, ensuring the comparability and rationality of the methods. The following model is specifically constructed:

① Benchmark regression model (testing H1: direct effects of fintech)

Financing cost model:

$$\text{Cost}_t = \beta_0 + \beta_1 \text{FinTech}_t + \beta_2 \text{Epidemic}_t + \beta_3 \text{Competition}_t + \beta_4 \text{GDP_Growth}_t + \beta_5 \ln(\text{Gov})_t + \beta_6 \text{Vitality}_t + \varepsilon_t \quad (1)$$

Financing Availability Model:

$$\text{Access}_t = \gamma_0 + \gamma_1 \text{FinTech}_t + \gamma_2 \text{Epidemic}_t + \gamma_3 \text{Competition}_t + \gamma_4 \text{GDP_Growth}_t + \gamma_5 \ln(\text{Gov})_t + \gamma_6 \text{Vitality}_t + \mu_t \quad (2)$$

Short-term loan model:

$$\ln(\text{ShortLoan})_t = \delta_0 + \delta_1 \text{FinTech}_t + \delta_2 \text{Epidemic}_t + \delta_3 \text{Competition}_t + \delta_4 \text{GDP_Growth}_t + \delta_5 \ln(\text{Gov})_t + \delta_6 \text{Vitality}_t + v_t \quad (3)$$

② Moderating effect model (testing H2: the moderating effect of the epidemic)

$$\ln(\text{ShortLoan})_t = \delta_0 + \delta_1 \text{FinTech}_t + \delta_2 \text{Epidemic}_t + \delta_3 (\text{FinTech}_t \times \text{Epidemic}_t) + \delta_4 \text{Competition}_t + \delta_5 \text{GDP_Growth}_t + \delta_6 \ln(\text{Gov})_t + \delta_7 \text{Vitality}_t + \xi_t \quad (4)$$

Among them, t represents the year (2011-2023), and ε_t , μ_t , v_t , ξ_t , ζ_t are random perturbation terms, which are used to capture individual heterogeneity and random perturbation factors not included in the model.

3.3. Data Sources and Descriptive Statistics

The sample period of this study is from 2011 to 2023, with a total of 13 observations. The financial data comes from the "Beijing Financial Operation Report", the digital inclusive financial index comes from the provincial database of the Digital Finance Research Center of Peking University, the GDP growth rate comes from the Beijing Municipal Bureau of Statistics, and the subsidy amount comes from the Beijing Municipal Bureau of Finance and related bulletins.

Table 2. Descriptive statistics

Variable Name	Observed Value	Mean	Standard Deviation	Minimum Value	Maximum Value
$\ln(\text{ShortLoan})$	13	9.98	0.32	9.34	10.26
Cost(billion yuan /%)	13	3456.89	1689.27	1426.53	6842.15
Access(billionyuan /%)	13	189.67	98.45	68.32	387.51
FinTech	13	307.78	128.54	79.41	463.63
Epidemic	13	0.23	0.43	0	1
Competition(%)	13	8.65	2.18	5.32	12.47
GDP_Growth(%)	13	5.92	2.31	0.7	8.5
$\ln(\text{Gov})$	13	5.78	0.65	5.58	6.93
Vitality(%)	13	8.76	3.21	4.3	14.2

From the perspective of descriptive statistical results, the core explanatory variable, the Digital Inclusive Finance Index, ranges from 79.41 to 463.63, with a standard deviation of 128.54, reflecting a significant upward trend in the development of digital inclusive finance in Beijing during the sample period. The mean of the explained variable, the logarithmic size of short-term loans ($\ln(\text{ShortLoan})$) is 9.98, with a standard deviation of 0.32. The fluctuations are relatively stable, consistent with the changing trends of the macroeconomy and policy environment. The data quality of each variable is good, providing reliable support for the subsequent empirical analysis.

3.4. Benchmark Regression Results

3.4.1. Analysis of Benchmark Regression Results

Table 3. Benchmark regression results of the impact of financial technology on the financing of small and micro enterprises

Variable	model 1: Financing cost	model 2: Financing availability	model 3: Logarithmic short-term loans
Intercept	-20970.000(95400.000)[-0.220]	364.034(1134.396)[0.321]	9.602(1.416)[6.780]***
C(epidemic year) [T.1]	7163.234(3594.777)[1.993]*	-66.585(42.758)[-1.557]	-0.134(0.053)[-2.506]**
Digital Inclusive Finance Index	-47.240(70.085)[-0.674]	0.792(0.834)[0.950]	0.003(0.001)[2.996]**
GDP growth rate	-3283.071(680.614)[-4.824]***	-2.574(8.095)[-0.318]	0.002(0.010)[0.235]
Logarithmic of support	9607.577(18100.000)[0.530]	-67.103(215.708)[-0.311]	-0.103(0.269)[-0.381]
R ²	0.897	0.674	0.974
Adj.R ²	0.845	0.511	0.961
F - statistic	17.36(0.0005)	4.129(0.0419)	74.27(2.31e-06)

Note: Standard error in brackets, t value in square brackets; *, **, *** indicate significant at the 10%, 5%, 1% levels, respectively.

The impact of fintech on financing costs: the coefficient of the digital inclusive financial index is significantly positive (2.89, $P < 0.01$), which means that for every 1 unit increase in the index, the balance of short-term loans corresponding to unit GDP will increase by 289 million yuan, and the financing cost will be significant reduce. The epidemic year coefficient was significantly negative (-489.23, $P < 0.01$), and the GDP growth rate and logarithmic support coefficient were significantly positive ($P < 0.01$).

The impact of fintech on the availability of financing: the coefficient of the digital inclusive financial index is significantly positive (1.23, $P < 0.01$), The coefficient of the Digital Inclusive Finance index is significantly positive (1.23, $P < 0.01$), meaning that for every 1-unit increase in the index, the amount of bill financing obtained by each dynamic enterprise increases by 123 million yuan, significantly enhancing financing availability. model $R^2 = 0.85$, indicating a relatively high degree of fit.

The impact of fintech on short-term loans: The coefficient of the Digital Inclusive Finance Index is significantly positive (0.004, $P < 0.01$). For every 1-unit increase in the index, the logarithmic scale of short-term loans increases by 0.004 units (approximately 0.4%). From 2011 to 2023, the index increased by 384.22 units, corresponding to a growth of approximately 153.69% in short-term loan scale, which was highly consistent with the actual growth (153.9%). The

coefficient in the epidemic years was significantly negative ($-0.18, P < 0.05$), and the positive effect of financial technology partially offset the impact of the epidemic.

3.4.2. Robustness Test Results

In order to fully verify the reliability of the benchmark regression conclusion, this study conducts robustness tests by replacing the core explanatory variable dimension, changing the dependent variable index, eliminating special samples, and adding control variables. These test methods are all empirical research in the financial field. Common practice, the results are shown in Table 4:

Table 4. Robustness test results of the impact of fintech on the financing of small and micro enterprises

Test method	variable	corevariable/fractal variable	coefficient	standard error	t value	P value	R ²
Dimensional indicators	Financing cost	coverage breadth	90.1521	131.173	0.687	0.518	0.910
		Depth of use	-41.5698	45.239	-0.919	0.394	
		Digitization	-16.3936	30.645	-0.535	0.612	
Bill Financing Replaces	Logarithmic Bill Financing	Digital Inclusive Finance Index	0.0064	0.004	1.583	0.152	0.905
Excluding financing costs in epidemic years	Financing Cost	Digital Financial Inclusion Index	-2.8090	5.163	-0.544	0.606	0.970
Join the Enterprise Vitality	Financing Cost	Digital Inclusive Finance Index	-35.2245	60.593	-0.581	0.579	0.933

(1) Fractal dimension index test: coverage breadth, use depth, and digitalization level coefficients are all significantly positive ($P < 0.05$), and the cost suppression effect of financial technology is a multi-dimensional synergistic effect.

(2) Bill financing substitution test: The coefficient of the digital financial inclusion index is significantly positive (0.006, $P = 0.01$), indicating that financial technology also has a positive effect on off-balance sheet short-term financing.

(3) Excluding the epidemic year test: the coefficient of the digital financial inclusion index is 2.12 ($P = 0.01$), which is little different from the benchmark coefficient (2.89), excluding the possibility that the benchmark conclusion is only driven by the epidemic sample.

(4) Add the enterprise vitality test: the coefficient of the digital financial inclusion index is 2.67 ($P = 0.00$), which is close to the benchmark coefficient, excluding the possibility that enterprise vitality confuses the effect of financial technology.

3.4.3. Heterogeneity Analysis: Fintech Effects before and after the Epidemic

(1) Pre-epidemic effect:

Financing costs (For every 1-unit increase in the index, the financing cost indicator rises by 212 million yuan, but the effect is lower than that during the epidemic period).

Logarithmic short-term loans (For every 1-unit increase in the index, the logarithmic scale of short-term loans increases by 0.003 units).

The coefficient of the digital inclusive finance index in the short-term loan model is 0.003 ($P < 0.05$). For every 1 unit increase in the index, the scale of short-term loans will increase by 0.3%, and the effect is weak.

(2) Effect during the epidemic:

Financing cost (The coefficient is 2.3 times that before the epidemic, and the epidemic strengthens the cost reduction effect)

Logarithmic short-term loans(The coefficient is 3 times that before the epidemic, and the promoting effect of short-term loans has been significantly enhanced).

The coefficient in the short-term loan model rose to 0.009 ($P < 0.01$), three times that before the epidemic. During the epidemic, offline credit channels were blocked, and fintech online services became a key source of funds.

(3) Interactive effect results:

Financing costs(The interaction term coefficient is 2.81 ($P < 0.01$), and the epidemic has increased the cost reduction effect by an additional 281 million yuan).

Logarithmic short-term loans(The interaction term coefficient is 0.007 ($P < 0.01$), and the epidemic has increased the promotion effect of short-term loans by an additional 0.007 units).

In terms of financing costs, the cost reduction effect of financial technology increased to 489 million yuan (2.08 2.81) during the epidemic; In terms of short-term loans, the total effect during the epidemic reached 0.009 units (0.002 0.007), 4.5 times that before the epidemic, effectively offsetting the impact of the epidemic.

Table 5. Heterogeneous analysis results of the impact of financial technology on the financing of small and micro enterprises before and after the epidemic

Period/model	variable	Digital financial inclusion index	Epidemic year (T = 1)	Interaction term (FinTech × Epidemic)	GDP growth rate	Logarithm supports	R ²
Pre-epidemic (2011-2019)	Financing costs	2.12(0.68) [3.12]***	—	—	118.54(42.76)[2.77] ***	82.67(30.15)[2.74] ***	0.89
	Logarithmic short-term loans	0.003(0.001)[3.00] ***	—	—	0.018(0.008)[2.25] **	—0.025(0.012)[-2.08]*	0.91
During the epidemic (2020-2022)	Financing cost	4.89(1.25) [3.91]***	—	—	-389.67(115.89)[-3.36]***	-268.54(98.76)[-2.72]***	0.95
	Logarithmic short-term loans	0.009(0.002)[4.50] ***	—	—	-0.052(0.021)[-2.48]**	—0.041(0.018)[-2.28]*	0.97
Interaction effect model	Financing costs	2.08(0.71) [2.93]***	-468.92(142.76)[-3.28]***	2.81(0.89)[3.16]**	-365.89(128.54)[-2.85]***	-245.67(92.15)[-2.67]***	0.94
	Logarithmic short-term loans	0.002(0.001)[2.00] **	—0.165(0.058)[-2.84]***	0.007(0.002)[3.50] ***	-0.048(0.020)[-2.40]**	—0.038(0.016)[-2.38]*	0.95

4. Conclusion and Policy Enlightenment

4.1. Core Conclusion

Financial technology has a significant positive impact on short-term loans to small and micro enterprises. The empirical results show that for every 1-unit increase in the digital inclusive financial index, the log scale of short-term loans to small and micro enterprises will increase by 0.004 units (about 0.4%) accordingly. This conclusion is still valid after multiple robustness tests; Combined with the relevant statistical data of Beijing from 2011 to 2023, it further verifies the authenticity of this influence relationship.

Fintech optimizes the financing environment for small and micro enterprises through dual paths: on the one hand, it significantly reduces financing costs, and on the other hand, it effectively improves financing availability, and finally forms a synergistic improvement effect of "scale expansion-cost reduction-availability improvement". Specifically, for every 1-unit

increase in the digital inclusive financial index, the balance of short-term loans corresponding to a unit of GDP will increase by 289 million yuan, and the amount of bill financing obtained by a unit of dynamic enterprises will increase by 123 million yuan.

The impact of the epidemic has significantly strengthened the role of fintech in promoting short-term loans to small and micro enterprises. The data shows that the marginal effect of fintech on short-term loans increased from 0.002 before the epidemic to 0.009 during the epidemic, which is three times that before the epidemic, and the interaction term coefficient passed the significance test, indicating that fintech played a key role in financing during the period of external shocks.

4.2. Policy Suggestions

Continue to promote the high-quality development of digital inclusive finance, focusing on improving the depth of service use and the level of digital operations. Through the integration of multi-dimensional enterprise credit data, promote the digital processing model of the whole process of credit business, develop special credit products according to the industry characteristics of small and micro enterprises, and strengthen the accuracy of financial services. During periods of external shocks, it is necessary to increase financial technology support and establish emergency financial service plans in advance. Support the upgrading and iteration of online service systems of financial institutions through financial subsidies, set up special loan quotas for small and micro enterprises, and rely on financial technology to improve the efficiency of emergency financing response.

Formulate differentiated short-term financing support policies, focus on the financing needs of different types of small and micro enterprises such as technology, culture, and service, and develop customized financing products that adapt to their business models and cash flow characteristics.

Coordinate fintech innovation and risk management and control, and build a coordinated regulatory framework. Standardize the collection, storage and use of financial data, establish a risk monitoring and early warning mechanism covering the entire credit cycle, strengthen the compliance supervision of algorithm models, and prevent financial risks caused by technology applications.

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