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Research on the Impact of Fintech on SME Financing Constraints and Transmission Mechanisms

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Abstract: SMEs have always been an important pillar of the national economy, but they have long struggled with narrow financing channels, information asymmetry and credit allocation imbalance. The traditional financial system, limited as it is, is restricted by cost and risk considerations and knows it is incapable of adequately meeting the financing requirements of SMEs. In recent years, the emergence of fintech is proving to be an opportunity to break this historical stalemate, relying on big data, artificial intelligence, blockchain and other technologies to reconstruct core links in risk assessment, credit profiles and capital matching, among others. However, research on the practical application of fintech has revealed certain deeply rooted contradictions, such as weak data governance, uneven technology penetration and underdeveloped regulation, and therefore its potential to relieve financing constraints is not fully unlashed. Systematic academic inquiry is urgently needed to clarify the synergistic trajectory between technological empowerment and institutional adaptation

1. Introduction

The survival and development of SMEs rely on efficient financing support, but traditional financial models can hardly meet their needs due to information barriers and cost constraints. Fintech has injected innovative kinetic energy to break this deadlock through technology-driven credit reconstruction: big data mining enterprises' multi-dimensional business traces, artificial intelligence optimizing risk pricing models, and blockchain enhancing supply chain finance transparency. However, the tension between technological innovation and the institutional environment should not be ignored - data silos and the risk of privacy breaches undermine the credibility of the technology, the digital divide between regions and industries exacerbates the imbalance in the allocation of financing resources, and the regulatory framework lags behind the speed of business model iteration. If these issues are not properly addressed, FinTech may degenerate from a “game breaker” to a new market segmentation tool. How to find a dynamic balance between efficiency and safety, innovation and compliance has become a key proposition for promoting the in-depth development of financial inclusion [1].

2. The Impact of Financial Technology on Financing Constraints of Small and Medium-sized Enterprises and Transmission Mechanisms

2.1. The Direct Impact of Fintech on SME Financing Constraints

The fintech platform constructs a multi-dimensional credit scoring model by dynamically collecting non-financial data such as the enterprise's water and electricity consumption and supply chain payback records, so that small food processing factories with unsound traditional financial statements are able to obtain credit lines by virtue of the evaluation of their stable cold chain logistics partners. Smart contract technology encodes the goods confirmation link of order pledge financing into automated execution terms. When the logistics signing information deposited in the blockchain triggers the preset conditions, the bank's fund transfer instruction can directly reach the enterprise account without manual review, compressing the fund retention cycle caused by the flow of paper documents under the traditional mode. The accounts receivable sub-ledger system developed by the third-party payment institution allows manufacturing enterprises to split the electronic commercial bills of large customers into multi-period financing targets according to the production progress, and discount the bills in batches according to the degree of completion of the process before maturity, thus alleviating the liquidity mismatch pressure caused by the pledge of the whole bill in the past.

2.2. The Indirect Impact of Fintech on SME Financing Constraints

In the wave of industrial digital transformation, the industry association promotes the industry chain data sharing pool for small and medium-sized ceramic enterprises to provide the viability of endorsement, the member units of the kiln temperature curve and yield data encrypted uploaded to the alliance chain node, enabling financial institutions to assess the actual operational efficiency of the enterprise with reference to the industry benchmark value. The export credit insurance linkage mechanism built by the cross-border e-commerce platform allows small and medium-sized garment factories to obtain dynamic credit enhancement by virtue of the real-time inventory data of overseas warehouses, and the return rate of overseas consumers and store scores are synchronized into the credit adjustment parameters, forming a new type of credit proof system that is distinctive from collateral guarantee [2]. The supply chain financial ecology led by cold chain logistics giants connects the transportation temperature control records and freshness loss rate indicators into the financing risk control model, helping cooperatives to exchange the quality maintenance data of saints' fruits during transportation for prepayment support before the harvest season, activating the movable asset financing potential that is difficult to mobilize in the traditional agricultural supply chain. The in-depth coupling of environmental protection supervision platform and enterprise carbon account enables small and medium-sized paper mills to obtain green credit interest rate discounts through real-time monitoring data of wastewater treatment, and the amount of sewage right pledge financing floats dynamically with the operating efficiency of environmental protection equipments, forcing the enterprises to turn the cost of environmental governance into financing advantages. The patent cross-licensing blockchain platform constructed by the Industrial Technology Alliance allows smart hardware startups to use technology equity records as credit enhancement certificates, and obtain R&D special loans by virtue of the adoption rate of technology within the alliance before generating stable cash flow.

2.3. Transmission Mechanism of FinTech's Impact on SME Financing Constraints

The blockchain traceability system completely uplinks pesticide spraying records and cold chain transportation tracks during the production cycle of agricultural products, enabling local commercial banks to match the pace of credit investment based on the growth stage of the crop, and

automatically releasing special loans for the procurement of drip irrigation equipment when the sensors capture soil moisture in the orchard reaching a specific threshold value. The supply chain data pool led by core enterprises correlates and analyzes the mold usage frequency of small and medium-sized auto parts manufacturers with the production scheduling plan of the host factory, dynamically evaluates the risk exposure of the order pledge, and completes the accounts receivable corroboration financing of the three-tier suppliers within two hours after the host factory confirms the receipt of goods. The government data center connects the enterprise registration information of the municipal supervision department and the energy consumption curve of the power company to generate a dynamic business activity index, according to which the local agricultural and commercial bank implements credit limit flexibility management for catering merchants, and automatically raises the credit loan base of merchants around scenic spots three months before the peak tourist season. The intelligent risk control model introduces the semantic analysis function of industrial and commercial change records, identifying technology startups with optimized and adjusted shareholder structure, which can still obtain R&D funding revolving loan support based on the frequency of patent outputs of the technology team even if the current period's profit does not meet the traditional credit standard. The exchange rate fluctuation buffer mechanism constructed by the cross-border payment platform allows export-oriented SMEs to lock in the exchange rate range for the next six months for foreign exchange settlement, and activate the raw material procurement loan immediately after the signing of the foreign trade order, which effectively avoids delays in the financing cycle due to foreign exchange risks under the traditional mode.

3. Problems of FinTech in Relieving Financing Constraints of Small and Medium-sized Enterprises

3.1. Problems of data quality and security

There are structural deficiencies in the data base on which fintech relies, and the core data generated by SMEs in their daily operations, such as transaction records, logistics information and tax declarations, are dispersed on different platforms with different format standards, which makes it difficult for financial institutions to form a complete assessment framework for constructing an enterprise's credit profile. Some enterprises artificially embellish operational data to meet financing conditions, inflate sales or conceal related transactions, which are easily misjudged by algorithms as high-quality customers in the absence of cross-validation mechanisms, resulting in a mismatch of credit resources. Privacy protection loopholes in technology application scenarios have exacerbated business owners' resistance to data sharing, and the frequent leakage of biometric information or misuse of trade secrets by third parties have made SMEs cautious about fintech platforms even when facing financing difficulties. Regulators have yet to establish governance rules covering the entire chain of data collection, storage and use, and the ambiguity of the boundaries of data rights and flow has led to a game of three-way distribution of data rights and interests among fintech enterprises, financial institutions and SMEs, restricting the release of synergistic value of data elements [3].

3.2. Inadequate Fintech application capacity

The actual penetration of fintech tools faces multiple obstacles. Against the background of the lack of digital management experience and infrastructure, SMEs have cognitive faults in the operation logic of intelligent risk control systems and blockchain financing platforms, and frequently touch the red line of technology by mistake or fail to activate the service function fully. Although traditional financial institutions have introduced algorithmic models to optimize the credit process, the compatibility of the technology module with the original business system is insufficient, and account managers stick to the inertia of manual approvals, resulting in intelligent

decision-making recommendations being suspended or implemented in a compromised manner in the practical aspects. When developing solutions for SMEs, technology providers overly focus on generic functions and ignore the scene specificity of segmented industries, such as order pledge financing in manufacturing and cash flow forecasting in retail, which require differentiated data capture dimensions, making it difficult to adapt standardized products to multiple needs. The misalignment of the three parties' understanding of the technology and value demands makes the cost reduction and efficiency effect that fintech is supposed to have dissipate in the landing process, and some enterprises are still trapped in the paradox of "digital tools in hand but no door to financing".

3.3. Incomplete regulation and legal system

The existing regulatory framework has a delayed response to new business forms derived from fintech, and the legal effects of cross-border data flows and smart contracts have yet to be clearly defined in the Commercial Banking Law or the Securities Law, making supply chain finance platforms face compliance disputes in cross-border trade scenarios. Local financial regulators lack penetrating regulatory tools for algorithm-driven credit pricing models, and some institutions use technological black boxes to implement discriminatory interest rate pricing or over-credit, instead exacerbating the accumulation of debt risk for SMEs. The legal standards for cutting data ownership and usage rights are ambiguous, and fintech companies are forced to invest high costs in building data firewalls to meet compliance requirements, but the lack of legal recourse mechanisms for the misuse of biometric information or the secondary sale of customer profiles has weakened the foundation of trust for SMEs to participate in data sharing. The development of regulatory technology (RegTech) is lagging far behind the market demand, the risk early warning system is difficult to capture shadow financing activities based on distributed ledgers, and the regional regulatory arbitrage space has induced some technology platforms to wander in the policy margins, leading to regional disconnections in the practical effects of financial inclusion.

3.4. Unbalanced development of FinTech

The geographical disconnection and industry fragmentation in the development of fintech has exacerbated the mismatch of resources. With mature digital infrastructure and dense technology service provider clusters, the eastern coastal region has promoted the rapid penetration of blockchain note financing and intelligent risk control tools, while small and medium-sized enterprises (SMEs) in the central and western regions are still trapped in the physical bottleneck of the lack of basic data collection equipment and insufficient network coverage. The depth of technology application is polarized in the industrial chain dimension, with data-native industries such as e-commerce and logistics being able to seamlessly connect to intelligent investment and supply chain finance platforms, while traditional manufacturing industries are lagging behind in the digitization of production processes, making it difficult for them to meet the high-frequency data supply standards required for algorithmic credit granting [4]. The mismatch between policy support and market-oriented operation has further widened the technological gap between enterprises, with government-led fintech pilot projects often giving priority to the importation of above-average enterprises, while market-oriented institutions are more inclined to serve high-net-worth customers due to profitability constraints, and a large number of micro-enterprises have been excluded from the scope of technological empowerment. Differences in digital literacy have led to the differentiation of financing opportunities among enterprises of the same size. While SMEs with professional teams can effectively utilize open banking interfaces to integrate financial data, home-based operators have given up applying for smart credit products due to the complexity of operation, and the universality of technology has evolved into an implicit screening mechanism in practice.

4. Measures for Utilizing FinTech to Ease SME Financing Constraints

4.1. Enhancing Data Quality and Security

Building a cross-industry data governance alliance can help crack the information silo dilemma. Industry associations should take the lead in formulating SME data collection standards covering logistics, taxation, banking and other multi-dimensional aspects, eliminating format barriers and semantic ambiguities between different systems, so as to enable financial institutions to capture real and complete business trajectories. Technology providers need to embed dynamic desensitization modules in the blockchain architecture, implement hierarchical authorization management for core business data, and allow business owners to independently set the scope of data visibility for upstream and downstream enterprises in the supply chain, so as to ensure the need for verification of order information and at the same time block the path of leakage of sensitive information. Regulators should promote the establishment of a dynamic assessment mechanism for data quality, require fintech platforms to submit data cleaning logs and outlier handling reports on a regular basis, and introduce third-party auditing organizations to conduct penetrating verification of the data input sources of algorithmic models, so as to reduce the room for operation of artificially tampering with financial indicators. We propose exploring the establishment of a contribution-based data-sharing incentive mechanism. Under this framework, small and medium-sized enterprises (SMEs) that provide compliant data would be rewarded with credit points. These points could then be converted into preferential loan interest rates or guarantees rate discounts, thereby addressing the common misconception that 'increased data sharing necessarily elevates risk exposure.' This approach aims to stimulate a virtuous cycle in the circulation of data elements through market-oriented incentives.

4.2. Enhancement of Fintech Application Capability

Financial institutions should join hands with technology developers to design a lightweight intelligent matching engine, customize the interactive interface for SMEs in terms of their equipment connectivity and operating habits, and simplify the process of blockchain authentication and smart contract execution into a visual operation with less than three clicks, so as to lower the threshold of use. Local governments can rely on industrial parks to build fintech sandbox incubation platforms and invite technical experts to be on-site to guide business owners to transform production data flow into qualified credit assets, for example, guiding agricultural and sideline product processing enterprises to transform cold chain temperature monitoring data into credit-enhancing credentials for inventory financing. Industry associations need to establish a hierarchical digital skills certification system, develop hands-on courses on intelligent report generation tools for financial staff, and customize scenario-based training on customer behavior analysis systems for sales teams, so that technology application capabilities penetrate into the capillaries of business operations. We propose establishing regional technology sharing centers wherein state-mandated cloud service providers deliver standardized intelligent risk control modules and modular data center architectures. This framework enables SMEs to access API interfaces through subscription-based operational fees, thus mitigating costly duplication in R&D investments. The model cultivates a digital transformation pathway characterized by government-backed infrastructure foundations and enterprise-owned core business autonomy [5].

4.3. Improvement of regulatory and legal system

Regulatory technology enterprises shall develop a risk penetration system adapted to new financing tools, conduct real-time compliance scanning of the terms of transfer of income rights nested in smart contracts, and automatically identify abnormal fund paths in violation of foreign exchange controls in cross-border payment scenarios, so as to reduce the risk of a regulatory

vacuum under the principle of technological neutrality. The legislature shall add rules on the affirmation of digital debt certificates in the Contract Part of the Civil Code, and clarify the legal effect hierarchy of blockchain deposits and the remedial procedures for the consequences of the automatic execution of smart contracts, so as to enable supply chain financial platforms to quickly complete the reversal of the burden of proof in disputes over the affirmation of rights of goods. The local financial office can join hands with the judicial department to establish a case sharing library for fintech disputes, and refine the adjudication standards for financing refusal caused by big data killing or algorithmic miscalculation, so as to provide SMEs with case-like references in the litigation of data image correction. Cross-border regulatory collaboration mechanisms urgently need to be embedded with technological elements, allowing SMEs in ASEAN countries to use cross-border e-business licenses to directly access domestic supply chain finance platforms relying on the mutual recognition system of digital identities under the RCEP framework, and at the same time requiring platform operators to keep a complete audit trail of smart contracts in the cross-border payment system of the central bank. An algorithmic ethics review committee should be set up within commercial banks to conduct quarterly backtests of regional economic weighting factors and industry discrimination factors in credit models, and force model iteration procedures to be triggered when a systematic suppression of credit limits is found to exist for manufacturing enterprises in counties [6].

4.4. Promoting Balanced Development of Fintech

Financial infrastructure operators can join hands with satellite communication providers to deploy low-orbit IOT terminals in remote counties to relay livestock ear tag data in pastoral areas and carbon sink monitoring information in forest areas back to the cloud-based credit assessment model in real time, cracking the data blind spot of farming and animal husbandry enterprises due to geographic isolation. Head tech companies should dialectize the smart contract development toolkit and build in voice interaction protocols in Southwest Mandarin and Southern Min, so that family workshop owners with limited literacy can complete the automated confirmation of blockchain receivable vouchers by dictating order information. Regional equity trading centers need to open a special fintech board to allow small and medium-sized enterprises (SMEs) to use data asset governance capability as an additional valuation indicator, and attract venture capital to prioritize capital injection in those specialty agricultural product processing enterprises that have successfully migrated from traditional ledgers to distributed ledger systems. Cross-provincial government data platforms should open up API interfaces for fintech companies to apply for calls, retrieve utility payment records and environmental penalty information to supplement risk control portraits after obtaining authorization from enterprises, and establish a data return mechanism for financial institutions to reverse write credit results into local credit systems. The Science and Technology Ethics Committee should formulate an algorithmic inclusiveness assessment framework, conduct dialect recognition accuracy and extreme network environment suitability tests on smart credit apps used by rural cooperatives, and make it mandatory for service providers to retain at least two account managers with offline due diligence capabilities in sub-county outlets to serve as physical backup nodes for algorithmic decision-making.

5. Conclusion

Fintech's repositioning of the SME financing ecosystem is actually a deep binding of technology-based rationality and financial-based ethics. In effect, it has opened up a fairer financing portal for SMEs through the information "fog", reducing the transaction friction. Nevertheless, characteristic of technology is its instrumental, or tool-like characteristic, where its impact is governed by the co-evolution of data quality, application capacity and institutional environment. Future efforts must focus on establishing a multi-linked governance regime: improving the

market-oriented allocation mechanism of data elements, elevating the digital viability of small- to medium-sized enterprises (SMEs), implementing an inclusive and prudential regulatory sandbox, and enabling the penetration of technology dividends into the weak link of the real economy. Only then, can fintech be transformed from a "possibility" into a "certainty force" for financial inclusion, and ultimately, a new engine of SMEs to break the financing dilemma.

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