Scholar Publishing Group
International Journal of Business Management and Economics and Trade
https://doi.org/10.38007/IJBMET.2026.070301
ISSN 2790-0959 Vol. 7, Issue 3:1-9

Construction and Empirical Study of Credit Risk Assessment Index System for Small and Micro Enterprises in Commercial Banks

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Keywords: Small and micro enterprises credit risks; Evaluation index system; Urban Commercial Bank; Risk management.

Abstract: SMEs are vital for new quality productivity but face credit disadvantages due to poor stability and opaque finances. Despite China's inclusive SME loans exceeding 32 trillion yuan, urban commercial banks still struggle with risk identification, evaluation objectivity, and warning systems. This study, based on information asymmetry and credit risk theories, systematically addresses risk identification, assessment, warning, and control. Results show: (1) A comprehensive evaluation system with four quantitative dimensions (debt paying 35pts, profitability 25pts, operational 25pts, development 15pts), twelve qualitative dimensions, and two industry access dimensions was built. (2) A four-level warning system (red/orange/yellow/green) covering twelve indicators across financial, non-financial, and guarantee dimensions was established, shifting risk control to branches. (3) Empirical verification confirms strong discriminatory ability between defaulting and non-defaulting enterprises. (4) Optimization measures include unified credit review, expanded committee with random selection, refined mitigation tools, organizational restructuring, talent development, performance-based compensation, intelligent upgrades, and risk culture. This study breaks through traditional financial-statement-only evaluations, offering practical tools for urban commercial banks' precise risk control.

1 Introduction

Small and micro enterprises [1]are the micro foundation of the national economy, and their healthy development is directly related to employment stability, industrial structure optimization, and overall economic resilience.At the critical stage of economic restructuring, small and micro enterprises (SMEs) have become vital forces in fostering new productive forces and expanding domestic demand, yet they face inherent weaknesses—poor operational stability, opaque financial information, lack of collateral, family-style management, and talent shortages—placing them at a disadvantage in traditional credit systems. Despite national policies promoting inclusive finance (with SME loan balances exceeding 32 trillion yuan and declining interest rates), credit accessibility remains insufficient. Urban commercial banks, as key local economy servants, still struggle with inaccurate risk identification, subjective evaluations, weak warning systems, and unscientific risk

control amid rapid SME credit growth. Effectively controlling NPL ratios while sustaining business growth and reconstructing risk management logic through fintech has become an urgent challenge. This study focuses on constructing and empirically analyzing an SME credit risk evaluation index system for commercial banks, aiming to break through traditional financial-statement-only limitations. Drawing on comprehensive risk management theory, it systematically analyzes pain points across risk identification, evaluation, early warning, and control.This study constructed a multi-dimensional credit risk evaluation index system that covers enterprise operating environment, financial status, credit records, and non-financial soft information [2], and verified its effectiveness through empirical data, filling the gaps in the comprehensiveness and pertinence of existing research in indicators。Meanwhile, big data-driven risk management optimization strategies were proposed, offering practical tools for precise risk control across pre-, mid-, and post-loan stages. Systematic safeguard measures were designed covering organizational structure, talent development, compensation, and technological empowerment. This helps reduce credit default losses, improve asset quality and regulatory ratings, while providing references for similar city commercial banks' high-quality development in the universal finance context.

2 Correlation theory

2.1 Commercial Bank's Negative Debt Business and Management Objectives

The asset business of commercial banks [3] refers to the activities in which banks use their own capital and deposit funds for investment and operation to obtain profits, mainly including loans, securities investment, interbank lending, foreign exchange trading, and off balance sheet business. The loan business is the core, which can bring stable interest income but faces credit, market, and liquidity risks; Securities investment[4]provides diversified returns but is subject to market fluctuations; Foreign exchange and derivatives have higher returns but also greater risks. Banks conducting asset business must establish a sound risk management system that balances safety and profitability. Debt business[5]is the core link for banks to raise funds and support asset operations, with deposit absorption as the cornerstone, providing stable and low-cost funds; Issuing financial bonds can broaden financing channels; Borrowing from the central bank is an emergency measure; Interbank borrowing meets short-term funding needs. Debt business mainly faces interest rate risk [6]and liquidity risk. Rising market interest rates will increase interest costs, and difficulties in obtaining funds may lead to systemic risks. Therefore, banks must ensure the stability and safety of their funding sources. Asset liability management follows the three principles of "profitability, safety, and liquidity". Profitability is the overall business goal, reflecting the management situation and laying the foundation for development; Security requirements to avoid credit, interest rate, exchange rate and other risk losses; Liquidity refers to the ability to meet customers' withdrawal and loan needs at any time. As a special enterprise engaged in currency management, banks' profit goals are constrained by safety and liquidity. Simply pursuing profit will inevitably lead to operational chaos, so it is necessary to achieve coordination and unity among the three.

2.2 The connotation of small and micro enterprises

According to the statistical classification method for large, medium, small, and micro enterprises, the classification of small and micro enterprises is based on indicators such as the number of employees, operating income, and total assets in different industries. There are significant differences in industry standards, such as the requirement for less than 300 employees and operating income of less than 20 million yuan in the industrial sector, less than 50 employees and operating income of less than 5 million yuan in the retail sector, and less than 20 employees and operating

income of less than 50 million yuan in the wholesale sector. Small and micro enterprises usually have a small number of employees, low total assets and operating income. Most enterprises have registered capital between 100000 and 500000 yuan, scarce professional talents, are at the end of the industry chain, have low core resources and value, weak risk resistance, unstable operations, and are in a relatively weak position in market competition. But the characteristic of being small and refined also gives it a high degree of flexibility and the ability to quickly respond to market changes. It can quickly adjust its business strategy, focus on specific niche markets, provide customized and differentiated products or services, and has strong innovation and adventurous spirit. However, the main bottleneck restricting its development is the difficulty and high cost of financing. The incomplete credit record and insufficient collateral make it difficult for it to obtain bank loan support. In addition, problems such as talent shortage and technological bottlenecks result in high operating costs. Nevertheless, small and micro enterprises have created a large number of job opportunities, and their innovative activities have promoted technological progress and industrial upgrading, making significant contributions to economic and social development.

3 Research method

3.1 Credit Allocation and Risk Management Theory

The theory of information asymmetry [7]was proposed by Stiglitz, Akerlof, and Spence, which states that the party with sufficient information is in a more advantageous position in the transaction. In bank credit, information asymmetry leads to high-quality enterprises receiving preferential interest rates, while small and micro enterprises with low information transparency are subject to interest rate increases or rejections, while also triggering adverse selection. Small and micro enterprises lacking business proof often use intermediary packaging materials, making it difficult to verify authenticity during loan review, and ultimately unable to repay loans at maturity, exacerbating financing difficulties. The credit allocation theory [8]refers to the situation where credit demand exceeds supply under fixed interest rate conditions, and some applicants are unable to obtain loans even if they are willing to pay higher interest rates. This theory reveals the risk preference and screening mechanism of banks in loan approval, providing theoretical support for banks to optimize credit structure and manage credit risks for small and micro enterprises. The theory of financial risk management covers various types such as credit risk, market risk, operational risk, liquidity risk, etc. The key links include risk identification, assessment, warning, and control. In the credit business of small and micro enterprises, credit risk management is particularly critical, including identifying default factors by analyzing the borrower's financial situation, evaluating default probability using credit rating systems, continuous post loan tracking and monitoring, setting loan limits, requiring mortgage guarantees, and other measures to achieve risk control. The theory of comprehensive risk management is a comprehensive management framework that was officially established with the publication of the New Basel Capital Accord in 2004. It requires the development of risk management from a single credit risk model to comprehensive coverage of credit risk, market risk, and operational risk. The COSO Committee's release of the "Internal Control Framework" and "Enterprise Risk Management Framework" provides a systematic theoretical basis for it. This theory emphasizes the comprehensiveness, systematicity, foresight, and dynamism of risk management, providing commercial banks with a systematic risk management framework that helps to achieve stable operations and sustainable development.

3.2 Development and Loan Quality of Small and Micro Credit Business of City Commercial Bank

The bank's small and micro enterprise credit business has always adhered to the core concept of "serving small and micro enterprises and supporting growth", covering a diverse range of credit products, and deeply optimizing product design, service processes, risk management, and other aspects. Among them, the working capital loan, as the flagship product, has a maximum credit limit of up to 10 million yuan and a maximum of 5 years. It allows enterprises to withdraw funds multiple times through a revolving credit mechanism, and repayment methods include multiple options such as equal principal and interest, equal principal and net interest repayment. The calculation formula for equal monthly principal and interest payments is

$$PMT=P\times\frac{r(1+r)^n}{(1+r)^n-1} \quad (1)$$

Among them, PMT is the monthly repayment amount, P is the loan principal, r is the monthly interest rate, and n is the total number of repayment periods. Under the equal principal method,The first month's repayment amount is:

$$PMT_1=\frac{P}{N}+P\times r \quad (2)$$

The loan term can reach up to 10 years, with project operating income as the main source of repayment, and supporting project financing consulting services to fully assist enterprise development. The inclusive small and micro loan business of the bank originated in the late 1990s and has become a leader in the domestic inclusive small and micro financial service field after years of development. In terms of credit structure, the bank focuses on optimizing its loan portfolio, introducing credit rating, big data analysis and other means to improve approval efficiency, and actively expanding diversified guarantee methods such as government financing guarantees and intellectual property pledges. As of December 31, 2023, the balance of corporate loans of the bank was nearly 200 billion yuan, of which the balance of inclusive small and micro enterprise loans was nearly 80 billion yuan, accounting for nearly 45%. The non-performing loan ratio continued to optimize to 3.04%, a significant decrease from 3.75% in 2021. At the same time, the bank fully utilizes financial technology tools such as mobile banking and online loan applications to simplify processes, and collaborates with government departments and industry associations to build a one-stop service platform. See Table 1 for details.

Table 1 Urban Commercial Banks' Corporate & SME Loans

Year	Corporate Loans	NPL Ratio (%)	SME Legal Entity Loans	NPL Ratio (%)
2021	97.570	2.45	64.025	3.75
2022	100.020	2.22	61.020	3.61
2023	104.689	2.10	79.315	3.04

3.3 Credit Risk Analysis of Small and Micro Credit in Commercial Banks

The core risk of small and micro credit in commercial banks is credit risk, which originates from three aspects: at the level of small and micro enterprises, outdated management models, inadequate financial systems, insufficient collateralized assets, and the possibility of default exacerbated by information asymmetry; At the banking level, there is a lack of professionalism among practitioners, inadequate targeted institutional systems, and poor transmission; At the macro level, the economic downturn has had a significant impact, with interest rate liberalization compressing

profit margins. At the same time, regulation focuses more on post event than pre event measures, and warning mechanisms are weak. In terms of credit risk management, risk identification is divided into two dimensions: group customers and individual customers. Group customers establish a relationship tree to unify credit and prevent excessive credit, while individual customers combine on-site and off-site investigations and cross validate financial data; Risk assessment is carried out from two aspects: industry access and enterprise credit rating. Industry access is qualitatively evaluated from four aspects: policy, characteristics, current situation, and trends. "Two highs and one surplus" prohibit access, and emerging industries are prioritized for access. The enterprise credit rating adopts a combination of quantitative (70%) and qualitative (30%), with a total of 8 levels, of which 5 levels and above are access; Risk warning signals are set up from three dimensions: financial, non-financial, and guarantee, using a vertical management path of bottom-up reporting and top-down transmission, and using the out of date method for seven level classification; In terms of risk control, before the loan, it will be evaluated by dedicated review personnel and approved by a 5-person committee through voting. After the loan, the "4321" quadruple defense mode will be implemented, and a risk mitigation system of collateral and guarantee tools will be established. The collateral ratio will be set according to the liquidity, and the guarantor will only accept entities that meet the rating requirements.

4 Results and discussion

4.1 Main problems and causes of credit risk management in small and micro credit

The credit risk of small and micro loans in commercial banks originates from the superposition of enterprises, banks, and macro factors, and there are obvious deficiencies in the four links of identification, evaluation, warning, and control. In terms of risk identification, the implicit association identification of group customers is incomplete, and shell companies often use policy loopholes to embezzle funds. The financial analysis of a single customer remains at the level of basic ratio calculation, and non-financial investigations are merely a formality; In terms of risk assessment, the credit score table indicators lack operational capability and cash flow analysis, and industry evaluations are detached from regional realities, leading to the loss of high-quality customers; In terms of risk warning, the indicator system is not systematic, the triggering conditions are vague, the warning process chain is too long, and the effect is lagging behind; In terms of risk control, there is a lack of pre loan review standards, insufficient approval checks and balances, extensive post loan management, and improper use of mitigation tools. The non-performing loan ratio of mortgage loans continues to be higher than that of credit and guarantee loans. The causes of the above problems mainly focus on five aspects: organizational structure, lack of standardization in credit review, narrow vision of policy makers, and insufficient parallel intervention of risk specialists in the headquarters and branches; In terms of reward and punishment mechanisms, there is a serious mismatch between the workload and abilities of frontline personnel, and the phenomenon of "greeting" and "relying on relationships" interferes with fair approval, resulting in unclear performance evaluation and incentive effects; In terms of talent development, the promotion channels are not clear, with vocational students directly engaged in credit and those with higher education being assigned to teller positions. The talent gap makes it difficult for frontline personnel to balance post loan and new business; In terms of digital support, risk warning still relies on the traditional hierarchical reporting model, and the credit system lacks effective support in credit judgment, compliance verification, and other aspects; In terms of risk management culture, a common risk management concept has not yet been formed internally, and employees see risk control as an additional burden, with low risk sensitivity and poor collaboration, further increasing the difficulty of management.

4.2 Model experiment

Addressing SME credit risk issues in urban commercial banks, optimization measures are proposed across risk identification, assessment, warning, and control, based on information asymmetry and credit risk theories. For risk identification: first, comprehensively grasp customer relationships by investigating legal representatives, shareholders, and executives, analyzing fund flows and guarantee chains via credit system data, and using platforms like Tianyancha/Qichacha to track counterparties and equity structures. Second, strengthen cross-guarantee monitoring through inter-institutional information sharing, unified credit limits, a related-party management module with auto-alerts, and AI tools for efficient identification. Third, formulate a pre-loan survey checklist.In terms of financial analysis, a comprehensive analysis matrix of financial indicators is established, covering four dimensions: debt paying ability, profitability, operational ability, and development ability. After investigators fill in the data according to the matrix, the system automatically calculates the comprehensive financial situation, which facilitates efficient evaluation by reviewers. At the same time, attention is paid to the consistency of report preparation methods and the authenticity of accounting information, and verification is assisted by invoice verification and other methods. In terms of non-financial investigations, a list of investigation elements including customer subject qualifications, credit status, financial status, operating status, purpose information, guarantee information, etc. will be developed and jointly implemented by the host and co host customer managers. The list will be verified item by item through a combination of on-site and indirect investigations, with video evidence retained. The focus will be on verifying the authenticity of trade background, counterparties, funding sources, and repayment sources, in order to improve the ability to identify shell entities and false transactions.

4.3 Effect analysis

To optimize risk assessment, first enrich industry access with two new dimensions: "regional development level" (identifying local pillar industries with strong cash flow) and "emerging industry chain links" (capturing core enterprises with growth potential). The six-dimension assessment (industry prospects, characteristics, status, trends, regional level, chain links) is graded into green/yellow/orange/red. Second, optimize scoring: quantitative scoring now includes four balanced dimensions—debt paying (35pts), profitability (25pts), operational capability (25pts, newly added), and development capability (15pts), totaling 100pts; qualitative scoring covers 12 dimensions including policy support, bargaining power, customer concentration, financial data verifiability, management stability, and personal loan status. Third, improve the warning system with real-time dynamic monitoring: financial (asset-liability ratio, current ratio, profit margin, sales growth), non-financial (cases, overdue, cooperation), and guarantee status (ability and willingness changes). Each indicator has four-level signals (red/orange/yellow/green), e.g., asset-liability ratio ≥100% is red, 80%-100% orange, 60%-80% yellow, <60% green.This abandons vague standards and comprehensively promotes quantitative analysis. Secondly, we need to optimize the risk warning process and shift the focus of risk control downwards. After the adjustment, the head office only retains the functions of credit asset risk classification and risk policy formulation, and does not participate in daily post loan management. Branches retain the functions of personnel management and warning data summary and reporting, and undertake the function of warning signal analysis. Branches are granted risk management authority, and when enterprises trigger warning signals, they can independently complete post loan management according to the plan without waiting for superior instructions. The adjusted risk warning process is as follows:

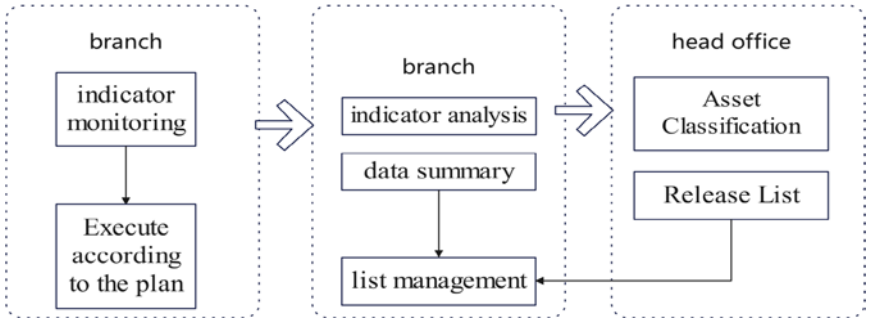

Figure 1 Risk Warning Process Map of Urban Commercial Banks

To improve risk control, first, unify the credit review process by establishing a consistent system covering financial analysis, non-financial factors, financing use, guarantee ability, and risk conclusions to ensure standard consistency. Second, clarify approval responsibilities—covering policy compliance, customer contribution, risk disclosure, and risk-return ratio—and expand the review committee from 5 to 7 members with a chairman, fixed and randomly selected members, plus non-voting experts for mutual checks and balances. Third, build an efficient warning-response mechanism with green/yellow/orange/red signals and corresponding management actions, enabling branches to conduct targeted inspections and improve post-loan management. Finally, refine risk mitigation tools into three categories—substance compensation (collateral disposal/guarantor compensation), deterrence (joint guarantees, mortgage notarization), and information (compulsory execution notarization)—and combine them to complement each other and effectively reduce credit risk.

5 Conclusion

This study focuses on the construction and empirical analysis of the credit risk evaluation index system for small and micro enterprises in commercial banks. In response to the problems in credit risk management in a certain commercial bank's small and micro enterprise credit business, combined with information asymmetry theory and credit risk management theory, and following the principles of comprehensiveness and applicability, improvement plans are proposed from four aspects: risk identification, evaluation, early warning, and control. A guarantee system is constructed from five dimensions: organizational structure, talent construction, salary incentives, technological support, and cultural construction. In terms of risk assessment optimization, two new industry access dimensions, "regional development level" and "emerging industry chain links", have been added, and the quantitative scoring system[9] has been adjusted to four balanced dimensions: debt paying ability of 35 points, profitability of 25 points, operational ability of 25 points, and development ability of 15 points. At the same time, a qualitative scoring system has been constructed from twelve dimensions, including industrial policy support, industry status, and upstream and downstream bargaining power, to comprehensively improve the accuracy and comprehensiveness of the evaluation. In terms of improving risk warning, quantitative monitoring indicators are set up from three dimensions: financial, non-financial, and guarantee status, classified according to the four levels of red, orange, yellow, and green warning signals, and the focus of risk control is shifted to branches to simplify management paths and improve response efficiency. In terms of improving risk control, the unified credit review plan covers four aspects: financial analysis, non-financial evaluation, financing purposes, and guarantee capabilities. The credit approval committee will be expanded to seven members and a randomly selected full-time committee mechanism will be introduced. Differentiated post loan management plans will be

developed based on the four level warning signals, and risk mitigation tools will be subdivided into three categories: substantive compensation, deterrence, and information to achieve combined application. In terms of safeguard measures, a dedicated credit risk management department for small and micro enterprises will be established and an internal control mechanism will be set up. A risk management talent pool will be built through competency exams and job exchange mechanisms, and a secondment training plan will be implemented. The salary structure will be optimized through a performance points system and a risk management responsibility weighting mechanism. The information management system [10]will be upgraded using big data and artificial intelligence technology, and information sharing mechanisms with tax, credit, court and other institutions will be improved. At the same time, the risk management culture will be incorporated into the training system and an inheritance and evaluation feedback mechanism will be established. Although this study systematically explored the credit risk management of small and micro enterprises, the research on the dynamic transmission mechanism of cross regional economic differences, industry risks, and macroeconomic fluctuations is still insufficient. In the future, cross regional comparative research can be conducted to construct a differentiated risk evaluation model with regional adaptability, and to deeply study the interactive relationship between risk management systems and employee behavior patterns from the perspective of organizational behavior[11-30].

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