Research on the impact of fintech on corporate technological innovation: A sample test of A-share listed companies based on non-financial institutions

Zhesheng Yu[*]

Business School, University of Birmingham, Birmingham, United Kingdom

*Corresponding author: Zheshengyu@gmail.com

Keywords: Fintech; Enterprise technology innovation; Level of digitization; R&d investment

Abstract: The integration of financial services and Internet technology, known as fintech, has the potential to positively influence numerous aspects of enterprise development. This paper evaluates the relationship and mechanism between corporate technological innovation and fintech using data from Chinese A-share listed companies from 2010 to 2022. The research discovers that fintech has the potential to considerably enhance the technological innovation of enterprises. This conclusion remains valid following a series of robustness tests and endogeneity treatment. In terms of mechanism, this paper demonstrates that fintech can foster corporate technological innovation by enhancing the level of digitalization and increasing R&D investment. Additional research indicates that the promotion effect of fintech on technological innovation is more substantial in high-tech enterprises and non-state-owned enterprises. This paper enhances the research on the economic repercussions of fintech, investigates the mechanism of action between the two, and offers targeted development recommendations from the perspective of enterprises and governments, which have a certain practical significance.

1. Introduction

High-quality economic development and industrial transformation are closely linked to enterprise participation, with technological innovation being key to sustaining their vitality. Enterprises drive economic growth, making innovation crucial for social and economic advancement. However, factors like limited funds, uncertainties, and high risks hinder technological innovation. Fintech can stimulate innovation by using data mining algorithms to monitor and predict progress, reducing information asymmetry in the process [1]. Technologies such as big data, blockchain, and cloud computing further enable fintech to support innovation [1]. Numerous scholars have explored fintech's influence on investment [1], financing [2], capital [3], and enterprise value [4], recognizing its spillover effect. While research exists on policy, environment [5], technology [6], and management [7], little focuses on fintech's role in digital transformation and R&D investment. Theoretically, fintech can enhance innovation by lowering costs, providing resources, and supporting digital transformation. This paper contributes by (1) examining the link between fintech and technological innovation at the micro level, highlighting fintech's positive impact; (2) analyzing heterogeneity based on property rights and high-tech industry membership; and (3) offering practical recommendations for fintech implementation and policy support to boost innovation.

2. Literature review

The concept of fintech first appeared in the scientific literature in 1972, where it was defined as a financial technology that could combine banking expertise with technologies such as modern computers[8]. Nowadays, people believe that fintech is the connection between Internet technology and typical financial service business, in which Internet technology includes cloud computing, big data, mobile Internet, etc., while typical financial service business includes payment, loan, etc. [9]. In the process of relying on advanced Internet technology and integrating with financial business,

fintech has had a positive impact on many aspects of national and social development, and fintech has also been a hot topic of academic research in recent years.

3. Theoretical analysis

3.1 Path analysis based on increasing enterprise R&D investment

Fintech promotes technological innovation by increasing corporate R&D investment. On one hand, continuous R&D investment is crucial for technological innovation, and fintech effectively enhances the intensity of such investments. Ye et al. (2024) suggest that fintech identifies valuable innovation projects and supports R&D decisions. Additionally, fintech helps companies expand financing channels, providing sufficient financial backing for increased R&D spending. Ren and Wang (2024) noted that fintech alleviates funding constraints and encourages higher R&D investment. More R&D spending, in turn, boosts technological innovation, as Duan (2020) showed that increasing R&D investment strengthens innovation accumulation and achievement transformation. Thus, fintech raises the level of technological innovation by driving greater R&D investment. This paper proposes hypothesis:

H1: The technological innovation of enterprises can be substantially enhanced by fintech.

H2: The digitalization level of enterprises can be enhanced by fintech by enhancing the technological innovation level of enterprises.

H3: Enterprises can enhance their technological innovation levels by expanding their R&D investment through fintech.

4. Research design

4.1 Sample selection and data sources

The initial sample in this paper is comprised of data from China's A-share listed corporations from 2010 to 2020. The data undergoes the subsequent operations: (1) The samples of financial enterprises are excluded; (2) ST and *ST enterprise samples are eliminated; (3) missing variable observation values are removed from the samples; (4) the influence of extreme values is controlled, and all continuous variables are Winsorise at 1% and 99%. Following the aforementioned sifting, a total of 33676 samples are obtained in this paper. The CSMAR database and the Wind database are the primary sources of data for this paper.

4.2 Variable Definition

4.2.1 Explained variable: Enterprise technological innovation

This paper, which is based on the research of Gao et al. (2024), employs the ratio of R&D investment to total assets to assess enterprise technological innovation (Innovation). The R&D investment intensity is employed in this paper to represent the technological innovation of enterprises.

4.2.2 Core explanatory variable: Fintech

Referring to the research of Song et al. (2021), this study calculates the enterprise's fintech level by dividing the annual number of fintech companies in the prefecture-level city where the enterprise is located by 100,000. Keywords like "fintech," "cloud computing," "big data," and "blockchain" are retrieved from the Tianyancha website. Only the samples that contain keywords in the company name or business scope are kept. Then, we use regular expressions to fuzzy match financial related keywords such as "finance," "insurance," "credit," and "liquidation" in the company's business scope, and retain the samples with successful matching.

4.2.3 Control variables

In order to control other economic characteristics affecting enterprise technological innovation, this paper introduces a series of control variables (as shown in Table 1). It includes return on total

assets (*Roa*), enterprise Age (*Age*), ownership nature (*Soe*), asset-liability ratio (*Lev*), Dual (*Dual*), board Size (*Bsize*), management shareholding ratio (*Mh*) and company size (*Size*).

Table 1: Main variables

Type	Variables	Symbol	Definition
Variable explained	Enterprise technology innovation	*Innovation*	R&D investment / Total assets
Explanatory variables	Financial Technology	*Fintech*	The annual count of fintech companies in the prefecture-level metropolis where the enterprise is situated is divided by 100,000.
Control variables	Return on total assets	*Roa*	Net profit/total assets
	Age of enterprise	*Age*	The difference between the year of establishment of the enterprise and the corresponding year is calculated by taking the natural logarithm after adding one.
	Nature of equity	*Soe*	If the enterprise is a state-owned enterprise, the value is 1, and otherwise, it is 0.
	Asset-liability ratio	*Lev*	Total liabilities/total assets
	Two in one	*Dual*	The value is 1 when the chairman and the general manager hold concurrent positions, and 0 otherwise
	Size of the Board	*Bsize*	Natural logarithm of the number of board members
	Management shareholding ratio	*Mh*	Management shareholding ratio
	Size of company	*Size*	The total assets of the company at the conclusion of the period are calculated as the natural logarithm.
	Industry	*Ind*	Dummy variable
	Year	*Year*	Dummy variable

4.2.4 Descriptive statistics of main variables

The descriptive statistical results of the primary variables are presented in Table 2. The maximum value of *Innovation* is 0.1103, the minimum is 0.0000, and the standard deviation is 00212; the maximum of *Fintech* is 0.0320, the minimum value is 0.0000, and the standard deviation is 0.0101.

Table 2: Descriptive statistics

Variable	Number	Mean	Standard	Median	Minimum	Maximum
Innovation	33676	0.0208	0.0212	0.0169	0.0000	0.1103
Fintech	33676	0.0066	0.0101	0.0013	0.0000	0.0320
Roa	33676	0.0378	0.0646	0.0390	-0.2681	0.2027
Age	33676	2.8977	0.3444	2.9444	1.7918	3.5264
Soe	33676	0.3636	0.4810	0.0000	0.0000	1.0000
Lev	33676	0.4171	0.2124	0.4057	0.0484	0.9375
Dual	33676	0.2949	0.4560	0.0000	0.0000	1.0000
Bsize	33676	2.1204	0.1974	2.1972	1.6094	2.6391
Mh	33676	14.0156	19.9887	0.6847	0.0000	68.2575
Size	33676	22.1463	1.3161	21.9512	19.6873	26.2576

4.3 Model setting

4.3.1 Benchmark model

The following model is established to investigate the relationship between fintech and enterprise technological innovation:

$$Innovation_{i,t} = \beta_0 + \beta_1 Fintech_{i,t} + \sum \gamma CVs + \sum Ind + \sum Year + \varepsilon \qquad (1)$$

The explained variable of the model is enterprise *Innovation*, and the core explanatory variable is *Fintech*. This paper adopts fixed effects, and industry (*Ind*) and time (*Year*) fixed effects are controlled in the model.

4.3.2 Mediating effect model

In order to evaluate the mechanism role of enterprise digitalization level and R&D investment in the influence of fintech on enterprise technological innovation, this paper draws on the research of Jiang (2022) and uses the mediation two-step method to run regression on Models (1) and (2), and *Mechanism_{i,t}* represents the mediating variable.

$$Mechanism_{i,t} = \beta_0 + \beta_1 Fintech_{i,t} + \sum \gamma CVs + \sum Ind + \sum Year + \varepsilon \qquad (2)$$

5. Analysis of empirical results

5.1 Analysis of benchmark regression

Table 3 displays the regression results of fintech on corporate technological innovation. The findings suggest that fintech has the potential to substantially enhance the level of technological innovation within enterprises, which is in accordance with the previous research hypothesis H1. Column (1) shows that control variables are added without controlling industry and year, and Fintech's regression coefficient is significantly positive at the level of 1%. The regression coefficient of Fintech remains substantially positive at the 1% level, as evidenced by the results of the addition of industry and year fixed effects in Column 2.

Table 3: Benchmark regression results

Variables	Innovation	
	(1)	(2)
Fintech	0.3859***	0.1748***
	(29.77)	(15.66)
Roa	0.0125***	0.0242***
	(5.40)	(11.84)
Age	-0.0013***	-0.0039***
	(-4.14)	(-12.44)
Soe	-0.0053***	-0.0006***
	(-19.81)	(-2.74)
Lev	-0.0118***	-0.0019***
	(-18.51)	(-3.34)
Dual	0.0022***	0.0011***
	(8.58)	(4.99)
Bsize	-0.0011*	0.0025***
	(-1.84)	(5.07)
Mh	0.0001***	0.0000***
	(15.02)	(6.11)
Size	-0.0009***	-0.0004***
	(-9.22)	(-4.66)
Cons	0.0485***	0.0163***
	(20.64)	(6.82)
Ind	No	Yes
Year	No	Yes
N	33676	33676
R^2	0.1476	0.4496

5.2 Robustness test

5.2.1 Replace explained variables

The proxy variable for enterprise technological innovation (Patent) in this paper is the number of invention patent applications of enterprises plus one, and then substitutes patent for innovation in the regression model to test the null hypothesis, as per the research of Ye and Zhang (2024). In addition, the logarithm is employed as the proxy variable. The regression results of the original model with the explained variable replaced are reported in Column (2) of Table 4. At a significance level of 1%, there is still a positive correlation between fintech and enterprise technological innovation.

Table 4: Regression results of replacing explained variables

Variables	Patent	
	(1)	(2)
Fintech	9.3082***	3.8781***
	(11.13)	(5.21)
Roa	0.2421*	0.6026***
	(1.95)	(5.48)
Age	-0.0854***	-0.0662***
	(-3.56)	(-2.94)
Soe	-0.1550***	0.1778***
	(-7.44)	(10.12)
Lev	-0.6322***	-0.2107***
	(-14.15)	(-5.37)
Dual	0.0982***	0.0481***
	(5.56)	(3.20)
Bsize	-0.0225	0.1702***
	(-0.50)	(4.61)
Mh	0.0072***	0.0023***
	(16.76)	(5.97)
Size	0.5294***	0.6041***
	(63.95)	(83.79)
Cons	-9.5018***	-12.9622***
	(-48.91)	(-66.45)
Ind	No	Yes
Year	No	Yes
N	33676	33676
R^2	0.1572	0.4509

5.2.2 Replacing core explanatory variables

This paper, which draws from the research of Guo and Shen (2015), uses the Baidu search engine to calculate the word frequency of 12 fintech-related keywords. The ratio of the number of original keywords in annual news to the total number of annual news is then used as the annual word frequency of keywords to determine the fintech development level of a city. As the fintech (frequency) proxy variable. Then, Frequency substitutes Innovation into the regression model to test the null hypothesis. Table 5's Column (2) presents the regression outcomes of the initial model subsequent to the substitution of the primary explanatory variables.

Table 5: Regression results with replacement of core explanatory variables

Variables	Innovation	
	(1)	(2)
Frequency	0.0033***	0.0017***

	(43.05)	(15.21)
Roa	0.0215***	0.0272***
	(9.31)	(13.01)
Age	-0.0062***	-0.0036***
	(-17.21)	(-11.51)
Soe	-0.0036***	-0.0004*
	(-13.08)	(-1.76)
Lev	-0.0079***	-0.0017***
	(-12.44)	(-2.91)
Dual	0.0017***	0.0010***
	(6.30)	(4.41)
Bsize	0.0009	0.0024***
	(1.49)	(4.62)
Mh	0.0001***	0.0000***
	(12.48)	(6.26)
Size	-0.0017***	-0.0005***
	(-16.86)	(-5.67)
Cons	0.0607***	0.0146***
	(24.70)	(5.80)
Ind	No	Yes
Year	No	Yes
N	29275	29275
R^2	0.1772	0.4497

5.2.3 Excluding samples during the epidemic

COVID-19 in 2019 has had a huge negative impact on China's economic development and enterprise operations from 2019 to 2022. In order to eliminate the impact of the epidemic, this paper excludes the samples during the epidemic period from 2020 to 2022 and conducts regression. Column (2) of Table 6 shows that after excluding the samples during the epidemic, the coefficient between *Fintech* and enterprise technological innovation is 0.1365, still significant at the 1% significance level, which can prove the robustness of the model in this paper.

Table 6: Regression results excluding samples during the pandemic

Variables	Innovation	
	(1)	(2)
Fintech	0.1748***	0.1365***
	(15.66)	(8.76)
Roa	0.0242***	0.0315***
	(11.84)	(13.61)
Age	-0.0039***	-0.0035***
	(-12.44)	(-10.40)
Soe	-0.0006***	-0.0001
	(-2.74)	(-0.46)
Lev	-0.0019***	-0.0025***
	(-3.34)	(-3.98)
Dual	0.0011***	0.0008***
	(4.99)	(3.34)
Bsize	0.0025***	0.0025***
	(5.07)	(4.38)
Mh	0.0000***	0.0000***
	(6.11)	(6.40)
Size	-0.0004***	-0.0006***

	(-4.66)	(-5.91)
Cons	0.0163*** (6.82)	0.0200*** (7.06)
Ind	Yes	Yes
Year	Yes	Yes
N	33676	22484
R^2	0.4496	0.4467

5.2.4 Instrumental variable method

Endogeneity issues may exist between corporate technological innovation and fintech. This paper employs the one-period-lagged term of the primary explanatory variable as the instrumental variable of fintech to mitigate the impact of endogeneity on the conclusion. The instrumental variable satisfies the conditions of exogeneity and correlation. The regression analysis in this paper employs the two-stage least squares method, and the results are presented in Table 7. The coefficient between fintech and enterprise technological innovation is still positive and significant at the 1% level, as demonstrated in Column 2. This suggests that the effect of fintech on improving enterprise technological innovation can still be demonstrated to be robust, even after accounting for endogeneity.

Table 7: Regression results of instrumental variable method

Variables	Fintech	Innovation
	(1)	(2)
Fintech		0.1651*** (15.86)
L.Fintech	1.0473*** (790.62)	
Roa	0.0007*** (3.65)	0.0257*** (16.27)
Age	-0.0001 (-1.51)	-0.0040*** (-11.93)
Soe	0.0001*** (3.55)	-0.0003 (-1.33)
Lev	-0.0002** (-2.18)	-0.0025*** (-4.23)
Dual	0.0000* (1.71)	0.0011*** (5.02)
Bsize	-0.0001** (-2.23)	0.0024*** (4.82)
Mh	0.0000*** (6.14)	0.0000*** (8.27)
Size	0.0001*** (7.79)	-0.0005*** (-4.80)
Cons	-0.0023*** (-6.81)	0.0329*** (11.86)
Ind	No	Yes
Year	No	Yes
N	29145	29145
Weak instrumental variables are tested for F-values	625077	

6. Mechanism test

6.1 Test of digitization level mechanism

Using the text analysis method, this paper constructs the enterprise digital transformation index (DT) as a measurement method of enterprise digitalization level. To evaluate the mechanism, it employs the two-step method of mediating effect model, as per the research of Wu Fei et al. (2021). Table 8 displays the regression results of the mediating effect model (2). Consequently, fintech has the potential to stimulate enterprise technological innovation by enhancing enterprise digitalization, which is in accordance with Hypothesis H2 above.

6.2 R&D investment mechanism test

This paper employs the two-step method of mediating effect model to evaluate the mechanism, utilizing the total R&D expenditure disclosed in the annual report of enterprises as the measurement method of enterprise R&D Input (Input). Table 8 displays the regression results of the mediating effect model (2). Consequently, the level of enterprise technological innovation can be enhanced by fintech by increasing R&D investment, which is in accordance with Hypothesis H3 above.

Table 8: Results of the mechanism test

Variables	DT	Input
	(1)	(2)
Fintech	7.8407***	8.8364***
	(11.70)	(10.44)
Roa	-0.4895***	-0.0383
	(-4.71)	(-0.82)
Age	0.0001	-0.1484***
	(0.00)	(-6.89)
Soe	-0.1779***	0.0292**
	(-11.94)	(2.19)
Lev	-0.0586*	-0.1912***
	(-1.65)	(-8.85)
Dual	0.0585***	0.0124
	(4.31)	(1.22)
Bsize	0.0376	-0.1925***
	(1.21)	(-4.72)
Mh	0.0006*	-0.0005***
	(1.73)	(-3.43)
Size	0.1719***	0.3051***
	(30.58)	(25.98)
Cons	-3.4987***	-5.7488***
	(-23.02)	(-27.86)
Ind	Yes	Yes
Year	Yes	Yes
N	33676	33676
R^2	0.4893	0.2286

7. Further analysis

7.1 Heterogeneity analysis based on enterprise property rights

The enterprise property right is a relatively apparent distinguishing characteristic of Chinese enterprises. Enterprises with varying property rights may induce distinct corporate behaviors in response to fintech, which subsequently has an asymmetric effect on corporate technological innovation. Table 9 illustrates that the coefficient between fintech and enterprise technological

innovation is 0.2592 and significant at the 1% significance level for non-state-owned enterprises, as indicated by this regression analysis. Conversely, the coefficient between fintech and enterprise technological innovation is 0.0170 and insignificant for state-owned enterprises. This demonstrates that fintech has a more significant impact on the promotion of technological innovation in non-soes than on soes. State-owned enterprises may not have a strong subjective motivation to develop innovative technologies through fintech, as they take policy support from various aspects of the state and have special advantages in resources and funds. Conversely, non-state-owned enterprises must employ alternative strategies to satisfy their developmental needs in the absence of national policy support, and fintech is an effective approach. Simultaneously, non-soes are more inclined to employ fintech to enhance their technological innovation level, as they have greater innovation requirements than soes. As a result, fintech has a more substantial impact on the technological innovation level of non-SOEs.

7.2 Heterogeneity analysis based on whether enterprises are in high-tech industries

The influence of fintech on corporate technology innovation may differ based on the organization's membership in a high-tech industry. Table 9 indicates that the coefficient between fintech and enterprise technological innovation for high-tech enterprises is 0.2150 and significant at the 1% level, as indicated by this regression analysis. Conversely, the coefficient between fintech and enterprise technological innovation for non-high-tech enterprises is 0.0835 and significant at the 1% level. Nevertheless, the coefficient is considerably lower than that of enterprises in high-tech sectors. This illustrates that fintech has a more significant effect on the technical innovation of businesses in high-tech sectors than it does on businesses in non-high-tech industries. The potential explanation is that high-tech enterprises are more susceptible to the effects of fintech due to their increased sensitivity to technological R&D. Furthermore, the technology iteration speed of high-tech industries is rapid, and high-tech enterprises are also under increased competitive pressure. Consequently, they are more inclined to employ fintech to enhance their technological innovation level. Consequently, fintech is more influential in fostering the technological innovation of high-tech enterprises.

Table 9: Heterogeneity analysis

Variables	Innovation			
	(1)State-owned enterprises	(2)Non-state-owned enterprises	(3)Enterprises in high-tech industries	(4)Enterprises in non-high-tech industries
Fintech	0.0170 (1.17)	0.2592*** (16.98)	0.2150*** (12.31)	0.0836*** (5.60)
Roa	0.0305*** (11.41)	0.0218*** (8.47)	0.0370*** (11.80)	0.0196*** (7.68)
Age	-0.0037*** (-8.06)	-0.0039*** (-9.73)	-0.0031*** (-6.33)	-0.0032*** (-8.33)
Soe	-	-	0.0007* (1.80)	-0.0002 (-0.61)
Lev	-0.0022*** (-2.83)	-0.0021*** (-2.59)	0.0001 (0.09)	-0.0025*** (-3.67)
Dual	-0.0003 (-0.75)	0.0013*** (5.27)	0.0012*** (3.82)	0.0007** (2.46)
Bsize	0.0022*** (3.18)	0.0030*** (4.38)	0.0028*** (3.43)	0.0003 (0.55)
Mh	0.0002*** (4.17)	0.0000*** (5.25)	0.0000*** (2.71)	0.0000*** (4.91)
Size	-0.0004***	-0.0002*	-0.0015***	0.0005***

	(-4.01)	(-1.75)	(-8.32)	(5.02)
Cons	0.0145***	0.0142***	0.0402***	-0.0003
	(4.81)	(3.78)	(9.22)	(-0.10)
Ind	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
N	12244	21432	15410	16198
R^2	0.5148	0.3881	0.2773	0.4954

8. Conclusions and recommendations

Fintech positively impacts businesses by raising technological innovation, a key driver of social and economic progress. This study examines the relationship between fintech and corporate technology innovation using data from Chinese A-share listed companies (2010–2022). Key findings include: (1) Fintech significantly boosts technological innovation, confirmed by robustness tests and endogeneity checks like variable substitution and instrumental methods. (2) Fintech stimulates innovation by increasing R&D investment and digitalization. (3) Non-state-owned and high-tech companies benefit more from fintech's support for innovation.

Recommendations include: (1) Enterprises should leverage big data and fintech tools to drive innovation, optimize their technological and financial integration, and strengthen employee skills in fintech application. (2) Governments should promote fintech through policy support, subsidies, and regulatory frameworks to harness fintech's potential while managing risks. (3) Non-state-owned and high-tech companies should capitalize on fintech's advantages to boost innovation. (4) As fintech enhances digitalization and R&D investment, businesses should increase R&D spending to ensure a strong foundation for technological breakthroughs.

References

[1] He Y, Wang K, Zhang Y, et al. Research on the effect and mechanism of fintech affecting enterprise innovation investment [J]. Journal of Finance and Economics Theory and Practice, 2024, 45(02):25-32.

[2] Zhang L, Xu K, Zhang L, et al. Policy support, fintech and credit financing of small and micro enterprises [J]. Statistical Research, 2023, 40(12):50-61.

[3] Cheng, Y., Yu, M. & Li, B. et al. How fintech promotes the Optimization of corporate capital structure [J]. Financial Regulation Research, 2024, (02):77-97.

[4] Luo S, Sun Y, Yang F, et al. Does fintech innovation promote enterprise transformation? Evidence from China [J]. Technology in Society, 2022, 68: 101821.

[5] Li, Z., Zhao, H. & Sun, S. Optimizing the business environment and the quality of enterprise technology innovation: from the perspective of "patent bubble" [J]. Learning and Exploration, 2024, (04):63-74.

[6] Zhen Meirong, Liu Rui. The Realization mechanism of technological innovation in Digital Enabling Manufacturing Enterprises: Research based on data life cycle theory [J]. Journal of Technical Economics, 2024, 43(03):64-76.

[7] Wang L, Zeng T, Li C. Behavior decision of top management team and enterprise green technology innovation [J]. Journal of Cleaner Production, 2022, 367: 133120.

[8] BETTINGER A.A series of 40 time shared models used at manufacturers Hanover trust company [J]. Interfaces, 1972, 2(4):62-63.

[9] GOMBER P, KOCH J-A, SIERING M. Digital finance and fintech: current research and future research directions [J].Journal of business economics,2017,87(5):537-580.