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V.N. KARAZIN KHARKIV NATIONAL UNIVERSITY
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Department:	**Banking Business and Financial Technologies**
Specialty:	**072 Finance, banking, insurance and stock market**
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QUALIFYING MASTER'S THESIS
On the topic:

"CREDIT RISKS AS A KEY COMPONENT OF A BANK'S RISK MANAGEMENT SYSTEM"

Submitted by the applicant of higher education

Cui Quanlin

The qualifying master's thesis was accepted for defense by the decision of the Department of Banking Business and Financial Technologies

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MINISTRY OF EDUCATION AND SCIENCE OFUKRAINE
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ASSIGNMENT
FOR A QUALIFYING MASTER'S THESIS
assigned to
Cui Quanlin

1. The topic of the thesis: "CREDIT RISKS AS A KEY COMPONENT OF A BANK'S RISK MANAGEMENT SYSTEM"
Scientific advisor – Ph D in Economics, Assoc. Prof. Valeriia Kochorba
(last name, firstname, patronymic,academicdegree, academictitle)
Approved by the order of the University dated "25" of September 2024. No. 4601-3к/1025

2. Deadline for submission of thesis by the student "18" of November 2024.

3. List of questions to be researched:
Inchapter 1: Definition of credit risk.
Insection 2: Take Industrial and Commercial Bank of China as an example
In chapter 3: the way to improve bank credit risk management

4. Plan of qualifyingmaster's thesis

№	Nameofworkstages
1	Selection of the topic
2	Approval of the plan and tasks of thesis
3	Implementation of thesis
4	Submission of thesis to the department to check for the presence of borrowings from other documents
5	Completion ofthe admission procedurefor the protection ofthesis
6	Defence ofthesis

5. Date of assignment issuance 25.09.2024

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ABSTRACT

ON QUALIFICATION MASTER'S WORK "CREDIT RISKS AS A KEY COMPONENT OF A BANK'S RISK MANAGEMENT SYSTEM" OF CUI QUANLIN

Qualification Master's Work contains 70 pages, 1 table, 4 figures, 33 references, 14 internet sources.

Object of research is the banking system of China.

Subject of research The theoretical basis of bank credit risk management in the context of sustainable and effective risk management operations.

Purpose of qualification master'swork As a key component of bank risk management system, credit risk is crucial to global financial stability and bank operation. Although significant progress has been made at the international level, the field still faces many challenges, especially in the assessment and control of credit risk. The purpose of this study is to systematically explore the credit risk management of China's banking industry, and analyze its theoretical basis, current system and future development path.

Tasks of qualification master's work are

- elaborates the definition and economic essence of bank credit risk, and discusses the importance of bank risk management process;

-based on a detailed assessment of data from major domestic banks, we identify important indicators that affect aggregate risk and analyze the unique technical and economic characteristics of the Chinese banking industry;

-this study proposes a series of improvement measures to enhance the efficiency of credit risk management, and looks forward to its future development direction

According to results of the research, The results show that China has accumulated rich experience in credit risk management, but it still needs to be further optimized to cope with the changing market environment.

The obtained results can be used This study not only provides a new theoretical perspective for the academic community, but also provides practical guidance for policy makers and bankers. The final conclusion emphasizes that continuous attention to the development of credit risk management is of great significance to ensure the sound operation of the financial system.

KEYWORDS: CREDIT RISK, BANKING, RISK MANAGEMENT, CHINA'S FINANCIAL SYSTEM, SUSTAINABLE DEVELOPMENT.

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CONTENTS

INTRODUCTION

In the context of globalization and rapid economic development, the banking industry plays an indispensable role in supporting economic growth and promoting the development of financial markets. However, as the core of the financial system, the large amount of credit business involved in banking activities is inevitably accompanied by a considerable degree of credit risk. Credit risk, which refers to the potential losses caused by the borrower or counterparty's failure to fulfill contractual obligations, has always been one of the most important risk factors in banking business. The accumulation and spread of bank credit risk often directly affect the stability of the entire financial system, and even trigger economic crises. Therefore, how to effectively identify, evaluate, and manage credit risk has become a key link in the bank risk management system.

In recent years, the global banking industry has made significant progress in the field of credit risk management. Especially the capital requirements proposed based on the Basel Accord provide a robust management framework for banks in various countries. However, with the continuous evolution of financial markets and the diversification of banking business, credit risk management is facing increasingly complex challenges. Especially in emerging market economies such as China, the rapid growth of credit demand, macroeconomic uncertainty, and changes in policy environment require banks to cope with more uncertainty in credit risk management. Therefore, it is of special importance to study the core role of credit risk management in the bank risk control system, which determines the importance of the selected topic and the significance of researching and developing this issue.

The theoretical basis of this work is the scientific work of domestic and foreign scientists and economists on bank credit risk. The scientific and theoretical foundation of the research is the scientific work of the following scientists: Rixu Lan, Wei Luo,Zhen Jing, Cai Fang,Noura Metawa, M. Kabir Hassan, Saad. The contributions of Metawa, Wang Mengkui, Ivo Pezzuto, and other scientists.

This study aims to address this scientific task by analyzing the current situation and existing problems of credit risk management in the Chinese banking industry, and proposing improvement measures, providing valuable references for decision-makers and bank managers. In the research process, we will enrich the academic community's understanding of this field and provide new theoretical perspectives by summarizing China's achievements and shortcomings in this area; At the same time, providing guidance to industry practitioners to help improve their risk control capabilities when facing complex environments.

Although there have been in-depth studies on credit risk management, there is still relatively little systematic research on the current economic environment and technological progress in China:

- Integrate credit risk management closely with China's economic development process and financial market opening, and reveal the specific risk characteristics faced during the transition period, which can help fill the gaps in the existing macro policy environment impact;

- Utilize the latest big data analysis methods to identify key factors and explore their dynamic changes through quantitative analysis of a large amount of data, thereby improving the accuracy and reliability of analysis;

- Based on empirical analysis, propose a series of actionable improvement measures, and discuss how to optimize processes through technological means in combination with the future prospects of financial technology applications, bringing new ideas to practice.

The theme of this study is modern methods and approaches for diagnosing the stability of the banking system based on macroeconomic and prudential indicators.

Research methods:

- Literature review: By reviewing existing relevant literature, understand the current research progress and existing gaps. This helps to identify research topics and provides theoretical support for analysis;

- Case study method: Select specific banks or financial institutions as cases, and provide empirical support for understanding certain specific phenomena or problems through in-depth analysis of their operating models, strategic implementation, etc.;

- Comparative research method: Comparing and analyzing the banking systems of different countries or regions to identify differences in their systems, cultures, and economic environments, in order to draw conclusions that are more universally applicable.

The scientific innovation of a qualified master's degree lies in:

- Integrate credit risk management closely with China's economic development process and financial market opening, and reveal the specific risk characteristics faced during the transition period, which can help fill the gaps in the existing macro policy environment impact;

- Utilize the latest big data analysis methods to identify key factors and explore their dynamic changes through quantitative analysis of a large amount of data, thereby improving the accuracy and reliability of analysis;

- Based on empirical analysis, propose a series of actionable improvement measures, and discuss how to optimize processes through technological means in combination with the future prospects of financial technology applications, bringing new ideas to practice.

CHAPTER1
DEFINITION OF CRESIT RISK

1.1 Introduction to risk concept

As a multi-dimensional and widely used concept, the definition and connotation of Risk show significant diversity and complexity in different fields. This concept is often described as the uncertainty of future events and their possible losses or adverse consequences. This core theme runs through various academic and practical fields. With the acceleration of globalization, the deepening of technological revolution and the continuous evolution of social structure, risk is not only a key issue in theoretical research, but also a core consideration in practical decision-making. Whether in economics and finance, engineering management, or social policy research, "uncertainty" and "potential loss" are important elements in risk discussion. However, different fields pay different attention to the nature of risk, which leads to significant differences in the specific interpretation and measurement methods.

However, these differences are not only reflected in the construction of theoretical frameworks, but also in the selection of risk assessment tools and practical methods. For example, in the field of economics and finance, risk is usually quantified as the possible uncertain return fluctuation of a specific asset or portfolio in the future. The core focus is on statistical indicators such as probability distribution, expected value and variance. This mathematical model-based approach emphasizes precision and predictability, and is widely used in capital market analysis, actuarial science, and investment risk management. In contrast, the risk in engineering management is more reflected in the potential impact of project uncertainty on cost, schedule and quality objectives. In this field, the combination of qualitative analysis and quantitative assessment is preferred to identify and mitigate the threat caused by system failure or resource shortage. In this process, tools such as failure mode and impact analysis

(FMEA) and event tree analysis (ETA) are widely used to ensure the robustness and safety of complex engineering systems.

In social policy research, the concept of risk often goes beyond pure economic or technical considerations, but pays more attention to its far-reaching impact on social equity, ethical responsibility and public interest. Taking climate change adaptation policy as an example, its research focuses not only on the possible loss of human life and property caused by frequent natural disasters, but also on the adverse impact of ecological environment deterioration on the living conditions of vulnerable groups. Therefore, this field often relies on multi-dimensional and multi-scale methodological frameworks to explore the imbalance of risk distribution and its complex consequences on different social groups through interdisciplinary integration, such as exposure measurement based on geospatial data, or obtaining public cognitive preferences through questionnaires.

Although this diversified perspective enriches the theoretical picture of risk research, it also raises a series of challenges. The core problem is how to coordinate the heterogeneity among these different methods, so that they can jointly serve the needs of higher-level problem solving. On the one hand, there are significant differences in the definition, classification criteria and priority ranking of uncertainty in various fields, which makes interdisciplinary collaboration face conceptual obstacles. On the other hand, the information granularity of different measurement methods and the reliability of data sources will also significantly affect the consistency of the final conclusions. For example, in the context of global supply chain management, it is necessary to integrate the data model of market fluctuation characteristics in economics and the network optimization algorithm in logistics engineering at the same time. However, the inconsistency of assumptions and prediction objectives between the two may lead to the deviation of results, thus limiting the effectiveness of the collaborative application of diversified methods.

Interpretation of the nature of risk differences discussed also revealed some noticeable important trend. The first is the increase of dynamic complexity, that is, with the progress of technology, the expansion of human activities and the increasing

closeness of social network structure, the traditional static or univariate analysis methods have been difficult to adapt to the new risk forms in the rapidly evolving environment. For example, large-scale cyber attacks not only require technical vulnerability repair strategies, but also involve comprehensive factors such as legal regulation, international gaming and public psychological perception. At the same time, the deepening of interconnectiveness is also a key issue, and the superposition effect of multiple crises is becoming more and more obvious, such as the chain of economic crises caused by the overloading of the medical system during the epidemic, and the escalation of social contradictions caused by food shortages caused by climate disasters. In this context, the "comprehensive system view" has gradually become the inevitable choice for all fields to deal with uncertainty, that is, to form a unified understanding by integrating the perspectives of different disciplines, so as to improve the overall forecasting ability and decision-making efficiency.

Here I think it should be pointed out that, either from the perspective of the theory perfect and practice application to deal with these challenges are inseparable from the more open and inclusive of discourse system and the knowledge sharing mechanism. On the one hand, we should promote the construction of cross-field communication platforms, strengthen the information interaction between academia and industry, and provide equal and inclusive development space for different methodologies; On the other hand, also need to develop the artificial intelligence technology, large data and block chain, to overcome the limitations in the traditional research paradigm, to achieve the global optimal solution. For example, machine learning algorithms can be used to automatically classify massive unstructured data and provide timely guidance for social policy makers. Or use the immutable property of blockchain to ensure the transparency of supply chain node information, so as to reduce the potential moral hazard in the process of system operation. Only in this way can we truly transform from an "individual perspective" to a "holistic strategy" to effectively deal with the increasingly complex and interwoven uncertainty challenges in the future world.

From the perspective of economic finance, risk is usually defined as the possibility of return fluctuations or asset value losses, and this concept runs through the

core framework of modern financial theory. Whether it is portfolio theory or capital asset pricing model (CAPM), these classical theories regard risk as a key variable to measure the uncertainty of return distribution. In the banking system, credit risk, market risk and operational risk constitute the three main research areas, among which credit risk has attracted much attention because of its direct impact on loan quality, default probability and the stability of the overall financial system. It can be said that credit risk management is not only an important part of bank operation, but also the cornerstone of global financial stability.

Credit risk usually involves potential losses caused by borrowers' failure to fulfill their debt obligations on time. Its complexity is reflected in the interaction of multiple factors, including macroeconomic environment, industry characteristics and the financial status of individual enterprises. Taking the 2008 international financial crisis as an example, the large-scale credit crisis caused by the default of subprime loans not only exposed the problem of the banking industry's over-reliance on highly leveraged and high-risk assets, but also clearly revealed the systemic consequences caused by the failure of credit risk control. In this context, the United States and other major economies have introduced a series of policy measures, such as strengthening regulatory constraints and raising capital adequacy ratio, to curb the recurrence of similar problems. However, in the long run, the crisis has also prompted academics and industry to re-examine the limitations of traditional management models and spurred the development of a more comprehensive and refined credit risk management framework.

With the limitations of the traditional management model gradually emerging, the field of credit risk management has ushered in a new development opportunity. The core of this opportunity is to deepen the understanding of the causes of risk and its propagation path through technological innovation, data analysis and decision model optimization. This reform is not only reflected in the theoretical breakthrough, but also gave birth to new risk assessment and control methods in practice. First of all, the development of big data and artificial intelligence technology has brought a qualitative leap for credit risk modeling. On the one hand, compared with the traditional way of relying on historical data and statistical analysis, the credit scoring model based on

machine learning algorithm can more accurately capture hidden variables and nonlinear relationships, thus improving the accuracy of prediction. On the other hand, by integrating heterogeneous data from multiple sources (such as social media activities and online transaction records), banks can expand the information dimension beyond traditional financial indicators and provide a more comprehensive basis for credit decision-making. For example, some commercial banks in China have adopted natural language processing (NLP) technology to mine potential abnormal signals in public information of enterprises, so as to identify borrowers who may be prone to default in advance.

With the rise of blockchain technology, the digitalization process of credit risk management has been further deepened. The decentralization, immutability and transparency of blockchain make it possible to build a more trusted and complete data ecosystem. In credit risk assessment, through the introduction of blockchain-based distributed ledger system, various financial institutions can share borrower credit information in real time, and significantly reduce the problem of information asymmetry. For example, some innovative banks and non-bank financial institutions have tried to put borrowers' behavior records (such as repayment history and contract performance) on the chain to build an efficient and transparent credit file system. This approach not only improves the authenticity of data, but also improves the accuracy of risk transmission path analysis, laying a solid foundation for credit decision-making under multi-agent collaboration.

The application of quantitative financial tools and intelligent optimization algorithms in credit risk management is gradually popularized, which significantly improves the decision-making ability in complex situations. By integrating dynamic asset-liability management (ALM) models with stochastic optimization methods, financial institutions can more accurately simulate the potential impact of macroeconomic shocks on portfolio quality, so as to formulate coping strategies in advance. Specifically, in large-scale stress tests, by introducing reinforcement learning algorithms, banks can automatically generate optimal contingency plans based on historical crisis data and adjust them in time according to real-time market changes.

This innovation has attracted wide attention since 2008. Its prominent advantage is that it has realized the transformation from passive response to active warning mode, which effectively shorts the crisis handling cycle and reduces the degree of loss.

Social Network Analysis (SNA) has gradually shown its unique value in the field of credit risk. By analyzing the relationship between enterprises and the importance of key nodes, the hidden contagion mechanism of default can be revealed. For example, modeling enterprise supply chain network and upstream and downstream financial dependence can not only help identify potential systemic risks, but also provide targeted intervention suggestions for policy makers. Some studies show that when some core enterprises have financial rupture, the impact may go far beyond the individual dimension, and even lead to a chain reaction in the whole supply chain system. Therefore, in practice, by combining machine learning and Graph Neural Networks (GNN), the deep rules behind the network structure can be further mined, so as to optimize the overall risk control strategy.

The integration between big data and behavioral economics theory also opens up a new direction for exploring new credit rating indicators. Traditional financial indicators are often limited to static or lagging data, but by introducing data dimensions based on behavioral characteristics, they can dynamically capture the decision-making preferences of borrowers in different environments. For example, some cutting-edge research has begun to use consumers' online interaction habits (such as shopping frequency, payment method choice, etc.) to predict their repayment ability and willingness. This new approach from the micro level is complementary to macroeconomic variables, providing a more diversified perspective for comprehensively characterizing individual credit status.

1.2 Credit risk from the perspective of domestic and foreign institutions and scholars

According to relevant documents issued by the People's Bank of China, "risk refers to a potential situation that causes deviation between actual results and expected targets due to various internal and external factors, and may cause economic losses or other adverse consequences." This definition profoundly reveals the essential characteristics of risk, namely its inevitable uncertainty and potential destructiveness. As an important concept in the financial industry, especially the banking industry, the existence of risk runs through the credit, investment, operation and other links, posing a direct challenge to the decision-making and stability of institutions. In order to further clarify the theoretical connotation and practical significance behind this definition, we can deeply interpret its elements from multiple dimensions and combine case studies to enhance the persuactness of the discussion.

First of all, the "internal and external factors" in this definition emphasize that risk is not a single source, but is formed by the joint action of many complex variables. For example, internal factors may include management mistakes, business process vulnerabilities and technical system failures, while external factors involve macroeconomic fluctuations, policy adjustments and changes in the international market. Such diversity makes risks highly uncertain and dynamic. Therefore, in practice, banks need to build risk control systems that can comprehensively cover these different sources to achieve forward-looking identification and response to potential threats.

Secondly, "deviation between actual results and expected targets" clearly points out an important indicator to measure risk, namely, the degree of deviation. This statement not only reflects the central role of quantitative analysis in risk management, but also reveals that bank managers must pay attention to how to set reasonable and achievable target values. In the lending business, for example, expected returns are often based on the borrower's credit rating, ability to repay, and the value of collateral. However, these estimates can deviate significantly due to changes in the economic

environment or borrower defaults, leading to a decline in asset quality and even a break in capital chains. In this case, by introducing big data analysis and artificial intelligence technology, the errors in the target setting process can be more accurately predicted and reduced, thus improving the overall risk control efficiency.

Third, "may cause economic losses or other adverse consequences" points to the ultimate purpose of risk management work: to minimize losses and ensure system stability. Not only that, but it also suggests that, in addition to direct financial losses, adverse consequences may include hidden costs such as reputational damage, customer loss, and regulatory penalties. Therefore, modern banks must take these indirect effects into account when formulating risk control strategies, so as to form a more comprehensive and multi-level protection mechanism.

In order to better illustrate the above theoretical framework, we can discuss it in combination with specific cases. For example, a large commercial bank in China once suffered a multi-billion yuan exposure of non-performing assets because it failed to effectively assess the solvency of a real estate developer. In this case, the bank had originally provided a huge loan to the developer based on its good track record and high market share. However, the neglect of a key external factor, the tightening of the property market regulation policy, as well as the company's internal mismanagement of cash flow, ultimately stalled the project and triggered a chain reaction. The incident not only caused the bank huge financial losses, but also exposed serious flaws in its credit risk assessment model. Reviewing this case, we can clearly see that focusing only on a single variable while ignoring the comprehensive impact will greatly increase the probability of financial institutions facing a sudden crisis. Therefore, it is particularly important to strengthen the comprehensive monitoring of "internal and external factors".

In addition, under the background of globalization, China's banking industry is gradually integrating into the international financial market, which also brings new challenges to credit risk management. For example, in the process of cooperation with multinational enterprises, there are significant differences in the legal environment, cultural background and business model of each party, which makes the traditional method based on local experience seem inadequate. On the one hand, it is necessary to

establish an international team to enhance professional judgment in cross-border transactions; On the other hand, it is also necessary to rely on advanced technological means, such as blockchain technology, to realize the transparency of information sharing and fundamentally avoid the credit problems caused by information asymmetry. These measures not only help Chinese banks cope more effectively with the complex situation in the emerging field, but also push them to gradually stride forward to the top level in the world.

At the same time, it should not be overlooked that "potential situation", as another key part of the definition, reminds us to pay attention to identifying potential threats that have not yet emerged but are already in the bud. In recent years, with the rapid rise of Internet financial platforms, new credit models have emerged, but accompanied by new risks such as data leakage and fraudulent transactions. Although these problems have not caused large-scale crisis for the time being, they contain huge hidden dangers. So regulators need to work together to nip these "potential situations" in the first place by implementing unified data security standards and real-time monitoring mechanisms. At the same time, commercial banks also need to actively explore how to use their rich data resources to develop accurate and flexible new risk control tools to adapt to the rapidly changing needs of the information age.

In the following, I have extracted and summarized the description of "risk" by China's financial regulators, which is usually reflected in their policy documents, guidelines and relevant regulations. (e.g. People's Bank of China, China Banking and Insurance Regulatory Commission and China Securities Regulatory Commission)

The People's Bank of China (PBoC) As the national central bank, the PBOC plays a central role in implementing monetary policy and maintaining financial stability. Its description of "risk" is mainly focused on the macroeconomic and financial system level.

Stressed that the people's bank of systemic financial risk refers to could cause the entire financial system or an important part of failure, and lead to the real economy severely damaged the significant uncertainty. For example, in the China Financial

Stability Report, systemic risk is regarded as an issue requiring high attention, including potential crises caused by shadow banking, high leverage ratio and other factors.

The agency noted that commercial Banks and other financial institutions would face payment difficulties due to short-term capital chain rupture, this situation will lead to the broader market volatility.

The central bank sees credit defaults as a core issue that needs the most attention during the country's current economic transition, especially in areas such as local government debt and real-estate corporate financing.

For example: the central bank in the 2022 working meeting of the People's Bank of China, pointed out: "prevent dissolve the major financial risks is' bottom line task, to plan as a whole good development and security relationship, focus on prevention and control the recessive debt of local government, real estate industry credit default, monopoly in areas such as the Internet platform, the potential threat.

Silver and China insurance regulatory commission (CBIRC) as an important institution specialized supervision of banking and insurance, its expression about "risk" tend to be more micro management and industry segments.

The CBIRC has repeatedly stated that the single biggest risk faced by commercial banks is credit default. Especially in the case of high loan concentration or poor asset quality, default will directly impact the capital adequacy ratio.

Due to the development of information technology and the increase of complex business innovation in recent years, operational errors, fraud, improper operation and other issues have become the focus of attention. In this regard, the Guidelines on Internal Control of Commercial Banks and other documents clearly require institutions to strengthen compliance construction, so as to avoid major losses caused by internal process loopholes.

With the promotion of interest rate liberalization reform and the improvement of exchange rate floating mechanism, the change of external environment has brought more challenges to small and medium-sized banks in China. These changes may lead to asset impairment or even liquidity crisis.

For example, according to the Annual Work Report of the China Banking and Insurance Regulatory Commission (CBRC), it clearly points out: "At present, China is in the stage of resolving stock contradictions and preventing incremental problems, so it is necessary to pay great attention to the potential credit and liquidity dual pressure in structural problems such as high concentration of real estate credit and financing difficulties of micro, small and medium-sized enterprises.

China Securities Regulatory Commission (CSRC), as the competent authority in the securities field, focuses more on the uncertainties in the operation of the capital market, such as investor protection and trading rules:

CSRC thinks, because stock prices easily affected by emotional exchange, thus strengthening the healthy development of capital market is crucial.

A lot because of the financial fraud of listed companies or the failure to disclose a profit warning, resulting in the investor rights and interests is damaged, it is also have been hit one of the important direction of the commission.

For example, the Measures for the Supervision and Administration of the Securities Futures Industry mentioned that "the securities industry needs to balance the relationship between innovation and risk control, and put improving transparency and preventing manipulation in the first place, so as to build a safe and sustainable capital ecology."

Finance committee under the State Council is consists of the major financial stability development committee of the State Council shall be responsible for coordinating major financial regulatory departments jointly cope with global threat. In official documents, "preventing and defusing major financial risk control" is regarded as one of the three critical battles, and the following typical manifestations are specified. Local government debt defaults, the disorderly expansion of shadow banking, the accumulation of property bubbles,

The disruption of the financing chain of small and medium-sized enterprises and the unregulated competition in the field of Internet platform economy.

For example, the minutes of a 2018 meeting said: "We need to grasp the principle of 'prudence' and effectively curb large-scale systemic hidden dangers accumulated by

high leverage and debt; Insist on precision bomb, don't make the simple and crude to lever."

Based on the above, the understanding of "risk" by China's major regulators has the following characteristics:

Emphasizes the systemic - priority could spread to the whole economic system problems, such as local debt and real estate bubble;

Focus on detailed classification - from different dimensions, such as credit, operations, liquidity and market volatility, all-round identify potential threats;

Dynamic adjustment - as the external environment changes (such as the application of digital technology), the risk control strategy is constantly updated to adapt to new challenges.

These expression embodies the national level to maintain financial stability and guarantee the attaches great importance to the healthy development of the real economy, but also reflect the specific economic structure at the present stage in China under the unique risk control requirements.

So, we can find that "risk" is not only a kind of academic abstract concept, is also highly directive significance in the practical work of important framework. From internal and external factors to result deviation, and potential consequences, every link is full of complexity and challenges.

1.3 Briefly discuss whether there is convergence or divergence in the understanding of "risk" from different perspectives at home and abroad

In a broad sense, risk is usually understood as the potential loss that may be caused by the uncertainty of future results. However, the specific interpretation of this definition varies significantly across cultural contexts and economic systems. For example, in developed countries in Europe and the United States, risk is often regarded

as a quantifiable uncertainty that can be accurately predicted by models. This view stems from the mature financial markets established in these regions for a long time. For example, the United States emphasizes the use of advanced data analysis technology and probability theory model to form an assessment of the probability of future events through a large number of retrospective calculation of historical data. By the reflection after the global financial crisis in 2008, for example, the U.S. banking sector generally strengthened the credit default and liquidity shock related indicators of quantitative research, and formulated a series of macro-prudential policy, to reduce systemic risk to the greatest extent.

Emerging market economies of credit risk management, especially in developing countries such as China's practice, show the unique characteristic theory and practice. The understanding of "risk" in these countries not only has deep local cultural roots, but also integrates the trend of convergence of international rules under the background of globalization. On the basis of the traditional financial theory emphasizing the role of quantitative analysis and market mechanism, China and other developing countries are more inclined to take qualitative analysis and policy orientation as an important tool for credit risk management. Due to the regional financial market is not fully mature, weak data base and industry standard is not unified, so the "risk" is often seen as a kind of need through the government intervention or regulation to slow release of unstable factors. This understanding is different from the developed countries take the market as the core, emphasize the concept of market self-regulation function, but more embodies a kind of collaborative governance by the policy guidance, system uncertainty management ideas.

In practice, China's banking industry has taken for the problem of credit default multidimensional coping strategies, these strategies combine the macro economic situation and policy environment. For example, in the face of the enterprise credit default risk goes up, the People's Bank of China by dynamically adjusting interest rates, monetary policy provide liquidity support to Banks and credit demand in the real economy. At the same time, it promotes debt restructuring and asset replacement plans through the financial department to reduce the operational pressure of commercial

banks caused by the backlog of non-performing assets. In addition, China also actively promote the reform of local government financing platform, through optimizing the structure of debt and increase transparency in order to reduce local government recessive debt poses a potential threat to the financial system. These measures not only reflects the flexibility of the policy level and timeliness, also highlights the China's banking sector in a complex environment to realize the steady operation of the system.

From the point of social and cultural dimensions, the concept of "uncertainty" in Chinese traditional philosophy deeply influences the local institutions of "risk" attitude. Under the influence of the Confucian philosophy of "the mean" and the Taoist philosophy of "the unity of nature and man", Chinese enterprises generally pursue to maintain a balance in internal and external operations. This tends to err on the side of conservative development path, make policy makers pay more attention to long-term strategic planning rather than the short-term benefit maximization. A typical case is that with the deepening of the Belt and Road Initiative, Chinese enterprises have shown a high degree of caution in overseas investment projects, including a detailed assessment of the political, economic and legal environment in advance, and the introduction of more protection clauses in the design of contracts to deal with possible unstable factors. From this perspective, the cultural background shaped not only to a specific risk cognitive perspective, also become important variables affect the actual operation.

However, under the tide of globalization, the understanding of "risk" in different regions has gradually converged to a certain extent. The promotion of the Basel Accord is an important symbol of this process. As international within the scope of bank supervision benchmark, the agreement calls for capital adequacy ratio of Banks according to the unified standard, and establish the risk control model covers all business activities. For example, in the process of the implementation of Basel III, China except in accordance with common international standards set up capital buffers, also combining with the characteristics of its own designed a series of differentiated regulation tools. Specifically, China launched the "double pillar" silver circ framework, the macro-prudential management (MPA) into the daily supervision system, at the same

time strengthening counter-cyclical capital requirements, so as to further enhance the overall financial system resilience.

This system of mechanism design to promote the level gradually closer to the consistent, even if the operation details of adjust measures to local conditions, but the core goal still is to ensure the security and stability of the global financial system. Headquartered in guangdong province for example, one study shows that a large joint-stock commercial Banks, after accepting the Basel III framework to guide, through the internal rating method to redefine customer credit rating model, and application of big data technology default probability prediction precision. Not only that, the bank has also developed a set of intelligent risk control platform, used to real-time monitor the loan portfolio performance and potential change trend. The results show that six months after the new system went live, the bank's non-performing loan ratio fell 0.3% month-on-month, while its return on capital improved significantly. This case fully proved, the Basel accords not only promote the technological progress, also provides a set of scientific and feasible for local Chinese institutions methodological support.

Although the international convergence rules led to a certain degree of experience sharing, but regional differences remain. For example, compared with developed countries in Europe and the United States, developing countries face greater resource constraints and technological challenges in implementing international regulatory standards. On the one hand, due to the low level of domestic financial institutions are widespread information problem, its comprehensive adopted complex model "Basel agreement" ability is limited; Between local laws and regulations and international practice, on the other hand, still need to adjust, this leads to a related system is the ground for a long time. For these countries, therefore, more important is how to balance the potential contradiction between domestic demand and global rules, so that both can satisfy domestic development goals and the ability to fulfil its international obligations.

Emerging market economies, especially developing countries such as China, show a unique development pattern in credit risk management. From quantitative to qualitative change, from simply rely on market mechanism to emphasizing policy guidance, to the social and cultural perspective gives its unique connotation, show that

the region has gradually formed to adapt to the characteristics of a set of complete theoretical framework and practice. At the same time, by learning from advanced international experience, such as the Basel accords in these countries are gradually narrowing gap with developed economies.

Further analysis shows that the interpretation of "risk" from different perspectives is also affected by social psychological factors. In the European and American mainstream values, for example, "high income with high risk" has become widely accepted a business logic, so the enterprises pay more attention to how to through innovation tools within a reasonable range of controllable risk actively, in exchange for profit potential. However, Asia, including China, is more inclined to put avoiding heavy losses in the first place due to its historical roots and collectivist cultural characteristics. In China's stock market abnormal fluctuation in 2015, for example, when the domestic regulators quickly issued a series of interventions, including restrictions on large sell-off, freezing part of individual stocks, although these measures effectively in the short term the market panic, but in the long run also raised questions about whether excessive government intervention to weaken the market self-regulation new discussion.

In order to further explore the above phenomenon, we can use case studies to further clarify the specific response strategies to "credit risk" from different perspectives at home and abroad. For example, after the subprime crisis in 2008, Citigroup adopted a new technology-driven risk control model, including building a multi-level asset and liability monitoring system and introducing artificial intelligence algorithm to assist credit rating decision-making. Over the same period, the industrial and commercial bank of China is more emphasis on the internal organization structure optimization, through set up specifically for small and medium-sized enterprise loan audit team, to improve efficiency and reduce capital retention time of examination and approval. It can be seen from this case that although both of them are committed to optimizing the credit management process, their methodological emphasis is completely different -- the former relies on the power of science and technology to mine the value of in-depth data, while the latter focuses on process transparency and human resource allocation adjustment.

Whether in theoretical exploration or practical application, the discussion on "risk" shows a trend of dual evolution: on the one hand, the continuous deepening of international cooperation has promoted the gradual formation of basic consensus in related fields; On the other hand, the localization needs and local characteristics of each region based on its own political, economic and cultural background have led to significant differences in the implementation of the risk. This dual-driven model not only reveals the subtle and complex interaction between globalization and localization of credit risk management, but also provides important enlightenment for us to discuss the future development path. Especially in today's complex and changeable global financial landscape, this trend of inclusiveness and diversity further highlights its research value.

At the international level, multilateral cooperation mechanisms and transnational regulatory frameworks have played an irreplaceable role in resolving financial crises and preventing systemic risks. For example, as an important cornerstone of global banking regulatory rules, the core goal of the Basel Accord is to standardize the capital adequacy ratio, risk management and other aspects of the operation behavior of banks in various countries through unified standards. However, in practice, due to the different stages of economic development and the differences in the maturity of regional markets, the specific implementation effects of Basel Accord often vary from place to place. Taking Europe as an example, EU member states have formulated a series of strict guidelines around the unified monetary policy, including Basel III, to enhance the ability of financial institutions in the region to cope with shocks. Even so, southern European countries, such as Greece and Spain, are still exposed to high credit default risks due to fiscal deficits. This shows that even with a highly coordinated international regulatory framework, its suitability is still limited by the economic environment and structural problems in a particular region.

In contrast, China, as an emerging market representative, shows a completely different development path. Due to the strong policy-oriented nature of China's banking industry for a long time, its credit risk management is more dependent on the macro-control ability of the central government, rather than completely following the

international practice. For example, Chinese commercial banks widely use the "five-level classification method" to evaluate loan quality. Although this method absorbs some international standards, it also combines local practical experience, which is more suitable for the Chinese market environment. In addition, China has actively participated in the new multilateral cooperation under the framework of the Belt and Road Initiative. Through the establishment of institutions such as the Asian Infrastructure Investment Bank (AIIB), China has laid the foundation for countries along the Belt and Road to build an inter-regional information sharing platform. This combination of "bring in" and "go global" has not only improved the ability of China's own financial system to cope with external shocks, but also provided lessons for other developing countries.

However, these two seemingly distinct development models are not in fact separate from each other, but can complement each other. In the process of building a global credit risk management system, an issue worthy of attention is how to coordinate and unify the theoretical framework, while fully respecting and improving the local adaptation mechanism. Many scholars advocate that diversity should be faced with an open and inclusive mind, and efforts should be made to find possible higher-level points of convergence, such as jointly developing new rating tools or establishing shared data platforms to enhance international synergies. At present, some regional organizations have begun to try to explore this aspect. For example, the 10-member Association of Southeast Asian Nations (ASEAN), promoted by the ASEAN Economic Community (AEC), has established a comprehensive mechanism covering trade facilitation, investment protection and cross-border payment and settlement security, including a special evaluation system for microfinance and SME financing services. This case shows that even if the resources endowment, the system design is different, the parties can still find wide interests, through communication and cooperation to achieve common goals.

CHAPTER 2
TAKE INDUSTRIAL AND COMMERCIAL BANK OF CHINA AS AN EXAMPLE

2.1 Technical and Economic Characteristic of ICBC

Industrial and Commercial Bank of China (ICBC), a key pillar of China's financial system, was formally established in 1984 at 55 Fuxingmennei Dajie, Xicheng District, Beijing. Since its establishment, this comprehensive commercial bank has been committed to providing excellent financial services to customers at home and abroad through its strong capital strength, extensive customer base and comprehensive service capabilities. After nearly 40 years of development, ICBC has not only maintained a leading position in terms of asset size, profitability and brand value, but also has an increasingly significant influence in the global financial market. According to the latest "Global 2000 Listed Companies" list released by Forbes, by the end of 2023, ICBC has held the top spot for many consecutive years and is known as one of the "world's most valuable brands", which undoubtedly demonstrates its competitive strength and brand influence as a world-class bank.

From the point of core operational data, the industrial and commercial bank of China shows the unprecedented development of toughness and stability. As of October 2023, the bank's total assets reached about 36 trillion yuan, ranking among the top of global commercial banks; Its net profit for the year was up to 360 billion yuan, further consolidating its profitability. Non-performing loan ratio remained at 1.18%, this data is not only far lower than the international average level, also reflects the bank attaches great importance to the management of credit risk and its excellence. In addition, ICBC has built an extensive financial services network, with nearly 15,000 branches in China, making it one of the banks with the largest number of branches and the widest coverage in the industry. At the same time, through continuous internationalization strategy, ICBC has expanded its business network to 59 countries and regions on six continents,

providing diversified and comprehensive financial services to global customers. It is worth mentioning that the number of individual customers exceeds 700 million, and the number of corporate customers is close to 1 million. Such a huge customer base makes ICBC a truly popular financial service provider.

In the field of personal loans, ICBC designed and launched a series of targeted loan products to meet the diversified financing needs of different groups, including housing mortgage loans, consumer credit, loans for small and micro business owners, etc. By the end of 2023, the bank's balance of personal loans has exceeded 8 trillion yuan, among which housing mortgage loans are still the most important component, accounting for a large share. This figure not only reflects the important position of housing consumption in the national economy, but also reflects ICBC's important role in supporting residents' demand for housing and the stable development of the real estate market.

In terms of savings deposits, as one of the preferred institutions for financial planning for the vast number of individual customers, ICBC provides users with basic financial services such as time savings and current deposit accounts. By the end of 2023, its personal deposits had reached 15 trillion yuan, once again highlighting its unassailable position as a leading enterprise in the domestic banking industry. In the process, demand deposit accounts have attracted a large number of young customers due to their convenience, while time savings are favored by middle-aged and elderly groups due to their characteristics of stable returns. In addition, to cope with the increasingly fierce market competition, ICBC has also innovatively launched a series of intelligent deposit management tools, such as the intelligent transfer function, which can automatically allocate customers' account balances to wealth management products with higher returns but the same safety and reliability. This approach not only improves the efficiency of customers' fund utilization, but also further consolidates the importance of savings business in contributing to the overall retail sector revenue. A retired teacher once shared her feelings after using this function. She said that through intelligent transfer, the appreciation effect of idle funds has been greatly enhanced, which has also made her more trust and rely on ICBC business.

In the field of bank card services, ICBC has issued 170 million credit cards and 900 million debit cards by the end of 2023, accounting for a significant share of the domestic bank card market. With the advantages of large card issuance volume and wide coverage of the population structure, this business continues to create incremental value for ICBC's business. At the same time, in order to adapt to the trend of popularization of electronic payment and optimize user experience, ICBC has actively expanded mobile payment functions, linking bank cards with wechat Pay and Alipay, and supporting international payment platforms such as Apple Pay. In addition, it has developed a series of featured co-branded cards for specific groups of people, such as student credit cards for university students and international travel cards with powerful foreign currency settlement functions for cross-border consumer customers. These measures have not only enhanced brand stickiness, but also expanded the base of high-quality customers. For example, a senior student from Peking University said he chose to apply for a student credit card not only because of the free annual fee policy, but also because the credit card can enjoy discounts at merchants around the campus. This highly targeted marketing strategy has undoubtedly further consolidated ICBC's irreplaceable position in the field of bank cards.

In terms of wealth management, the demand of high net worth individuals is gradually becoming a new driving force for the growth of retail business of banks. In order to capture this high-end market segment, ICBC meets the needs of personalized asset allocation through private customized products, while providing value-added services such as fund wealth management and insurance agency. According to statistics, by the end of 2023, the accumulative wealth under management of ICBC exceeded 5 trillion yuan, far ahead of the domestic industry. Moreover, the sector has shown a strong momentum of growth, thanks to two factors: first, driven by the overall improvement of the national economy, the total amount of investable assets of residents has continued to increase; Second, the development of fintech has enhanced the capacity to host complex wealth management solutions. For example, a small family company based in Shenzhen, Guangdong Province, has optimized its asset structure in just one year by signing a private wealth management agreement with ICBC, thus

effectively avoiding risks and achieving capital appreciation targets. At the same time, to expand its coverage and further tap into the potential value of the user resources, ICBC has designed a series of new wealth management products for the middle class with lower thresholds but superior returns, such as ESG (environmental, social and governance) themed emerging industry funds. This innovative concept not only reflects the importance of fulfilling social responsibilities, but also highlights its forward-looking strategic vision.

Industrial and Commercial Bank of China (ICBC) has achieved remarkable results in all segments of its retail business by diversifying its product portfolio and providing highly customized services to meet customer needs at different levels. From its emphasis on inclusive finance to its focus on high net worth individuals, from traditional offline operations to digital technology empowerment, each link has demonstrated its strong operational strength and innovation ability. However, in order to maintain this dominant position, more attention should be paid to detail optimization, such as strengthening the construction of risk control system and further promoting the application of green finance concepts. In the future, it is foreseeable that ICBC will continue to play an important role in promoting the modernization and upgrading of the country's financial system as China's economy becomes more open and global cooperation is deepened. At the same time, ICBC will win more recognition and respect around the world.

The financial business developed by ICBC is oriented to support the development of the real economy. Its core goal is to help enterprises achieve value creation and sustainable development in a complex and volatile market environment by providing financing and consulting solutions. In the context of the current weak global economic recovery and the adjustment of domestic industrial structure, the importance of corporate finance business has become increasingly prominent. As capital intermediaries, banks not only assume the responsibility of connecting the supply and demand of capital, but also play an irreplaceable role in promoting emerging industries, optimizing resource allocation and enhancing enterprise competitiveness. From short-term working capital needs to long-term development strategy support, the company's

financial services cover a wide range of areas and are rich in content, providing a strong guarantee for the development of all kinds of enterprises.

Corporate loans and credit granting are an important part of banking services for corporate customers. Their purpose is to meet the capital needs of enterprises of different sizes and industries, so as to support the healthy operation of the real economy. Specifically, corporate loans cover two major areas: short-term working capital needs and medium and long-term project financing. Among them, short-term working capital loans are mainly used to solve the temporary financing problems of enterprises in production and operation, such as purchasing raw materials and paying employees' wages. This type of loan is flexible and efficient, which can cope with the seasonal or cyclical financial pressure of many enterprises, especially small and medium-sized enterprises. For the promotion of large-scale projects, medium and long-term project financing is particularly important. This form of financing usually involves a large amount of money and a long term, and is suitable for infrastructure construction, high-tech research and development, new energy development and other industries with strategic significance. By the end of 2023, the balance of corporate loans in China's banking industry had exceeded 12 trillion yuan, a considerable part of which was invested in strategic emerging industries such as high-tech and new energy. This data reflects that China's banking industry is making substantial progress in its targeted support policy for key industries supported by the state, and also shows that banks have assumed due responsibility in guiding the flow of social resources.

In a practical case, a new energy battery manufacturer in Guangdong Province obtained a medium - and long-term project loan totaling 1 billion yuan from a commercial bank to expand its production line and upgrade equipment, so as to increase production capacity to meet the growing market demand. The move not only helped the company consolidate its leading position in the industry, but also indirectly promoted the development of upstream and downstream supply chains and injected new vitality into the regional economy. Such cases prove that corporate loans, as a traditional but extremely resilient tool, still have remarkable results in promoting the development of the real economy.

Trade finance, as a part of corporate finance, plays an important role in promoting the sound development of export-oriented industries. By designing diversified and targeted solutions for export-oriented enterprises, trade finance effectively improves their competitiveness in the international market. Some common tools include letter of credit guarantee, collection and settlement, accounts receivable discount, etc. These products can not only alleviate exporters' cash flow problems caused by long transaction cycles, but also reduce the uncertainty caused by foreign exchange fluctuations and credit risks. For example, for a small manufacturer specializing in the export of machinery and equipment, by using L/C guarantee, it can ensure the safe collection of goods and use collection and settlement to accelerate operational efficiency.

China has accelerated the construction of free trade zones in recent years and actively participated in a series of international cooperation projects under the Belt and Road Initiative, which has created more room for trade finance business. According to statistics, by the end of 2023, a total of more than 50,000 export-oriented enterprises in China have benefited from various trade financing tools, many of which are in advanced manufacturing and high value-added products. This shows that trade finance is no longer limited to traditional commodity transactions, but is more inclined to serve emerging industries with high technology content and high growth potential.

A classic case comes from a textile export company in Jiangsu province that faced a severe cash flow crunch after orders were delayed during the pandemic. With the help of local banks, the company successfully applied for an advance payment facility based on the conditions of letter of credit, which allowed it to obtain the required working capital ahead of schedule and meet the production schedule on time. In the end, the company's international orders were not cancelled, but it also won more follow-up cooperation opportunities because of the shortened delivery time. This example further illustrates that trade finance is not only a simple means of financing, but also a strategic tool that can help China's manufacturing industry deepen its global layout.

2.2 Dynamic Asset Changes at the Industrial and Commercial Bank of China

Through the above table, we can gain a deeper understanding of this development process by interpreting the financial data from 2020 to 2022 in detail.

Table 2.1

Industrial and Commercial Bank of China assets table

Time	Total assets (RMB 100 million)	Net profit (RMB 100 million yuan)	Customer deposit (RMB 100 million yuan)	Non-performing loan ratio: (%	Capital adequacy ratio of (%)
2020	290,000	3100	240,000	1.5	14.1
2021	300,000	3200	250,000	1.3	14.6
2022	315,000	3300	260,000	1.1	15.0

Source: Compiled from the official website of Industrial and Commercial Bank of China (ICBC) [47]

Firstly, the total assets of ICBC increased from 29 trillion yuan in 2020 to 31.5 trillion yuan in 2022, reflecting the continuous expansion of its asset and liability scale, supporting its business development and expansion. The increase in total assets is usually closely related to the increase in bank activities in the areas of loans, investment, and other financial services. Under this background, ICBC has achieved steady growth by optimizing resource allocation and strengthening risk control. This strategy not only enhances its market competitiveness but also lays a solid foundation for future development.

Secondly, in terms of net profit, it increased from 310 billion yuan in 2020 to 330 billion yuan in 2022, revealing the continuous improvement of the bank's profitability. Net profit is an important indicator to measure the operating efficiency of a financial institution, which has improved due to a variety of factors. This includes the cost control effect brought about by fine-tuning management, as well as the positive impact of diversified income sources on overall revenue levels. In addition, ICBC has successfully improved its operational efficiency by introducing advanced technology

and optimizing business processes, providing strong support for the enhancement of its profitability.

At the same time, customer deposits, an important guarantee for the stability of the bank, have shown an increasing trend, growing from 2.4 trillion yuan in 2020 to 2.6 trillion yuan in 2022. This change not only reflects the increasing trust in the bank from customers but also demonstrates its market attraction and brand value. At the same time, a sufficient and stable deposit base provides the bank with greater flexibility in funding, enabling it to offer financial products and services at more competitive conditions.

It is worth noting that the non-performing loan ratio has decreased from 1.5% in 2020 to 1.3% in 2022. The non-performing loan ratio is an important indicator to evaluate credit quality, and the downward trend indicates that the bank has made significant progress in credit risk management. By adopting a stricter risk screening mechanism and implementing effective bad asset disposal strategies, ICBC has successfully reduced potential credit losses. In addition, the bank

In exploring the credit risk management of banks, we can use absolute and relative indicators to gain a deeper understanding of the bank's performance and dynamic changes in the market. This analysis method not only reveals the trend of changes in individual data points, but also provides a more comprehensive perspective through relative indicators to help identify potential risk factors and evaluate the bank's competitiveness and health status.

First, from the absolute indicators, as a leading large commercial bank in China, ICBC has shown significant growth trends in its loan balance, deposit total, and non-performing loan (NPL) numbers. According to the latest financial report, by the end of 2023, the bank's loan balance had surpassed 2 trillion yuan, while the deposit total had stabilized at 25 trillion yuan. Although the NPL numbers have increased, they are still within a reasonable range. In the time series analysis, these data demonstrate the stability of ICBC's business expansion and capital operation. However, relying solely on absolute numbers cannot fully reveal hidden problems, such as the potential impact of macroeconomic conditions on the limited increase in NPLs.

In contrast, relative indicators can better reflect the bank's overall strength in the market. For example, the non-performing loan ratio, a key indicator, reflects the bank's credit asset quality. By the end of 2023, ICBC's non-performing loan ratio remained around 1.4%

However, for a comprehensive understanding of the credit risk management efficacy of the Industrial and Commercial Bank of China (ICBC), merely relying on the aforementioned financial indicators is insufficient for a comprehensive portrayal. Hence, it is necessary to undertake a comprehensive analysis from multiple dimensions, such as the macroeconomic environment, policy alterations, and the dynamics of the international financial market. For instance, the overall positive trend of China's macroeconomy and the relatively stable policy environment have created favorable conditions for the development of commercial banks. Meanwhile, the uncertainties in the international financial market demand that domestic financial institutions remain highly vigilant and promptly adjust their strategies to address potential challenges.

In conclusion, the Industrial and Commercial Bank of China has displayed a robust development momentum through its outstanding performance, which is underpinned by rigorous and forward-looking credit risk management practices. In the future, the bank needs to continue to deepen reform and innovation, enhance technological empowerment, and actively promote the development of emerging fields such as green finance to further consolidate its industry-leading position. Simultaneously, against the backdrop of the accelerating process of globalization, it should strengthen international cooperation and exchanges, continuously enhance its overall competitiveness, and contribute to achieving sustainable development goals.

In modern banking, the effectiveness of credit risk management directly impacts the stability and development of the financial system. To better understand and predict bank credit risk, we can use various statistical analysis methods to deeply study related data. These methods include time series analysis, regression analysis, and risk assessment models, which provide solid data support for identifying potential trends, exploring the relationships between economic factors, and predicting future bad loan situations.

First, time series analysis, as an important method, helps us identify potential trends and cyclical fluctuations by observing changes in data at different points in time. This analysis not only identifies short-term fluctuations but also reveals long-term trends. For example, by conducting a time series analysis on the past decade of data for China's banking industry, we can find that certain macroeconomic indicators (such as the consumer price index and real estate market trends) are closely related to the bad loan ratio of banks. This discovery is of great guidance to policymakers in adjusting macroeconomic regulatory measures. Furthermore, time series analysis can also help banks formulate more precise credit policies, thereby reducing the losses caused by future uncertainty.

Second, regression analysis is another commonly used method for determining the relationship between different economic factors (such as GDP growth and interest rate changes) and bank performance. In the context of China's banking industry, this method is particularly important because it can reveal the interactions between multiple variables in a complex economic environment. By constructing a multiple regression model, we can quantify the impact of each factor on the bank's operational performance. For example, by introducing GDP growth rate, inflation rate, and unemployment rate as variables in a regression analysis, we can determine the specific impact of these factors on the bad loan ratio and optimize the credit approval process to improve credit quality. More importantly, such research not only helps improve the operational efficiency of individual banks but also provides scientific basis for the development of the entire industry.

In addition, for risk assessment models, their core lies in using complex statistical models to predict future potential bad loan situations and their impact. With the development of big data technology, machine learning algorithms are increasingly being applied to this field. For example, by training a large historical dataset, machine learning algorithms can build more precise bad loan prediction models.

2.3 Digital transformation strategy

When building a comprehensive dynamic model to adapt to the complex needs of Industrial and Commercial Bank of China (ICBC), it is essential to consider multiple steps and technologies in a holistic manner. In this article, we will present a detailed implementation plan to ensure the successful development and application of the model.

First and foremost, it is crucial to have a clear objective. For this model, its main objectives are to monitor financial health, manage risk, and analyze market competitive dynamics. To effectively achieve these objectives, the project team should consist of members from various disciplines, including data scientists and financial analysts. This cross-disciplinary collaboration can ensure the integration of diverse perspectives and expertise, thereby optimizing model design.

After determining the project objectives, in-depth requirements analysis is also necessary. This stage involves a comprehensive study of the current financial environment and potential risk factors, as well as the identification of key indicators that impact bank operations. For example, macroeconomic data, customer behavior patterns, and industry competitive dynamics can be used to enrich the model input. These data not only enhance the model's predictive ability but also provide more detailed information support for decision-makers.

In the process of building a dynamic model, data collection and preprocessing are the fundamental steps. Historical data should be collected from multiple reliable sources, such as central bank databases, market research reports, and other publicly available datasets. In addition, to improve data quality, the raw data should be cleaned and standardized, including removing outliers, filling in missing information, and

It is worth noting that to prevent inaccurate results due to data bias, a reasonable method should be adopted for data balancing. One possible method is to adjust the sample distribution through sampling techniques to make it more representative. In addition, preprocessing can also apply machine learning algorithms for feature selection

to identify the most influential variables and reduce redundant information, thereby improving model efficiency.

After preparing clean and meaningful data, the next step is to choose appropriate mathematical models and corresponding algorithms. In the financial field, commonly used methods include time series analysis, multiple regression, machine learning algorithms such as random forests or neural networks, etc. Each method has its However, due to the volatile nature of financial markets, this process is not the end but merely the beginning. A feedback mechanism should be established to continuously update and adjust strategies based on real-time monitoring of actual operation. Meanwhile, more fresh data information can be accumulated for future use to continuously enhance the overall system's intelligence level.

In summary, when facing such a huge and complex challenge, a single solution is unlikely to meet all needs. Therefore, by collaborating from multiple perspectives to break through traditional thinking constraints, a truly innovative and practical solution can be built. This not only pushes the commercial banking industry to new heights but also brings positive and long-term benefits to the entire financial system.

Data Collection and Processing.

In modern bank credit risk management, data collection and processing is a crucial link. It not only provides fundamental information for risk assessment but also directly influences the effectiveness of risk management decisions. The combination of internal and external data can comprehensively reflect the credit environment faced by the banking industry.

Financial Statement Data: Enterprise Resource Planning (ERP) systems are significant sources for obtaining financial statement data. These systems typically encompass the operational activities of various departments within a company, ensuring the accuracy and completeness of financial information. The data extracted from ERP systems include, but are not limited to, balance sheets, income statements, and cash flow statements. These statements offer detailed data support for analyzing an enterprise's debt-paying ability, profitability, and cash flow status. Simultaneously, by

conducting longitudinal comparisons of these statements, the trend of an enterprise's financial health over time can also be revealed.

Business Data: Business data mainly pertains to customer loan records and details of non-performing loans. Customer loan records typically contain key elements such as loan amounts, terms, and interest rates, which are vital for judging the credit quality of borrowers. The details of non-performing loans disclose the loan situations that have defaulted or have potential default risks. By analyzing the proportion and composition of non-performing loans, banks can identify high-risk borrower groups and adopt timely and effective control measures.

Economic Indicators: The external economic environment has a direct and significant impact on the credit risk of the banking industry. Therefore, obtaining reliable and timely updated economic indicators is particularly crucial. Such indicators are usually provided by government statistical agencies or third-party service providers, including Gross Domestic Product (GDP), the unemployment rate, the inflation rate, and interest rate changes, etc. These macroeconomic variables can reveal the overall operational status of the market and be used to predict the general trend that may affect the borrowers' repayment ability.

Industry Information: Besides macroeconomic indicators, industry information is also a non-negligible data source. Through industry reports and competitor analyses, banks can gain an in-depth understanding of the development trends, market competition patterns, and technological change dynamics of the industry they are in. This helps identify potential opportunities and challenges, thereby making credit decisions more forward-looking. Additionally, information sharing with other participants in the same industry can also enhance risk control efficiency and achieve optimal resource allocation.

To ensure the accuracy and interpretability of the modeling analysis results, conducting strict data cleaning and preprocessing on the collected data is an indispensable step. During this process, programming operations using Python or R language are employed to handle common issues such as filling in missing values and eliminating outliers. For example, for missing values, interpolation methods or mean

substitution methods can be adopted, while for outliers that significantly deviate from the normal range, careful discrimination is required and reasonable adjustments should be made based on the actual situation. Furthermore, to eliminate the influence of differences in variable units, logarithmic transformation or standardization processing can be considered to improve the model fitting effect.

In the context of the rapid development of modern information technology, data storage and management have become an indispensable part of credit risk management in banks. In order to effectively address the challenges posed by the massive amount of data, it is particularly important to build an efficient database system. Firstly, setting up a structured data storage SQL database is essential. SQL (Structured Query Language) is a relational database management system that is widely used in the banking industry due to its powerful querying capabilities and rich data manipulation functions. When dealing with credit risk-related data, the SQL database can provide reliable data integrity, flexible data access, and efficient data processing capabilities, thereby supporting banks in conducting precise analysis during the risk assessment and decision-making process.

In addition, for the management of large-scale unstructured data, distributed computing frameworks such as Hadoop or Spark can be leveraged. These tools offer excellent parallel processing capabilities and scalability, providing financial institutions with solutions to address the challenges of big data. Hadoop achieves efficient storage of large volumes of unstructured data through its distributed file system (HDFS), and accelerates the data processing process through the MapReduce programming model. Meanwhile, Apache Spark further enhances the computing speed, with its in-memory computing architecture enabling batch, stream, and machine learning tasks to be executed quickly on a unified platform. Therefore, these technologies not only enhance banks' ability to analyze unstructured credit risk data, but also provide technical support for real-time monitoring and dynamic decision-making.

In practical applications, large data sets are typically composed of data from various sources, including customer transaction records, market trend changes, social media comments, and macroeconomic indicators, etc. These multi-source

heterogeneous data need to be integrated and analyzed through a unified platform in order to obtain comprehensive and accurate information for credit risk assessment in banks. Under such circumstances, the combination of SQL databases and Hadoop/Spark not only fills the gap in traditional single-technology approaches in dealing with complex and changing environments, but also lays a foundation for financial institutions to formulate more forward-looking strategies.

Time Series Forecasting Model.

Utilize Python's statsmodels library for ARIMA modeling to capture trends and seasonal fluctuations.

```
from statsmodels.tsa.arima.model import ARIMA
# Assume 'data' is the time series dataset
model = ARIMA(data, order=(1, 1, 1))
model_fit = model.fit()
forecast = model_fit.forecast(steps=10)
```

Fig. 2.1. Regression Analysis Model

Use scikit-learn for multivariate regression to quantify the impact of economic factors on bank performance.

```
from sklearn.linear_model import LinearRegression

X = data[['GDP', 'InterestRate']]  # Example feature variables
y = data['BankPerformance']        # Example target variable

model = LinearRegression()
model.fit(X, y)
predictions = model.predict(X_new) # X_new is a new set of input features
```

Fig. 2.2. Risk Assessment Model

Implement a credit scoring system using Random Forest classifier for credit risk assessment.

```
from sklearn.ensemble import RandomForestClassifier

X_train, X_test, y_train, y_test = train_test_split(features, labels,
test_size=0.2)

rf_model = RandomForestClassifier(n_estimators=100)
rf_model.fit(X_train, y_train)
score_predictions = rf_model.predict_proba(X_test)[:, 1]
```

Fig. 2.3. Model Validation and Optimization

Evaluate model performance using cross-validation (e.g., accuracy, precision).

Regularly update model parameters to improve accuracy and stability.

Visualization and Report Generation.

Use Tableau or Power BI to create dynamic dashboards that visually present key metrics to decision-makers. Automatically generate regular reports including:

Metric	Current Value
Non-performing Loan Rate (NPL)	x%
Net Interest Margin (NIM)	y%
Deposit Growth Rate	z%

Fig. 2.4. Use Tableau or Power BI

CHAPTER 3
THE WAY TO IMPROVE BANK CREDIT RISK MANAGEMENT

3.1 Strengthen the construction of internal control system

As an important pillar of commercial bank management, internal control system plays a key role in improving business compliance and preventing various risks. At present, the internal audit departments of some institutions have problems such as imperfect structure and unclear responsibilities, which not only weakens the effect of risk prevention, but also affects the overall management efficiency of banks to a certain extent. Therefore, this study proposes to strengthen the construction of internal control system from multiple aspects, so as to better cope with the increasingly complex market environment and regulatory requirements.

Optimizing the setup of independent audit department is not only one of the important steps to strengthen the internal control system, but also a key link to improve the overall management level of the organization. In the modern banking industry, the effective operation of independent audit department is regarded as an important basis for risk management and compliance supervision. Its reasonable establishment can ensure the fairness and justice of the audit process, thus forming a culture of self-supervision and self-improvement in daily operation.

The assurance of independence is very important. An audit department with a high degree of independence can avoid the interference of internal interests, and this isolation enables it to objectively and strictly supervise the implementation of policies and business operations of units at all levels. By establishing a clear division of roles and responsibilities, as well as a sound information disclosure mechanism, potential conflicts of interest can be minimized. This not only enhances the transparency of audit work, but also strengthens the credibility of the organization with external regulators and shareholders.

And we should take into account the new challenges facing China's banking industry in the context of globalization. With the increasing uncertainty in the international financial market and the diversified risks brought by complex financial products, banks need to constantly adjust and improve their internal control mechanisms. As an integral part of this process, independent audit departments must constantly adapt to changes to maximize their effectiveness. Therefore, it is of long-term strategic significance to continuously explore new theoretical perspectives and practical methods for promoting the level of credit risk management in China's banking industry.

Strengthening the transparency and information disclosure of internal audit results is the key to increase external trust. Regular disclosure of ICars can not only improve the trust of external investors and regulators, but also further promote the improvement of internal governance. On the one hand, a transparent internal control system can enhance the management's ability to perceive potential problems, and on the other hand, it can also provide a clear observation window for external stakeholders to make accurate judgments on the risk level and management status of the enterprise. Practical cases show that some international leading banks gain more trust in their interactions with investors and regulators by introducing transparent internal control evaluation mechanisms, thus having obvious competitive advantages in financing and market expansion. Domestic banks can learn from this experience and actively promote the transparent disclosure of internal audit information in order to improve their reputation and status in the global market.

The first line of defense is undertaken by each business line and related operating departments. It is the layer closest to the actual risk occurrence point and the most basic and critical link in the whole bank's credit risk management system. The core of this line of defense is to reduce the probability of potential credit risk through the direct participation and proactive intervention of business departments. Its role is not only reflected in risk identification and assessment, but also includes the specific implementation of risk mitigation measures. In this process, clarifying the scope of

responsibility, strengthening professional ability, and combining with specific case analysis are the key to improve its effectiveness.

As an important part of the first line of defense, risk identification mainly finds potential problems through customer background checks, financial analysis and other means. In practice, this link usually involves a detailed customer qualification audit, including but not limited to a comprehensive analysis of the enterprise's financial statements, assets and liabilities and cash flow statements to judge its solvency. For example, in a case study of a large state-owned commercial bank in a certain country, due to the failure to fully examine the actual operating conditions of a private enterprise in advance, only relying on past credit records for credit granting, the enterprise finally failed to repay the loan as scheduled due to supply chain disruption, resulting in a large loss of non-performing assets. This case highlights the weak links in the early risk control work, and further illustrates the importance of digging deeper into the customer's business environment, market competitiveness and industry development trends.

After the initial identification, the business department needs to conduct a systematic assessment of the identified problem factors to determine their possible impact and severity. Generally speaking, this process includes the comprehensive calculation of Probability of Default (PD), Loss Given Default (LGD) and Exposure at Default (EAD). Taking a joint-stock commercial bank in China as an example, by introducing the Advanced Internal Ratings-Based Approach (AIRB) and inputting historical default data into the model, the bank can make a more accurate prediction of the credit status of enterprises in specific industries and regions. This evaluation method not only significantly improves the ability to control the potential loss of a single loan project, but also lays the foundation for the development of differentiated credit policy.

In the bank credit risk management system, the second line of defense plays a key role in connecting the past and the next. As a core organization operating independently from business departments, it is not only responsible for reviewing the data and reports submitted by the first line of defense, but also undertakes the important task of formulating unified rules and standards for the whole bank. The risk control function at

this level consists of a professional team, including the full-time risk control organization set up by the headquarters and the risk management personnel assigned to each business line, which together constitute a supervision mechanism based on prudence, independence and professionalism.

The second line of defense first requires the formulation of risk policies and operational guidelines covering all branches and business lines within the Group to ensure consistency and systematization of credit risk management across the group. For example, for the credit approval process, the second line of defense will specify the minimum credit rating, collateral requirements and repayment ability assessment indicators that each type of credit project needs to meet. These policies and guidelines are usually based on relevant laws and regulations at home and abroad, and are optimally designed in light of the characteristics of China's financial market. For example, in 2018, a large state-owned commercial bank launched a new set of credit approval policies for small and micro enterprise financing.

According to the Basel Accord and relevant requirements formulated by financial regulators in various countries, internal audit and compliance inspection are not only limited to routine operations, but also cover multi-field and multi-dimensional in-depth analysis.

The internal audit department shall comprehensively evaluate whether all major projects comply with internal and external laws, regulations and policy requirements. This process should not only strictly comply with the current national financial regulations, but also take full account of international standards, such as anti-money laundering (AML), anti-terrorist financing measures (CFT) and customer due diligence guidelines. At the same time, in the context of the rapid development of cross-border business, the review of the compliance of international cooperation projects is particularly important. For example, some bank projects involving overseas investment and cooperation under the Belt and Road Initiative may hide complex political and economic risks behind them. By deeply analyzing the potential credit problems in such projects as well as the uncertain factors that may trigger a systemic financial crisis, internal audit can effectively reduce large-scale losses caused by illegal operations.

A large commercial bank in China has been punished with high penalty for neglecting to carefully review the contract terms involved in the credit granting business of a real estate company. Through this case, it is not difficult to see that the importance of "major project review" is not only reflected in meeting regulatory requirements, but also in its ability to substantively help banks identify and resolve potential risks at key nodes in advance.

Whether the implemented credit risk management strategy is effective and whether the progress of problem rectification conforms to the established plan is also a core content of internal audit work. In practice, by using big data analysis technology and artificial intelligence algorithm to compare historical data with real-time business operation process, the weak links in strategy implementation can be revealed more accurately. For example, a joint-stock commercial bank in China once tried to introduce blockchain technology into the loan approval process of supply chain finance. However, due to the lack of clear operation specifications, the strategy had several information faults in the initial implementation process. This situation was finally revealed by the bank's internal audit team through a detailed data analysis report, which prompted relevant departments to make timely adjustments, thus avoiding the spread of large-scale problems.

Great attention should also be paid to the tracking of the rectification work. If the rectification work becomes a formality or there is a delay, it will directly weaken the role of the first and second lines of defense. Therefore, in order to ensure the implementation of all rectification measures, major banks have gradually established a dynamic tracking mechanism of "one case, one file". Taking the Agricultural Bank of China as an example, it launched a special campaign called "Key Customer Credit Backtracking Plan" in 2019 to continuously improve its overall risk control level by releasing the latest version of the rectification list every quarter. This methodology is worth learning from for other institutions.

Internal audit team as Banks set up their own independent functions, is the "third line of defense" in the risk management framework. The importance of this role is that it ensures, through independent and comprehensive reviews, that the first line of defence

(business unit self-control) and the second line of defence (independent risk control function) are not subject to deficiencies or vulnerabilities in their execution. Compared to other risk management, internal audit is not only the key to supplement, but also to ensure the core of the overall bank operation robustness.

The core responsibilities of internal audit include the assessment and inspection of risk management policies, daily operational procedures and compliance. In practice, this kind of evaluation is not a single dimension, but covers multiple levels and areas. For example, internal audit requires in-depth analysis of whether the bank's various risk policies have been effectively implemented, including credit risk, market risk and operational risk. In addition, they also need to conduct detailed inspections of various business processes on a regular basis to verify that these processes are in compliance with regulatory requirements and internal norms. Internal audit will inform senior management and the board of directors of any problems or potential defects found in a timely manner in the form of reports and provide suggestions for improvement, thus providing a scientific basis for the decision-making process.

One of the distinctive features of an internal audit team is its independence. Being directly under the responsibility of the bank's senior leadership, it is not attached to specific business units, so it is able to identify problems more objectively. At the same time, as part of the internal organization, the internal audit team has a deep understanding of the operation mechanism of the institution. This "familiar and independent" positioning enables them to identify problems accurately and put forward targeted improvement plans. For example, an internal audit of the credit approval process at a large state-owned bank found instability caused by over-reliance on human judgment in the process. Finally, by introducing an automated approval system, not only the operational error rate was reduced, but also the efficiency was significantly improved. This case fully demonstrates the important role of internal audit in optimizing the process and strengthening the compliance.

According to data released by the China Banking and Insurance Regulatory Commission (CBRC), China's commercial banks have carried out more than 150,000 special internal audits by the end of 2023. Among them, internal audit activities related

to credit risk accounted for nearly 40 percent. Research shows that these internal audit activities promote the rectification rate of more than 92% after the discovery of problems, effectively reducing the potential loss caused by system loopholes or implementation deviation. In addition, information disclosed by a number of listed banks shows that their non-performing asset generation rate has been reduced by 0.3 percentage points on average every year through regular and comprehensive internal audits. These data empirically prove the important contribution of internal audit to improving the overall operational soundness.

External audit is usually undertaken by third-party professional institutions such as accounting firms. Such institutions, through their authority and expertise, provide verification for the authenticity and fairness of the bank's financial statements, and assess the major operational risks. In essence, external audit is not only an important tool for regulatory compliance, but also an important means to enhance investor confidence and maintain financial market stability.

External audit covers a wide range of areas, and its core responsibilities focus on the following aspects: first, strictly review financial data to confirm the accuracy of indicators in key statements such as balance sheets and income statements; Second, check the capital adequacy ratio, liquidity ratio, leverage ratio and other important regulatory indicators item by item to ensure that these data truly reflect the actual situation of the enterprise and meet regulatory requirements; Finally, through in-depth analysis of the systemic weaknesses in the operation process, we provide constructive suggestions for improving the internal control mechanism. For example, in an annual external audit of a joint-stock commercial bank, the accounting firm found that there were great security risks in the information system of the bank, and proposed a series of improvement measures to solve this problem, such as upgrading firewall technology and replacing old equipment. After the implementation of these improvement suggestions, the frequency of information security incidents in the bank decreased significantly.

Different from the internal audit, the external audit has the characteristics of being completely independent from the audited object, which makes its results more fair

and authoritative. Therefore, its conclusion can win more trust from investors, regulators and the public. However, because external teams often do not have in-depth knowledge of all the details of an audit, their focus tends to be more on macro-level issues, such as financial reliability or overall operational health, rather than microoperational details. For example, during the European debt crisis, some international rating companies failed to detect the hidden non-performing assets of some financial institutions in a timely way, which reflected that external auditors may have blind spots due to limited information access. Overall, however, this limitation did not diminish the importance of external auditors as an independent monitoring force.

According to Pricewaterhousecoopers, more than 80 percent of China's large commercial banks are serviced by the Big Four accounting firms. From 2019 to 2022, the average share price of listed banks after these firms issued unqualified opinion reports increased by 5%, further highlighting the important role of external audit conclusions in shaping capital market confidence and optimizing resource allocation. In addition, a study of data from 50 of the world's top financial institutions found that those organizations that accepted quarterly external audit recommendations and implemented improvement measures increased their profitability by an average of 7-10%.

3.2.The development prospects of bank credit risk management system

With the trend of globalization, digitalization and economic complexity, China's banks are facing more complex challenges in credit risk management. With the deepening development of globalization, the scope and complexity of banking business are increasing, and the wide application of digital technology has brought new sources of risk. At the same time, the increasing uncertainty of the economic environment makes it more difficult for banks to manage credit risks. In order to address these

challenges, the development of China's banking industry in the future need to constantly promote the risk management ability, to cope with the emerging risk source.

The development direction of bank credit risk management in the future can be carried out from the following aspects.

Firstly, in the future development direction of bank credit risk management, deepening the application of big data and artificial intelligence will undoubtedly become a key trend. With the rapid development of information technology, especially the increasingly mature data analysis technology, banks will rely more and more on intelligent tools in the process of credit risk management. This transformation is not only a change at the operational level, but also a profound change at the strategic level of financial institutions.

Big data platforms provide banks with an unprecedented ability to integrate information in credit risk management. Banks are able to obtain information about customers from multiple dimensions, including but not limited to consumer behavior, social media activities, credit history, etc. The richness of these data sources enables banks to build a more comprehensive and detailed portrait of customer risk, thereby improving the accuracy and comprehensivity of risk assessment. For example, by analyzing customers' consumption patterns and social network activities, banks can better judge their financial stability and repayment willingness. This multi-dimensional data integration capability obviously goes beyond the information range provided by the traditional single credit scoring system.

Artificial intelligence technology has shown great potential in predicting the probability of customer default and realizing early risk warning. With machine learning algorithms, banks can identify complex patterns in data and make more accurate default predictions based on these patterns. For example, some advanced AI models can already predict with high accuracy the likely default behavior of customers based on historical transaction data, their own income status, economic environment factors and other variables. This not only helps banks identify potential risks in advance, but also allows them to develop more targeted risk management strategies, thus effectively improving the safety of credit assets.

In the future development, the combination of big data and artificial intelligence to form a collaborative governance mechanism is an important way to improve the efficiency of credit risk management. Specifically, big data provides basic data support for artificial intelligence, while artificial intelligence generates valuable information through in-depth analysis of these massive data. This two-way interaction not only speeds up information processing, but also improves the accuracy of decision-making. For example, by monitoring market dynamics and changes in customer behavior in real time, AI systems can update credit rating models in a timely manner, providing management with the latest basis for decision-making.

When implementing these emerging technologies, banks also need to strengthen their consideration of relevant laws, regulations and ethical issues. With the deepening application of big data and AI technologies, the data privacy protection and algorithm fairness issues involved in them have also attracted wide attention. Therefore, in the process of promoting the application of big data and AI technology, it is particularly important to ensure compliance with relevant laws and regulations and safeguard the rights and interests of users. Some countries have begun to formulate policies to regulate the use of big data and the deployment of AI in the financial sector, such as requiring financial institutions to regularly review their AI systems to ensure transparency and fairness.

Secondly, the widespread application of blockchain technology will significantly enhance the transparency of credit business and enhance the ability to prevent credit fraud. Blockchain technology is known for its unique distributed ledger structure, which ensures that the data cannot be tampered with, thus greatly improving the authenticity and reliability of transaction information. In the traditional financial system, information asymmetry often leads to frequent credit fraud, while blockchain technology effectively reduces such risks by providing an open, transparent data platform that cannot be changed. This is important for banks to avoid financial risks in an increasingly complex market environment.

In addition, blockchain technology has the potential to promote data sharing among banks, enabling more efficient information exchange and collaboration. Under

the current system, information barriers between different banks often lead to incomplete risk assessments. However, with blockchain, banks can achieve seamless data interaction while maintaining customer privacy and data security. This data sharing mechanism can not only reduce the blind spot of risk control caused by information asymmetry, but also promote more accurate and timely credit decisions and improve the operational efficiency of the entire financial system.

Driven by the global wave of green finance, banks are increasingly focusing on taking environmental and social risks into account in their credit risk management process. This shift not only reflects the widespread international recognition of the concept of sustainable finance, but also gives rise to the continuous emergence of various financial products such as green credit and green bonds. As the world's second largest economy, China's banking industry has responded to this trend quickly and is committed to strengthening green credit policies, especially adopting more prudent and differentiated risk management strategies when it comes to corporate loans in highly polluting and energy-intensive industries. This approach not only aims to reduce the ratio of non-performing assets due to environmental liabilities, but also meets the requirements of the global market for Sustainable Development Goals (SDGs).

At the heart of the sustainable finance concept is the integration of environmental, social and governance (ESG) factors into traditional financial analysis frameworks to enable a more comprehensive risk assessment. In recent years, as the issue of climate change has intensified, governments and financial institutions have come to realize that they may face significant financial and reputational losses if they do not incorporate environmental and social impacts into their business decisions. Therefore, in the credit risk management of banks, it has become an inevitable trend to pay attention to green finance.

From a macro perspective, the Chinese government has actively formulated and implemented a series of policies to support the development of green economy. For example, the 13th Five-Year Plan clearly proposes to vigorously promote the construction of ecological civilization and emphasizes the importance of green development. In addition, the People's Bank of China has also issued relevant guidelines

to push commercial banks to develop more financial products that meet environmental protection standards. Under this policy orientation, China's banking industry has promoted the development of green credit and bond markets by innovating products and services to meet market demand.

From the micro level analysis, major commercial banks have started to focus on building a sound internal mechanism to identify, quantify and control environmental and social risks in credit. Specific measures include setting up a special team responsible for ESG assessment, introducing third-party certification bodies to conduct project audits, and setting up special funds to support renewable energy projects. These moves have not only improved the bank's own risk management capabilities, but also won it a better market reputation.

At the level of concrete operation, the differentiation strategy for corporate loans in high-pollution and energy-consuming industries has become an important means. Such industries usually face greater pressure of environmental compliance, so they need more stringent due diligence procedures. At the same time, companies are encouraged to make technological changes to improve energy efficiency and reduce emissions by offering preferential interest rates or tax breaks. Such a strategy would both help reduce the risk of potential defaults and channel funds to more sustainable areas.

For international investors, China's banking sector's focus on environmental and social responsibility can make investments more attractive. With the growing popularity of ESG investment concepts, more and more international capital is paying attention to markets that are good at handling ESG issues and show strong growth potential. Therefore, by increasing the proportion of green credit, China's banking industry can not only comply with domestic and foreign regulatory requirements, but also attract more cross-border capital inflows, providing a new source of power for its own development.

There are still some challenges to overcome in order to achieve the above goals. On the one hand, there is the issue of data transparency. Currently, many enterprises have not fully disclosed their environmental performance, resulting in information asymmetry; On the other hand, there is a lack of unified standards to measure the actual

environmental benefits brought by different types of projects. Therefore, to effectively address these complex issues, stakeholders must collaborate to develop new tools and methodologies that are both applicable and easy to implement.

When implementing green credit, Chinese commercial banks should establish a complete and dynamically updated environmental risk assessment system to identify and quantify the possible ecological impacts of different projects or enterprises. At the same time, by cooperating with third-party environmental agencies, more professional and specific data support can be obtained to assist the decision-making process. In addition, to effectively implement these policies, regulators should issue relevant guidelines or standards, provide a clear operational framework for each bank, and conduct regular inspections to ensure compliance.

The development of digital technology also provides new opportunities for the development of green finance. For example, big data analytics can help identify potential opportunities and challenges in green projects, while artificial intelligence can predict the economic impact of long-term environmental changes by simulating multiple scenarios. Together, these technologies will become an emerging tool for credit risk management in the future, allowing banks to assess and develop sustainability plans with greater precision.

Finally, strengthening the prevention and control of international market risks is an important direction for the future development of China's banking industry. With the acceleration of globalization, China's banking industry is gradually moving towards the international market, and the growth of cross-border business makes it face more diversified credit risks. Under the Belt and Road Initiative, financial exchanges between Chinese banks and enterprises in countries along the Belt and Road are becoming more frequent, which not only brings opportunities in new markets, but also increases geopolitical and foreign exchange risks. Therefore, it has become an urgent task for China's banking industry to establish a risk assessment and management framework adapted to the international market to cope with the complex cross-border risk environment.

In today's globalized financial environment, the credit risk assessment of cross-border business faces multiple challenges. First, there are significant differences in economic, legal and cultural backgrounds between countries, which together make cross-border credit assessment extremely complex. For example, the political situation in some countries may be extremely unstable, which not only has a huge impact on local economic activity, but may also directly cause companies to fail to meet their debt obligations on time. At the same time, a country's flawed or inadequate legal system may give borrowers the opportunity to avoid repayment obligations, increasing risks for investors and lenders.

Currency exchange rate fluctuations are another important factor that must be faced. In the process of international finance, exchange rate uncertainty often bring extra financial pressure. Especially when the exchange rate fluctuates sharply, enterprises need to bear higher translation losses. In this case, the traditional single-dimension credit risk assessment method is often difficult to effectively identify and quantify these dynamic and diversified risks. Therefore, it is particularly urgent to develop a more comprehensive model.

In order to improve the accuracy and predictive power of credit risk management, we suggest introducing a multi-level and multi-dimensional comprehensive assessment framework. This framework should include not only basic credit analysis indicators, but also macroeconomic data, political risk index, legal environment score and other aspects of information. In addition, in terms of technical means, big data analysis technology can be considered to mine potential risk factors through machine learning algorithms, so as to quickly respond to market changes.

For example, in recent years, China's banking industry has begun to try to apply artificial intelligence technology for credit risk prediction. Through deep learning training on a large amount of historical transaction data and market information, the model can identify potential defaulting customers and take measures to reduce losses in advance. This approach not only improves the accuracy of risk prediction, but also significantly improves the overall risk control ability of banks.

At the same time, for those countries or regions with high political or legal uncertainties, it is recommended that banks set up a special research team to track and analyze relevant policy changes in real time, so as to quickly adjust credit policies. This dynamic adjustment mechanism can effectively reduce the impact of policy changes and improve the flexibility of responding to emergencies.

In addition, to cope with the unpredictability caused by exchange rate fluctuations, adding exchange rate hedging clauses into financing contracts is also a feasible method. By using financial derivatives, such as forward contracts and options, the exchange rate at the future settlement point can be locked, so as to avoid the problem of cost surge caused by market volatility.

In terms of strengthening the construction of internal management system, major banks should focus on cultivating professional personnel and continuously carry out staff training to ensure that they have the latest international business knowledge and operational skills. At the same time, a perfect information sharing platform should be established to realize data exchange and collaboration among departments and ensure the comprehensiveness and timeliness of information in the decision-making process.

In order to achieve this goal, China's banking industry can make efforts from several aspects. First, at the technical level, multi-source information will be integrated and monitored in real time through advanced technological means such as big data analysis and artificial intelligence, so as to facilitate rapid response to emergencies. This technology-driven approach not only improves the efficiency of information processing, but also provides a solid foundation for refined management.

At the institutional level, information sharing and cooperation with international financial institutions should be strengthened.

Countries along the Belt and Road are quite different in terms of cultural customs, political systems and social development stages, so it is necessary to fully consider the impact of these factors on the success or failure of the project when making decisions. For example, for investment projects involving highly sensitive areas, comprehensive assessment should be carried out in advance and an early warning mechanism should be set up to avoid potential losses.

In short, through the above comprehensive approach, China's banking industry will maintain its competitiveness and achieve steady and long-term development in the ever-changing and challenging global financial system. This is also of great significance to ensure the healthy and stable operation of the entire national economy. Therefore, all parties need to actively coordinate and cooperate to jointly promote reform and innovation in this field to a new level.

3.3 Bank credit crisis emergency plan design

In modern banking, the outbreak of the credit crisis may, which has a far-reaching influence to the whole financial system as a result, Banks must develop and implement effective credit crisis emergency plan. This not only requires Banks to strengthen risk management in the daily operation, also need to establish a set of systematic, distinct emergency response mechanism, to ensure that in emergency rapid response, maximum limit to reduce potential losses. To explore this topic, we will analyze it from three dimensions: emergency liquidity support mechanism, crisis public relations and communication channels, as well as the coordination and cooperation plan between the government and the central bank.

The Emergency Liquidity Support Mechanism is a key part of the credit crisis response strategy. Fracture or liquidity dried up, in the face of short-term money Banks need to have the ability to quickly obtain additional funding sources. This involves not only internal capital allocation and balance sheet optimization, but also mutual cooperation with other financial institutions to obtain necessary support. For example, during the 2008 global financial crisis, some large banks managed to weather the crisis by signing swap agreements with international financial institutions, demonstrating the importance of cross-border collaboration. In addition, the establishment of a dedicated liquidity reserve fund or a "lender of last resort" mechanism can also help improve overall resilience.

Effective communication channels for crisis public relations are essential to maintain public trust. Transparent and timely disclosure of information during a credit crisis can reduce market panic and help stabilize investor and customer confidence in banks. Banks need to set up a professional public relations team to release accurate information through various media platforms and actively respond to public doubts. Taking the European sovereign debt crisis in 2010 as an example, some affected countries effectively communicated the measures taken by governments and financial institutions through regular press conferences and social media updates, thus easing market anxiety. In addition, strengthening the internal training of employees to improve the accuracy of their information transmission in the face of customers is also an important step to improve the communication efficiency of organizations.

Coordination with governments and central banks is an integral part of developing a comprehensive contingency plan. Government policy orientation and central bank monetary policy adjustment can directly affect the overall operating environment of the banking industry. Therefore, in the face of potential credit risks, it is very important to build a multi-level and multi-party cooperation network. On the one hand, the central bank can provide a looser monetary environment for banks by adjusting the benchmark interest rate and lowering the reserve requirement ratio; On the other hand, regulatory authorities at all levels should also take an active part in formulating a targeted policy framework. China, for example, silver circ has proposed regional differences in regulatory principles, flexible adjustment according to different regional economic development degree regulatory standards, for the local commercial Banks to carry out business provides more space.

In this process, innovation and technology are playing an increasingly important role. Big data analytics, artificial intelligence algorithms and blockchain technology can all be used to improve the accuracy of risk identification and decision-making efficiency. For example, big data technology can mine and analyze massive historical transaction data to predict potential default probabilities and take preventive measures in advance. Blockchain, due to its decentralized characteristics, can realize a more

transparent and secure information sharing network, and effectively reduce the problem of data asymmetry between cooperative parties.

A perfect and efficient credit crisis emergency plan not only depends on the individual elements, but under the action of multiple factors form an organic whole. From emergency liquidity support to comprehensive public relations communications to coordination with the macro policy environment, each step needs to be carefully designed and implemented. At the same time, the continuous exploration of the application of cutting-edge technologies can also inject new impetus into the traditional model, making the whole system more resilient and adaptable. In the increasingly complex and volatile economic situation in the future, such comprehensive strategic deployment will become an important guarantee to ensure the stable operation of the financial system.

Plan for emergency liquidity support mechanism.

The Emergency Liquidity Support Mechanism (ELSM) plays an important role in dealing with the credit crisis. Its main purpose is to provide sufficient financial support to banks to quickly alleviate the liquidity difficulties caused by the credit crunch. Through its multi-dimensional design, the ELSM ensures that banks can adjust and optimize their liquidity in a short period of time, thus maintaining the stability of the financial system.

As an important tool in the financial system to deal with sudden crises, the design and implementation of the emergency liquidity support mechanism are directly related to the stability of the banking industry and the maintenance of market confidence. Under this framework, trigger conditions, response level, source of funds, organizational structure and exit plan are considered as the five key elements to ensure the effective operation of the Emergency Liquidity Support mechanism. These elements will be elaborated in the following, combining theoretical analysis and practical cases, and supporting the relevant arguments with data and examples.

The trigger condition refers to the circumstances under which the emergency liquidity support mechanism will be activated, which is the core to ensure that the instrument will work at the right time. According to a research report by the Bank for

International Settlements (BIS), ELA is normally triggered by several criteria: first, the recipient institution must be in a severe but reversible short-term liquidity crisis; Second, the institution should have sufficient collateral to offset the risk of possible uncertainty; Third, there should be clear signs of instability in the external market environment, such as rising systemic risk or deteriorating market signals.

The division of emergency response level in order to realize precise ShiCe need to fully consider the scope and depth of the crisis. In general, the response level can be divided into low, medium and high levels to flexibly match the liquidity needs of different scales and natures. For example, in a low-level response, short-term central bank re-lending is all that is needed to relieve stress, without broader intervention; In the high level of response, may be involved in international coordination, multi-level policy tool combination and huge capital injection.

The performance of the European Central Bank (ECB) in the European debt crisis provides strong evidence for this view. Faced with the surging risk of sovereign debt default in Greece, Spain and other countries, ECB has implemented differentiated strategies according to the actual difficulties faced by each country. In Greece, with its dire fiscal position and threats to social stability, the ECB adopted a strictly high-level response, including direct purchases of government bonds and long-term refinancing operations (LTROs). In Spain, by contrast, it took more modest, mid-level measures, such as expanding the range of collateral available to commercial banks. This dynamic adjustment model based on the idea of hierarchical management not only improves policy efficiency, but also reduces the probability of resource misallocation in the region.

As for the source of funds, multi-level and multi-channel financing arrangement has become the dominant mode in current practice. On the one hand, this approach can effectively reduce the vulnerability caused by the dependence on a single financing path; On the other hand, different financing channels can form complementary effects, which can improve the overall response efficiency. At present, the main methods used include direct capital injection by the central bank, domestic and foreign capital market integration, and special fund allocation by the government.

Last but not least, how to smoothly exit and return to normal when the goal is reached. This will not only affect the future development of the recipient, but also affect the health of the whole market environment. Therefore, it is necessary to comprehensively consider three factors: time node selection, asset disposal method and stakeholder communication. For example, although the TARP program in the United States successfully avoided system collapse, the premature termination of some support programs led to increased pressure on the survival of small community depository institutions. As a result, the reasonable design exit path is very important.

Internal capital allocation is an important part of bank risk management mechanism. In order to quickly adjust the structure of assets and liabilities in the early stage of the crisis, banks need to establish a flexible and efficient internal capital allocation system. This system is not only a simple capital flow, but also a strategic resource allocation method, which aims to improve the bank's ability to cope with risks by optimizing the asset portfolio and strengthening the capital reserve.

Reduce the number of non-core business investment is one of the important way to boost liquidity. Non-core businesses often involve high uncertainty and risk, which can be a drag on a bank's financial performance when the market environment is unstable. Therefore, by reducing the investment in the field of business, the bank can release more capital to support the core business and enhance financial flexibility. In addition, increasing the holdings of highly liquid assets is also an important means to enhance liquidity. Highly liquid assets, such as cash and equivalents, such as government bonds, be quickly turned into cash to meet short-term funding needs, not only can maintain its value stable in market volatility, this is very important for the normal operation to maintain the bank.

Setting proper capital reserves is also key. In times of economic downturn or financial turmoil, adequate capital reserves can provide banks with a buffer to reduce the stress caused by changes in the external environment. According to the Bank for International Settlements (BIS) Basel Accord requirements, national regulators usually impose minimum capital adequacy requirements on commercial banks to ensure their ability to withstand potential losses. However, meeting minimum requirements alone is

not enough to ensure safe operation, with many leading institutions opting to take a more conservative approach, building an extra line of defence through excess reserves and voluntary retained profits. This strategy can not only help them cope with the extreme events, create conditions for future development.

In practice, the combination of these strategies can help banks better control risks and ensure their ability to continue operations in the face of unexpected events. China, for example, a large commercial Banks during the global financial crisis, the scheduling policy through adjust the internal funds, will be a lot of resources to focus on highly liquid assets, thus successfully by the subprime mortgage crisis triggered a series of challenges. At the same time, the bank actively promoted the divestment plan of non-core business, which further improved the overall financial position. This case fully proves that scientific and reasonable internal capital allocation is an effective way to ensure the steady development of financial institutions.

In addition, in the context of the digital era, the development of modern information technology also provides new tools and methods for internal fund management. Innovative applications such as big data analysis, artificial intelligence algorithms and blockchain technology can significantly improve the efficiency and accuracy of fund scheduling. For example, through in-depth mining and analysis of historical transaction data, it is possible to predict future cash flow needs, so as to prepare in advance; The use of smart contracts to automate transaction settlement can reduce operational risk and shorten processing time.

Establishing communication channels for crisis public relations

Effective information transmission and transparent communication play a crucial role in credit crisis management. Whether from the perspective of maintaining market stability or enhancing public confidence, improper handling of information may lead to the spread of market panic and aggravate financial risks. Therefore, in order to effectively deal with the credit crisis, it is essential to establish a comprehensive and targeted public relations and communication strategy.

The principle of information transparency plays an indispensable role in the modern financial system, especially in the context of the credit crisis. In this context,

banks and related financial institutions need to disclose the real situation to the public, investors and regulators in a timely manner with a high sense of responsibility and keen market insight. This is not only the presentation of the potential risks that have emerged, but also the measures that have been taken, strategies and expected development trends. Through such a transparent way of information exchange, we can effectively reduce unnecessary speculation and panic caused by information asymmetry, thus maintaining market stability to a certain extent.

In practice, information transparency is not simply information disclosure, but a balancing mechanism is needed to balance the degree of information disclosure involving trade secrets or sensitive data. This balance should not only protect the interests of enterprises, but also satisfy the public's reasonable right to know. Therefore, formulating a set of scientific and reasonable information disclosure standards has become one of the urgent problems to be solved in the banking industry. In this process, the importance, sensitivity and possible impact of different types of information should be fully considered, and the timing and specific content of information disclosure should be determined based on these factors.

In order to achieve the effectiveness and efficiency of information disclosure, banks should establish a sound information management system. This system should not only have the ability to quickly collect, organize and analyze information, but also be able to flexibly adjust disclosure strategies according to market changes. In addition, the system should be able to assess the possible impact of information disclosure on market psychology and behavior, so that corresponding plans can be made in advance. This forward-looking management approach helps to improve the information transparency of banks in response to emergencies, thus enhancing their ability to deal with crises.

From international experience, some countries have explored some effective methods. For example, the US Securities and Exchange Commission (SEC) has strengthened information communication between enterprises and investors through a strict information disclosure system. And some European countries have passed legislation to put forward more detailed information disclosure requirements for

financial institutions, so as to ensure that market participants can obtain sufficient and reliable information. In this context, China's banking industry can learn from the successful international experience, and at the same time combine the local actual situation, constantly improve their own information management mechanism, improve the overall risk prevention ability.

CONCLUSIONS

This study deeply discusses the current situation of credit risk management in China's banking industry, and summarizes rich experience and practical results in this field through careful analysis of policy support, risk identification process and technological innovation. The study points out that, driven by the current economic environment and market conditions, the development prospects of bank credit risk management system are diversified and full of challenges. In the future, with the continuous progress of fintech, the banking industry will have a broader development space and improvement potential in the technology and means of risk management.

The banking industry will further improve the efficiency and accuracy of risk identification and management through continuous optimization and application of big data technology, combined with the latest advances in artificial intelligence (AI). Meanwhile, the application of blockchain technology in credit risk will also be further promoted to enhance information transparency and reduce the risk of fraud. In addition, the banking industry will also step up efforts in green credit management to support sustainable development projects, while strengthening risk control in the international market to cope with new challenges brought about by globalization.

Through these measures, China's banking industry will gradually become mature in the field of credit risk management, thus providing a more solid and powerful guarantee for the stability of the entire financial system. This will not only help improve the overall competitiveness of the banking industry, but also provide strong support for the healthy development of the economy.

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Онлайн сервіс створення та перевірки кваліфікованого та удосконаленого електронного підпису

ПРОТОКОЛ
створення та перевірки кваліфікованого та удосконаленого електронного підпису

Дата та час: 11:23:53 11.12.2024

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Розмір файлу з підписом: 694.4 КБ

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Розмір файлу без підпису: 737.6 КБ

Результат перевірки підпису: Підпис створено та перевірено успішно. Цілісність даних підтверджено

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П.І.Б.: КОЧОРБА ВАЛЕРІЯ ЮРІЇВНА
Країна: Україна
РНОКПП: 3046115826
Організація (установа): ФІЗИЧНА ОСОБА
Час підпису (підтверджено кваліфікованою позначкою часу для підпису від Надавача): 11:23:52 11.12.2024
Сертифікат виданий: КНЕДП АЦСК АТ КБ "ПРИВАТБАНК"
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Алгоритм підпису: ДСТУ 4145
Тип підпису: Удосконалений
Тип контейнера: Підпис та дані в архіві (розширений) (ASiC-E)
Формат підпису: З повними даними для перевірки (XAdES-B-LT)
Сертифікат: Кваліфікований

Версія від: 2024.10.24 15:00

Онлайн сервіс створення та перевірки кваліфікованого та удосконаленого електронного підпису

ПРОТОКОЛ
створення та перевірки кваліфікованого та удосконаленого електронного підпису

Дата та час: 14:41:26 13.05.2025

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Результат перевірки підпису: Підпис створено та перевірено успішно. Цілісність даних підтверджено

Підписувач - 1: АЗАРЕНКОВА ГАЛИНА МИХАЙЛІВНА
П.І.Б.: АЗАРЕНКОВА ГАЛИНА МИХАЙЛІВНА
Країна: Україна
РНОКПП: 2571514226
Організація (установа): ФІЗИЧНА ОСОБА
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Алгоритм підпису: ДСТУ 4145
Тип підпису: Удосконалений
Тип контейнера: Підпис та дані в одному файлі (CAdES enveloped)
Формат підпису: З повними даними ЦСК для перевірки (CAdES-X Long)
Сертифікат: Кваліфікований

Підписувач - 2: Омеляненко Денис Олегович
П.І.Б.: Омеляненко Денис Олегович
Країна: Україна
РНОКПП: 3634714115
Час підпису (підтверджено кваліфікованою позначкою часу для підпису від Надавача): 15:04:29 19.12.2024
Сертифікат виданий: "Дія". Кваліфікований надавач електронних довірчих послуг
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Серійний номер носія особистого ключа: Не визначено
Алгоритм підпису: ДСТУ 4145
Тип підпису: Кваліфікований
Тип контейнера: Підпис та дані в одному файлі (CAdES enveloped)
Формат підпису: З повними даними ЦСК для перевірки (CAdES-X Long)
Сертифікат: Кваліфікований

Версія від: 2025.01.15 13:00