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Digital Finance, Intelligent Risk Management, and the Alleviation of Financing Constraints among SMEs—An Analysis of National Trends, Taizhou's Pilot Practices, and Regional Comparisons

Ying Zhang[1]

[1] School of Economics, Minzu University of China, Beijing, China

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Abstract

The key obstacle to financing small and medium-sized enterprises (SMEs) is information asymmetry between banks and enterprises. Drawing on a literature review, policy document analysis, and comparative analysis, this paper examines how digital finance alleviates financing constraints through banks' intelligent risk management, and assesses this mechanism using national trends, data from the Taizhou pilot zone, and regional comparisons. At the end of 2024, outstanding inclusive loans to micro and small enterprises (MSEs) in China totaled RMB 32.93 trillion, representing year-on-year growth of 14.6%; however, credit loans accounted for only 27.3%, and the loan access rate among technology-based SMEs was 46.9%. In the Taizhou pilot zone, the number of MSEs receiving loans increased from 240,000 to 613,200; the share of credit loans and guarantee-backed loans rose from 40% to 59.60%; the interest rate fell from 8.27% to 4.13%; and the non-performing loan (NPL) ratio declined from 1.58% to 0.72%. On a comparable statistical basis, loans to MSEs accounted for 55.19% of all loans in Taizhou, compared with approximately 31.4% nationwide, while inclusive MSE loans accounted for only about 8.6% in Liaoning. On this basis, the paper identifies four categories of barriers—data provision, model capabilities, enterprise readiness, and institutional arrangements—and proposes corresponding policy pathways for governments, financial institutions, enterprises, and regulators.

Keywords

digital finance, intelligent risk management, small and medium-sized enterprises (SMEs), financing constraints, credit information sharing

1. Introduction

1.1 Research Background and Questions

Traditional lending relies on financial statements and fixed-asset collateral, making it difficult for asset-light SMEs with insufficient collateral to obtain adequate credit. Banks are not necessarily short of funds; rather, they lack cost-effective means of identifying these firms' underlying risks. Data from the People's Bank of China (PBOC) show that, at the end of 2024, outstanding inclusive loans to MSEs amounted to RMB 32.93 trillion, up 14.6% year on year. This growth rate was 7 percentage points higher than that of all loans, and such lending accounted for 12.88% of total outstanding loans. The number of MSE borrowers with inclusive credit facilities exceeded 60 million, covering approximately one-third of all business entities. The weighted average interest rate on newly issued inclusive loans to MSEs fell to 4.13%. However, growth in aggregate lending does not necessarily translate into an improvement in the structure of credit. During the same period, credit loans accounted for only 27.3% of inclusive MSE loans, indicating that collateral and guarantees remained the main basis for credit provision. The loan access rate among technology-based SMEs was 46.9%, meaning that more than half of these enterprises had not obtained loan support. These figures suggest that financing constraints have eased at the aggregate level, but substantial gaps remain for asset-light and start-up enterprises.

Digital finance offers a new way to address this gap. The Digital Financial Inclusion Index developed by Guo Feng and colleagues provides a unified tool for measuring regional differences. Xie Zhiyong and Zhang Haotian show that the concentration of data factors can ease financing constraints through corporate digital transformation. Huo Shengping and Wang Jing find that digital finance supports innovation among specialized, sophisticated, distinctive, and innovative SMEs by enabling the capitalization of data assets. Zhou Yong argues that digital and intelligent technologies are reshaping financial productivity through cost reduction and efficiency gains, improved risk management, and the extension of inclusive financial services to underserved segments. Existing studies have focused largely on the direct effects of digital finance; fewer treat banks' intelligent risk management capabilities as a distinct link in the process, and empirical comparisons explaining substantial differences in regional outcomes remain limited.

1.2 Research Methods

This paper combines normative analysis with applied statistical data analysis. First, a literature review is conducted to examine representative studies and distill the underlying mechanisms. Second, policy document analysis is used to compare policy objectives with implementation practices. Third, comparative analysis draws on data from the PBOC, local governments, and publicly available reports to make both cross-sectional and longitudinal comparisons at the national, pilot-zone, and local levels.

1.3 Research Significance

The theoretical contribution lies in treating banks' intelligent risk management as an independent analytical component rather than merely a background condition for digital finance. It develops a three-stage chain—data access, risk assessment, and credit extension—to provide a unified framework

for explaining why digital finance produces markedly different effects across regions and types of enterprise. Whereas much of the existing literature treats technology as a homogeneous input, this paper emphasizes that its effects depend on the underlying data infrastructure and institutional environment. This perspective helps address the explanatory limitations of technological determinism.

The practical contribution is that the national trends, Taizhou pilot-zone data, and regional comparisons provide comparable benchmarks for assessing the alleviation of financing constraints. The four categories of barriers and the corresponding four policy pathways are mapped respectively to data, capabilities, enterprise actors, and institutions, and can be applied directly to the design and evaluation of local inclusive-finance reforms. Commercial banks can use the analysis to determine priorities for upgrading risk models; SMEs can identify the digital credit assets they need to accumulate; and regulators can clarify the appropriate boundaries for algorithmic governance and data circulation.

2. Current Development of Digital Finance and Intelligent Risk Management

2.1 Institutional Provision: From Policy Frameworks to Platform Mechanisms

In 2013, the Third Plenary Session of the 18th Central Committee of the Communist Party of China proposed the development of inclusive finance. The availability of loans to MSEs became an indicator in regulatory performance assessments, while support instruments, reserve-requirement incentives, and differentiated regulation jointly encouraged lending.

In December 2015, Taizhou was approved as a national pilot zone for financial service reform and innovation for MSEs. The local pilot explored credit information sharing and risk sharing, creating a pattern of breakthroughs at pilot sites alongside lagging progress in broader adoption.

The National Integrated Financing Credit Service Platform Network has incorporated 74 categories of enterprise-related credit information into an institutionalized sharing mechanism. Banks can access the information with authorization, creating a two-tier supply structure based on national aggregation supplemented by local data.

In March 2025, the General Office of the CPC Central Committee and the General Office of the State Council issued the Opinions on Improving the Social Credit System, clarifying rules for credit information aggregation and sharing as well as credit repair. The National Financial Regulatory Administration (NFRA) established separate statistical definitions and monitoring indicators for inclusive loans to MSEs.

2.2 The National Landscape: Aggregate Expansion and Structural Shortcomings

The main indicators are presented in Table 1. At the end of 2024, outstanding inclusive loans to MSEs amounted to RMB 32.93 trillion, up 14.6% year on year—7 percentage points faster than the growth of all loans. The weighted average interest rate on newly issued loans was 4.13%, down 0.33 percentage points from the previous year, and had fallen further to 4.03% by the end of February 2025. Both lending volume and loan pricing therefore moved in a favorable direction.

Structural shortcomings, however, remain evident. Credit loans accounted for 27.3% of inclusive MSE

loans, rising only to 27.6% by the end of February 2025; more than 70% of loans still required collateral or a third-party guarantee. The loan access rate among technology-based SMEs was 46.9%. The growth rate declined from 14.6% to 12.6%, suggesting that policy-driven expansion in coverage was approaching diminishing marginal returns. Further improvement therefore requires stronger risk management capabilities rather than simply a larger volume of lending.

Table 1. Key Indicators of Inclusive Financing for MSEs Nationwide

Indicator	**End of 2024 (PBOC basis)**	**End of Feb. 2025 (NFRA basis)**
Outstanding inclusive MSE loans (RMB trillion)	32.93	33.90
Year-on-year growth (%)	14.6	12.6
Share of total outstanding loans (%)	12.88	—
Share of inclusive MSE loans represented by credit loans (%)	27.3	27.6
Weighted average interest rate on newly issued loans (%)	4.13	4.03
Borrowers with inclusive MSE credit facilities (10,000 borrowers)	Over 6,000	—
Loan access rate among technology-based SMEs (%)	46.9	—

Source: People's Bank of China, Report on the Analysis of China's Inclusive Finance Indicators (2024-2025); Statistical Report on the Allocation of Loans by Financial Institutions, Fourth Quarter of 2024.

2.3 The Pilot Region: A Decade of Development in the Taizhou Pilot Zone

The Taizhou approach closely follows the three-stage chain: first, establishing a credit information-sharing platform to ensure data access; second, encouraging banks to develop models to enable risk assessment; and third, using government-backed financing guarantees to facilitate credit extension. Changes in key indicators between the end of 2015 and the end of May 2026 are shown in Table 2.

2.3.1 Expanded Coverage

The number of MSEs receiving loans increased from 240,000 to 613,200, an increase of approximately 1.6 times the 2015 level. The first observable outcome was an increase in the number of enterprises obtaining loans.

2.3.2 An improved Guarantee Structure

The share of credit loans and guarantee-backed loans rose from 40% to 59.60%, an increase of 19.6 percentage points. This provides direct evidence of reduced reliance on collateral.

2.3.3 Simultaneous Improvements in Price and Asset Quality

The weighted average annual lending rate fell from 8.27% to 4.13%, a decline of 4.14 percentage points; the NPL ratio decreased from 1.58% to 0.72%. The simultaneous expansion of coverage and decline in the NPL ratio provide directional evidence of improved risk management capabilities. However, government guarantees and interest subsidies were also in place during the same period, so the improvements should not be attributed to algorithms alone.

2.3.4 An Established Data Foundation

The Taizhou Digital and Intelligent Finance Platform has aggregated 480 million credit-information records from 38 government departments and established credit files for all 1.0371 million market entities in the city. Based on the full statistical coverage of loans to MSEs, the outstanding balance reached RMB 1,128.832 billion, accounting for 55.19% of all outstanding loans—approximately 24 percentage points higher than the national figure calculated on the same basis.

Table 2. Main Outcomes of the Taizhou Pilot Zone for Financial Service Reform and Innovation for MSEs

Indicator	End of 2015	End of May 2026	Change
Number of MSEs receiving loans (10,000 borrowers)	24.00	61.32	+37.32
MSE loans as a share of total outstanding loans (%)	—	55.19	Approx. 24 percentage points above the national figure on the same basis
Share of credit loans and guarantee-backed loans (%)	40.00	59.60	+19.60
Weighted average annual lending rate (%)	8.27	4.13	−4.14
NPL ratio of the banking sector (%)	1.58	0.72	−0.86
Credit information aggregated by the platform	—	480 million records from 38 departments	Coverage of 1.0371 million market entities

Source: Taizhou Municipal Financial Development Center, Letter of Reply to Proposal No. 2026053 Submitted to the Fifth Session of the Sixth Taizhou Municipal Committee of the Chinese People's Political Consultative Conference (July 2026).

2.4 Regional Comparison: Liaoning and the National Average

Compared with Taizhou, Liaoning is characterized by relatively strong lending, a low lending share,

and lagging platform development. A comparison of the three regions using the available statistical definitions is presented in Table 3.

2.4.1 A relatively low lending share

At the end of 2024, the balance of inclusive loans to MSEs in Liaoning stood at RMB 449.2 billion, up 13.5% year on year—8 percentage points higher than the average growth rate of all loans. Using total outstanding loans of RMB 5.2 trillion as the denominator, the share was approximately 8.6%, below the national average of 12.88%.

2.4.2 A growth rate close to the national level

Liaoning's 13.5% growth rate was broadly comparable to the national rate of 14.7% calculated on the same statistical basis. This indicates that lending willingness was not lagging; the gap instead reflected differences in the outstanding loan structure and the base period.

2.4.3 Progress in platform development and model building

The provincial platform “Liao Xintong” has aggregated 3.5 billion information records on 5.32 million enterprises, helping 152,000 enterprises obtain RMB 232.6 billion in financing. Following joint model development by Dalian and the Industrial and Commercial Bank of China (ICBC), the number of entities granted credit increased from 30,000 to 190,000, while the amount of credit granted rose from RMB 11 billion to RMB 36 billion.

In Table 3, the national and Liaoning figures refer to the end of 2024, whereas the Taizhou figure refers to the end of May 2026. They also cover two different statistical scopes: inclusive loans to MSEs and loans to MSEs under the full statistical scope. Comparisons are therefore made only within the same statistical scope; no conversion is applied across different scopes.

Table 3. Regional Comparison of Loans to MSEs

Region	Reference date	Loan balance	Share of total loans (%)	YoY growth (%)	Statistical scope
Nationwide	End of 2024	RMB 32.93 trillion	12.88	14.6	Inclusive MSE loans (credit limit below RMB 10 million per borrower)
Nationwide	End of 2024	RMB 81.4 trillion	Approx. 31.4	—	Loans to MSEs (full statistical scope)
Taizhou, Zhejiang	End of May 2026	RMB 1,128.832 billion	55.19	—	Loans to MSEs (full statistical scope)

Region	Reference date	Loan balance	Share of total loans (%)	YoY growth (%)	Statistical scope
Liaoning	End of 2024	RMB 449.2 billion	Approx. 8.6	13.5	Inclusive MSE loans (credit limit below RMB 10 million per borrower)

Source: People's Bank of China, Statistical Report on the Allocation of Loans by Financial Institutions, Fourth Quarter of 2024, and other sources.

Overall, aggregate improvement has outpaced structural improvement. Outstanding balances, borrower numbers, and interest rates have all moved in a favorable direction, but credit loans still account for less than 30% of inclusive MSE lending, and fewer than half of technology-based SMEs obtain loans. The benefits of expanded coverage have therefore not fully reached asset-light enterprises. Pilot performance is stronger than the broader national picture: all four indicators in Taizhou improved simultaneously, showing that the chain of data access, risk assessment, and credit extension can function under specific institutional conditions. In contrast, Liaoning's lending growth was broadly in line with the national rate, but its lending share was only about two-thirds of the national average, indicating that pilot experience has not yet been replicated on a broad scale. Finally, technological development has advanced faster than institutional refinement: platforms and models have progressed considerably more rapidly than the provision of standards, the confirmation of data rights, and accountability rules. These three features point to a common conclusion: regional differences stem not from technology itself, but from whether data are accessible, models are appropriately adapted, and institutional arrangements are in place.

3. Practical Applications and Mechanisms of Intelligent Risk Management

3.1 Analytical Framework: From Data Access to Credit Extension

Digital finance alleviates financing constraints through two channels: direct and indirect. The direct channel relies on data generated in online business scenarios to assess creditworthiness when collateral is unavailable, reducing the cost per loan and making small-value, high-frequency financing economically viable. The indirect channel operates through banks' risk management capabilities and comprises three links. First, data access: transaction records, orders, tax payments, and utility-payment information are continuously accumulated as machine-readable data assets. Second, risk assessment: algorithms identify actual operating capacity and the probability of default, shifting the basis for pricing from collateral toward cash flows and behavioral characteristics. Third, credit extension: risk assessment results are incorporated into approval decisions and matched with differentiated credit limits, maturities, and interest rates to meet financing needs that are short-term, small-scale, frequent,

and urgent.

Compared with traditional risk management, intelligent risk management relies on high-frequency, multi-source data rather than static financial statements; uses behavioral-sequence prediction rather than static indicators; and replaces manual review of each loan application with a cost structure in which marginal costs decline as volume increases. Its effectiveness depends on data quality and model suitability. Every link in the chain may fail: without accessible data, models cannot be trained; if models are poorly adapted, risk identification becomes inaccurate; and without supporting institutions, risk assessment results may not translate into loan disbursement.

3.2 Empowering Finance with Public Data: The National Integrated Financing Credit Service Platform Network

The platform has brought 74 categories of key enterprise-related credit information into an institutionalized system for aggregation and sharing. Banking institutions can query and use the information with authorization, and direct system-to-system connections with banks have created a standardized data-supply channel. By the end of February 2025, cumulative loans issued through the network had reached RMB 37.3 trillion, including RMB 9.4 trillion in credit loans. The volume of credit loans had increased by 25.8% year on year, substantially faster than the overall growth of inclusive MSE loans. Without imposing additional collateral requirements, multidimensional credit profiles can be used to identify low-risk borrowers. This is the most basic practical realization of the "data access" link and a major foundation for the increase in the share of credit loans nationwide. Nevertheless, local data-aggregation standards remain inconsistent and updates are sometimes delayed, limiting the range of information available to models. Some provinces have completed only system connectivity and have yet to establish sustainable mechanisms for data updating and quality verification.

3.3 Bank-Government Joint Model Development: Expanding Credit Lending in Dalian

In Dalian, a financing credit service platform and ICBC jointly developed risk models and online credit-loan products. Enterprises can apply and receive approval immediately without providing collateral, while government administrative data are directly incorporated into banks' risk management models. The number of business entities granted credit rose from 30,000 to 190,000, representing an increase of approximately 5.3 times the initial figure; the amount of credit granted increased from RMB 11 billion to RMB 36 billion, an increase of approximately 2.3 times. The average credit limit per enterprise declined, indicating that coverage extended further into the small-business long tail. In regions with relatively weak data foundations, joint model development with a nationwide bank can strengthen model capabilities without requiring the construction of a new local system. This is a relatively cost-effective way to implement the "risk assessment" link, and may be more replicable in northern China than independently building local platforms.

3.4 Digital Banking: MYbank's "310" Model

The model operates entirely online, with a three-minute application process, one-minute loan

disbursement, and zero manual intervention. Risk management draws on e-commerce transactions and payment records, while satellite remote sensing is used to identify crops and interactive risk assessment supplements fragmented information. MYbank has cumulatively served 68.51 million MSE customers. More than 80% of its new customers over the past five years had no prior credit records, and the average loan size per customer was RMB 72,000. Satellite remote sensing covered 1.81 million farming households across 31 provinces, with an identification accuracy rate of 93%. The model demonstrates the sustainability of algorithm-based risk management by serving long-tail customers at extremely low unit cost. Its limitation is its dependence on the platform ecosystem, which makes it less suitable for large-value and medium- to long-term financing needs.

3.5 Risk Sharing: The Taizhou Credit Guarantee Fund for MSEs

The fund is financed primarily by government contributions, supplemented by bank contributions. Combined with digital screening, it creates an integrated arrangement of data screening, guarantee-based credit enhancement, and bank lending. The outstanding amount of guarantees was RMB 16.456 billion, the guarantee leverage ratio was 12.90-fold, and the fund had cumulatively served 44,000 enterprises. The average guarantee fee rate was 0.68%, and the cumulative guarantee compensation rate was 0.76%. The coexistence of low fees and a low compensation rate suggests that credit enhancement enables risk to be shared in a controlled manner when supported by data. This provides a key complement to the “credit extension” link, although the fund's scale is constrained by fiscal capacity.

These cases show that workable practices already exist in China for every link in the chain, confirming the viability of the technological approach itself. Differences in outcomes across the four cases arise from differences in data and institutional arrangements, rather than from the level of technological sophistication.

4. Practical Constraints

4.1 Data Dimension: Lagging Regional Platforms and Persistent Interdepartmental Data Silos

The comparison in Table 3, based on consistent statistical definitions, shows that loans to MSEs account for 55.19% of all loans in Taizhou, approximately 24 percentage points above the national figure. In Liaoning, inclusive MSE loans account for about 8.6%, below the national level of 12.88%. The gap is not attributable to differences in economic development alone, but rather to the breadth of data aggregation and the maturity of platform development. Taizhou has established comprehensive credit files for all 1.0371 million market entities, whereas many regions in northern China continue to face incomplete data aggregation and delayed updates.

Interdepartmental data separation also constrains model development. Although the 74 categories of information have been identified for sharing, data held by market-regulation, tax, social-security, utility, and banking institutions remain isolated from one another, and sharing often exists only at the level of formal agreements. Zhou Suxia argues that barriers to data circulation further exacerbate information

asymmetry between banks and enterprises. Missing fields and delayed updates can also directly cause misjudgments. Constraints related to data quality are more binding than those related to data quantity, resulting in a situation in which technological capabilities exist but the necessary data are unavailable.

4.2 Capability Dimension: Limited Model Capabilities and Insufficient Incentives for Transformation among Smaller Banks

Locally incorporated banks face funding and talent constraints and therefore invest insufficiently in systems. They tend to transplant templates developed by large banks and lack representative samples suited to local industries. Inclusive loans to MSEs are small in individual size and costly to operate. Even when risk management costs decline, overall returns remain limited, creating reluctance to undertake transformation and uncertainty about the risks of doing so.

More importantly, incentives and accountability are misaligned. Detailed rules on exemption from liability for duly performed duties have not been effectively implemented at the grassroots level, and responsibility for algorithmic decisions remains unclear. To avoid personal liability, loan officers continue to rely on collateral, making it difficult for model outputs to enter the approval process. Although some rural commercial banks have introduced risk management systems, credit approvals continue to rely primarily on manual experience, leaving the systems operational in name but underused in practice.

4.3 Enterprise Dimension: Weak Digitalization Creates "Credit-Invisible" Enterprises

Many traditional SMEs in manufacturing and commerce have rudimentary financial management systems. Orders, transaction records, and ledgers are not retained digitally, leaving fragmented information that cannot easily be converted into standardized data recognizable by risk models. MYbank has disclosed that more than 80% of its new customers over the past five years had no prior credit records, indicating that a considerable number of small-business operators remain credit-invisible. Even when such enterprises are located in areas covered by digital-finance services, they may still struggle to obtain meaningful credit. In addition, some financial products continue to follow design principles intended for large enterprises, resulting in mismatches between credit limits and loan maturities and insufficient adaptation despite technological progress.

4.4 Institutional Dimension: Inadequate Algorithmic Risk Governance and Digital Credit Arrangements

Chen Liuqin points out that digital credit risk management commonly faces risks involving personal-data privacy breaches, algorithmic opacity, and algorithmic discrimination. Models may not clearly explain the logic behind credit decisions, leaving rejected enterprises without an adequate basis for appeal. Training samples may be biased toward larger enterprises, potentially creating a new form of digital exclusion, while sensitive data may be exposed during circulation.

Institutional provision is also incomplete. The confirmation of data rights and the valuation of data assets remain underdeveloped, making it difficult for operational data to qualify as collateral or pledged assets. There is no unified standard for digital credit assessment, and different institutions assign

different risk weights to industries and regions. The same dataset may therefore produce conflicting assessments, while enterprises applying to multiple banks must repeatedly submit the same materials. Luo Yonggen and colleagues argue that institutional arrangements must be improved alongside efforts to release the credit-allocation effects of digital technologies; otherwise, institutional frictions will weaken their impact.

5. Policy Recommendations

5.1 Government: Strengthen Regional Digital Infrastructure and Open Data Channels

5.1.1 Strengthen Infrastructure

Increase investment in digital infrastructure in northern China, central and western regions, and county-level areas. Provide computing resources and talent support for the risk management upgrades of locally incorporated banks. Prioritize provinces with low MSE lending shares when promoting the Taizhou experience, and use provincial platforms to aggregate enterprise-related credit information in a unified manner. Ensure comprehensive coverage of enterprise credit files and incorporate data quality into performance assessments.

5.1.2 Open Data Channels

Establish de-identified data-sharing platforms supported by federated learning and privacy-preserving computation, making data usable without exposing the underlying information. Clarify the responsibilities of government departments for data provision and the frequency of updates, and incorporate these requirements into performance evaluations so that information sharing moves beyond formal agreements.

5.2 Financial Institutions: Upgrade Risk Models and Improve Incentives and Accountability Arrangements

5.2.1 Optimize Models

Increase the weight assigned to samples from private enterprises, technology-based firms, and county-level businesses; incorporate soft information such as orders, tax records, and social-security contributions; and reduce reliance on collateral. Drawing on the Dalian experience, cooperate with nationwide banks and credit-information platforms in joint model development while retaining the ability to adjust parameters to local conditions.

5.2.2 Improve Mechanisms

Adopt a human–machine collaborative process in which models conduct preliminary screening and staff carry out manual reviews. Establish routine back-testing and feed soft information gathered by front-line personnel back into the models. At the same time, clarify the boundaries of responsibility between model recommendations and human decisions, and implement exemptions from liability for duly performed duties to prevent systems from remaining idle in practice.

5.3 SMEs: Advance Internal Digitalization and Accumulate Digital Credit

Standardize the digital retention of financial records, orders, and tax ledgers; maintain public credit

records relating to taxation and social-security contributions; and proactively accumulate supply-chain and online business data. Huo Shengping and Wang Jing argue that enterprises' digital operating capabilities amplify the enabling effects of digital finance. Given the still-high proportion of borrowers with no prior credit records, establishing verifiable operating records is itself a substantive investment in improving the likelihood of obtaining loans. Enterprises should also avoid excessive borrowing.

5.4 Regulators: Improve Algorithmic Governance and the Digital Credit Framework

5.4.1 Regulate data and algorithms

Prohibit excessive data collection and improper retention, and establish mechanisms for holding parties accountable for data breaches. Require algorithm filing and routine audits, with particular attention to potential algorithmic exclusion of SMEs. Encourage explainable artificial intelligence (XAI) and provide appeal channels for enterprises whose loan applications are rejected.

5.4.2 Improve the credit framework

Establish interoperable digital credit assessment standards for SMEs that are mutually recognized across institutions. Advance the confirmation of data rights and value assessment so that operational data can be pledged as collateral and circulated.

6. Conclusions and Outlook

First, the alleviation of financing constraints operates through both direct and indirect channels. The key is whether the chain of data access, risk assessment, and credit extension is complete. Second, workable practices already exist for each link in China, but replication remains far from complete: credit loans account for less than 30% of inclusive MSE lending, and the loan access rate among technology-based SMEs is 46.9%; loans to MSEs account for 55.19% of all loans in Taizhou and approximately 31.4% nationwide, while inclusive MSE loans account for about 8.6% in Liaoning. The disparities are substantial. Third, bottlenecks are concentrated in four areas: data provision, model capabilities, enterprise readiness, and institutional arrangements. Constraints relating to data and institutions are the most significant.

Data channels and the credit system form the foundational layer; models and operating mechanisms constitute the implementation layer; and enterprise digitalization represents the demand side. The foundational layer should be established first by governments and regulators, followed by implementation efforts by financial institutions, with tools and training provided to support demand-side adoption. Reversing this sequence can create mismatches, such as systems being launched without sufficient business use, or strong demand emerging before adequate data become available.

Future research could combine provincial panel data with field investigations to test the marginal effects of model suitability and examine new developments arising from the use of generative large language models in credit risk management.

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