Research on the Impact of Digital Inclusive Finance on Enterprise Innovation: An Analysis Based on the Moderating Role of Institutional Environment

Yaojun Fan[1]* and Sze-Ting Chen

Received: September 2, 2024. Revised: February 15, 2025. Accepted: April 25, 2025

Abstract

This paper explores the impact of digital inclusive finance on corporate innovation. Using benchmark regression analysis, the study finds that digital inclusive finance significantly enhances corporate innovation, as evidenced by increased patent applications by firms. Robustness checks further corroborate this finding, demonstrating that the positive effect of digital inclusive finance is consistent across various innovation metrics. Additionally, the analysis of the moderating effects of the institutional environment reveals that the degree of marketization significantly amplifies the positive impact of digital inclusive finance on corporate innovation. In regions with a higher level of marketization, the effect of digital inclusive finance on corporate innovation is notably more pronounced. The paper also presents several policy recommendations, including promoting digital inclusive finance, optimizing the institutional environment, enhancing financial technology applications, supporting innovation in small and medium-sized enterprises, and strengthening innovation resource allocation. These measures are proposed to more effectively leverage the role of digital inclusive finance in fostering corporate innovation.

Keywords: Digital Inclusive Finance; Enterprise Innovation; Marketization Level; Moderating Effect;

---

[1] Chinese International College, Dhurakij Pundit University.

Corresponding Email: yaojunfan996@gmail.com

1. Introduction

In today's rapidly developing global economy, innovation has become a key driving force for enterprises to maintain competitiveness and achieve sustainable development. As crucial micro-entities in national economic development, the innovation capability of enterprises not only concerns their growth but also serves as a core driver for a country's overall economic growth and industrial upgrading. In recent years, the Chinese government has significantly promoted enterprise innovation, making it a vital component of the national development strategy. The 2021 "14th Five-Year Plan and 2035 Long-Term Goals Outline" explicitly stated the need to "uphold the central role of innovation in China's overall modernization efforts" and emphasized the importance of "strengthening the principal role of enterprises in innovation and promoting the convergence of various innovation elements toward enterprises." In 2022, the report of the 20th National Congress further highlighted the need to "accelerate the implementation of the innovation-driven development strategy," calling for "thorough implementation of the strategies of rejuvenating the country through science and education, strengthening the nation through talent, and driving development through innovation." The 2023 Government Work Report once again underscored the importance of accelerating the construction of a modern industrial system and enhancing the level of industrial chains, emphasizing the crucial role of enterprise innovation in promoting high-quality development.

However, faced with increasingly fierce market competition and a complex, ever-changing economic environment, many enterprises, especially small and micro enterprises, still encounter numerous challenges in the innovation process, such as insufficient funding, lack of talent, and technological bottlenecks. Therefore, finding effective ways to promote enterprise innovation and enhance core competitiveness has become an urgent issue that needs to be addressed.

At the same time, with the rapid development of information technology and the booming rise of the digital economy, digital inclusive finance, as a new financial model, is reshaping the traditional financial landscape and providing new possibilities for addressing the many challenges faced by enterprise innovation. Digital inclusive finance, by leveraging emerging technologies such as big data, artificial intelligence, and blockchain, has broken through the geographical and temporal limitations of traditional financial services, reduced the cost of financial services, and improved the efficiency of financial resource allocation. This has enabled more enterprises, especially small and micro enterprises, to access more convenient and efficient financial services. In 2022, the People's Bank of China released the "Financial Technology Development Plan (2022-2025)," which explicitly proposed to "promote the empowerment of digital inclusive finance through financial technology" and emphasized the need to "enhance the level of inclusive financial services and improve the capability of financial services for small and micro enterprises and the agriculture sector." In 2023, the "Opinions on Further Deepening Financial Services for Small and Micro Enterprises" further emphasized the need to "innovate financial products and service models and improve the application of financial technology" better to meet the financing needs of small and micro enterprises. Against this backdrop, how does digital inclusive finance impact enterprise innovation? What are its mechanisms of action? Exploring these questions undoubtedly holds significant theoretical value and practical importance.

With the rapid development of digital technology, digital inclusive finance has become a significant force driving financial innovation and the development of inclusive finance. Existing literature generally finds that digital inclusive finance plays a positive role in promoting economic growth (Ahmad et al., 2021; Daud, 2023; Chen et al., 2022), alleviating financing constraints for small and medium-sized enterprises (Lu et al., 2022; Fang & Zhang, 2022; Yang & Zhang, 2020), promoting green development (Wang et al., 2022; Jin et al., 2023; Xue & Zhang, 2022), and reducing income inequality (Liu & Guo, 2023; Peng & Mao, 2023; Shen et

al., 2022). However, its impact exhibits heterogeneity across different regions and groups (Liu et al., 2021; Li & Ma, 2021; Ma & Li, 2021).

Furthermore, enterprise innovation is a crucial engine for economic growth and social progress. As global competition intensifies and technology rapidly advances, innovation has become essential for enterprises to achieve sustainable development. Scholars have conducted in-depth research on enterprise innovation from perspectives such as the institutional environment, digital transformation, executive characteristics, and innovation ecosystems. Regarding the institutional environment, government environmental regulations and subsidy policies significantly impact corporate green innovation (Liu et al., 2021; Shao et al., 2020; Zhang et al., 2022). While R&D subsidies may crowd out enterprises' investments, they help expand the scale of R&D and promote external financing through signaling effects (Boeing et al., 2016; Wu, 2017). Digital transformation is reshaping the innovation model of enterprises. Applying digital technologies can reduce transaction costs, promote servitization, stimulate innovation investment (Li et al., 2022), increase corporate transparency and liquidity, and drive green innovation (Chen & Kim, 2023). In the digital age, enterprise innovation is characterized by greater openness and collaboration (Benitez et al., 2020; Cenamor et al., 2019). Executive characteristics, such as overseas experience and gender, influence their environmental awareness and preferences, affecting corporate innovation behavior (Javed et al., 2023; Yuan & Wen, 2018). The roles of factors such as executive tenure, educational background, and career experience require further exploration. The innovation ecosystem theory provides a new perspective for understanding corporate innovation. The digital innovation ecosystem emphasizes applying digital technologies, discovering entrepreneurial opportunities, and business model innovation (Autio et al., 2018), reshaping how enterprises create value and drive theoretical innovation (Nambisan et al., 2019). The regional institutional environment influences external connections, such as industry-academia collaboration and global innovation networks (Kafouros et al., 2015).

Digital inclusive finance, as a product of the combination of digital technology and inclusive finance, has injected new vitality into enterprise innovation. Existing literature generally finds that digital inclusive finance positively impacts enterprise innovation. Xiong et al. (2023) and Zhu & Li (2021) respectively found that digital inclusive finance significantly promotes innovation in Chinese and agricultural enterprises, outperforming traditional finance, primarily through mechanisms such as alleviating financing constraints and improving market efficiency. Xue and Zhang (2022) and Yang et al. (2022) found that digital inclusive finance can drive corporate green innovation by alleviating financing constraints and promoting ambidextrous innovation, thereby enhancing corporate value. For small and medium-sized enterprises (SMEs), studies by Babilla (2023) and Yao & Yang (2022) indicate that digital inclusive finance helps improve the financing availability for SMEs, promoting their innovative development. However, Chen et al. (2022) and Wang (2022) also point out that the impact of digital inclusive finance varies among enterprises with different ownership structures, regions, and debt levels. Future research needs to explore the underlying mechanisms of this heterogeneous impact further. In summary, developing digital inclusive finance has become essential for promoting enterprise innovation and facilitating high-quality economic development. However, how to tailor strategies to local conditions and implement precise policies better to leverage the innovation-enabling role of digital inclusive finance remains to be further explored.

Although existing literature has made valuable explorations into the relationship between digital inclusive finance and enterprise innovation, there are still some shortcomings. First, most studies focus on the direct effects of digital inclusive finance while neglecting the moderating role of the external institutional environment. Enterprise innovation activities are deeply embedded in the institutional context in which they operate, and different institutional arrangements may influence the innovation effects of digital inclusive finance. Second, existing research often uses overall samples for analysis, lacking an examination of the heterogeneity among

different types of enterprises. Enterprises differ significantly in scale, ownership, and industry, and the innovation effects of digital inclusive finance may vary depending on the type of enterprise. Therefore, future research needs to introduce the perspective of the institutional environment to thoroughly analyze the impact of digital inclusive finance on the innovation of different types of enterprises under various institutional backgrounds and their mechanisms of action. This not only helps to enrich the theoretical understanding of the relationship between digital inclusive finance and enterprise innovation but also provides policy insights for promoting the development of digital inclusive finance in a way tailored to local conditions and better serves the innovation of the real economy.

Based on the background and current research status mentioned above, this paper aims to explore the impact of digital inclusive finance on corporate innovation, focusing on the moderating role of the institutional environment in this process. Specifically, the study will proceed as follows: Firstly, by constructing theoretical models and conducting empirical analysis, it will systematically examine the direct effects of digital inclusive finance on corporate innovation and the mechanisms of these effects. Secondly, from an institutional environment perspective, it will analyze how market-oriented institutional factors moderate the relationship between digital inclusive finance and corporate innovation. Finally, based on the research findings, the paper will propose policy recommendations to promote the development of digital inclusive finance, optimize the institutional environment, and enhance corporate innovation capabilities. Through this in-depth analysis, the study aims to enrich the theoretical understanding of the relationship between digital inclusive finance and corporate innovation, providing valuable references for government policy-making and corporate innovation strategies, thereby contributing to the high-quality development of the economy and the implementation of innovation-driven strategies in China.

2. Theoretical Foundations

2.1 Schumpeter's Innovation Theory

Schumpeter's innovation theory is a crucial theoretical foundation for studying corporate innovation. In his work The Theory of Economic Development, Schumpeter proposed that innovation is the fundamental driving force of economic development, and entrepreneurs are the key actors in driving innovation. He defined innovation as "new combinations of production factors," which include introducing new products, adopting new production methods, opening new markets, acquiring new sources of raw materials or semi-finished goods, and implementing new organizational forms. Schumpeter emphasized that innovation is a dynamic process requiring continuous financial investment and risk-taking. Within this theoretical framework, the development of the financial system is crucial for innovation, as it provides the necessary financial support for innovative activities.

2.2 Financial Development Theory

Financial development theory emphasizes the significant role of the financial system in promoting economic growth and innovation. This theory posits that a sound financial system can foster innovation through various channels. Firstly, financial intermediaries can effectively collect and process information, reducing information asymmetry and better identifying and supporting innovative projects with potential. Secondly, financial markets can disperse risks, making investors more willing to invest in high-risk, high-reward, innovative activities. Lastly, the financial system can enhance the efficiency of resource allocation, transferring funds from less efficient sectors to more efficient ones, thus promoting the optimal allocation of innovative resources.

2.3 Resource-Based View

The resource-based view is a significant theory in strategic management, emphasizing that a firm's competitive advantage stems from its unique resources and capabilities. According to this theory, a firm's innovation capability depends on its ability to acquire and integrate various financial, human, and technological resources. In the innovation process, firms must integrate internal resources and obtain external

resources to support innovative activities. Therefore, a firm's ability to acquire external resources, especially financial ones, significantly impacts its innovation performance.

Analysis of the Impact Mechanism of Digital Inclusive Finance on Corporate Innovation

Based on Schumpeter's innovation theory, digital inclusive finance significantly enhances corporate innovation capabilities by providing convenient financing channels and reducing costs (Wu, 2023; Hou & Cui, 2022). Digital inclusive finance enables companies to obtain the necessary funds more quickly, which can be invested in product, process, and market innovation (Li & Lin, 2023). This financial convenience not only accelerates the innovation process of enterprises but also reduces the uncertainties and funding shortages faced during the financing process, thereby promoting sustained innovation by enterprises (Yao & Yang, 2022).

The information asymmetry theory within financial development theory indicates that digital inclusive finance reduces the problem of information asymmetry in financial markets through extensive data analysis and intelligent risk control technology (Sun, 2023). This technology enhances financial institutions' risk identification and management capabilities, enabling more enterprises, especially small and medium-sized enterprises (SMEs), to access loans and other financial services, thereby supporting their innovation projects (Han & Gu, 2021). By improving risk management capabilities, digital inclusive finance helps enterprises control risks more effectively during the innovation process, ensuring the smooth progress of innovation activities and increasing success rates (Yan et al., 2023).

The Resource-Based View (RBV) posits that a firm's resources and capabilities are crucial to acquiring competitive advantages. Digital inclusive finance enhances firms' resource acquisition and risk management capabilities by providing convenient financing channels and intelligent risk control services, thereby promoting innovation (Wang et al., 2022). By enhancing the firm's ability to allocate and utilize resources

effectively, digital inclusive finance not only provides necessary financial support to enterprises but also optimizes resource allocation efficiency, enabling enterprises to invest more resources into innovation activities and achieve a higher level of innovative development (Wang et al., 2023).

In summary, digital inclusive finance significantly promotes corporate innovation capabilities through three pathways: financing convenience, risk management, and resource allocation efficiency. Digital inclusive finance provides enterprises with ample financial support and risk management safeguards while optimizing resource allocation efficiency, allowing enterprises to focus more on innovation activities and driving continuous innovation and development for enterprises.

The Moderating Role of Institutional Environment

As the external context for corporate operations and innovation activities, the institutional environment may significantly mediate the relationship between digital inclusive finance and corporate innovation (Han & Gu, 2021). This study mainly focuses on the degree of marketization as a critical institutional factor, analyzing how it affects the effectiveness of digital inclusive finance on corporate innovation (Wu, 2023). The degree of marketization refers to the extent to which an economy or region has transitioned towards a market economy, reflecting the decisive role of the market in resource allocation and the rationality of the relationship between the government and the market (Jiang et al., 2022). A highly marketized environment typically features well-established property rights protection systems, less government intervention, sufficient market competition, and well-developed factor markets (Lu & Dagestani, 2023).

Based on institutional theory and the above analysis, we believe that the degree of marketization may moderate the impact of digital inclusive finance on corporate innovation through various mechanisms. Firstly, a highly marketized environment can strengthen resource allocation efficiency, making it more likely for financial resources provided by digital inclusive finance to flow towards enterprises that truly have innovation potential and efficiency (Wang et al., 2023). Secondly, a high degree of marketization is usually accompanied by more comprehensive

legal systems and contract enforcement mechanisms, which help reduce transaction costs and information asymmetry in the process of digital inclusive financial services (Wang et al., 2023). Thirdly, regions with a higher degree of marketization often have more robust competitive environments and more comprehensive intellectual property protection systems, which provide enterprises with more substantial incentives to invest the acquired financial resources into innovation activities (Jiao et al., 2021).

Furthermore, a high degree of marketization may also enhance the role of digital inclusive finance in promoting corporate innovation by improving the quality of financial services, optimizing the innovation ecosystem, and reducing government intervention (Fan et al., 2022). In a highly marketized environment, digital inclusive financial service providers have more substantial incentives to enhance service quality and develop financial products that are more suited to the innovation needs of enterprises (Gu et al., 2023). At the same time, regions with a higher degree of marketization typically have a more comprehensive innovation support system, allowing digital inclusive finance to better synergize with other innovation elements in such an environment, forming an ecosystem more conducive to corporate innovation (Ma et al., 2022).

Based on the analysis above, this study posits that the degree of marketization positively moderates the impact of digital inclusive finance on corporate innovation. In other words, in regions with higher marketization, digital inclusive finance exerts a more substantial promotional effect on corporate innovation. Specifically, the degree of marketization is likely to enhance the positive influence of digital inclusive finance on corporate innovation through mechanisms such as alleviating financing constraints, improving resource allocation efficiency, expanding channels for accessing innovation resources, reducing innovation risks, and fostering an innovation ecosystem.

3. Empirical Analysis

To investigate the impact of digital inclusive finance (dfi) on corporate innovation (gi), this paper employs the following benchmark regression model for empirical analysis. The model incorporates a series of control variables and includes fixed effects for firms and years, with standard errors clustered at the firm level. The benchmark regression model is set up as follows:

$$\mathrm{gi}_{it} = \beta_0 + \beta_1 \mathrm{dfi}_{it} + \beta_2 \mathrm{ROA}_{it} + \beta_3 \mathrm{NetProfit}_{it} + \beta_4 \mathrm{Liquid}_{it} + \beta_5 \mathrm{Cashflow}_{it} + \beta_6 \mathrm{REC}_{it} + \beta_7 \mathrm{FIXED}_{it} + \beta_8 \mathrm{Growth}_{it} + \alpha_i + \lambda_t + \epsilon_{it}$$

In the model, the dependent variable (gi) represents corporate innovation, measured by taking the logarithm of one plus the number of patent applications made by the firm. The independent variable (dfi) denotes the level of digital inclusive finance at the city level, gauged using the "Peking University Digital Inclusive Finance Index." Control variables include Return on Assets (ROA), which measures the profitability of the firm; Net Profit, reflecting the firm's profit level; Liquidity Ratio (Liquid), assessing the firm's short-term debt-paying ability; Cash et al. (Cashflow), indicating the firm's cash flow situation; Receivables Ratio (REC), reflecting the level of accounts receivable; Fixed Assets Ratio (FIXED), measuring the firm's investment in fixed assets; and Growth Rate (Growth), indicating the firm's business growth. To ensure the robustness of the regression results, this paper employs robust standard errors clustered at the firm level, controlling for potential intertemporal correlation and heteroscedasticity issues. The model incorporates fixed effects for both firms and years to control for firm-specific and time-varying effects, ensuring the reliability and explanatory power of the results.

The data used in this paper include the "Peking University Digital Inclusive Finance Index" and relevant corporate data from the CSMAR database. The Digital Inclusive Finance Index is sourced from the Peking University Digital Inclusive Finance Index, while other data are derived from the CSMAR database. The data cover various types of enterprises across multiple industries and span the period from 2011 to 2022.

Descriptive statistics of the data are presented in Table 1.

VarName	Obs	Mean	SD	Median	Min	Max

gi	29919	2.721	1.728	2.833	0.000	9.610
dfi	29919	0.244	0.074	0.260	0.021	0.361
ROA	29919	0.039	0.075	0.038	-1.130	1.285
NetProfit	29919	0.059	0.475	0.067	-37.419	20.907
Liquid	29919	2.497	3.210	1.667	0.026	204.742
Cashflow	29919	0.046	0.074	0.045	-0.742	0.876
REC	29919	0.124	0.107	0.101	0.000	0.813
FIXED	29919	0.207	0.160	0.173	0.000	0.971
Growth	29919	5.342	783.028	0.103	-0.999	1.35e+05

4. Empirical Results

4.1 Benchmark Regression Results

Table 2 presents the benchmark regression results of the impact of digital inclusive finance (dfi) on corporate innovation (gi). Model (1) considers only the effect of digital inclusive finance, while Model (2) incorporates control variables, including Return on Assets (ROA), Net Profit, Liquidity Ratio (Liquid), Cash Flow Ratio (Cashflow), Receivables Ratio (REC), Fixed Assets Ratio (FIXED), and Growth Rate (Growth), along with fixed effects for both firms and years. Standard errors are robust and clustered at the firm level.

In Model (1), the regression coefficient for digital inclusive finance (dfi) is 3.097, significant at the 10% level ($p<0.1$), indicating a significant positive impact of digital inclusive finance on corporate innovation. Upon considering the control variables, Model (2) yields a regression coefficient for digital inclusive finance of 3.185, which remains significant at the 10% level ($p<0.1$), further supporting the conclusion that digital inclusive finance significantly enhances corporate innovation capabilities.

Regarding the control variables, the regression coefficients for Return on Assets (ROA) and Net Profit are 0.322 and 0.027, respectively, both significant at the 1% and 5% levels ($p<0.01$ and $p<0.05$), indicating that a firm's profitability and profit level have a significant positive impact on corporate innovation. The regression coefficients for the Liquidity Ratio (Liquid) and Cash Flow Ratio (cash flow) are insignificant, suggesting that

these variables do not significantly impact corporate innovation. The regression coefficient for the Receivables Ratio (REC) is 0.707, significant at the 1% level ($p<0.01$), indicating a significant positive effect of the receivable ratio on corporate innovation. The regression coefficient for Fixed Assets Ratio (FIXED) is insignificant, suggesting that it does not significantly impact corporate innovation. The regression coefficient for Growth Rate (Growth) is 0.000, significant at the 1% level ($p<0.01$), indicating that a firm's business growth has a significant positive impact on corporate innovation.

In summary, the benchmark regression results indicate that digital inclusive finance significantly promotes corporate innovation, and this conclusion remains valid after controlling for various firm-specific characteristics. Additionally, a firm's profitability, profit level, receivables ratio, and business growth significantly affect corporate innovation. The benchmark regression results in Table 2 provide a solid foundation for the subsequent in-depth analysis in this paper.

Table 2: Benchmark Regression Results

	(1)	(2)
	gi	gi
dfi	3.097*	3.185*
	(1.739)	(1.726)
ROA		0.322***
		(0.116)
NetProfit		0.027**
		(0.011)
Liquid		-0.001
		(0.003)
Cashflow		-0.085
		(0.105)
REC		0.707***
		(0.207)
FIXED		-0.046

		(0.135)
Growth		0.000***
		(0.000)
cons	1.965***	1.858***
	(0.425)	(0.424)
Control	No	YES
Firm_FE	YES	YES
Year_FE	YES	YES
Obs	29919	29919
r2_a	0.774	0.774

4.2 Robustness Checks

This paper conducts two robustness checks to verify the robustness of the benchmark regression results. The first robustness check involves replacing the original dependent variable with the logarithm of one plus the number of invention patent applications (gi2). The second robustness check substitutes the original dependent variable with the research and development expenditure ratio to operating revenue (gi3). Table 3 presents the regression results of these two robustness checks.

In Model (1), the regression coefficient for digital inclusive finance (dfi) on corporate innovation (gi2) is 5.021, significant at the 1% level ($p<0.01$), indicating that digital inclusive finance significantly promotes the number of invention patent applications by firms. Among the control variables, the regression coefficient for Return on Assets (ROA) is 0.270, significant at the 5% level ($p<0.05$); for Net Profit (NetProfit), the coefficient is 0.018, significant at the 10% level ($p<0.1$); for Receivables Ratio (REC), the coefficient is 0.386, significant at the 10% level ($p<0.1$); and for Growth Rate (Growth), the coefficient is 0.000, significant at the 1% level ($p<0.01$). These results are consistent with the benchmark regression findings, further supporting the positive impact of digital inclusive finance on corporate innovation.

In Model (2), the regression coefficient for digital inclusive finance (dfi) on corporate innovation (gi3) is 14.785, significant at the 1% level

($p<0.01$), indicating that digital inclusive finance significantly increases the proportion of research and development expenditure to operating revenue. Among the control variables, the regression coefficient for Net Profit (NetProfit) is -2.832, significant at the 1% level ($p<0.01$); for Liquidity Ratio (Liquid), the coefficient is 0.159, significant at the 5% level ($p<0.05$); for Cash Flow Ratio (Cashflow), the coefficient is -2.981, significant at the 1% level ($p<0.01$); for Receivables Ratio (REC), the coefficient is -3.305, significant at the 1% level ($p<0.01$); and for Fixed Assets Ratio (FIXED), the coefficient is 1.123, significant at the 5% level ($p<0.05$).

In summary, the results of the robustness checks indicate that whether replacing the original dependent variable with the logarithm of one plus the number of invention patent applications (gi2) or with the ratio of research and development expenditure to operating revenue (gi3), the impact of digital inclusive finance (dfi) on corporate innovation remains significant and positive. This further validates the reliability and robustness of the benchmark regression results, demonstrating that digital inclusive finance plays a significant role in promoting corporate innovation.

Table 3: Robustness Check Results

	(1)	(2)
	gi2	gi3
dfi	5.021***	14.785***
	(1.586)	(5.516)
ROA	0.270**	0.844
	(0.106)	(1.115)
NetProfit	0.018*	-2.832***
	(0.010)	(0.580)
Liquid	-0.003	0.159***
	(0.003)	(0.051)
Cashflow	-0.054	-2.981***
	(0.094)	(0.652)
REC	0.386*	-3.305***
	(0.200)	(0.611)

FIXED	-0.178	1.123**
	(0.128)	(0.473)
Growth	0.000***	0.012
	(0.000)	(0.018)
_cons	0.790**	1.281
	(0.390)	(1.367)
Control	YES	YES
Firm_FE	YES	YES
Year_FE	YES	YES
Obs	29919	21280
r2_a	0.762	0.796

4.3 Test of the Moderating Effect of Institutional Environment

To test the moderating effect of the institutional environment (marketization level) on the relationship between digital inclusive finance (dfi) and corporate innovation (gi), this paper measures the marketization level (market) using the ratio of urban private and individual employees to urban employed personnel. It introduces an interaction term between marketization level and digital inclusive finance into the regression analysis. Table 4 presents the regression results of the moderating effect test.

In Model (1), the regression coefficient for the marketization level (market) is -0.072, which is insignificant. The regression coefficient for digital inclusive finance (dfi) is 2.655, which is also insignificant but still indicates a positive influence. The regression coefficient for the interaction term between marketization level and digital inclusive finance (adj) is 0.285, significant at the 10% level ($p < 0.1$), suggesting that the marketization level positively moderates the relationship between digital inclusive finance and corporate innovation.

In Model (2), control variables including Return on Assets (ROA), Net Profit (NetProfit), Liquidity Ratio (Liquid), Cash Flow Ratio (Cashflow), Receivables Ratio (REC), Fixed Assets Ratio (FIXED), and Growth Rate (Growth) were added. With the inclusion of these control variables, the

regression coefficient for digital inclusive finance (dfi) slightly increased to 2.741, yet it remains insignificant. However, the regression coefficient for the interaction term between marketization level and digital inclusive finance (adj) remains at 0.285. It is significant at the 10% level ($p < 0.1$), further supporting the positive moderating effect of marketization level on the relationship between digital inclusive finance and corporate innovation.

Regarding the control variables, the regression coefficient for Return on Assets (ROA) is 0.365, significant at the 1% level ($p<0.01$), indicating a significant positive impact of a firm's profitability on corporate innovation. The regression coefficient for Net Profit (NetProfit) is 0.023, significant at the 5% level ($p < 0.05$), also indicating a positive effect of profit level. The regression coefficient for the Receivables Ratio (REC) is 0.602, significant at the 1% level ($p < 0.01$), suggesting a significant favorable influence of the receivable ratio on corporate innovation. The regression coefficient for Growth Rate (Growth) is 0.000, significant at the 1% level ($p < 0.01$), indicating that a firm's business growth has a significant positive impact on corporate innovation.

In summary, the results of the moderating effect test indicate that the marketization level significantly moderates the impact of digital inclusive finance on corporate innovation. Specifically, a higher level of marketization enhances the positive effect of digital inclusive finance on corporate innovation. This finding suggests that the promotional effect of digital inclusive finance on corporate innovation is more pronounced in regions with a higher degree of marketization, providing an important reference for formulating relevant policies.

Table 4: Results of the Moderating Effect Test

	(1)	(2)
	gi	gi
adj	0.285*	0.285*
	(0.170)	(0.170)
market	-0.072	-0.074

	(0.046)	(0.046)
dfi	2.655	2.741
	(1.799)	(1.799)
ROA		0.365***
		(0.123)
NetProfit		0.023**
		(0.009)
Liquid		-0.003
		(0.003)
Cashflow		-0.032
		(0.110)
REC		0.602***
		(0.207)
FIXED		-0.051
		(0.135)
Growth		0.000***
		(0.000)
_cons	2.073***	1.983***
	(0.420)	(0.423)
Control	NO	YES
Firm_FE	YES	YES
Year_FE	YES	YES
Obs	26129	26129
r2_a	0.789	0.789

5 Conclusions and Recommendations

5.1 Conclusions

This paper investigates the impact of digital inclusive finance on corporate innovation and, through benchmark regression, robustness checks, and analysis of the moderating effects of the institutional environment, arrives at the following key conclusions:

Firstly, the benchmark regression results indicate that digital inclusive finance significantly promotes corporate innovation. By providing

convenient financing channels and reducing financing costs, digital inclusive finance offers vital financial support for corporate innovation activities. This finding suggests that digital inclusive finance plays a significant and positive role in enhancing corporate innovation capabilities.

Secondly, the robustness checks further validate the positive impact of digital inclusive finance on corporate innovation. Regardless of whether the original dependent variable is replaced with the logarithm of one plus the number of invention patent applications (gi2) or the ratio of research and development expenditure to operating revenue (gi3), the effect of digital inclusive finance on corporate innovation remains significant and positive. This indicates that digital inclusive finance has a consistent promotional effect across different measures of innovation.

Lastly, the analysis of the moderating effects of the institutional environment reveals that the level of marketization significantly enhances the promotional effect of digital inclusive finance on corporate innovation. In regions with a higher degree of marketization, the positive impact of digital inclusive finance on corporate innovation is more pronounced. This suggests that the institutional environment plays a crucial moderating role in the relationship between digital inclusive finance and corporate innovation.

5.2 Recommendations

Based on the conclusions drawn from the study, the following policy recommendations are proposed:

Firstly, the government should actively promote the development of digital inclusive finance. Formulate relevant policies and regulations to encourage financial institutions to leverage digital technologies to provide more inclusive financial services, especially for small and medium-sized enterprises (SMEs), thereby reducing the financing costs associated with corporate innovation. Policy support further expands the coverage and impact of digital inclusive finance.

Secondly, optimize the institutional environment and enhance the level of marketization. Improve market transparency and competitiveness to create a favorable institutional environment, strengthening the

promotional effect of digital inclusive finance on corporate innovation. The government can promote the development of private enterprises and individual businesses and increase marketization through reforms and market liberalization, thereby enhancing the effectiveness of digital inclusive finance.

Thirdly, financial institutions should continuously improve the application level of digital technology. They should optimize extensive data analysis and intelligent risk control technology to enhance the efficiency and accuracy of financial services. By improving risk management capabilities, financial institutions can better support corporate innovation projects and provide more precise and efficient financial services to enterprises.

Additionally, the government and financial institutions should pay special attention to the innovation needs of small and medium-sized enterprises (SMEs), offering targeted financial products and services to help SMEs overcome financing challenges and enhance their innovation capabilities and competitiveness. SMEs' healthy development and continuous innovation can be promoted by providing more support and services.

Lastly, enterprises should actively utilize digital inclusive finance tools to enhance resource acquisition and risk management capabilities. By optimizing resource allocation, enterprises can better utilize funds for innovation activities, driving the company towards a higher level of innovative development and strengthening market competitiveness. With these policy recommendations, the significant role of digital inclusive finance in promoting corporate innovation can be better harnessed, facilitating sustained and healthy economic development and achieving high-quality economic growth.

References

Ahmad, M., Majeed, A., Khan, M. A., Sohaib, M., & Shehzad, K. (2021). Digital financial inclusion and economic growth: Provincial data analysis of China. **China Economic Journal, 14**(3), 291-310.

Autio, E., Nambisan, S., Thomas, L. D., & Wright, M. (2018). Digital affordances, spatial affordances, and the genesis of entrepreneurial ecosystems. **Strategic Entrepreneurship Journal, 12**(1), 72–95.

Babilla, T. U. K. (2023). Digital innovation and financial access for small and medium-sized enterprises in a currency union. **Economic Modelling,** 120, 106182.

Benitez, G. B., Ayala, N. F., & Frank, A. G. (2020). Industry 4.0 innovation ecosystems: An evolutionary perspective on value co-creation. **International Journal of Production Economics,** 228, 107735.

Boeing, P., Eberle, J., & Howell, A. (2022). The impact of China's R&D subsidies on R&D investment, technological upgrading, and economic growth. **Technological Forecasting and Social Change**, 174, 121212.

Cenamor, J., Parida, V., & Wincent, J. (2019). How entrepreneurial SMEs compete through digital platforms: The roles of digital platform capability, network capability and ambidexterity. **Journal of Business Research,** 100, 196-206.

Chen, P., & Kim, S. (2023). The impact of digital transformation on innovation performance mediating role of innovation factors. **Heliyon, 9**(3).

Chen, Y., Yang, S., & Li, Q. (2022). How does the development of digital financial inclusion affect the total factor productivity of listed companies? Evidence from China. **Finance Research Letters**, 47, 102956.

Daud, S. N. M. (2023). Financial inclusion, economic growth and the role of digital technology. **Finance Research Letters**, 53, 103602.

Fan, W., Wu, H., & Liu, Y. (2022). Does digital finance induce improved financing for green technological innovation in China? **Discrete Dynamics in Nature and Society, 2022**(1), 6138422.

Fang, D., & Zhang, X. (2021). The protective effect of digital financial inclusion on agricultural supply chain during the COVID-19

pandemic: Evidence from China. **Journal of Theoretical and Applied Electronic Commerce Research, 16**(7), 3202-3217.

Gu, F., Gao, J., Zhu, X., & Ye, J. (2023). The impact of digital inclusive finance on SMEs' technological innovation activities—Empirical analysis based on the data of new third board enterprises. **Plos one, 18**(11), e0293500.

Han, H., & Gu, X. (2021). Linkage between inclusive digital finance and high-tech enterprise innovation performance: role of debt and equity financing. **Frontiers in Psychology**, 12, 814408.

Hou, W., & Cui, Z. (2022). **Research on the impact of digital inclusive finance on enterprise's green innovation --with government grants as a mediating variable**. BCP Business & Management. https://doi.org/10.54691/bcpbm.v25i.1901.

Javed, M., Wang, F., Usman, M., Gull, A. A., & Zaman, Q. U. (2023). Female CEOs and green innovation. **Journal of Business Research**, 157, 113–515.

Jiang, Z., Ma, G., & Zhu, W. (2022). Research on the impact of digital finance on the innovation performance of enterprises. **European Journal of Innovation Management, 25**(6), 804–820.

Jiao, H., Yang, J., & Cui, Y. (2022). Institutional pressure and open innovation: the moderating effect of digital knowledge and experience-based knowledge. **Journal of Knowledge Management, 26**(10), 2499-2527.

Jin, S., Chen, Z., Bao, B., & Zhang, X. (2023). Study on the influence of digital financial inclusion on agricultural carbon emission efficiency in the Yangtze River Economic Belt. **International Journal of Low-Carbon Technologies,** 18, 968-979.

Kafouros, M., Wang, C., Piperopoulos, P., & Zhang, M. (2015). Academic collaborations and firm innovation performance in China: The role of region-specific institutions. **Research Policy, 44**(3), 803–817.

Li, C., Huo, P., Wang, Z., Zhang, W., Liang, F., & Mardani, A. (2023). Digitalization generates equality? Enterprises' digital transformation, financing constraints, and labor share in China. **Journal of Business Research**, 163, 113924.

Li, C., & Lin, Y. (2023). Digital Finance, Enterprise Innovation, and Equity Financing Constraints of Small and Medium-sized Enterprises. **Academic Journal of Business & Management, 5**(19), 153–163.

Li, T., Ma, J., Li, T., & Ma, J. (2021). Does digital finance benefit the income of rural residents? A case study on China. Quant. **Financ. Econ, 5**(4), 664-688.

Liu, G., Huang, Y., & Huang, Z. (2021). Determinants and mechanisms of digital financial inclusion development: Based on urban-rural differences. **Agronomy, 11**(9), 1833.

Liu, L., & Guo, L. (2023). Digital financial inclusion, income inequality, and vulnerability to relative poverty. **Social Indicators Research, 170**(3), 1155-1181.

Liu, Y., Wang, A., & Wu, Y. (2021). Environmental regulation and green innovation: Evidence from China's new environmental protection law. **Journal of Cleaner Production,** 297, 126698.

Lu, F. (2023). How does the financial development environment affect regional innovation capabilities? New perspectives from digital finance and institutional quality. **Journal of Information Economics, 1**(1), 31–46.

Lu, Z., Wu, J., Li, H., & Nguyen, D. K. (2022). Local bank, digital financial inclusion and SME financing constraints: Empirical evidence from China. **Emerging Markets Finance and Trade, 58**(6), 1712-1725.

Ma, J., & Li, Z. (2021). Does digital financial inclusion affect agricultural eco-efficiency? A case study on China. **Agronomy, 11**(10), 1949.

Ma, R., Li, F., & Du, M. (2022). How does environmental regulation and digital finance affect green technological innovation: Evidence from China. **Frontiers in Environmental Science,** 10, 928320.

Nambisan, S., Zahra, S. A., & Luo, Y. (2019). Global platforms and ecosystems: Implications for international business theories. **Journal of International Business Studies,** 50, 1464-1486.

Peng, P., & Mao, H. (2023). The effect of digital financial inclusion on relative poverty among urban households: a case study on China. **Social Indicators Research, 165**(2), 377-407.

Shao, S., Hu, Z., Cao, J., Yang, L., & Guan, D. (2020). Environmental regulation and enterprise innovation: a review. **Business strategy and the environment, 29**(3), 1465-1478.

Shen, H., Luo, T., Gao, Z., Zhang, X., Zhang, W., & Chuang, Y. C. (2023). Digital financial inclusion and the urban–rural income gap in China: Empirical research based on the Theil index. **Economic research-Ekonomska istraživanja, 36**(3).

Sun, A. (2023). Financial Market Stability, Development of Digital Inclusive Finance and Enterprise Innovation Output. **Financial Engineering and Risk Management, 6**(7), 8-19.

Wang, S., Yuan, L., Xiong, Z., & Liu, Y. (2023, April). **The Impact of Digital Inclusive Finance on Enterprise Financing in Fujian Province.** In Proceedings of the 2023 7th International Conference on E-Commerce, E-Business and E-Government (pp. 93-101).

Wang, W., He, T., & Li, Z. (2023). Digital inclusive finance, economic growth and innovative development. **Kybernetes, 52**(9), 3064-3084.

Wang, X., Wang, X., Ren, X., & Wen, F. (2022). Can digital financial inclusion affect the CO2 emissions in China at the prefecture-level? Evidence from a spatial econometric approach. **Energy Economics,** 109, 105966.

Wang, Y. (2023). **The Impact of Commercial Banks' Interest Rate Policies on SME Innovation under Digital Inclusive Finance**. Advances in Economics, Management, and Political Sciences. https://doi.org/10.54254/2754-1169/46/20230337.

Wu, A. (2017). **The signal effect of government R&D subsidies**