

The Impact of Digital Inclusive Finance on the Growth Path of Chinese Private Enterprises: From the Perspective of Financing Constraints

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Abstract

Digital inclusive finance, as an innovative financial service model, is gradually becoming an important means to alleviate financing constraints for private enterprises and promote the sustainable and healthy development of the private economy. To better leverage the role of digital inclusive finance, further research is needed to understand the mechanisms through which it promotes private economic development. This paper first explains the theoretical mechanisms by which digital inclusive finance affects the development of the private economy, focusing primarily on the perspective of financing constraints. Using panel data from 1,329 private enterprises in China from 2016 to 2022, a fixed effects model is employed to empirically analyze the impact mechanisms of digital inclusive finance on the development of the private economy nationwide. The main conclusions are as follows: From 2016 to 2022, both the digital inclusive finance index and the level of private economic development in China showed an upward trend, but significant differences exist between different cities. Through fixed effects analysis, this paper finds that digital inclusive finance promotes the development of the private economy nationwide by alleviating financing constraints.

Keywords: Digital inclusive finance; private economy; financing constraints; fixed effects model

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1.0 Introduction

Since the reform and opening-up, the private economy has gradually risen to become an indispensable driving force in China's economic development. According to statistics from the State Administration for Market Regulation, as of the end of May 2023, the number of private enterprises in China reached 50.9276 million, a 3.7-fold increase compared to 10.857 million at the end of 2012. Meanwhile, the proportion of private enterprises among all enterprises increased from 79.4% to 92.4%, highlighting the increasingly prominent role of the private economy in the development of the national economy. In recent years, with the implementation of a series of government reforms aimed at streamlining administration, delegating power, and improving the business environment, the momentum of private economic development has become even stronger.

However, private enterprises in China still face numerous challenges in their development, with financing difficulties being particularly prominent and serving as a bottleneck that restricts their further growth. One major issue is the "siphoning effect" of financial resources,

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where high-quality financial resources tend to be concentrated in large state-owned enterprises or government-backed projects. Private enterprises, especially small and micro enterprises, often struggle to access equivalent financing opportunities due to factors such as their smaller scale, incomplete credit systems, and lower information transparency. This imbalance in resource allocation directly leads to a situation where private enterprises, in dire need of financial support for expanding production, upgrading and transforming, or coping with market fluctuations, face difficulties in securing financing and the high cost of borrowing.

In addition, the inherent limitations within private enterprises themselves exacerbate the financing problem. On one hand, some private enterprises lack forward-looking development concepts and strategic planning, which undermines investor confidence in them. On the other hand, a shortage of professional talent, particularly in critical areas such as financial management and capital operations, leaves these enterprises at a disadvantage in financing negotiations, risk assessment, and subsequent fund management. Furthermore, issues such as incomplete corporate governance structures and non-standard financial management practices in some private enterprises further diminish their attractiveness to potential financiers.

Moreover, even in an improved financing environment, simply lowering financing thresholds or adopting a "one-size-fits-all" approach to lending cannot effectively resolve the financing difficulties faced by private enterprises. Such measures could trigger a series of chain reactions, such as increasing financial risk. Lowering thresholds might attract enterprises with low-risk tolerance and weak repayment capacity into the credit market, ultimately leading to a higher rate of bad debts. Additionally, failing to fully consider the individual differences and actual needs of enterprises could result in a misallocation of funds, where companies with real growth potential but temporary difficulties may not receive the necessary support.

Since the G20 Summit officially advocated for digital inclusive finance in 2016, this service model has played an increasingly important role in promoting the development of small and micro private enterprises. In the digital economy era, the deep integration of inclusive finance and digital technology has provided new impetus for the development of small and micro private enterprises. Particularly through innovative models of digital inclusive finance, not only have financial service processes been optimized and financing costs reduced, but financing channels for enterprises have also been broadened, facilitating the rapid development of the private economy.

The decision of the 20th Central Committee Third Plenary Session of the Communist Party of China points out the need to improve policies and systems supporting private enterprise financing to address the issues of financing difficulties and high costs. Therefore, this paper explores how digital inclusive finance has promoted the development of the private economy and its mechanisms, as well as whether there are significant differences in effects across different industry sectors. The main content of this paper includes: studying the impact and mechanisms of digital inclusive finance on the development of private enterprises with a focus on 1,329 private enterprises in China; examining the heterogeneity of this impact based on enterprise size; assessing the robustness of the impact of digital inclusive finance on private economic development by replacing independent variables; analyzing the role of financing constraints as a mediating variable in this impact mechanism; and finally, proposing relevant policy recommendations on how to promote the development of digital inclusive finance to support the sustainable development of private enterprises.

This paper delves into how digital inclusive finance influences the growth trajectory of private enterprises in China by alleviating financing constraints. Its marginal contribution lies in addressing gaps in previous literature, which has primarily focused on the impact of digital inclusive finance on the high-quality development of the private economy using data from prefecture-level cities. In contrast, this paper examines a sample of private enterprises nationwide, specifically exploring the effects of digital inclusive finance on their development.

The study employs data from private enterprises and introduces financing constraints as a mediating variable to analyze in detail how digital inclusive finance facilitates the growth of private enterprises by mitigating these constraints. This approach not only deepens the understanding of the specific mechanisms through which digital finance addresses financing challenges but also introduces a new perspective to the theory of private enterprise development, enriching related research. Moreover, these findings provide valuable references for policymakers, guiding the optimization of financial policies to better support private enterprises. They also offer direction for financial institutions, encouraging them to adopt digital transformation and innovative service models to more effectively serve private enterprises. Finally, practical strategic recommendations are provided for private enterprises themselves, helping them leverage digital inclusive finance tools to overcome financing bottlenecks and achieve more robust and sustainable development.

2.0 Theoretical mechanisms and research hypotheses

2.1 The Development of Digital Inclusive Finance

Digital inclusive finance evolved from traditional inclusive finance. With the rapid development of digital technology, both domestic and international scholars have increasingly delved into research on digital inclusive finance.

Internationally, Dev (2006) defined inclusive finance as providing financial services to previously underserved poor and vulnerable groups, effectively addressing financial exclusion issues. Currently, there is no globally standardized measure for digital inclusive finance. Gupte et al. (2012) quantified the availability and application of inclusive finance, establishing a benchmark for its evaluation. Manyika et al. (2016) developed a comprehensive evaluation system based on dimensions such as mobile and smartphone penetration, network coverage, digital payment systems, credit, and insurance services, to assess the development levels of digital inclusive finance in emerging countries like Brazil and China. Klapper et al. (2016) noted that digital finance significantly improves the accessibility and efficiency of financial services by reducing transaction costs and expanding service coverage, especially in developing countries and regions, where digital inclusive finance has become a key driver of economic growth and social development. Beck (2017) further emphasized that digital inclusive finance not only optimizes the allocation of financial resources but also meets the financing needs of various types of enterprises by offering a diverse range of financial products and services.

Domestically, scholars have explored digital inclusive finance extensively in the context of China. Guo Feng et al. (2019) used the "Peking University Digital Inclusive Finance Index" to systematically analyze the development status of digital inclusive finance in China and its impact on economic growth. They found that digital inclusive finance significantly promotes economic growth, particularly in facilitating financing for small and micro enterprises and

advancing rural economic development. Huang Yiping (2020) pointed out that digital inclusive finance, through advanced technologies such as big data and cloud computing, effectively alleviates information asymmetry issues, lowers the threshold and costs of financial services, and provides more convenient and efficient financial services to small and micro enterprises and vulnerable groups.

Currently, the "Peking University Digital Inclusive Finance Index," proposed by the Digital Finance Center at Peking University, is widely used in China to measure digital inclusive finance. This index covers the breadth of digital financial coverage, the depth of digital financial use, and the degree of digitization of inclusive finance, providing a comprehensive reflection of the development trends of digital inclusive finance across different regions in China. According to the data, the digital inclusive finance index in China has seen significant growth from 2016 to 2022.

2.2 The Development of China's Private Economy

Since 2011, China's private economy has experienced significant "leapfrog development." According to recent data released by the State Administration for Market Regulation, as of the end of May 2024, the total number of private economic entities in China reached 18.045 million, with their share of all business entities increasing from 95.5% in 2019 to 96.4%. This growth is attributed not only to supportive policy environments but also to the active participation of social capital. General Secretary Xi Jinping has placed high importance on the development of the private economy, clearly stating that the private economy is an intrinsic element of China's economic system and that private enterprises and entrepreneurs are "our own people." He emphasized the need to adhere to the fundamental economic system, uphold the "two unwavering commitments," and promote the healthy development of the non-public sector economy and the well-being of non-public sector economic individuals. The 20th National Congress of the Communist Party of China highlighted the need to optimize the development environment for private enterprises, legally protect the property rights of private enterprises and the rights of entrepreneurs, and promote the growth and strengthening of the private economy.

Currently, China's development strategy for the private economy has undergone a profound transformation, shifting from the past emphasis on quantity and speed—characterized by "extensive development"—to a focus on quality and efficiency, known as "intensive development." This transformation is evident not only in the expansion of enterprise-scale but also in aspects such as technological innovation, brand building, and market competitiveness, achieving a leap from quantity accumulation to quality enhancement. Qiao Zhen (2023) points out that the private economy has become an important component of the socialist economic system with Chinese characteristics. The "two unwavering commitments" represent the Party and the state's fundamental attitude toward the private economy. Under these premises, increasing support for the private economy has gained significant assurance and practical foundation. However, it is crucial to find better paths for effectively promoting the development of the private economy.

Nevertheless, the private economy in China still faces significant challenges during its development. Wang Xue et al. (2022) note that social conditions continue to constrain the development of the private economy, particularly in terms of financing difficulties. Many small and micro private enterprises encounter bottlenecks in financing, with funding issues

leading to severe challenges and even causing some enterprises to go bankrupt. These social constraints severely impact the healthy development of the private economy.

2.3 Digital Inclusive Finance and Private Economic Development

From a macro perspective, digital inclusive finance helps alleviate financial repression and financial exclusion. Scholars have developed numerous models to validate this. Specifically, research involving inclusive finance as an independent variable often explores its relationships with corporate financing, economic growth, narrowing income gaps between urban and rural areas, and residents' entrepreneurship and employment.

In non-corporate domains, studies frequently examine the relationship between macroeconomics and inclusive finance. For instance, international scholars like Gomber et al. (2017) argue that digital inclusive finance simplifies financing processes and lowers barriers to funding by providing online financing platforms and using big data for credit evaluation. This enables private enterprises, which previously had difficulty accessing traditional financial support, to obtain the necessary funding.

Domestic scholars, such as Li Yang (2018), have found through empirical research that the development of digital inclusive finance significantly alleviates financing constraints for private enterprises and promotes their investment and growth. Zhang Lin, Wang Yanxia, and Zheng Qiang (2023) indicate that digital inclusive finance can facilitate the high-quality development of private enterprises by easing financing constraints. Gao Xiaolin and Han Wen (2022) studied digital inclusive finance from the perspectives of alleviating financing constraints and promoting corporate innovation, finding that digital inclusive finance positively impacts both areas. In a study by Wan Jiayu, Zhou Qin, and Xiao Yi (2020) on digital finance and corporate innovation, it was discovered that digital finance influences innovation by affecting financing constraints.

2.4 The transmission mechanism of the impact of digital inclusive finance on the development of private economy

Traditional financial institutions rely on costly physical branches and complex operational structures, resulting in high financial service costs and making it difficult for many regions and individuals to access necessary financial services. In such cases, enterprises that cannot bear high costs or meet the requirements of traditional financial institutions often face financial exclusion, meaning they are unable to access or are excluded from traditional financial services. Additionally, traditional financial institutions may face limitations in their ability to innovate quickly in response to technological advancements and changing business needs. This slow pace of innovation can hinder their ability to provide more flexible and personalized services, contributing to financial repression, where economic entities cannot fully access the financial products and services they need.

The combination of traditional finance and financial inclusion, known as inclusive finance, has expanded the coverage of financial services and improved accessibility, allowing more enterprises, especially small and micro enterprises previously neglected or difficult to reach by traditional financial services, to obtain and use financial services. The integration of inclusive finance with digital technology has led to the development of digital inclusive finance. This integration allows digital inclusive finance platforms to use digital technologies, such as electronic payments and online banking, to more accurately understand and meet the

needs of enterprises, providing personalized financial products and services and promoting more financial innovation.

The development of digital inclusive finance offers enterprises more convenient and diverse financing channels, helping them reduce operational risks and promote precise resource allocation, thereby enhancing new productive forces. First, digital inclusive finance provides enterprises with more convenient and efficient financing channels. Traditional financial institutions often have cumbersome and time-consuming financing methods, posing high entry barriers for small and micro enterprises. Digital inclusive finance, through technologies like the Internet and mobile payments, breaks down the geographical limitations and information asymmetry of traditional finance, offering more convenient and rapid financing services. Enterprises can obtain funding through digital inclusive finance platforms to expand production scale, introduce advanced technologies, and enhance productivity and competitiveness. Second, digital inclusive finance offers a wider range of financial products and services, helping enterprises reduce operational risks. Digital inclusive finance platforms use big data analysis and risk assessment technologies to provide personalized financial products and services, such as microloans and supply chain finance, helping enterprises manage and mitigate operational risks better. Enterprises can select financial products suited to their needs, effectively avoid risks, and achieve more stable operational and production goals. Finally, the development of digital inclusive finance platforms promotes precise resource allocation. Through big data technologies and smart algorithms, digital inclusive finance platforms can more accurately identify the financing needs and risk characteristics of enterprises, providing more precise financial services. This accurate resource allocation helps enterprises use funds and other resources more effectively, improving production efficiency and quality, and driving continuous enhancement of new productive forces. The transmission mechanisms are illustrated in Figure 1.

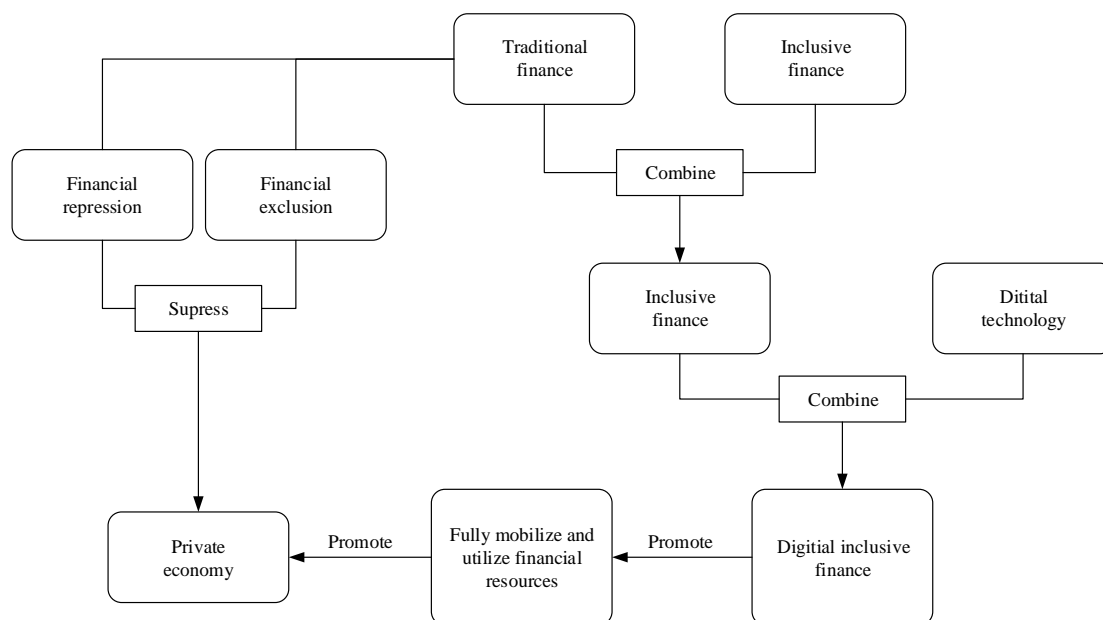


Fig1: Schematic diagram of conduction mechanism

Although the potential of digital inclusive finance in enhancing the economic growth of private enterprises has received widespread attention, there are still some unresolved issues in the academic field. First, while existing studies have pointed out that digital inclusive finance

can improve the growth rate of total revenue for private enterprises, the specific promotion mechanisms and pathways are not yet clear. Second, most existing literature has not thoroughly explored the heterogeneous effects of digital inclusive finance across different industries of private enterprises, that is, the differences in benefits among different types of enterprises. Research in this area is crucial for understanding the broad application of digital inclusive finance and its effectiveness across various industries. Lastly, although some studies suggest that digital inclusive finance can promote economic growth by alleviating financing constraints, the specific ways to enhance financing accessibility and the mediating effects of alleviating financing constraints have not been fully validated or quantified. Future research needs to examine in more detail the specific impacts of digital inclusive finance under different circumstances and further verify its differential effects and mechanisms across various types of enterprises and industries, addressing the current research gaps. Therefore, we propose the following hypotheses: Therefore, the following hypothesis is proposed:

Hypothesis 1: Digital inclusive finance has a promotional effect on increasing the RGR for private enterprises.

Hypothesis 2: The promotional effect of digital inclusive finance on the revenue growth rate of private enterprises is heterogeneous, with varying levels of benefits across different industries.

Hypothesis 3: Digital inclusive finance can effectively enhance the economic growth of private enterprises, and this enhancement is primarily achieved by alleviating the financing constraints of private enterprises, thus improving their financing accessibility.

3.0 Research design

3.1 Model setting

To verify whether digital inclusive finance has an impact on the development of China's private economy, the following regression equation is constructed for verification:

$$RGR_{it} = \beta_0 + \beta_1 DIFI_{it} + \gamma CVs + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

In the above regression equation, RGR represents the dependent variable, the growth rate of total operating revenue, and DIFI represents the core explanatory variable, the Digital Inclusive Finance Index; CVs represent all the control variables mentioned above; Fixed effects for individual enterprises; Fixed time effect; For residual terms; I is the enterprise; T is the year.

To explore the impact path of digital inclusive finance on the growth rate of total revenue of private enterprises in China, this paper constructs a mediation effect model based on the method of Wen Zhonglin and Ye Baojuan (2014):

$$RGR_{it} = \alpha_1 + \theta_1 DIFI_{it} + \beta_1 control_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (2)$$

$$FC_{it} = \alpha_1 + \theta_1 DIFI_{it} + \beta_1 control_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (3)$$

Among them, FC is the mediating variable, namely financing constraint, and the other variables are set the same as in model (1).

3.2 Variable selection

The variable symbols, measuring method and their meanings are shown in the Tab1:

Tab 1: Variable Definition Table

Variable type	Variable symbol	Variable	Measuring method
Explained variable	RGR	Growth rate of total operating revenue	Growth rate of total operating revenue of the enterprise
Explanatory variable	DIFI	Development level of digital inclusive finance	Peking University Digital Inclusive Finance Index
Intermediary variable	FC	Financing constraints	Financial institution loans/deposits
	TobinQ	Tobin's Q value	Enterprise market price(stock price)/enterprise's reset cost
	OCRG	Growth rate of total operating costs	(Total operating costs of the current year-Total operating costs of the previous year)/Total operating costs of the previous year
	Lev	Asset liability ratio	Liabilities/Assets
Control variables	size	Enterprise size	Total Assets
	Led	Level of economic development	Gross Domestic Product of prefecture level cities
	IS	Industrial structure	The composition and interrelationships of various industries in different cities
	Fal	Financial agglomeration level	The degree of concentration and development of the financial industry in various cities

3.3 Data source

This study selects development data from 1,329 private enterprises in China for the years 2016 to 2022 for empirical analysis. The enterprise data is sourced from the Guotai An Database, and the Digital Inclusive Finance Index data is provided by the Digital Finance Research Center at Peking University. Additionally, to ensure the validity of the data, the study excluded ST enterprises, financial industry enterprises, samples with abnormal financial data, and samples with severe data missingness and finally obtained 9232 observations.

4.0 Analysis of empirical results

4.1 Descriptive statistics of variables

Tab2 presents descriptive statistics of variables.

Tab 2: Descriptive statistics of variables

Variables	N	Mean	p50	SD	Min	Max
RGR	9232	0.254	0.179	0.452	-0.186	3.595
Ln(DIFI)	9232	5.633	5.653	0.150	5.121	5.889
TobinQ	9232	2.277	2.230	0.635	1.102	5.013
Lev	9232	0.401	0.402	0.0780	0.188	0.707
Ln(size)	9232	22.55	22.40	0.782	20.77	24.65
Led	9232	11.61	11.73	0.464	10.23	12.23
IS	9232	0.577	0.570	0.120	0.349	0.839
Fal	9232	1.047	0.977	0.529	0.0120	12.43
OCRG	9232	0.222	0.178	0.296	-0.154	2.253
FC	9232	0.777	0.782	0.203	0.426	1.233

4.2 Baseline Regression Analysis

This paper first employs a two-way fixed effects model to regress and preliminarily determine the relationship between digital inclusive finance and the development of private enterprises in China. The results in Tab3 show that the estimated coefficient of digital inclusive finance is significantly positive at least at the 5% level, indicating that digital inclusive finance has a significant promoting effect on the growth rate of total operating revenue of private enterprises in China. Specifically, for each one-unit increase in the Digital Inclusive Finance Index, the growth rate of total operating revenue of enterprises increases by an average of 0.630 units. This supports Hypothesis 1 of this study, which posits that promoting the development of digital finance is an important way to achieve the development of private enterprises in China. In fact, digital inclusive finance has greatly optimized resource allocation, reduced the short-term profit-seeking nature of capital, enhanced risk management, and improved service capabilities, effectively supporting the development of private enterprises in China. Therefore, Hypothesis 1 is preliminarily validated, confirming that digital inclusive finance has a positive promoting effect on the development of private enterprises in China.

Tab 3: Basic regression results

	(1)	(2)	(3)
	RGR	RGR	RGR
Ln(DIFI)	0.325 (0.551)	0.067 (0.191)	0.630** (0.245)
TobinQ		0.006 (0.007)	0.003 (0.007)
Lev		-0.334***	-0.340***

		(0.117)	(0.117)
Ln(size)		0.001 (0.024)	0.006 (0.025)
OCRG		1.447*** (0.018)	1.449*** (0.017)
Led			-0.151*** (0.028)
IS			-0.331*** (0.115)
Fal			-0.009 (0.007)
_cons	-1.227 (2.980)	-0.367 (1.406)	-1.608 (1.584)
Year	Yes	Yes	Yes
Id	Yes	Yes	Yes
N	9232	9232	9231
R2	0.107	0.840	0.841

Note: Standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4.3 Heterogeneity analysis

To study the heterogeneous impact of industry, this paper uses the industry classification at the end of 2022 as the baseline and divides the sample enterprises into capital-intensive, labor-intensive, and technology-intensive categories based on the proportion of production factors. The regression results are as follows:

Tab 4: Heterogeneity analysis results

	(1)	(2)	(3)
	RGR for capital-intensive enterprises	RGR for labor-intensive enterprises	RGR for technology-intensive enterprises
Ln(DIFI)	0.613** (0.300)	0.589 (1.024)	0.888*** (0.249)
TobinQ	0.011 (0.018)	0.019 (0.022)	-0.011 (0.009)
Lev	-0.231 (0.147)	-0.697** (0.283)	-0.286 (0.181)
Ln(size)	-0.071 (0.091)	0.038 (0.083)	-0.005 (0.034)

	(1)	(2)	(3)
	RGR for capital-intensive enterprises	RGR for labor-intensive enterprises	RGR for technology-intensive enterprises
OCRG	1.421*** (0.053)	1.451*** (0.038)	1.468*** (0.021)
Led	-0.153** (0.074)	-0.114** (0.056)	-0.165*** (0.063)
IS	-0.288 (0.435)	-0.375 (0.377)	-0.513*** (0.118)
Fal	-0.031 (0.029)	-0.037 (0.031)	0.016 (0.015)
_cons	0.178 (2.208)	-2.368 (6.697)	-2.517 (1.804)
Id	Yes	Yes	Yes
Year	Yes	Yes	Yes
N	1561	2151	4533
R ²	0.821	0.767	0.881

Note: Standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Regarding the results of the heterogeneity test, the regression results for the three sample groups show that the Digital Inclusive Finance Index has a positive promoting effect on the growth rate of total operating revenue for enterprises, with coefficients of 0.613, 0.589, and 0.888, respectively. The hypothesis that digital inclusive finance can enhance the growth rate of total operating revenue for enterprises is once again validated, consistent with the baseline regression results. Moreover, this promoting effect is more pronounced in technology-intensive enterprises, fully validating Hypothesis 2.

The main reason is that technology-intensive enterprises typically require more investment in research and development and innovation activities, which often need substantial financial support. Digital inclusive finance, by providing more convenient and low-cost financial services, can effectively alleviate the financing constraints of these enterprises, thus promoting their revenue growth. Technology-intensive enterprises usually have higher growth potential and development prospects; the involvement of digital inclusive finance can help these enterprises better seize market opportunities, accelerate technological innovation and product upgrades, and thus enhance their market competitiveness and profitability.

Additionally, technology-intensive enterprises often need close ties with financial markets to obtain timely funding and financial services. The development of digital inclusive finance, through the application of modern information technologies such as the internet and big data, can overcome the geographic limitations of traditional financial services, enabling technology-intensive enterprises to more easily access the required funding and financial services, thereby accelerating their development pace.

In capital-intensive and labor-intensive enterprises, digital inclusive finance also plays a positive role, but its impact is relatively smaller. This may be because capital-intensive

enterprises can already access relatively adequate financial services within the traditional financial system, and labor-intensive enterprises rely more on the advantage of low-cost labor, with relatively lower demand for financial services. Therefore, while digital inclusive finance does have a promoting effect in these enterprises, it is not as significant as in technology-intensive enterprises.

4.4 Robustness test

To verify the robustness of the model, we employed the method of substituting explanatory variables for robustness checks. Specifically, we used the depth index as the dependent variable and conducted the regression analysis again. The regression results are shown in Tab6.

Tab 6: Robustness test results

	RGR
Ln(usage)	0.854*** (0.106)
TobinQ	0.006 (0.007)
Lev	-0.336*** (0.116)
Ln(size)	0.003 (0.027)
OCRG	1.458*** (0.018)
Led	-0.131*** (0.024)
IS	-0.349*** (0.101)
Fal	-0.015* (0.008)
_cons	-2.950*** (0.897)
id	Yes
year	Yes
N	9231
R ²	0.843

Note: Standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The regression results indicate that the use of the depth index still has a significant positive effect on the growth rate of total operating revenue for private enterprises in China, consistent with the results from other control variables. Specifically, the coefficient for the depth index is 0.503 and significant at the 1% level. This suggests that our research conclusions are not dependent on a specific explanatory variable and have strong robustness. The robustness

check results demonstrate that the positive impact of digital inclusive finance on the economy of private enterprises in China is reliable, and our research conclusions exhibit substantial robustness. This provides valuable references for policy-making and practice and helps to better understand and leverage the important role of digital inclusive finance in the development of the private economy.

4.5 Mediator effect test

Based on the baseline regression, we further explore whether financing constraints can serve as a bridge for the impact of digital inclusive finance on the development of private enterprises.

According to the mediation effect testing method, the first step examines the relationship between digital inclusive finance and the growth rate of total operating revenue for private enterprises. The regression results are shown in Table 7. In Regression (1), the coefficient for digital inclusive finance is significantly positive, indicating a positive promoting relationship between the two, and that digital inclusive finance significantly promotes the development of private enterprises. The second step involves regressing Model (3) to test the relationship between digital inclusive finance and the intermediary variable of financing constraints. The regression results are shown in Column (2) of Table 7. In Regression (2), the coefficient for digital inclusive finance is significantly positive, indicating a positive promoting relationship, and suggesting that digital inclusive finance significantly alleviates financing constraints. Digital inclusive finance platforms can monitor borrowers' economic activities and credit changes in real-time, adjust credit strategies promptly, and effectively control risks. By reducing information asymmetry, improving approval efficiency, expanding financing channels, offering flexible financing methods, lowering financing costs, and enhancing financial literacy, digital inclusive finance significantly alleviates financing constraints, enabling more SMEs and individual entrepreneurs to obtain the necessary funding, thereby promoting economic diversification and sustainable development.

The coefficients for digital inclusive finance in both Regression (1) and (2) are significantly positive, indicating that financing constraints play an important mediating role. Digital inclusive finance positively impacts the development of private enterprises by alleviating financing constraints. Hypothesis 3 is fully validated. On the basis of benchmark regression, further exploration was conducted on whether financing constraints can become a bridge for the impact of digital inclusive finance on the development of the private economy. The regression results of the mediation effect are shown in the table7.

Tab 7: Mediator effect test results

	(1)	(2)
	RGR	FC
Ln(DIFI)	0.630** (0.245)	0.366*** (0.136)
TobinQ	0.003 (0.007)	-0.003 (0.004)
Lev	-0.340*** (0.117)	-0.019 (0.042)
Ln(size)	0.006	0.015

	(0.025)	(0.015)
OCRG	1.449***	-0.013***
	(0.017)	(0.004)
Led	-0.151***	-0.068***
	(0.028)	(0.023)
IS	-0.331***	-0.155**
	(0.115)	(0.078)
Fal	-0.009	-0.026***
	(0.007)	(0.009)
_cons	-1.672	-0.706
	(1.643)	(0.888)
Year	Yes	Yes
Id	Yes	Yes
N	9231	9231
R ²	0.864	0.933

Note: Standard errors in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.0 Conclusions and recommendations

5.1 Research conclusions

Based on panel data from some private enterprises in China from 2016 to 2022, this paper conducted a fixed effects model test to examine the impact of digital inclusive finance on the development of the private economy in China and explored the mediating role of financing constraints. The results indicate that digital inclusive finance, as a new financial service model, shows a significant positive effect on promoting the development of private enterprises. Its impact varies across different industries, with the most notable effect observed in technology-intensive industries. Through theoretical and empirical analysis, it is clear that digital inclusive finance promotes the development of private small and micro enterprises by increasing their total revenue growth rate. Particularly in China, the widespread application and promotion of digital inclusive finance have injected stronger momentum into the development of private enterprises, contributing to the growth and prosperity of the private economy. Therefore, we can be confident that digital inclusive finance has an undeniable positive impact on the development of private enterprises, and the conclusions are robust.

5.2 Recommendations

Based on the above analysis, this paper proposes the following recommendations:

First, strengthen data foundations and promote regional collaboration. Construct a collaborative digital inclusive finance platform among regions. In the era of rapidly evolving technologies such as big data and artificial intelligence, digital inclusive finance is presented with unprecedented opportunities for development. We should seize this opportunity by deepening data mining, collection, and governance to build an efficient and stable digital inclusive finance platform. Additionally, integrating factors such as technological innovation, intellectual property value, green development strategies, and carbon reduction indicators into the innovation guarantee system is crucial for providing comprehensive support for high-

quality development in the private economy. It is also important to consider regional distribution differences, particularly the financial development situation in western regions, and use spatial spillover effects to promote the rational allocation and efficient use of financial resources. Accelerating the construction of internet and mobile communication infrastructure and improving platform coverage will foster the deep integration of digital inclusive finance with high-quality development of the private economy.

Second, encourage private enterprises to engage with digital inclusive finance. Actively encourage private enterprises to participate in digital inclusive finance services and provide necessary training and guidance. As key participants in digital inclusive finance, private enterprises should recognize the tremendous potential and significant advantages of this financial model. They should abandon traditional thinking, embrace digitalization, and actively integrate into this new financial service model. The government should play a guiding role, collaborating with financial institutions, technology companies, and relevant industry associations to offer systematic training and guidance. This training should aim to enhance digital capabilities, improve financial literacy, and enable enterprises to proficiently use digital inclusive finance platforms, optimize resource allocation, and increase operational efficiency, thereby driving high-quality development.

Third, develop customized service platforms and operational mechanisms. Establish a customized service platform and operational mechanism tailored to the needs of private enterprises. This platform should innovate financial products and services, and design multi-level loan incentive policies to provide more precise and effective financial support. Banks could develop dedicated credit automation platforms for private enterprises, leveraging advanced technology for automated and intelligent credit issuance to improve service efficiency. Additionally, banks need to establish accurate risk assessment models to evaluate the credit status of private enterprises, ensuring the safety and effectiveness of funds. These measures will enhance the overall effectiveness of inclusive financial services and provide strong support for the healthy development of the private economy.

Fourth, promote deep integration of digital inclusive finance and private enterprises. In the current economic environment, deep integration of digital inclusive finance with private enterprises is crucial for the development of both. This integration involves not only economic benefits but also the alignment of concepts and strategic connections. The government should play a guiding role by formulating relevant policies, encouraging financial institutions to increase support for private enterprises, and providing more convenient and efficient digital inclusive finance services. Society should also actively participate, offering additional resources and information support to private enterprises to promote digital transformation. As a product of financial technology, digital inclusive finance can provide more precise financial services to meet diverse financing needs. The innovative development of private enterprises will, in turn, offer more application scenarios and market demands for digital inclusive finance, fostering mutual benefits and win-win outcomes. This deep integration will enhance the overall competitiveness of private enterprises and contribute to the sustainable and healthy development of the entire economy and society.

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