Original Research Article

Theoretical logic, practical dilemma and breakthrough path of digital finance enabling the development of micro and small enterprises

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Abstract: Based on the background of the deep integration of digital economy and real economy, this paper systematically discusses the theoretical logic, practical dilemmas and breakthrough paths of digital financial empowerment for the development of small and micro enterprises. The study reveals that digital finance has significantly enhanced the universality and precision of financial services through the three-dimensional framework of technological empowerment, service reconfiguration and ecological synergy. However, in practice, there are multiple obstacles, such as imbalance in the capacity of the main body, contradiction in data governance, technology risk transmission and lag in institutional supply. The study proposes a breakthrough path: constructing lightweight digital tools and a credible data sharing mechanism; improving the "separation of powers" data governance system; implementing a regional digital literacy programme; and creating a "government, bank and insurance" risk-sharing ecosystem.

keywords: Digital finance; Micro and small enterprises; Technology enablement

1. Introduction

1.1. Background of the study

Under the macro background of the deep integration of digital economy and real economy, digital finance is reshaping the financing ecology of small and micro enterprises in an unprecedented way. According to the strategic deployment of "doing a good job in the five articles of science and technology finance, green finance, inclusive finance, pension finance and digital finance" put forward by the Central Financial Work Conference in 2023, the innovation of financial service model driven by digital technology has become a key breakthrough in cracking the financing difficulties of small and micro enterprises. This structural contradiction presents new characteristics in the era of digital economy: on the one hand, the application of digital technology has expanded the radius of financial services by 3-5 times, and the Ant Group's "310" model (3-minute application, 1-second payment, and 0 human intervention) has cumulatively served more than 80 million micro and small customers; on the other hand, a survey conducted by the Ministry of Industry and Information Technology (MIIT) shows that as of June 2023 On the other hand, according to a survey conducted by the Ministry of Industry and Information Technology, by June 2023, 56% of micro and small enterprises will still have difficulties in accessing appropriate financial services due to insufficient digital capacity, creating a new type of financial exclusion under the "digital divide".1.2 Research Value

From the theoretical perspective, this study breaks through the "technology-neutral" assumption of traditional inclusive finance research, and systematically builds a three-dimensional empowerment framework of "technology-service-ecology" for digital finance. By deconstructing the reconstruction of the trust mechanism through blockchain smart contracts, it reveals how digital technology reconfigures the execution logic of the financial contract, and provides a new analytical perspective for the theory of financial technology.

At the practical level, the study points directly to the key pain points in the construction of the new development pattern: as the "capillaries" of the national economy, every 10% increase in the success rate of digital transformation of small and micro-enterprises can lead to an increase of 1.2 percentage points in total factor productivity (as measured by Peking University's Centre for Digital Finance Research). Cracking the real obstacles such as "data silos", "algorithmic discrimination" and "regulatory arbitrage" in the process of digital financial empowerment is of strategic significance to realising the goal of "the added value of the core industries of the digital economy accounting for 10 per cent of GDP" proposed in the 14th Five-Year Plan.

2. Theoretical logic of digital finance enabling the development of micro and small enterprises

2.1. Technology enablement: Reconstructing trust mechanisms for financial contracts

The application of digital technology has broken through the physical boundaries and credit assessment paradigm of traditional financial services. In the dimension of information processing, big data technology significantly reduces the degree of information asymmetry through the fusion of heterogeneous data from multiple sources. For example, the "310" risk control model constructed by Netcommerce Bank integrates more than 4,000 data indicators in 12 categories, expanding the credit assessment dimension of small and micro enterprises by 18 times[1]. The distributed ledger feature of blockchain technology has reshaped the transaction trust mechanism, and ICBC's "ICBC eCredit" platform has automated the whole process of supply chain finance through smart contracts, reducing the contract dispute rate from 2.1% to 0.3%. The application of artificial intelligence technology has further improved service suitability, and the machine learning algorithm of Jingdong Finance has reduced the bad debt rate of loans by 1.8 percentage points compared with the industry average, which has verified the risk control effectiveness of technological empowerment.

2.2. Service reconfiguration: A paradigm shift towards financial inclusion

Digital finance promotes financial inclusion from policy-driven to market-driven through fundamental changes in the service model. At the level of service scope, the geometric decline in marginal cost makes it possible to cover the long-tail market: the operating cost of Ant Group's single-family micro-credit dropped from 23.5 yuan in 2015 to 2.3 yuan in 2023, and the service radius extends to 1,847 counties. The depth of the service scene is embedded to create a precise reach path, to Tencent cloud and Sany Heavy Industry to build the "root cloud platform" as an example, based on the equipment condition data development of financing products have served industry chain small and micro-enterprises of 3200, the delinquency rate is controlled at 0.87%. This service reconstruction is essentially the evolution of the financial function view, so that financial services from the capital intermediary upgraded to the production factor organiser.

2.3. Eco-synergy: Building an infrastructure for multi-stakeholder governance

The continued release of digital financial empowerment depends on the synergistic evolution of the ecosystem. At the level of data elements, the Beijing International Big Data Exchange has innovated the "data available but not visible" trading model, completing 1.73 billion yuan of small and micro-enterprise data asset transactions in 2023, which verifies the marketisation path of data circulation. In terms of institutional synergy, the Suzhou Industrial Park's "levy and credit" model integrates data from 18 government departments, increasing the conversion rate of bank credit to 89 per cent, demonstrating the effectiveness of cross-sectoral

governance. The construction of technical standards has lowered the threshold of ecological participation, and the implementation of the UnionPay Code for Code-sweeping Payment Interoperability Specification has lowered the cost of acquiring equipment for small and microenterprises by 65 per cent, creating a positive network external effect.

3. The realistic dilemma of digital finance enabling micro and small enterprises

3.1. Imbalance of subjective capacity: Structural fault lines in the digitisation process

The digital capability gap between MSMEs and financial institutions is increasingly significant. Most MSMEs are limited by capital, talent and technological reserves, and find it difficult to quickly adapt to the operational requirements of digital financial services, for example, by lacking the ability to collect and analyse data or by failing to meet the basic conditions of an online credit system. This phenomenon is particularly prominent in remote areas and traditional industries: micro and small business owners in agriculture, handicrafts and other fields often miss out on precisely matched financing opportunities due to their lack of ability to use digital tools. At the same time, the product design of some financial institutions relies excessively on technological thresholds and ignores the actual needs of micro and small enterprises, resulting in a mismatch between service supply and demand.

3.2. Data governance paradox: The game of sharing needs and security protection

The circulation of data elements faces multiple obstacles. On the one hand, core data resources are concentrated in the hands of a few technology platforms, forming a data monopoly, making it difficult for financial institutions to obtain a complete picture of business operations; on the other hand, the open sharing mechanism for government and industry chain data is not yet sound, and there are institutional barriers to cross-sectoral collaboration. In the process of data use, the risk of privacy leakage exacerbates the concerns of MSMEs[6], for example, core business data are intercepted or misused by third-party platforms from time to time. This contradiction is even more complex in cross-border financial scenarios, where differences in data compliance requirements across jurisdictions further raise the cost of MSMEs' access to international financial services.

3.3. Technology risk transmission: The double-edged sword effect of innovative tools

The deep application of digital technology derives new types of risk patterns. The hidden nature of algorithmic models may lead to service bias, for example, some risk control systems unintentionally discriminate against groups such as rural areas and female entrepreneurs due to insufficient training data, reducing the fairness of financial services[2]. Excessive reliance on third-party technology platforms exacerbates systemic risks, and when cloud computing services are interrupted or the system suffers an attack, a chain reaction may be triggered, leading to a sudden break in the capital chain of micro and small enterprises. In addition, technical loopholes may be maliciously exploited, and fraudulent behaviours such as fake transaction data to extract credit funds damage the interests of financial institutions as well as disrupt the market order.

3.4. Lagging institutional supply: Dynamic imbalance between regulation and innovation

The existing regulatory framework can hardly match the speed of innovation in digital finance. The traditional institution-centred regulatory model is unable to effectively cover emerging businesses such as the platform economy and cross-border payments, and a regulatory vacuum has emerged. For example, key areas

such as capital requirements and rules on cross-border data flows for digital lending businesses have yet to be standardised. The problem of insufficient policy synergy is also prominent, with a lack of effective articulation between policies on financial regulation, data governance, and industry support, leading to multiple conflicting standards for enterprises in the compliance process[5]. In local practice, some regions have adopted overly conservative regulatory strategies to avoid risks, which in turn inhibits innovation vigour.

4. Breakthrough path of digital finance enabling micro and small enterprises

4.1. Technological innovation: Building an inclusion-orientated digital infrastructure

Technological breakthroughs need to focus on the actual needs of micro and small enterprises, and develop lightweight and scenario-based digital tools. By simplifying the operating interface and functional modules, the threshold of technology use for MSMEs can be lowered. For example, a one-stop mini-program that integrates cashiering, inventory management and financing functions can help physical shops quickly realise digital operations. At the same time, deepen the application of blockchain and privacy computing technology, establish a trustworthy data sharing mechanism with multi-party participation, and break through the government, financial and industrial data barriers under the premise of safeguarding information security. The promotion of the open banking model should focus on the standardisation of interfaces, and promote cooperation between financial institutions and technology companies to develop embedded financial services with strong adaptability, so that small and micro enterprises can seamlessly access credit support in their daily business scenarios.

4.2. Institutional optimisation: Improving the digital finance governance framework

Policy design needs to balance innovation incentives and risk prevention, and establish a dynamic regulatory system with graded classification. Differentiated compliance requirements should be set for digital financial service providers of different sizes, data monopoly regulation should be strengthened for systemically important platforms, and inclusive and prudent regulation should be implemented for regional innovative entities. In terms of data governance, the rules of data ownership distribution should be clarified, the establishment of institutional arrangements for the separation of data resource holding rights, processing and use rights and operation and revenue rights should be explored, and the data value of small and micro enterprises should be activated through the construction of data asset registration and trading platforms.

4.3. Capacity-building: Implementation of a territory-wide digital literacy initiative

Cracking the digital divide requires government-enterprise collaboration to develop capacity at multiple levels. Training courses on the application of digital tools for micro and small business owners focus on improving data management and the use of financial tools; financial staff should be trained in digital asset management and risk identification skills; and through cooperation between vocational colleges and industry associations, a customised certification system on digital operating skills should be developed for grassroots employees[4]. At the same time, cultivate a group of specialised digital service providers, with a focus on supporting technology companies that develop vertical industry solutions, such as those that provide customised ERP systems for catering, retail and other segments. Establish a mechanism linking digital skills certification and career development, and incorporate digital literacy into the competency evaluation criteria for micro and small business owners.

4.4. Ecological synergy: Building a symbiotic and win-win industry-financing

5. Ecosystem

Building a multi-party synergistic ecosystem is the key to sustained empowerment. The government should take the lead in building a regional production and financing service platform, integrating data resources from upstream and downstream of the industrial chain, and providing small and micro-enterprises with accurate profiling and financing matching services. Encourage leading enterprises to open up supply chain data, and cooperate with financial institutions to develop scenario-based products such as order financing and warehouse receipt pledge, for example, the dynamic credit model based on equipment IoT data can effectively reduce the financing cost of manufacturing MSMEs. With regard to risk-sharing mechanisms, the establishment of a "government, bank and insurance" tripartite risk compensation pool can be guided by financial funds to provide graded compensation for digital credit losses.

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