FinTech and Corporate Innovation Efficiency

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Abstract. Based on data from Shanghai and Shenzhen A-share listed companies from 2012 to 2023, this paper empirically examines the impact of FinTech on innovation efficiency. The findings are as follows: (1) The development of FinTech significantly improves corporate innovation efficiency, a conclusion that remains valid after a series of robustness tests. (2) Mechanism analysis indicates that FinTech primarily enhances corporate innovation efficiency by reducing corporate debt financing costs and promoting supply chain digitalization. (3) Heterogeneity analysis reveals that the efficiency-enhancing effect of FinTech is more pronounced in enterprises without material weaknesses and in those located in eastern and central regions. This study not only deepens the understanding of the micro-level mechanisms through which FinTech empowers corporate innovation from an "efficiency" perspective but also provides empirical evidence for differentiated policymaking and corporate digital transformation practices.

Keywords: FinTech; Corporate Innovation Efficiency; Debt Financing Costs; Supply Chain Digitalization

1 Introduction

Currently, whether fintech can break through the limitations of traditional finance and shift from alleviating financing constraints to enhancing innovation efficiency is the core issue that needs to be clarified urgently. This raises a series of questions requiring in-depth consideration: First, does the development of FinTech have a significant enhancing effect on corporate innovation efficiency? That is, does a robust causal relationship exist between the two? Second, if there is an effect, through which specific channels or mechanisms does FinTech impact corporate innovation efficiency? Third, does the effect of this impact vary systematically among different types of enterprises? Clarifying these questions is essential for accurately assessing the policy effectiveness of FinTech and guiding its healthy development. Accordingly, this study, based on data from A-share listed companies from 2012 to 2023, aims to empirically examine the impact of FinTech on corporate innovation efficiency and its internal mechanisms.

The marginal contributions of this study are mainly in the following three aspects: First, it shifts the research focus from the scale of innovation to its efficiency, directly

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addressing the core concern of high-quality development. Second, it validates the overall effect and provides a more in-depth analysis of the multiple transmission paths through which FinTech influences innovation efficiency. Third, through heterogeneity analysis, it reveals the specific conditions under which the effects manifest, offering more precise insights for differentiated policies and corporate practices.

2 Literature Review

Recent work positions fintech as a key external driver of corporate innovation. On green innovation, Li and Xu (2026) highlight factor misallocation relief and knowledge search expansion as channels, conditional on strong property rights and regulation[1]. Wang and Gu (2026) identify reduced agency costs, eased financing constraints, and stronger internal controls — effects more pronounced in non-state-owned, highly digitized, and tightly regulated firms[2]. Regarding innovation quality, Jiang and Zhu (2025) find fintech raises both quantity and quality, with financing constraint mitigation and digital transformation as positive moderators[3]. Li and Xu (2025) add resource optimization, knowledge accumulation, and external oversight, noting synergy with science and technology finance policies[4]. On mechanisms, Su (2024) shows fintech fosters digital innovation via financing constraints, resource allocation, and subsidy effects, especially in state-owned and high-tech sectors[5]. Yang and Li (2024) distinguish external environments (alleviating external constraints) from internal development levels[6]. Jiang (2023) confirms fintech's positive effect on innovation efficiency in trade firms, with corporate culture moderating[7]. For innovation types, Liu and Hua (2022) demonstrate fintech favors substantive innovation by easing financing constraints, lowering credit costs, and enhancing subsidy incentives[8].

3 Research Design

(I) Model Specification

To further investigate the intrinsic relationship between FinTech and corporate innovation efficiency, this study establishes the following model:

$$InnoEff_{it} = \alpha_0 + \beta_0 Fintech_{it} + \sum \gamma_k Control_{it} + \varepsilon_{it} \quad (1)$$

In this equation, $InnoEff$, $Fintech$, $Controls$, ε represent corporate innovation efficiency, FinTech, a set of control variables, and the error term, respectively. α_0 denotes the constant term, β_0 and γ_k represent the coefficients for the corresponding variables.

(II) Variable Definitions

Explained Variable——Corporate Innovation Efficiency (InnoEFF), This study uses the number of patent applications per unit of R&D investment as a comprehensive

indicator of innovation efficiency. The specific calculation formula is: InnoEFF=ln (invention, utility model, and design patents+1)/ ln(1+R&D expenditure).

Core Explanatory Variable——FinTech, this study employs a machine learning method to extract the word frequency of 124 FinTech-related keywords from corporate annual reports. These keywords span six dimensions: artificial intelligence, blockchain, cloud computing, big data, online operations, and mobility. The resulting data is logarithmically transformed to obtain the FinTech development level for each firm in each year[9].

Control Variables. This study selects a series of control variables at both the corporate and macro levels, specifically including: (1) Firm-level variables: Firm size (Size), profitability, solvency, liquidity level, firm age, board size, executive compensation, shareholding concentration, and price-to-earnings ratio (P/E ratio); (2) Macro-level variables: Regional economic development level, regional industrial structure, and regional financial development level.

(III) Data Sources and Descriptive Statistics

This study selects A-share listed companies on the Shanghai and Shenzhen stock exchanges from 2012 to 2023 as the initial research sample. Samples with extensive missing data are excluded, and data for all variables are matched and integrated. Regarding data sources, the FinTech data is extracted from listed companies' annual reports; corporate innovation efficiency data is sourced from the CNRDS database; other firm-level data comes from the CSMAR database; and macro-level data is obtained from the Wind database. The descriptive statistics for all variables are detailed in Table 1.

Table 1. Descriptive Statistics of Variables.

VarName	Obs	Mean	SD	Min	Max
InnoEff	22297	0.168	0.082	0.000	0.441
Fintech	25701	3.496	1.323	0.000	6.263
Size	25486	3.093	0.061	2.848	3.357
ROA	25485	0.052	0.061	-0.163	0.171
Leverage	22908	1.172	0.564	0.630	4.947
Liquidity	25457	0.780	2.047	-5.723	8.204
Board	17692	8.331	1.646	0.000	17.000
Salary	17644	0.312	0.376	0.005	1.689
Age	25483	9.213	8.380	0.000	27.000
PE	21658	58.711	86.751	6.843	550.452
Top5	25241	0.483	0.187	0.200	0.991
Industry	25691	55.495	10.550	34.500	84.800
GDP	25691	10.775	0.748	6.565	11.818
Finance	25691	1.702	0.440	0.701	2.998

4 Empirical Analysis

(I) Basic Regression Analysis

The basic regression results are presented in Table 2 below. It can be observed that the regression coefficient of the core explanatory variable (Fintech) remains consistently positive and statistically significant across models (1) to (4). This indicates that financial technology enhances corporate innovation efficiency.

Table 2. Basic Regression Results.

VARIABLES	(1) InnoEff	(2) InnoEff	(3) InnoEff	(4) InnoEff
Fintech	0.0166***	0.0112***	0.0109***	0.0084***
	(38.25)	(24.20)	(19.09)	(13.45)
Enterprise financial control variables	NO	YES	YES	YES
Enterprise governance control variables	NO	NO	YES	YES
Macroeconomic control variables	NO	NO	NO	YES
Observations	22,297	19,942	13,690	13,684

Note: z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

(II) Robustness Analysis

First, the dependent variable is replaced. Innovation efficiency is now measured as InnoEFF2 = Patent2 / ln(1+R&D expenditure), where Patent2 equals the weighted sum of invention, utility model, and design patents (3:2:1 ratio) plus one. Table 3, column (1) shows the Fintech coefficient remains significantly positive. Second, the explanatory variable is lagged by one period. The regression result is shown in column (2) of Table 3. The coefficient for the one-period lagged FinTech variable (lag_Fintech) remains significantly positive. Third, a two-way fixed effects model is applied. The regression result is shown in column (3) of Table 3. The coefficient for the core explanatory variable (Fintech) again remains significantly positive, further indicating that FinTech enhances corporate innovation efficiency.

Table 3. Robustness Test Results.

VARIABLES	(1) Replacing Explained Variable	(2) Using Lagged Explanatory Variable	(3) Using Two-way Fixed Effects Model
Fintech	0.0087***		0.0046***
	(12.28)		(5.59)
lag_Fintech		0.0084***	
		(12.35)	

Control variables	YES	YES	YES
Observations	13,684	10,407	13,684

Note: z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

(III) Mechanism Analysis

This study measures corporate debt financing costs (Cost) as interest and financial expenses divided by total liabilities. Table 4, columns (1)-(2) show Fintech significantly reduces Cost, and Cost negatively affects innovation efficiency (InnoEff); thus, Fintech enhances innovation by lowering debt costs. For supply chain digitalization (Digital), using dictionary-based text analysis of MD&A sections, columns (3)-(4) confirm Fintech positively drives Digital, which in turn boosts InnoEff. Hence, Fintech also improves innovation via advancing supply chain digitalization.

Table 4. Results of Mechanism Tests.

VARIABLES	(1) Cost	(2) InnoEff	(3) Digital	(4) InnoEff
Fintech	-0.0013***	0.0083***	0.0011***	0.0082***
	(-9.71)	(13.31)	(11.57)	(13.10)
Cost		-0.0896***		
		(-2.85)		
Digital				0.1693***
				(3.20)
Control variables	YES	YES	YES	YES
Observations	15,103	13,684	14,684	13,446

Note: z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

(IV) Heterogeneity Analysis

This study further explores how FinTech's impact on corporate innovation efficiency varies by governance quality and region. Table 5 shows that FinTech significantly boosts efficiency only in firms without material internal control weaknesses (columns 1-2), indicating sound governance is a prerequisite. Geographically, FinTech enhances efficiency in eastern and central regions (columns 3-5) due to mature financial markets and digital infrastructure, but not in the western region, where weaker financial deepening and digital divides limit its spillover effects. Thus, FinTech's innovation effect operates under clear boundary conditions.

Table 5. Results of Heterogeneity Tests.

VARIABLES	(1) Enterprises with Material Weaknesses	(2) Enterprises without Material Weaknesses	(3) Eastern Region	(4) Central Region	(5) Western Region
Fintech	0.0403	0.0050***	0.0051***	0.0072***	0.0034

	(1.60)	(6.18)	(5.58)	(2.93)	(1.27)
Control variables	YES	YES	YES	YES	YES
Observations	89	13,595	10,775	1,645	1,203

Note: z-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

5 Conclusion

Based on data from Shanghai and Shenzhen A-share listed companies spanning 2012 to 2023, this paper empirically examines the impact of FinTech on corporate innovation efficiency. The findings are as follows: First, the development of FinTech significantly enhances corporate innovation efficiency. This conclusion remains robust after a series of tests, including substituting the original dependent variable, using a one-period lagged explanatory variable, and employing a two-way fixed effects model. Second, the mechanism analysis indicates that FinTech improves corporate innovation efficiency by reducing corporate debt financing costs and promoting supply chain digitalization. Third, heterogeneity analysis reveals that for firms without material weaknesses and for those located in eastern and central regions, FinTech significantly boosts innovation efficiency. In contrast, this effect is not significant for firms with material weaknesses or for those situated in western regions.

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