Research on the Alleviating Effect of Digital Economy Development on Financing Constraints of SMEs

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Abstract: In the wave of digital transformation of the global economy, digital economy has become an important driving force for promoting economic growth. Small and medium-sized enterprises (SMEs) are a new force in the development of the national economy, but they have long faced challenges such as narrow financing channels and Information asymmetry. The lack of collateral exacerbates the Financing difficulties of SMEs. The service blind spots of the traditional financial system further restrict the financing capacity of SMEs. World Bank data shows that about 40% of SMEs worldwide have financing gaps, and the proportion in China is particularly prominent. The rapid development of digital technology has provided a new path to solve the financing problems of SMEs. Digital finance has revolutionized traditional financial formats by means of big data and artificial intelligence. digital inclusive finance reduces the problem of Information asymmetry through the Data-driven credit assessment mechanism. This mechanism expands the service scope for the "Long-tail market", benefiting more SMEs. Supply chain finance and Platform ecological finance have effectively unlocked the potential of Movable property financing through digital integration of the industrial chain. Meanwhile, it examines the current status of SMEs financing under the development of digital economy, such as the rapid growth of digital inclusive finance and the improvement of financing accessibility; it also points out the challenges posed by issues like the digital divide and data security. Based on this, countermeasure suggestions are proposed from three levels: government, financial institutions, and enterprises, including strengthening digital infrastructure, deepening technology empowerment, and accelerating enterprise digital transformation. This research shows that giving full play to the advantages of the digital economy and through multi-party collaborative cooperation can effectively alleviate the Financing constraints of SMEs. At the same time, this is also helpful for promoting the sustainable development of SMEs.

1. Introduction

1.1. Research Background

In the wave of digital transformation of the global economy, digital economy has become an important driving force for economic growth [1]. As a new force in the development of the national economy, SMEs have long faced difficulties such as narrow financing channels, Information asymmetry and lack of collateral. The service blind spots of the traditional financial system have further exacerbated the Financing difficulties of SMEs. The development of digital economy in alleviating financing constraints is facing numerous challenges. The digital transformation of SMEs is insufficient, and the issue of "digital divide" has become increasingly prominent. Some enterprises find it difficult to integrate into the digital financial ecosystem due to insufficient technical capabilities. At the same time, problems such as data security risks, algorithmic discrimination and regulatory lag are weakening the actual effect of digital economy empowerment.

1.2. Research Significance

This study is of theoretical and practical significance. From the theoretical perspective, this study combines the Information asymmetry theory and establishes a framework to alleviate Financing constraints. This study finds out the mechanism of data-based credit analysis. Actually, this study is

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guided by policymakers and enterprises dynamically. Governments should further enhance investment in digital fields and improve data governance. Financial institutions should further innovate financial services through open banking system and technological means. SMEs should further accelerate digital transformation and enhance the awareness of data assets. This study also suggests paying attention to the regional differences and industry characteristics. This study proposes the measures to expand the inclusive finance for micro, small, medium enterprises and underdeveloped regions. Finally, through the efforts of multiple parties, the digital economy alleviates the financing problems. The digital economy will become the primary engine to promote the inclusive development.

2. Theoretical Mechanisms of How the digital economy Alleviates Financing Constraints for SMEs

2.1. Mechanism of Reducing Information Asymmetry

2.1.1. Data-Driven Credit Profiling

Traditional financial services rely on physical branches. SMEs spend a lot of time and energy on financing. Complex procedures increase the difficulty. The development of the digital economy is driving the transformation of financial services toward online and automated operations. Financial institution builds a network platform. SMEs can submit applications and upload files at any time. These platforms have introduced automatic approval mechanisms that quickly evaluate loan applications in accordance with pre-set rules. Approval time has been significantly shortened, and service efficiency has been greatly improved. Some banks have launched online credit services. Enterprises simply need to fill in basic information online, and the system can quickly complete preliminary approval [2]. Online services have accelerated the fund-raising process of financial institutions and reduced operating costs. Financial institutions can support more small and medium-sized enterprises and provide easier financing options by reducing costs.

2.1.2. Precision in Risk Pricing

When pricing risks for SMEs, financial institutions often face difficulties caused by information asymmetry and tend to adopt uniformly high interest rates to mitigate potential risks, which in turn increases SMEs' financing burdens [3]. Against the backdrop of the digital economy, Financial institution can conduct Accurate assessment and pricing of Risk of SMEs by leveraging Data analysis and modeling technology. By aggregating massive volumes of enterprise information and utilizing Machine learning algorithm for modeling, institutions can more accurately predict the Default probability of enterprises. Combined with Real-time market information and Economic indicators, risk pricing is dynamically adjusted. For enterprises with stable operations and excellent credit, Preferential interest rate can be offered. For enterprises with higher risks, interest rates are appropriately increased. This Precise risk pricing mechanism balances the returns and risks of Financial institution. Meanwhile, it reduces the Financing cost of high-quality enterprises and alleviates their Financing difficulties.

2.2. Mechanism of Optimizing Credit Resource Allocation

2.2.1. Online and Automated Service Channels

Traditional financial services are centered around physical branches. This require SMEs to invest significant time and energy in accessing financing [4]. Complex procedures add to the burden on enterprises. Digital economy promotes Financial Service channels transition to Online and Automated form. Networking platform helps SMEs submit financing application and upload documents anytime and anywhere. Platform applies Automated Approval System to quickly evaluate financing application based on previous rules and method. The financing approval period has been greatly shortened and service efficiency greatly enhanced. Bank provides Online Credit Service. Enterprise fills in basic situation online, and system will quickly finish approval. Online and Automated Services enhance the efficiency of Financial institution and greatly reduce the Operating Cost. Lowering Cost

benefits the Irrigation of Financial institution to more SMEs and optimization of Credit Resource Allocation. Provides More Convenient Solution for the Financing Demand of SMEs.

2.2.2. Coverage of the Long-Tail Market

In the traditional financial field, due to cost and risk constraints, financial institutions are more inclined to support large enterprises and high-quality customers. However, SMEs are often overlooked due to their large number and scattered financing needs. The rise of the digital economy has changed this. With the help of Internet technology and big data analysis, financial institutions can obtain information on SMEs at a lower cost and gain a deeper understanding of the characteristics of their financing needs. The online service model breaks through geographical and time constraints, enabling financial institutions to provide support to more SMEs. Some Internet financial platforms meet the needs of different types of SMEs through precise market positioning and customized financial products. Strengthen coverage of the long-tail market and bring previously neglected SMEs into the scope of financial services. Ultimately, this optimises the efficiency of the distribution of credit resources among enterprises of different sizes [5].

2.3. Mechanism of Innovating Financial Service Models

2.3.1. Deepening Supply Chain Finance

Traditional supply chain finance is based on the credit of core enterprises to provide financing support for upstream and downstream SMEs but often faces problems such as delayed information transmission and complex procedures [6]. The rise of digital economy has driven the in-depth development of Supply chain finance. Through the use of emerging technologies like blockchain and the Internet of Things, logistics, information flow, and capital flow have been connected in real time and are visible for all to see. Thanks to the blockchain technology, the immutability and traceability of the transaction records are guaranteed, which greatly improves the reliability of Supply chain finance. With the help of the Internet of Things technology, the status and location of goods can be tracked in real-time and this also significantly lowers the regulatory risk of pledged assets. In addition, in Supply chain finance, when the conditions of the blockchain smart contract are met, the fund payment and settlement can be automatically triggered. By optimizing the Supply chain finance model and strengthening the collaborative relationship between core enterprises and SMEs, the financing channels for SMEs can be expanded. This plays an important role in alleviating the financing pressure of SMEs.

2.3.2. The Rise of Platform Ecosystem Finance

The rise of various platform companies is an important achievement of the development of the digital economy. E-commerce platforms and industrial Internet platforms bring together a large number of transaction records and credit data of SMEs, giving rise to platform ecological finance. Relying on technological and data resources, platform enterprises collaborate with Financial institution to provide integrated financial services for SMEs within the platform. E-commerce platforms offer small-sum credit support based on data such as enterprise transaction flows and customer feedback. Industrial internet platforms integrate industrial chain resources to provide enterprises with various financial options including supply chain financing and equipment leasing. Platform eco-finance breaks through the limitations of traditional financial services and creates an open and shared financial ecosystem. Through the deep integration of finance and industry, it provides SMEs with more convenient and efficient financing channels.

2.3.3. Activation of Movable Asset Financing

SMEs hold a large amount of movable assets such as inventories and accounts receivable, which are difficult to evaluate and manage. Traditional Financial institution have maintained a relatively conservative attitude towards Movable property financing, and the rise of digital economy has provided technical support for this. Internet of Things technology enables real-time tracking of the status and location of movable properties, thereby ensuring asset security. Big data analytics can

accurately assess the market value of movable properties, providing a decision-making basis for Financial institution [7]. Taking inventory financing for instance, IoT sensors can collect information of inventory such as quantity, quality and circulation. By combining with dynamic market price analysis, accurate calculation of inventory value can be completed. By using Blockchain technology, the transaction process of Movable property financing is more transparent and can be traced, which reduces the risk for Financial institution. Promoting Movable property financing, SMEs can better use their own current assets as a basis for financing. This method opens up financing channels while effectively solving the financing problem for enterprises.

3. The Current Situation and Challenges of SME Financing under the Development of the digital economy

3.1. Analysis of the Current Situation of SME Financing under the Development of the digital economy

3.1.1. Rapid Development of Digital Inclusive Finance

In recent years, digital inclusive finance, through innovative forms such as mobile payments and internet banking, has achieved leapfrog progress and had a profound impact on the financing environment of SMEs [8]. Diversified fintech platforms and traditional Financial institution have built a well-structured financial service architecture. With the help of big data and artificial intelligence technologies, the service scope has been expanded to county economies, small and micro enterprises, and individual industrial and commercial households. Studies show that the outstanding balance of inclusive micro and small loans in China has grown rapidly, and the service coverage has expanded significantly. The rapid development of digital inclusive finance marks the transformation of financial services from a few large customers to the "Long-tail market". Digital technologies have significantly reduced information collection costs and effectively cut down operational and risk expenses. Through a sustainable model, stable credit support has been provided to small and micro enterprises.

3.1.2. Improved Financing Accessibility

The core value of the digital economy lies in its significant improvement of SMEs' access to financing. Under the traditional credit system, many active SMEs with light assets and no collateral were excluded from the formal financial system [9]. Digital financing methods have successfully broken through traditional financing bottlenecks through credit evaluation based on alternative data. "Digital traces" generated in business operations, such as e-commerce transaction flows, payment and settlement information, tax data, and supply chain connections, have been converted into valuable credit assets. These data make corporate credit status visible, evaluable, and quantifiable. Many enterprises that were unable to obtain loans due to "information scarcity and insufficient collateral" can now obtain initial credit support by virtue of their good operating flows and credit records. By addressing the issue of "difficulty in obtaining the first loan", digital financing has greatly expanded the scope of qualified borrowers. More SMEs with development potential have been able to enter the credit market and access financial resources that were previously unattainable and provide crucial support for their survival and development.

3.1.3. Improvement in Financing Efficiency and Experience

Digital economy has changed the financing process. It improves efficiency and user experience. The "short-term, small-amount, frequent, and urgent" financing needs of SMEs conflict with the complex approval procedures of traditional banks. Digital credit relies on online applications, automated approvals, and intelligent risk control to achieve "second-level application, minute-level approval, and instant disbursement". Enterprises no longer need to visit banks multiple times or sort out complicated paper documents, as all operations can be completed using a mobile phone. This model significantly shortens the time to obtain funds, helping enterprises seize market opportunities and address sudden capital needs. Financing has shifted from being complex, passive to simple, transparent and predictable. This change has improved the business environment of enterprises.

3.2. Challenges Faced by SME Financing under the Development of the digital economy

3.2.1. The Digital Divide

With the help of digital technologies, the financing dilemma has been eased, but a new type of inequality, the so-called "digital divide issue", has emerged. In terms of its expression, there are two dimensions. One is the divide in terms of regions. The eastern coastal area has more advanced digital infrastructure and a higher degree of technology penetration, while SMEs in the poor central and western regions have much more difficulties in obtaining digital financial services. The other is the divide in terms of enterprises. SMEs of different sizes, industries and levels have a large gap in their ability to obtain, use and innovate with digital technologies. Some traditional industries or small businesses led by older entrepreneurs struggle to effectively use digital financing tools due to low digital literacy, outdated equipment, or skepticism toward new technologies [10]. This has enabled the financing facilities provided by the digital economy to be given priority by some companies. And those disadvantaged companies that need financial support the most are excluded because they are on the edge of digitalization. This further creates new barriers to financing.

3.2.2. Data Security and Privacy Protection

As a core production factor, financial data's security and privacy protection issues are becoming increasingly prominent. When applying for digital credit, SMEs often need to authorize a large amount of sensitive information to platforms or financial institutions. This information includes the business conditions of the enterprise, personal information of legal representatives and related parties, etc. At every stage of data collection, transmission, storage, use and sharing, there is a risk of leakage, tampering, abuse or illegal transactions. Some platforms, leveraging their dominant market position, over-collect data unrelated to credit assessments or even divert it for other purposes without explicitly informing them. Once a data security incident occurs, it will not only violate the privacy rights and interests of enterprises and individuals but also may lead to the leakage of trade secrets, causing a devastating blow to enterprises. If data security issues are not properly resolved, it will severely undermine the trust foundation of SMEs in digital finance, thereby suppressing their enthusiasm for financing through digital channels.

3.2.3. Technological Risks and Algorithmic Discrimination

Technology is the core of digital finance, but it also gives rise to new technological risks. The "black box" nature of algorithmic models leads to opaque "algorithmic discrimination". When training data contains historical biases, algorithms will exacerbate these biases. Specific groups with good credit may thus be evaluated unjustly. Technical systems themselves have vulnerabilities, such as model flaws or system failures. These issues may result in ineffective risk control or approval disruptions. Incorrect credit decisions can bring losses to enterprises and Financial institution. Automated approval relies excessively on technical specifications and struggles to accommodate the special circumstances of enterprises. Compared with the flexibility of traditional credit, this model may exclude potential enterprises. Enterprises in temporary difficulties may thus be incorrectly rejected by the system.

3.2.4. Adaptability of Financial Supervision

Due to cross-border, mixed-industry and rapid innovation, digital finance has posed a severe test to the traditional regulatory system. Many digital financing platforms adopt new business models, but their legal positioning and business boundaries are unclear. Some platforms operate in regulatory gray areas, posing risks of regulatory arbitrage or regulatory vacuum. Some businesses are essentially credit activities but evade financial regulation in the name of technological services. The traditional segmented regulation model is difficult to cope with the complex risks interwoven by multiple subjects in the platform economy. The updating speed of regulatory rules and means often lags behind market innovation. In areas such as data use, algorithmic ethics, and consumer protection, regulation often appears lagging or weak. This uncertainty may accumulate systemic financial risks and also make the protection of legitimate rights and interests of SMEs more challenging when participating

in digital financing.

4. Strategies and Recommendations for Strengthening the Effect of the digital economy in Alleviating Financing Constraints

4.1. Government Level

4.1.1. Strengthening Digital Infrastructure Construction

Strengthening digital infrastructure is a key task to alleviate Financing constraints for SMEs. The government should increase capital investment in communication facilities such as broadband networks and 5G base stations, expand network coverage and improve service quality [11]. In remote areas, base station deployment should be strengthened and network signals should be optimized to ensure that local enterprises can also enjoy the financing convenience brought by digital economy. At the same time, the construction and optimization of public data platforms should be promoted to integrate data resources from multiple departments including industry and commerce, taxation, and social security system. By providing detailed and authentic enterprise information, the information acquisition cost and complexity for Financial institution can be reduced [12]. Improve financing efficiency and reduce financing obstacles for SMEs. Strengthening digital infrastructure will build a superior digital financing ecosystem for SMEs.

4.1.2. Improving the Data Governance System

Building a sound data governance framework is the key to ensuring the financing safety of SMEs. Optimizing regulations is an important responsibility of the government, and the guidelines for data collection, use and protection should be clarified. A data quality monitoring system needs to be established to ensure that the data is complete, accurate and true. Strengthen data security protection, severely punish abuse and leakage, and effectively protect the rights and interests of SMEs. Establish a special data regulatory agency to strictly supervise the data processing processes of financial institutions. Promote the unification of data standards, promote data circulation and sharing, and provide reliable support for small and medium-sized enterprise financing.

4.1.3. Implementing Inclusive and Prudent Supervision

Against the backdrop of the booming digital economy, the government should adopt an inclusive and prudent regulatory approach. It is necessary to advocate innovation in the financial sector and maintain an open attitude towards emerging digital financial formats and products. Necessary development space should be granted to digital finance, and Financial institution should be encouraged to explore service systems that are adapted to the financing needs of small, medium and micro enterprises. In addition, for innovative Supply chain finance solutions relying on blockchain technology, pilot programs can be allowed and gradually promoted under the premise of controllable risks. At the same time, it is necessary to strengthen the ability to monitor and predict financial risks, build a sound risk prevention system, and timely identify and resolve potential hidden dangers. Illegal and irregular behaviors must be severely punished in accordance with the law to maintain the stable operation and good order of the financial market. Through inclusive and prudent regulatory approaches, the sound development of digital finance can be promoted, and the financing needs of small, medium, and micro enterprises can be met more efficiently.

4.2. Financial Institution Level

4.2.1. Deepening Technological Empowerment

Financial institution needs to strengthen technological innovation and utilize big data, artificial intelligence, and blockchain to enhance the efficiency of SMEs financing services. Through big data analysis, Financial institution can comprehensively grasp the business status and Credit Risk of enterprises, and accurately complete risk assessment and pricing. Machine learning technology can mining finanical statement and transaction data of enterprise, and predict the solvency and default of enterprise. Artificial intelligence technology to achieve financing business automation and reduce

personnel occupation. Intelligent enquiry platform, answer enterprise financing questions real-time, optimize service experience. Based on the blockchain technology, the data has higher traceability and integrity, this process give better credit for the Supply chain finance. The Financial institution can better serve SMEs and provide them with financing solutions..

4.2.2. Building an Open Banking Ecosystem

Financial institution should build an open banking system and do collaborative cooperation with fintech company, e-commerce company and key enterprise in supply chain. Open application programming interface to achieve data sharing and cooperation in business. It helps Financial institution to provide all financial service with transaction data and give accurate credit support. The system achieves integration of resources, extends financial service and meets diversified requirements of SMEs. Collaboration can reduce cost and enhance cooperation. It can enhance competitiveness and give more support to SMEs.

4.2.3. Cultivating Interdisciplinary Talents

Cultivating compound talents is the key for Financial institution to enhance the effectiveness of SMEs financing services. Financial institution needs to set-up a talent team with both financial knowledge and information technology capabilities. It should strengthen the continuous education of internal employees and regularly offer training courses on digital technology and fintech applications. It effectively improve employees' digital cognition and practical business operation capabilities through training. At the same time, Financial institution should actively absorb external digital technology professionals to optimize the institution's talent reserve. It can focus on recruiting personnel proficient in technologies such as big data analysis and artificial intelligence development. The combined internal and external talent cultivation and introduction strategy can promote Financial institution to continuously innovate in the era of Digital economy. This provides solid talent support for SMEs and helps solve their financing difficulties.

4.3. Enterprise Level

4.3.1. Accelerating Internal Digital Transformation

SMEs should accelerate digital transformation. They should improve administration and enhance the high-impact operating efficiency. ERP and CRM realize the digital administration of Finance, procure and sale. This ensures accurate and high-impact data processing. Enterprises need to train employees' digital skills. The training should focus on e-commerce and data analysis. Digital transformation helps enterprises adapt to Digital economy. This also improves market competitiveness. The financing success rates have improved by standardized and transparent data.

4.3.2. Establishing Integrity and Data Asset Awareness

SMEs should establish a sense of integrity in their operations and data assets. Integrity is the foundation for a company to be based in the market. It must comply with laws and regulations, make payments on time, and maintain a good credit history. Only by having good credit can win the trust of financial institutions and obtain more financing support. At the same time, it should be recognized that data is an important asset of enterprises. Enterprises need to pay attention to the collection, organization and protection of data, use data rationally, tap its value, and provide support for business decisions and financing. By analyzing sales data, understanding market demand and optimizing product layout. As an important document to demonstrate the strength and development prospects of enterprises, data helps to improve the success rate of financing.

4.3.3. Actively Utilizing Diversified Digital Financing Channels

SMEs should take the initiative to use diversified digital financing channels to broaden their access to funds. In addition to traditional bank credit, attention should also be paid to innovative digital financing methods such as online lending, equity crowdfunding and supply chain finance. Through online lending platforms, small short-term funds can be quickly raised to meet temporary funding needs; participating in equity crowdfunding can help attract investors' funds and provide financial

support for corporate growth. At the same time, cooperation with core enterprises in the supply chain should be strengthened, and supply chain finance models should be used to obtain financing. By flexibly using diversified financing methods, enterprises can choose appropriate solutions based on their actual conditions, alleviate financial pressure and promote development.

5. Conclusion

This paper focuses on the role of digital economy in alleviating Financing constraints of SMEs, and puts forward the following core viewpoints: digital economy provides an important path for solving the Financing dilemma of SMEs by reducing Information asymmetry, improving Credit resource allocation and innovating Financial service model. Data-driven credit assessment and Precise risk pricing fill the gap of insufficient Enterprise credit information in traditional credit. The networking and automation of Service channels and the expansion of Long-tail market have significantly improved the accessibility of credit resources. The deepening of Supply chain finance, the rise of Platform ecological finance and the activation of Movable property financing have further broadened the financing channels for SMEs and constructed a Diversified financial service system.

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