Research on the Innovation of Banks' Credit Financing Models in Support of Small and Medium-sized Enterprises from the Perspective of Credit Capital

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Abstract: Small and medium-sized enterprises (SMEs), as an important engine of economic growth, cannot develop their financing without the effective support of banking institutions. In order to alleviate the difficulties of enterprise financing, a research on the innovation of banks' support for SMEs' credit financing model under the perspective of credit capital is proposed. The information asymmetry theory and transaction cost theory are analyzed, and the statistical method is used to analyze the status quo of microfinance business carried out by banks of different sizes, and it is found that the financing support and attention of small banks to microenterprises is greater than that of large banks. Secondly, the DEA model is used to analyze the credit financing efficiency of micro and small enterprises of large banks, medium-sized banks and small banks, and the results show that banks of different sizes have efficiency differences in supporting the financing of micro and small enterprises, and then the super-efficiency DEA model is used to further calculate the credit financing efficiency of micro and small enterprises of banks of various sizes, and the final result is that there is not a linear correlation between the size of the bank and the efficiency of the financing and credit. Based on the analytical results, specific credit financing model innovation paths are proposed, including optimizing the credit assessment system, innovating credit products and services, and strengthening policy guidance and incentive mechanisms. It aims to stimulate the innovation vitality of SMEs and promote their transformation and upgrading.

Keywords: small and medium-sized enterprises; credit capital; credit financing; model innovation; empirical research

1. Introduction

As a vital and crucial component within the economic landscape, the prosperous development of Small and Medium-sized Enterprises (SMEs) holds paramount importance in bolstering economic growth, fostering job creation, nurturing technological advancements, and refining industrial frameworks. Nevertheless, despite SMEs' escalating significance in the global economic tapestry, the perpetual challenges of inaccessible and costly financing continue to serve as a constraining factor hindering their expansion[1]. Particularly in today's era of rapid technological advancements, the imperative to harness credit capital efficiently and pioneer innovative bank-backed credit financing models tailored for SMEs has emerged as a pressing concern requiring urgent attention. Addressing the financing dilemmas confronting SMEs, it is paramount to embark on an exploration from the vantage point of credit capital, delving into the potential for revolutionizing banks' credit financing strategies. Such endeavors hold immense practical relevance, as they can substantially alleviate SMEs' financing predicaments, fostering their robust and enduring growth, which, in turn, reinforces the stability and prosperity of the broader economy. Leveraging cutting-edge technologies such as big data and blockchain offers a promising avenue for enhancing the precision and velocity of credit evaluations. By doing so, banks can mitigate credit risks and elevate the caliber and efficiency of their financial services[2]. The advent of big data has revolutionized credit assessment, transforming it into a data-driven endeavor[3]. The proliferation of open and shared big data sources has enriched the information pool for credit evaluations, ensuring a more comprehensive and nuanced assessment process. Furthermore, the evolution of internet finance has paved a novel pathway for SME financing, streamlining loan procedures and curbing financing costs by facilitating the aggregation of financing opportunities through digital platforms. In parallel, government-driven initiatives in numerous regions

of China have constructed comprehensive credit service platforms for enterprise financing, achieving noteworthy successes by facilitating the sharing of enterprise credit information and empowering commercial banks to refine their SME financial services. This study, adopting a credit capital-centric approach, endeavors to untangle the intricate financing challenges faced by SMEs and propel their healthy, sustainable growth through the ingenuity of reimagining banks' credit financing models in support of these enterprises.

2. Theoretical foundations

2.1 Information asymmetry theory

The information asymmetry doctrine refers to the imbalance of information and data held by the two subjects of the transaction, one of which knows more information, thus forming an information advantage, while the other party is an information disadvantage. This asymmetrical scenario frequently leads to the emergence of adverse selection phenomena, stemming from a decline in genuine operational performance[4]. Being inherently a high-stakes sector, commercial banking institutions are highly susceptible to credit decision-making distortions and an accumulation of delinquent loans, primarily due to the imbalance of information that exists during credit transactions with corporate entities. Consequently, the lack of transparency and equal access to crucial data fosters an environment conducive to such challenges. At the same time, commercial banks are worried about the information disadvantage and generate adverse selection, adjusting the credit allocation to the information opaque groups. From another perspective, domestic enterprises, especially small and micro enterprises often deliberately modify their own information so that the commercial banks in the information disadvantage is not easy to realize that commercial bank credit risk, but also easy to cause moral hazard[5]. Commercial banks' traditional credit model of information collection mainly relies on door-to-door investigation, enterprises to submit information, more passive, is not conducive to reflecting the actual business situation of enterprises, thus falling into the plight of the small and micro-enterprises without a strong guarantee measures difficult to lend. This paper studies the credit financing of SMEs (small and medium-sized enterprises). Considering that unlisted SMEs have limited information disclosure and their data are difficult to obtain, the study chooses listed companies on the SME board and the Growth Enterprise Market (GEM), which have more extensive financial information disclosure, as the research object[6]. It can be said that commercial banks relying on the credit system have utilized the data advantages of the credit system to alleviate the problem of information asymmetry.

2.2 Transaction cost theory

Transaction cost theory is an important theory in institutional economics, the British economist Coase (Coase) in 1937 proposed to take the transaction as the object of analysis, on its characteristics and costs to find a suitable mechanism to deal with. Williamson (1975) subdivides transaction costs into six items, such as collection costs[7]. This was later collated and differentiated into two categories, ex ante and ex post. Micro and small enterprises financing in the search for customers, evaluation of decision-making, default processing and several other links have obvious input and output is relatively low. When serving micro and small enterprises, financial institutions do not have convenient channels to reach them, and often rely on "sweeping buildings and streets" and "word of mouth" to carry out their business, and the cost of such a search depends not only on the number of customers that can be found, but also on whether the enterprises found meet the requirements for transaction matching[8]. The cost of searching depends not only on the number of companies that can be found, but also on whether the companies that can be found meet the requirements of transaction matching. Compared with large enterprises, credit services for small and micro-enterprises are prone to problems such as high costs and unpredictable effects, leading to a bias in credit rationing. Through the construction of credit system, big data and artificial intelligence can be used to carry out data modeling to realize accurate mining of enterprises, effectively reduce the search cost in the transaction, and enhance the activity of financing services for small and micro-enterprises. Apart from the expenditure incurred in customer acquisition, the expense associated with assessing decision-making processes constitutes another pivotal cost factor in credit services tailored for micro and small-scale enterprises[9]. Given the inherently modest scale and limited profitability of individual credit financing instances for these enterprises, the cost of decision-making holds a direct correlation with both the transactional efficiency and the overall profitability. Therefore, optimizing this cost is essential for enhancing the financial sustainability and

performance of credit services geared towards micro and small businesses. Traditional micro and small enterprise loans to mortgage guarantee as the main way to realize the control of decision-making costs of micro and small enterprises, but with the saturation of mortgage financing and the emergence of more and more high-tech, light-asset enterprise clusters, the assessment of decision-making for the micro and small enterprise information needs more and more diversified and long-term, and only relying on the more powerful enterprise data system can turn enterprise data into data assets, so that the innovation of the financing service mode. The innovation of financing service model becomes diversified and personalized[10].

3. Study design

3.1 Sample Selection and Data Sources

This paper studies the credit financing of SMEs, and, considering that unlisted SMEs have little information disclosure and data are difficult to obtain, it chooses the listed companies on the SME board and the GEM board, which have more financial information disclosure, as the research object[11]. The basic characteristics and financial data of listed companies are obtained from the Cathay Pacific database, the GDP growth rate of prefecture-level cities and municipalities is obtained from each local statistical yearbook, the interest expense data is obtained from the RESSET database, and the level of regional fintech development is obtained from the Digital Inclusive Finance Index of Prefecture-level Cities published by the Center for Inclusive Finance of Peking University.2 Since this Digital Inclusive Index only published the data for the period 2011 -2018 data, considering the data matching each other, the selected company financial data and GDP growth rate are from 2011-2018. Referring to the research practices of previous scholars, this paper excludes the samples of ST and *ST companies, the samples of financial companies, the samples with negative interest expenses, and the samples with missing variable data[12]. Furthermore, to mitigate the potential distortion caused by extreme values in the empirical outcomes, all continuous variables undergo a process of trimming, where they are adjusted by a margin of 1% both upwards and downwards. This refinement ultimately results in a refined dataset comprising 1,687 firm-year observations, ensuring a more accurate and reliable analysis.

3.2 Empirical methodology

In the empirical analysis of large and small banks' support for MSME financing, Data Envelopment Analysis (DEA) is chosen in this part to measure the efficiency of commercial banks' MSME lending. Scholars such as operations researchers A. Charnes and W.W. Copper proposed Data Envelopment Analysis (DEA) when studying the relative effectiveness of multiple input indicators and output indicators (called decision-making units, DMUs) [13]. This method is used to determine whether the decision-making unit is located on the "production frontier" of the production possibility set, and can effectively deal with multi-objective decision-making problems. Data Envelopment Analysis is mainly composed of BCC model and CCR model, and the principle of Data Envelopment Analysis will be analyzed in detail in the following.

The CCR model assumes that all decision-making units (DMUs) operate at the same scale payoff. It evaluates the combined technical efficiency (TE, Technical Efficiency) including scale efficiency. The CCR model is analyzed as follows:

$$TE = \frac{\max \sum_{i=1}^{k} w_i y_i}{\sum_{i=1}^{p} q_i x_i} \tag{1}$$

$$s.t. \sum_{i=1}^{k} w_i y_i \sum_{i=1}^{p} q_i x_{ij} \leq 0 \tag{2}$$

Where, x_i represents the input indicators, y_i represents the output indicators, q_i represents the input weights, and w_i represents the output weights. The BCC model relaxes the assumption of

constant returns to scale in the CCR model, and it assesses PTE (Pure Technical Efficiency), i.e., technical efficiency that excludes the effect of scale efficiency. Suppose there are n DMUs, each with m input variables and s and output variables. For the jth DMU, its corresponding input and output vectors are x_j and y_j, respectively. The BCC model adds a convexity constraint to the CCR model, i.e., the sum of the weights of all DMUs is 1, in order to allow for variations in the scale payoff. The corresponding objective function and constraint expressions are shown below.

$$J = \max_{\theta,\lambda,\mu} \theta \tag{3}$$

$$y_{j0} \geq \sum_{j=1}^{n} \lambda y_j \tag{4}$$

Where θ represents the efficiency value and λ represents the weight coefficient, which indicates the relative importance of other DMUs to the first DMU. By comparing TE and PTE, the scale efficiency SE can be further calculated as shown below.

$$SE = \frac{TE}{PTE} \tag{5}$$

In the empirical examination conducted herein, this study opts to establish distinct Data Envelopment Analysis (DEA) models tailored for large and small banks, respectively. By gathering comprehensive data on their respective inputs (encompassing capital, operational expenses, among others) and outputs (such as total lending to small and micro-enterprises, loan quality metrics, etc.), we calculate their individual efficiency scores. Subsequently, we undertake a comparative analysis to discern the disparities in efficiency among various bank types in supporting the financing needs of small and micro-enterprises, as well as to identify potential avenues for enhancement. Additionally, we delve into the exploration of innovative trajectories for the credit financing model, analyzing the paths that could lead to its further evolution and optimization.

3.3 Sample and Variable Selection

Considering the calculation principle of data envelopment analysis, it is necessary to distinguish between input and output indicators when selecting indicators for calculation. Since the selection of input and output indicators plays a key role in the analysis of this paper as well as the conclusions obtained, this paper makes the following arrangements for the selection of input and output indicators on the basis of the relevant studies of scholars in this field and the actual situation in China. Specifically as shown in Table 1.

Table 1: Input and output indicators

Indicator category	Specific variables
Input indicators	Total bank assets
	Capital adequacy ratio
	Number of branches
Output indicators	Cargo-to-deposit ratio
	Micro and Small Business Bandwidth Ratio
	Total Bank Profit

After selecting the object of study to be examined and selecting the input and output indicators, each variable was specifically analyzed.

Banks of all size types have increased in size year after year, with large bank assets growing by 46.62% in the five years from 2011 to 2015; medium-sized banks by 95.61%; and small banks by 124.61%. It can be seen that the smaller the bank, the faster the growth in size, which is mainly due to the small size base of assets of small banks(Fig.1).
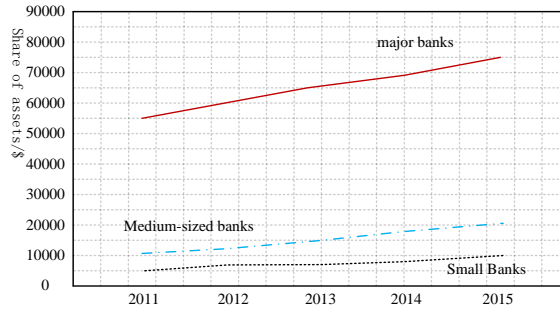
Figure1: Total assets of banks of different sizes

3.4 Analysis of empirical results

In this section, the specialized software MyDEA 1.0 is used to calculate the efficiency of credit financing for MSMEs in banks of different sizes by substituting the collated data for each of the selected variables.

The efficiency scores of credit financing for MSMEs of different bank sizes measured based on the DEA model are shown in Table 2.

Tables1: Ultra-efficiency scores of credit financing for MSMEs in banks of different sizes

	2011	2012	2013	2014	2015	average value
Large banks	1.0774	1.0659	1.0320	1.0160	0.9795	1.0348
Medium-sized banks	0.9995	0.9715	0.9420	0.9630	0.9686	0.9689
Small Banks	1.2686	1.2243	1.2768	1.3175	1.4084	1.3034
Difference in efficiency between large and small banks	0.2212	0.1584	0.1584	0.3015	0.4290	0.2692

The above results show that the super-efficiency score of credit financing for micro and small enterprises of large banks decreases year by year, from 1.0774 in 2011 to 0.9798 in 2015; the super-efficiency score of credit financing for micro and small enterprises of medium-sized banks shows a trend of decreasing firstly and then increasing later; and the super-efficiency score of credit financing for micro and small enterprises of small banks increases year by year from 2012, from 2011 to 1.2896 to 1.4087.Through observation, it is found that small banks have a larger efficiency score than large banks every year, and the efficiency difference can also be considered as increasing year by year from 2011 to 2015. 1.2896 to 1.4087 in 2015.Through observation, it is found that the efficiency scores of small banks are larger than those of large banks every year, and, the efficiency difference can also be regarded as increasing year by year, from 0.2122 in 2011 to 0.4290 in 2015. Evidently, small banks are increasingly prioritizing the credit services catering to micro and small enterprises over their larger counterparts. They endeavor to streamline their processes and implement measures aimed at enhancing the efficiency of small and micro credit financing. This relentless pursuit of optimization has led to a steady improvement in the competitiveness of their small and micro-enterprise offerings, thereby exacerbating the existing gap between small and large banks in this domain.

ICBC, among large banks, has maintained the top two positions in the super-efficiency score of credit financing for micro and small enterprises, and Minsheng Bank, a medium-sized bank, has a higher super-efficiency score of credit financing for micro and small enterprises in general than Bank of Beijing, a small-sized bank. From this, it can be argued that it is not the case that the smaller the size of the bank, the higher the micro-credit financing super-efficiency score[14]. Through data observation, it can be found that the proportion of loans to micro and small enterprises and the asset ratio of micro and small enterprise loan balances of medium-sized banks are much larger than that of large banks, which indicates that medium-sized banks pay much more attention to the business of micro and small enterprises than large banks, but the super efficiency score of credit financing for small and medium-sized enterprises is higher than that of large banks, which implies that the efficiency of micro and small enterprise credit financing and the attention paid to the business of micro and small enterprises of medium-sized banks do not match. The reasons behind this phenomenon may be related

to the medium-sized banks' branch layout, credit process and capital utilization. Therefore, it is not the case that the smaller the size of the bank, the higher the efficiency of micro and small credit financing.

4. Path Analysis of Banks' Innovation in Supporting SMEs' Credit Financing Models under the Perspective of Credit Capital

4.1 Optimize the credit assessment system and strengthen the application of credit capital

Banks should continue to optimize their credit assessment systems, especially the credit evaluation mechanism for micro and small enterprises. Traditionally, it is often difficult for small and micro enterprises to obtain the same credit treatment as large enterprises due to problems such as unsound financial information and insufficient collateral. Therefore, banks should actively explore credit evaluation models based on big data, cloud computing and other technologies, and take into account non-financial indicators of enterprises (such as operational stability, industry outlook, and personal credit of business owners) to form a more comprehensive and objective credit portrait. At the same time, the application of credit capital has been strengthened, and financial tools such as credit ratings and credit insurance have been used to lower the financing threshold of small and micro enterprises and improve their financing accessibility. In addition, banks can cooperate with third-party credit service organizations to share credit information resources and further enhance the accuracy and timeliness of credit assessment.

4.2 Innovate credit products and services to meet diversified financing needs

For different types of MSMEs at different stages of development, banks should design differentiated credit products and services to meet their diversified financing needs[15]. For example, for start-up MSMEs, credit loan products with low threshold and high flexibility can be introduced; for growth stage enterprises, comprehensive financial services such as medium- and long-term loans and supply chain finance can be provided. At the same time, banks should also optimize the credit approval process, simplify procedures, shorten approval time and improve service efficiency. In addition, banks can explore cooperation with financial technology companies and use financial technology means to enhance the intelligence level of credit services, such as through intelligent risk control systems to achieve rapid approval and dynamic monitoring, etc., to further reduce financing costs and enhance the financing experience.

4.3 Strengthen policy guidance and incentives to promote a win-win situation for banks and MSMEs

The government ought to bolster policy directives and incentives aimed at encouraging banks to bolster credit financing for micro and small enterprises (MSMEs). This can be achieved through a multifaceted approach, encompassing tax reliefs, financial subsidies, risk mitigation mechanisms, and other incentives. Additionally, the establishment and refinement of a robust credit guarantee framework tailored for MSMEs is paramount, offering credit enhancement services that alleviate bank credit risks. Furthermore, the government can facilitate a collaborative platform linking banks and enterprises, fostering information sharing and collaboration, thereby nurturing a mutually beneficial financing ecosystem. On the part of banks, they must devise a comprehensive internal incentive structure that integrates MSME credit operations into their performance evaluation metrics. This will ignite the enthusiasm and ingenuity of employees in serving MSMEs. Concurrently, banks should prioritize staff training, enhancing their comprehension of MSME operations and bolstering their service capabilities, ultimately delivering more proficient and efficient financial solutions tailored to the unique needs of micro and small enterprises.

5. Conclusion

Centered on credit capital as the pivotal focus, this research delves into the innovative models employed by banks to bolster SME credit financing. By integrating theoretical analysis with empirical exploration, it endeavors to unveil fresh perspectives and strategies that not only address the persistent financing challenges faced by SMEs but also foster their growth, refine the allocation of financial resources, and ultimately, drive comprehensive economic and societal advancement.

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