

# Research on the Impact of Digital Inclusive Finance on Financing Constraints for Small and Medium sized Enterprises

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**Abstract:** Small and medium-sized enterprises are an important force in absorbing employment, promoting innovation, and stabilizing the economy, but they have long faced prominent financing constraints. Digital inclusive finance, relying on technologies such as big data, cloud computing, and artificial intelligence, provides a new path to solving this problem. On the basis of reviewing the theory of financing constraints and the research context of digital inclusive finance, this article systematically analyzes the mechanism of the impact of digital inclusive finance on financing constraints for small and medium-sized enterprises from four dimensions: alleviating information asymmetry, reducing transaction costs, expanding financial service boundaries, and intensifying financial market competition. A bidirectional fixed effect research framework is constructed, with the Peking University Digital Inclusive Finance Index as the core explanatory variable and the SA index as the measurement of financing constraints. Research suggests that digital inclusive finance can significantly alleviate financing constraints for small and medium-sized enterprises, and this alleviation effect is more pronounced for non-state-owned enterprises, enterprises in economically underdeveloped areas, and small-scale enterprises. Finally, policy recommendations are proposed from the aspects of improving digital infrastructure, establishing a sound data sharing and credit system, and guiding traditional financial institutions to undergo digital transformation.

**Keywords:** Digital Inclusive Finance; Small And Medium-Sized Enterprises; Financing Constraints; Information Asymmetry; SA index

## 1. Introduction

Small and medium-sized enterprises are the driving force of China's national economy and social development, contributing over 50% of tax revenue, over 60% of GDP, over 70% of technological innovation, over 80% of urban labor employment, and over 90% of enterprise numbers. They play an irreplaceable role in stabilizing growth, expanding employment, promoting innovation, and benefiting people's livelihoods. However, due to the common characteristics of small and medium-sized enterprises, such as small scale, high operational uncertainty, opaque financial information, and insufficient collateralized assets, they often find themselves in a weak position in the traditional financial system dominated by banks, with long-term problems of difficult and expensive financing. According to the theory of prioritized financing, when internal funds are unable to meet investment needs and external financing costs are too high, corporate investment behavior will be suppressed, that is, trapped in financing constraints. Financing constraints not only constrain the growth and innovation of small and medium-sized enterprises, but also have a negative impact on macroeconomic vitality and employment stability.

In recent years, with the deep integration of digital technologies such as mobile Internet, big data, cloud computing, artificial intelligence and blockchain with traditional inclusive finance, digital inclusive finance has risen rapidly. New digital institutions represented by online commercial banks and WeBank have innovated the "310" credit model based on e-commerce transactions, payment records, tax invoices, and other alternative data, which means a 3-minute application, 1-second payment, and zero manual intervention, significantly reducing the threshold and cost of financial services. At the same time, traditional financial institutions such as Industrial and Commercial Bank of China and Construction Bank have also created online inclusive products such as "Business Quick Loan" and "Online Loan Connect" to promote

the onlineization, automation, and standardization of credit services. The rapid development of digital inclusive finance has provided new technological conditions and institutional environment to alleviate financing constraints for small and medium-sized enterprises.

In this context, the systematic study of whether digital inclusive finance can alleviate financing constraints for small and medium-sized enterprises, through what mechanisms it can play a role, and whether there are differences in its impact on different types of enterprises has important theoretical value and practical significance. This article aims to clarify the inherent logic of the impact of digital inclusive finance on the financing constraints of small and medium-sized enterprises, construct an operational empirical research framework, and propose targeted policy recommendations, in order to provide reference for further developing digital inclusive finance and improving the financing environment for small and medium-sized enterprises.

## 2. Theoretical Basis and Literature Review

### 2.1 Theoretical Causes of Financing Constraints

The theory of financing constraints is based on a breakthrough in the assumption of a perfect market. The MM theorem proposed by Modigliani and Miller holds that in a perfect capital market, the internal and external financing costs of a company are the same and can be completely replaced, and investment decisions are independent of the company's financial structure. However, in the real market, factors such as information asymmetry, transaction costs, tax and institutional frictions make it difficult for the premise of the MM theorem to hold. Fazzari, Hubbard, and Petersen innovatively pointed out that due to the premium of external financing, investments are highly sensitive to internal cash flows, and companies with more severe financing constraints have stronger investment cash flow sensitivity. Myers and Majluf further proposed the theory of prioritized financing, which suggests that due to the existence of adverse selection, corporate financing follows the order of internal financing, debt financing, and equity financing.

In terms of measuring financing constraints, the

academic community has formed three types of ideas: one is the investment cash flow sensitivity method represented by the FHP model; The second is to use the index method constructed by enterprise financial indicators, such as the KZ index constructed by Kaplan and Zingales, and the WW index constructed by Whited and Wu; The third is the SA index proposed by Hadlock and Pierce, which consists only of two exogenous variables: enterprise size (Size) and age of establishment (Age). The calculation formula is  $SA = -0.737 \times \text{Size} + 0.043 \times \text{Size}^2 - 0.04 \times \text{Age}$ . Due to the absence of endogenous financial variables, simple calculation, and good robustness, the SA index is widely used in empirical research on financing constraints. Generally, the larger the absolute value of SA, the stronger the financing constraints faced by the enterprise.

### 2.2 The Connotation and Measurement of Digital Inclusive Finance

Digital inclusive finance refers to all actions that use digital technology to promote inclusive finance, that is, to provide accessible, convenient, and affordable financial services to groups that are difficult to reach with traditional financial services through digital technology. Compared with traditional inclusive finance, digital inclusive finance has the characteristics of wide service boundaries, low marginal costs, accurate risk identification, and good customer experience. In empirical research, domestic scholars generally use the "Peking University Digital Inclusive Finance Index" jointly developed by the Peking University Digital Finance Research Center and Ant Group Research Institute to measure the level of regional digital inclusive finance development. This index covers 31 provinces, 338 prefecture level cities, and approximately 2800 counties in China, including three primary dimensions of digital finance coverage breadth, usage depth, and digitalization level, providing authoritative and continuous data support for relevant empirical research.

### 2.3 A Review of Research on the Impact of Digital Inclusive Finance on Financing Constraints

Existing research generally believes that digital inclusive finance can alleviate financing constraints for small and medium-sized enterprises. Most literature matches the Peking

University Digital Inclusive Finance Index with micro data of listed companies and uses bidirectional fixed effects models or system GMM models for testing. It is found that the Digital Inclusive Finance Index is significantly negatively correlated with the SA index of enterprises, indicating that the development of Digital Inclusive Finance significantly reduces the degree of financing constraints of enterprises. Some studies further indicate that there is significant heterogeneity in the alleviating effect: compared to state-owned enterprises, digital inclusive finance has a stronger alleviating effect on financing constraints for private enterprises; Compared to economically developed regions, its marginal improvement on small and medium-sized enterprises in the central and underdeveloped areas is more prominent. Scholars have also expanded their research from the perspectives of investment efficiency and corporate innovation, and found that digital inclusive finance can not only alleviate financing constraints, but also improve the investment efficiency of small and medium-sized enterprises and promote their technological innovation. Overall, existing research has formed relatively consistent conclusions, but there is still room for further deepening the systematic sorting of the mechanism of action and targeted analysis of the specific target of small and medium-sized enterprises.

### **3. The Mechanism of Digital Inclusive Finance in Relieving Financing Constraints for Small and Medium sized Enterprises**

#### **3.1 Relieve Information Asymmetry Between Banks and Enterprises**

Asymmetric information is one of the fundamental causes of financing constraints for small and medium-sized enterprises. The traditional credit model heavily relies on corporate financial statements, collateral guarantees, and on-site investigations by credit personnel, while small and medium-sized enterprises often have inadequate financial systems and lack standardized audit reports, making it difficult for banks to accurately assess their true operating conditions and repayment capabilities. Therefore, they tend to "cherish loans" and "be cautious about loans". Digital inclusive finance aggregates massive amounts of substitute data such as transaction flows,

payment records, tax invoices, logistics and warehousing, water and electricity payments, and even upstream and downstream relationships in the supply chain. It uses big data and machine learning algorithms to construct enterprise credit profiles, transforming previously "invisible" soft information into quantifiable and communicable hard information. This data-driven credit evaluation significantly reduces the information gathering cost and adverse selection risk of financial institutions, enabling them to extend credit services to more small and medium-sized enterprises under controllable risks, thereby alleviating financing constraints caused by information asymmetry.

#### **3.2 Reduce Transaction Costs During the Financing Process**

Excessive transaction costs are an important obstacle to the sinking of financial services. The traditional offline credit process is cumbersome, labor-intensive, and physically limited, making it difficult for small and dispersed small and medium-sized enterprises to sustain their business operations. Relying on the Internet channel and the automated approval system, digital inclusive finance has realized the online, standardized and intelligent whole process of customer acquisition, credit extension, approval, lending and post loan management. Represented by the "310" credit model, loan applications and approvals can be completed within minutes, significantly reducing manual intervention. The decrease in operating costs of financial institutions directly shortens the financing time and reduces transaction costs for enterprises. On the other hand, under the influence of market competition, cost savings are also transferred to the demand side of funds through lower interest rates, allowing small and medium-sized enterprises not only to "borrow" but also to "borrow cheaply".

#### **3.3 The Long Tail Effect of Expanding the Boundaries of Financial Services**

Traditional financial institutions tend to serve larger and more qualified top customers due to cost-benefit considerations, while a large number of dispersed and small and medium-sized enterprises belong to the neglected "long tail" group. Digital inclusive finance has broken through the limitations of physical branches and business hours, enabling

financial services to transcend geographical space, sink to counties and rural areas, and reach customer groups that were previously difficult to reach. As the number of service customers expands, fixed costs are continuously diluted, and marginal service costs approach zero, thus forming a "long tail effect". This means that small and medium-sized enterprises that were previously unable to access formal financial services due to small transaction amounts and remote locations can now equally access financial services such as credit, payment, and settlement, and the accessibility of financial services has significantly improved.

(4) Intensify competition in financial markets and improve credit supply

The development of digital inclusive finance has also enriched the supply of financial services and changed the situation where enterprises rely solely on traditional bank credit. The entry of new digital banks, Internet platforms and supply chain fintech companies has intensified competition in the credit market. On the one hand, competitive pressure drives traditional commercial banks to accelerate their digital transformation, proactively improve services, delegate approval authority, and optimize pricing mechanisms; On the other hand, diversified supply entities can design differentiated financial products for small and medium-sized enterprises of different types and growth stages. The intensification of competition in the credit market and the diversification of supply have overall improved the financing environment for small and medium-sized enterprises, giving them more choices in financing negotiations and further easing financing constraints.

## 4. Research Design

### 4.1 Sample Selection and Data Sources

To examine the impact of digital inclusive finance on financing constraints for small and medium-sized enterprises, companies listed on China's SME board and ChiNext board can be selected as initial research samples, and screened according to general principles: excluding financial and real estate listed companies, excluding ST, \* ST, and samples with missing major financial data, and rounding all continuous variables at the 1% and 99% percentiles to eliminate the influence of extreme values. The financial data of enterprises comes

from databases such as CSMAR and Wind. The regional digital inclusive finance data adopts the Peking University Digital Inclusive Finance Index compiled by the Peking University Digital Finance Research Center, and further uses its three sub indices of coverage breadth, usage depth, and digitalization degree for dimensional analysis.

### 4.2 Variable Definition

The dependent variable is the financing constraint (SA) of the enterprise, measured using the SA index proposed by Hadlock and Pierce. Based on the natural logarithm of the total assets of the enterprise and its establishment years, the larger the absolute value of SA, the stronger the financing constraint. The core explanatory variable is the level of digital inclusive finance development (DIFI) in the region. The natural logarithm of the Peking University Digital Inclusive Finance Index is taken, and three sub indices, namely coverage breadth, usage depth, and digitalization degree, are used to replace the overall index in the robustness test.

Referring to existing literature, the following control variables were selected: enterprise size (Size, natural logarithm of total assets), asset liability ratio (Lev, total liabilities/total assets), return on assets (ROA, net profit/total assets), enterprise growth (Growth, operating income growth rate), operating cash flow (Cashflow, net cash flow from operating activities/total assets), proportion of fixed assets (Fixed, net fixed assets/total assets), and enterprise age (Age, years of establishment). In addition, individual fixed effects and year fixed effects are controlled in the model to absorb firm characteristics that do not change over time and macro shocks that change over time.

### 4.3 Model Settings

To investigate the impact of digital inclusive finance on financing constraints for small and medium-sized enterprises, a two-way fixed effects model is constructed as follows:

$$SA_{i,t} = \alpha_0 + \alpha_1 DIFI_{i,t} + \alpha_2 Controls_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t}$$

Among them,  $i$  represents the enterprise and  $t$  represents the year; SA stands for Financing Constraints Index, DIFI stands for Digital Inclusive Finance Index; Controls are a series of enterprise level control variables;  $\mu_i$  is the fixed effect of the enterprise,  $\lambda_t$  is the fixed

effect of the year, and  $\varepsilon$  is the random perturbation term. Focus on the coefficient  $\alpha_1$  of the core explanatory variable DIFI: If  $\alpha_1$  is significantly negative, it indicates that the development of digital inclusive finance can significantly reduce corporate financing constraints. To alleviate potential endogeneity issues, robustness tests can also be conducted using lagged one period digital inclusive finance index, instrumental variable method, or system GMM method.

## 5. Heterogeneity Analysis and Discussion

### 5.1 Heterogeneity of Property Rights Nature

In China's traditional financial system, state-owned enterprises are more likely to obtain credit support and are relatively less constrained by financing, relying on government credit endorsements and long-term relationships with banks; Private enterprises, especially small and medium-sized ones, face strong financing constraints in the long run due to "credit discrimination" and information asymmetry. The credit evaluation of digital inclusive finance based on data and algorithms weakens the dependence on enterprise ownership attributes and traditional mortgage guarantees. Therefore, theoretically, its alleviation effect on financing constraints of private enterprises should be stronger than that of state-owned enterprises. This means that digital inclusive finance plays a role in correcting distortions in credit allocation and promoting fair distribution of financial resources.

### 5.2 Heterogeneity of Regional Development Levels

In the developed eastern regions with well-developed financial infrastructure and strong competition among financial institutions, small and medium-sized enterprises themselves have access to relatively sufficient financial services, and the marginal room for improvement in digital inclusive finance is limited; In the central and western regions and underdeveloped areas, traditional financial supply is insufficient, and a large number of small and medium-sized enterprises are excluded from the formal financial system. Digital inclusive finance can unleash a greater "filling" effect by crossing geographical limitations and sinking services. Therefore, it can be expected that digital inclusive finance

will have a more significant alleviating effect on the financing constraints of small and medium-sized enterprises in economically underdeveloped areas, which also reflects the value of digital inclusive finance in promoting regional coordinated development.

### 5.3 Heterogeneity of Enterprise Scale and Growth Stage

According to the general rule of smaller scale and stronger financing constraints, digital inclusive finance may have a more significant improvement in financing for small and medium-sized enterprises in the start-up stage. These types of enterprises usually lack mortgageable fixed assets and standardized historical financial data, and rely most on credit recognition brought by digital credit portraits; However, larger and mature enterprises have more financing channels, and the marginal contribution of digital inclusive finance is relatively limited. In addition, from the three dimensions of digital inclusive finance, the expansion of coverage can solve the problem of "whether there is", the deepening of depth can solve the problem of "whether it is used well", and the improvement of digitalization can solve the problem of "whether it is convenient or cheap". These three aspects may play a role in different stages and for different types of enterprises.

## 6. Conclusion and Policy Suggestions

### 6.1 Research Conclusion

This article focuses on the impact of digital inclusive finance on financing constraints for small and medium-sized enterprises. Based on the review of relevant theories and literature, the mechanism of its action is systematically analyzed and a corresponding empirical research framework is constructed. Based on comprehensive theoretical analysis and existing empirical evidence, it can be concluded that firstly, digital inclusive finance can significantly alleviate financing constraints for small and medium-sized enterprises. Its role is mainly achieved through four paths: alleviating information asymmetry between banks and enterprises, reducing transaction costs, expanding the long tail boundary of financial services, and intensifying financial market competition; Secondly, this alleviation effect exhibits significant heterogeneity, with a more

prominent marginal effect on private enterprises, enterprises in economically underdeveloped areas, and small-scale, start-up enterprises; Thirdly, digital inclusive finance not only improves the accessibility of financing for small and medium-sized enterprises, but also provides financial support for enhancing investment efficiency and promoting technological innovation, with positive spillover effects beyond financing itself.

## 6.2 Policy recommendations

Firstly, continuously improve the digital financial infrastructure. We should further promote the construction of new information infrastructure such as 5G and big data centers, improve network coverage and digital service accessibility in rural and underdeveloped areas, narrow the "digital divide", and enable more long tail small and medium-sized enterprises to equally enjoy the benefits of digital inclusive finance.

Secondly, establish a sound data sharing and social credit system. We should accelerate the opening up of public data barriers in taxation, market supervision, customs, electricity and other departments, promote orderly data sharing under the premise of legal compliance and protection of enterprise trade secrets, enrich the sources of credit information for small and medium-sized enterprises, and fundamentally reduce information asymmetry between banks and enterprises.

Thirdly, guide traditional financial institutions to undergo digital transformation. Commercial banks should be encouraged to use digital technology to transform credit processes, innovate credit evaluation models, shift their service focus, develop online, standardized, and

low threshold financial products for small and medium-sized enterprises, and form a pattern of benign competition and complementary development between new digital institutions and traditional banks.

Fourth, guard against digital financial risks and maintain the bottom line of security. While digital inclusive finance improves efficiency, it also brings new issues such as data security, algorithm risks, online fraud, and excessive credit. We should improve relevant regulatory rules, strengthen the standardization of data usage and algorithm models, guide the healthy development of digital inclusive finance under controllable risks, and truly achieve inclusive and sustainable financial services.

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