



The Impact of Fintech on Innovation in Manufacturing Firms

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Abstract. The real economy is the foundation of a country's economy and an important driving force for national development. As the foundation of the real economy, manufacturing SMEs are facing the problem of lack of core technology and the urgent need to improve their technological innovation capacity. The progress of financial technology can help stimulate the innovation ability of manufacturing SMEs. This paper uses the panel data of manufacturing SMEs in China's former small and medium-sized enterprises (SMEs) sector from 2014 to 2023, and applies the fixed-effect model to study the impact and mechanism of fintech on the innovation of manufacturing SMEs and puts forward relevant suggestions.

Keywords: fintech; manufacturing SMEs; financing constraints

1 Introduction

With the continuous development of SMEs in China, they have become an important part of China's social and economic development. However, difficulties in financing and high financing costs have also become bottlenecks hindering the development of SMEs. Fintech can well broaden the financing ideas and financing channels of enterprises and help SMEs solve financing problems. As a high-input, capital-intensive industry, the manufacturing industry is also the upstream industry of the supply chain, which has a high demand for capital. Its financing status relates to the development of the whole chain industry, and thus becomes the focus of this paper. This paper obtains the data of manufacturing SMEs listed on China's small and medium-sized boards, and adopts the mediation effect model model to verify that there are financing constraints in manufacturing SMEs, and that FinTech can alleviate the financing constraints of manufacturing SMEs to a certain extent. The digital transformation of enterprises plays a positive role in alleviating the financing constraints of manufacturing SMEs. Therefore, this paper puts forward relevant feasible suggestions for manufacturing SMEs, financial institutions and governmental decision-making departments, which can help promote the sustainable development of manufacturing SMEs.

2 Literature Review

2.1 Overview of firm innovation research

A review of recent literature reveals that corporate innovation is influenced by external and internal factors. External factors include FinTech development, government incentives, and intellectual property protection. Huang T. C. (2024) found FinTech enhances innovation, especially in less competitive, highly financialized, and high-tech industries, by easing financing constraints [1]. Li Xiuyu et al. (2024) noted that tax incentives and subsidies boost R&D by increasing returns and reducing risks, significantly promoting innovation [2]. Chen Hong et al. (2019) highlighted that subsidies benefit growth-stage firms in manufacturing and services, while tax incentives support mature-stage manufacturing firms [3].

Internal factors encompass financing constraints, executive traits, and corporate governance. Lu Xin et al. (2013) found financing constraints limit R&D in high-tech firms, especially in non-state-owned and small companies [4]. Liu Jiaming (2025) linked the characteristics of top executives to corporate innovation investment.[5]. Zou Guoping et al. (2015) observed that larger enterprises, particularly high-tech ones, experience reduced R&D investment [6]. Yang Daoguang et al. (2019) correlated stronger internal controls with higher innovation investment [7].

In summary, both external and internal factors shape corporate innovation. FinTech, as an external driver, enhances innovation by alleviating internal financing constraints and optimizing policy impacts.

2.2 Studies related to FinTech's impact on SME innovation

Current studies highlight FinTech's positive impact on SME innovation. Verma et al. (2023) emphasize the growing FinTech-SME relationship [8]. Wang S.W. et al. (2023) found FinTech enhances SME innovation by offering innovative financing and risk management solutions [9]. Zhang Tiancheng (2024) showed FinTech improves innovation performance by easing financing constraints, especially in less competitive, highly financialized, and high-tech industries [10]. Sun Jiguo et al. (2022) noted FinTech boosts SME value through technological innovation and improved transparency, particularly in innovative, small-scale firms and less marketized regions [11].

Innovation, crucial for high-quality development, faces challenges like high costs and information asymmetry, especially in SMEs [12] [9]. FinTech reduces information asymmetry, accelerates credit approval, and lowers financing costs, fostering innovation [13]. Huang et al. (2018) found FinTech improves loan decisions by incorporating non-financial data, enhancing service quality and supporting real economy growth [14]. Fuster et al. (2019) observed a 20% increase in loan approval efficiency without raising default risks [15]. Sanga et al. (2023) highlighted FinTech's role in overcoming financial barriers by streamlining information and fund allocation [16].

In summary, Hypothesis 1 is proposed: FinTech development positively influences innovation in manufacturing SMEs.

2.3 Studies related to financing constraints

Small and medium-sized enterprises (SMEs) are vital to China's economy but face significant financing challenges. Huang et al. (2014) identified information asymmetry as a key bottleneck [17]. Zheng Chao (2025) noted that the credit rating standards and conditions currently employed by Chinese banks have, to some extent, impeded credit financing for small and medium-sized enterprises (SMEs), resulting in higher financing costs and adversely affecting their financing prospects [18]. Wang Ge (2024) emphasized that narrow financing channels and high thresholds constrain the access to funds for SMEs [19].

To address these constraints, scholars have explored solutions. J Yang's (2024) research found that the rapid development of financial technology (FinTech) has provided new technological means to address the financing challenges faced by SMEs [20].

FinTech aids manufacturing SMEs through: (1) supply chain finance, integrating transaction data for better credit assessment; (2) big data credit scoring, analyzing operational data for efficient approvals; (3) blockchain, enhancing transparency and reducing asymmetry; and (4) AI, enabling real-time risk monitoring and dynamic credit adjustments. These innovations streamline credit approval, reduce financing time, and diversify funding sources, lessening reliance on traditional banking.

In summary, Hypothesis 2 is proposed: FinTech alleviates financing constraints, stimulating innovation potential in manufacturing SMEs.

3 Empirical analysis

3.1 Modeling

Benchmark modeling.

This paper establishes a benchmark model (1) to analyze the impact of FinTech on innovation of manufacturing SMEs. And through the robustness test, the fixed effect model is selected. The model is as follows.

$$\begin{aligned} \text{Invest}_{i,t} = & \alpha_0 + \alpha_1 \text{DIF}_{i,t} + \alpha_2 \text{Leverage}_{i,t} \\ & + \alpha_3 \text{Growth}_{i,t} + \alpha_4 \text{ROA}_{i,t} + \alpha_5 \text{PPE}_{i,t} + \alpha_6 \text{Flow}_{i,t} + u_i + \varepsilon_{i,t} \end{aligned} \quad (1)$$

where subscript i is the company and t is the year. $\text{Invest}_{i,t}$ denotes the firm's innovation ability; $\text{DIF}_{i,t}$ denotes the degree of development of FinTech; other variables are the control variables of this paper, all of which denote the firm's individual attributes: u_i denotes the firm's individual effect; $\varepsilon_{i,t}$ is the random error term. In addition, the α_1 coefficient of $\text{DIF}_{i,t}$ reflects the impact of FinTech on innovation of manufacturing SMEs, and if it is positive, it indicates that hypothesis 1 is valid.

Mediating effects modeling.

In this paper, the stepwise method is used to construct a mediated effects model, this model is used to test hypothesis 2, the model is as follows.

$$SA_{i,t} = \beta_0 + \beta_1 DIF_{i,t} + \beta_2 Leverage_{i,t} + \beta_3 Growth_{i,t} + \beta_4 ROA_{i,t} + \beta_5 PPE_{i,t} + \beta_6 Flow_{i,t} + u_i + \delta_{i,t} \quad (2)$$

$$Invest_{i,t} = \gamma_0 + \gamma_1 DIF_{i,t} + \gamma_2 SA_{i,t} + \gamma_3 Leverage_{i,t} + \gamma_4 Growth_{i,t} + \gamma_5 ROA_{i,t} + \gamma_6 PPE_{i,t} + \gamma_7 Flow_{i,t} + u_i + \eta_{i,t} \quad (3)$$

From the principle of mediation effect model, the total effect α_1 , direct effect γ_1 and indirect effect $\beta_1\gamma_2$ should satisfy: $\alpha_1 = \gamma_1 + \beta_1\gamma_2$. If γ_2 is negative, it means that the reduction of financing constraints can promote innovation of manufacturing SMEs.

Selection of variables.

The explanatory variable is corporate R&D investment. The study shows that the innovation ability of enterprises can be better reflected by the company's R&D investment, which is an effective indicator of technological innovation. Therefore, the company's R&D investment is chosen as an indicator of the enterprise's innovation ability and is expressed as Invest.

The core explanatory variable is the FinTech Index as a measure of the extent of FinTech across firms, denoted by DIF.

The mediating variable is financing constraints. In this paper, we use the SA index to measure corporate financing constraints and apply the index to construct a mediation effect model. the formula for SA is $-0.737 * Size + 0.043 * Size^2 - 0.04 * Age$.

A total of five control variables were selected for this paper:

(1) Gearing ratio. This indicator is calculated from the ratio of an enterprise's year-end liabilities to its year-end total assets, and reflects the enterprise's ability to obtain funds, expressed as Leverage.

(2) Growth indicator. net profit growth rate to measure the growth of the firm, which is denoted by Growth.

(3) Return on total assets. This indicator can reflect the efficiency of the enterprise's asset utilization, expressed as ROA.

(4) Fixed assets ratio. Calculated from the ratio of total fixed assets to total assets at the end of the year, this indicator reflects the production technology conditions of the enterprise and is the basis of the company's profitability. At the same time, considering that manufacturing enterprises tend to have more collateralizable assets, this indicator can also serve as an important basis for assessing the ease or difficulty of obtaining external funds, which is expressed as PPE.

(5) Corporate cash flow. This indicator reflects the health of an enterprise's financial flows and its ability to create value over the long term, and is expressed in Flow.

Table 1. Variable Name Definition Table

Variable type	variant	Variable Meaning
explanatory variable	Invest	Enterprise R&D investment
explanatory variable	DIF	Ln (Peking University Digital Financial Inclusion Index)

intermediary variable	SA	$-0.737*Size+0.043*Size^2-0.04*Age$
	ROA	return on total assets
	PPE	Total fixed assets/total assets at the end of the year
	Flow	(Net operating profit after tax + depreciation and amortization) - (capital expenditures + increase in working capital)
	Growth	(Net profit for the current period - net profit for the previous period)/net profit for the previous period
control variable	Leverage	Liabilities at year-end/total assets at year-end

3.2 Data description and statistical analysis

Sample Selection and Data Sources.

This paper takes manufacturing SMEs listed on the SME board as a sample, with a timeframe from 2014 to 2023. The data is obtained from iFinD Financial Terminal and CSMAR database.

Subsequently, the data were preprocessed by (1) removing ST and ST* companies and (2) deleting data with missing indicators. After processing, data from 642 listed companies were obtained, totaling 5346 annual observations.

Descriptive statistical analysis.

The results of the descriptive statistics are shown in Table 2 and are reported in terms of sample size, mean, median, standard deviation, minimum and maximum values. During the sample statistical period, the annual average enterprise R&D investment of manufacturing SMEs is 1.762, the standard deviation is 7.649, the median is 0.680, the minimum value is 0, and the maximum value is 399.2. This indicator reflects the differences in the level of innovation among manufacturing SMEs in China.

For the Peking University Digital Inclusion Index, the mean is 332.9, the standard deviation is 76.94, the minimum value is 143.9, and the maximum value is 473.8. These data show that there is obvious heterogeneity in the development of manufacturing SMEs in the field of digital inclusion, reflecting the uneven development among enterprises.

Table 2. Descriptive Statistical Analysis

Variable	N	Mean	p50	SD	Min	Max.
Invest	5346	1.762	0.680	7.649	0	399.2
Innovation	5346	25.30	7	97.76	0	2141
DIF	5346	332.9	340.8	76.94	143.9	473.8
ROA	5346	0.0330	0.0380	0.104	-3.200	1.408

Leverage	5346	0.384	0.379	0.182	0.00900	2.849
Flow	5346	-22.16	29	1362	-39000	27000
PPE	5346	0.221	0.205	0.117	0	0.872
Growth	5346	-0.991	-0.0450	116.9	-3179	6962
SA	5346	-3.664	-3.575	1.166	-10.92	-0.324

Correlation analysis.

The results of the correlation statistics are shown in Table 3, where the explanatory variable Invest is significantly positively correlated with the core explanatory variable DIF. It is significantly negatively correlated with the financing constraint SA index, and the digital transformation index is significantly negatively correlated with the financing constraint. Meanwhile, the absolute values of the correlation coefficients between the variables are mostly within 0.6, and most of them are significant at a confidence level of more than 1%, judging that there is no multicollinearity between the variables.

Table 3. Correlation Analysis

	Invest	DIF	ROA	Leverage	Flow	PPE	Growth
Invest	1						
DIF	0.092***	1					
ROA	0.026*	-0.060***	1				
Leverage	0.142***	0.135***	-0.411***	1			
Flow	0.103***	0.0190	0.121***	-0.046***	1		
PPE	0.028**	-0.063***	-0.098***	0.123***	-0.00700	1	
Growth	0.00300	0	0.048***	-0.034**	0.00500	-0.00800	1

3.3 Empirical results and regression analysis

Benchmark regression analysis and mediation effects analysis.

Table 4 represents the results of the benchmark regression. As can be seen in column (1), the coefficients of the core explanatory variables are significantly positive, validating hypothesis one, which states that innovation in manufacturing SMEs is positively influenced by fintech.

The results of the mediation effect test are shown in Table 4. According to the testing process, the total effect of the core explanatory variables affecting the explained varia-

bles is tested first, and the results are shown in column (1) of Table 4. Then the mediating effect is tested by model (2) and model (3). The results of model (2) are shown in column (2) of Table 4. The results show that the coefficient of the FinTech index is significantly negative, indicating that a high degree of FinTech in manufacturing SMEs can effectively attenuate their financing constraints. Subsequently, the regression results of model (3) are shown in column (3) of Table 4, and the results show that financing constraints play a partial mediating role, and by alleviating the financing constraints of manufacturing SMEs, FinTech helps to stimulate their innovation potential. Hypothesis (2) is verified, i.e., by alleviating the financing constraints of manufacturing SMEs, FinTech helps to stimulate their innovation potential.

Table 4. Benchmark regression and mediation effect test results

	(1) Invest	(2) SA	(3) Invest
DIF	3.323 *** (0.340)	-1.207 *** (0.027)	0.419* (0.209)
SA			-2.817 *** (0.497)
control variable	containment	containment	containment
_cons	-18.270 *** (1.938)	3.694 *** (0.151)	-10.516 *** (1.444)
N	5346	5346	5346

Robustness Tests.

This paper tests the robustness of the role of FinTech in influencing innovation in manufacturing SMEs. The method of replacing the explanatory variables is used.

Enterprise innovation is measured by Innovation Input (R&D investment) and Innovation Output (patents). R&D investment reflects an enterprise's commitment to innovation and is essential for patent acquisition. This study replaces Invest with Innovation (number of patents). Table 5 shows a significantly positive regression coefficient of 27.399 for FinTech's impact on R&D investment, aligning with earlier results and confirming the hypotheses and empirical findings.

Table 5. Robustness Tests

	(1) Innovation
DIF	27.392 *** (3.653)
control variable	containment
_cons	-130.923 *** (20.805)
N	5346

4 Summary

4.1 Conclusions of the study

After the previous analysis, the research conclusions of this paper are as follows:

First, FinTech evolution significantly boosts innovation in manufacturing SMEs, enhancing their innovation vitality as FinTech advances.

Second, Financing constraints mediate FinTech's role in promoting innovation. By leveraging digital technology, FinTech enables financial institutions to access more "non-public information," reducing information asymmetry, easing financing constraints, and freeing capital for innovation.

4.2 Policy recommendations

To enhance finance's role in supporting the real economy, the government should guide and regulate FinTech to ensure its healthy development. Simultaneously, banks, as key financial intermediaries, should leverage digital technology to streamline credit processes and reducing costs.

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