Risk Assessment of Commercial Bank Loans Based on AHP

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Abstract   Based on the defined concepts of loan risk and assessment of loan risk in commercial bank, this article classifies the loan risk into four categories: object risks, loan terms risks, management risks and system environment risks, and then discuss the risk assessment method   from the model AHP. The process is: establishing a hierarchical model and structure comparison matrix, calculating the relative weight and making consistency test of the matrix, then evaluating the results comprehensively. At last, this show conolnsion, that AHP is simple and easy to operate
Key words   Loan risk; Risk assessment; AHP

1 Introduction

The loan business is one of the main assets businesses in commercial bank. In the management process of commercial banks, the existence of loan business is bound to loan risk, and thus need to manage the loan risk. Therefore, in order to prevent and reduce loan losses, decrease the risk of bank management, ensure the safety and profitability of credit assets, improve the efficiency and quality of bank risk management, it is necessary to evaluate the size and quality level of loan risk to support the decision-making process.

2 Risk of Commercial Bank Loan

2.1 Risk of commercial bank loan

Loan risk refers to the possibility of loss that commercial banks can not recover the principal and interest according to the agreed loan contract, due to a variety of unforeseen uncertainties. Loan risk is mainly involving the non-performing loans. According to the degree of loan risk, loan classification system classified loans into five categories: normal; interest; secondary; doubt; loss. The non-performing loans are referring to the secondary, doubt and loss. By the end of 2009, the domestic banks' non-performing loans reached 497.33 billion RMB, the rate was 1.58%. The secondary loan balance was 203.13 billion RMB, doubt loans balance was 231.41 billion RMB, and loss loan balance was 62.79 billion RMB.

2.2 Risk assessment of commercial bank loan

Based on the loan risks' identification and estimation, and combining with other factors, commercial banks assess the probability of the credit risk occurrence or possible losses, and then decide to take appropriate measures. Effective risk assessment can prevent the generation of non-performing loans, strengthen the management of bank loan quality, and improve the efficiency and quality of bank risk management. Risk assessment is an important part of loan risk management in commercial bank.

3 Risk Factors of Commercial Bank Loans

Table 1   Risk Factors of Commercial Bank Loan

loan risk factors in commercial banks	object risks	borrower credit risk
		risk of borrower repayment ability
		risk of borrower repayment willing
		risk of project profitability
		risk of project potential
	loan terms risks	risk of loan way
		loan duration risk
		loan amount risk
		loan use risk
	management risks	bank cognition risk
		operation risk
		staff moral hazard
		intermediary risk
	system environment risks	policy risk
		interest rate risk
		risk of economical periodic fluctuation

It is necessary to identify the loan risks before risk assessment. Recognizing the causes and types of loan risks, the bank will accurately forecast the potential risks. Considering the multiple factors affecting loan risks, this article classifies the loan risks in commercial bank into four categories: the object risk, loan terms risk, management risk and system environment risk. The risk factors are shown in Table 1.

3.1 Object risks

Bank loans object is an important factor that can influence the bank recover the loan principal and interest according to contract, and lead to changes of the possibility of loan loss. Loan object risks include borrower credit risk, risk of borrower repayment ability, risk of borrower repayment willing, risk of project profitability, risk of project potential.

Generally, banks can not fully grasp the basic conditions of loan companies which include enterprise risk preferences, financial situation, repayment capacity, and industry development potential. It is difficult to make an exact check. Once the external market environment and internal conditions change, business operations will change in the loan period. It will influence the companies' repayment capacity at maturity. If the project which loans lent to is at large size, taking a long time, and with no experience to draw on. The project itself has a greater risk which will bring uncertainty to bank loan recovery. Project potential and project profitability will also influence loans recovery of commercial banks.

3.2 Loan terms risks

Loan terms refer to the loan amount, loan duration, loan purpose and etc.. These factors will have an impact on the loan recovery of bank according to the contract. Bank loan is including credit loans, secured loans (mortgage, pledge and guarantee) and Discount Notes. In general, secured loans take more risk than the credit loans. The longer the loan term is, the greater the impact has. The bank, company and project will subject to various uncertainties, the safety of loan recovery will be more difficult to determine. The greater the amount of loans is, the greater the likelihood of strategic default of the borrower is. Banks can maintain a moderate, reasonable structure by coordinating long, medium and short-term loan ratio. Loan funds invest to non-real economy bear greater risks than to invest in the real economy.

3.3 Management risks

Banks' own management also cause credit risk:① cognition risk. Bank does not fully understand the loan risks, focusing on quantity expansion and market share, ignoring the upgrade of the loans quality. It makes loans share high proportion in total bank assets. ② operational risk. Data collection, processing, computing and electronic system failures will bring banks into too much investment of loan management. Low level of bank credit management, such as loan status and responsibility is unknown, incomplete vetting mechanism, improper financial regulation, policy makers and managers make errors in the process of management, and etc. will bring uncertainties of the loan disbursement and recovery. ③ moral hazard. Bank credit officers at the personal interests release loan that does not meet the conditions deliberately. ④ intermediary risk. Intermediaries with weak sense of integrity, incomplete management systems related to the intermediary increase the loan risk of commercial banks.

3.4 System environment risks

The system environment risks involve policy risk, interest rate risk, risk of economical periodic fluctuation.

Government's financial policies or relevant laws, regulations make great changes, or important measures are introduced. It will bring the financial market fluctuation; commercial banks will have uncertain earnings. This is policy risk. Currently, domestic commercial banks obtain income by deposit and loan interest rate differential, so interest rates have a direct impact on the commercial banks. The risk of economical periodic fluctuation is brought by the economic cycle change. Changes in the economic cycle will greatly affect the economy and efficiency of the enterprise, as well as the repayment ability.

4 Risk Assessment of Commercial Bank Loan - AHP

AHP is a decision making method that decompose the relevant elements of the decision-making problem into several levels, then make qualitative and quantitative analysis according to the levels model. AHP analysis in-depth the nature, influencing factors and the intrinsic relationship of the complex decision-making problem, reduce to different levels, form a hierarchical structure model, make the decision-making process mathematical with less Quantitative information. AHP method generally

includes the following steps: establish a hierarchical model; structure comparison matrix, and calculate the relative weight; make Consistency test of the matrix, then evaluate the results comprehensively.

4.1 Establish a hierarchical model

The top of a hierarchy model is the target to be achieved by AHP. Here is commercial bank loan risk. The middle layer refers to the content that achieves the overall goal, namely index layer. For example, the factors affecting loan risk include the loan object, the loan term, the bank management and environment. Factors at the bottom support the factors at middle layer, namely sub-index layer. Loan object risks include borrower credit risk, risk of borrower repayment ability, risk of borrower repayment willing, risk of project profitability, risk of project potential. The hierarchical model is shown in Figure 1.

Define the set of loan risks as A, loan object risks A1, loan terms risks A2, management risks A3, system environment risks A4, define weight as W=(W1，W2，W3，W4,), then subdivide the four factors, A1=(S1、S2、S3、S4、S5)，A2=(S6、S7、S8、S9)，A3=(S10、S11、S12、S13)，A4=(S14、S15、S16)。
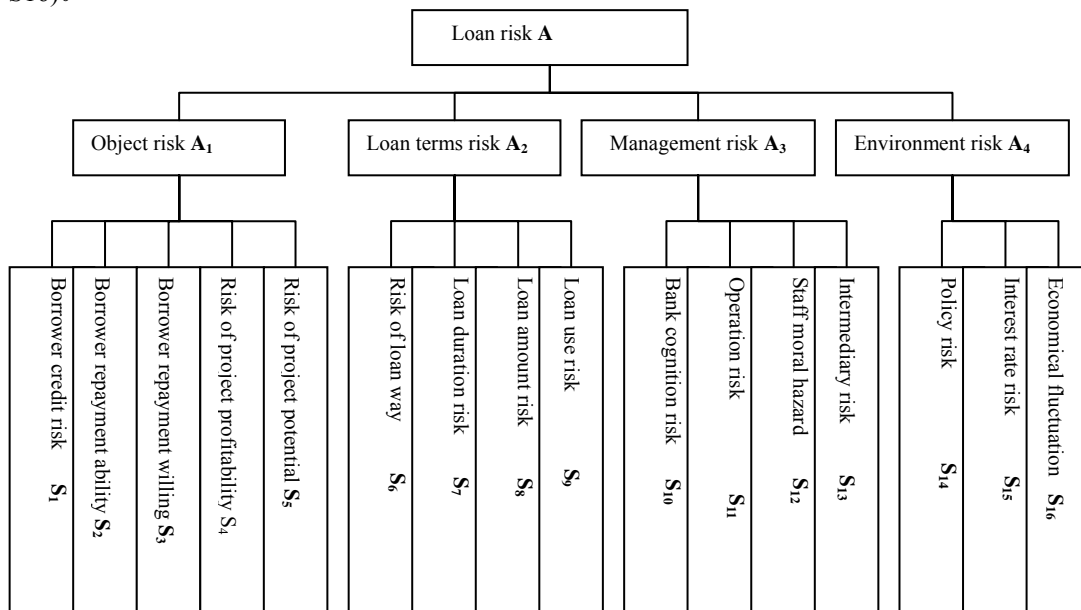

Figure 1　　Hierarchy Model of Commercial Bank Loan Risk

4.2 Establish comparison matrix

It is necessary to determine the quantitative criteria to judge before Comparison Matrix Construction, in order to carry out any two factors of middle layer to determine their relative importance. Here is 1-5 scaling method. Define indicators X= (X1, X2, Xn) impact on the same goal. Take two indicators Xi and Xj every time, Mij is the ratio that Xi and Xj degree of influence on the target. The value of Mij is decided by a 1-5 scale method.

Table 2　　1-5 Scaling Method

scale	meaning
1	two factors is of equal importance
2	the former is slightly important than the latter
3	the former is obviously important than the latter
4	the former is strongly important than the latter
5	the former is extremely important than the latter
reciprocal	Comparison of factors I and j is M_{ij}, comparison of the factors j and i is $1/M_{ij}$

By comparing the various factors, we can determine the affecting weight that the factors on one layer affect is to the next upper layer. Quantitative qualitative judgments, obtain the scale ratio of every factors, namely Comparison Matrix. In general, comparison matrix is obtained through filling in a questionnaire form by a number of experts and managers in the field and results processing. The

Comparison Matrix form is shown in table 3.

Table 3   Comparison Matrix M

	M_1	M_2	...	M_n
M_1	m_{11}	m_{12}	...	m_{1n}
M_2	m_{21}	m_{22}	...	m_{2n}
...	...	...	...	...
M_n	m_{n1}	m_{n2}	...	m_{nn}

mij is a numerical representation of relative importance that factor Mi to Mj that at the same layer for one element at the upper layer. When mij> 1, factor i is more important than factor j to the expressed goal. The number size means degree of relative importance. While mji = (1/mij) <1, factor j is less important than factor i , the number size means relative less important. The form of Comparative judgment matrix of commercial bank loan risk is shown in Table 4.

Table 4   Comparative Judgments Matrix of Loan Risk

A	A_1	A_2	A_3	A_4
A_1	m_{11}	m_{12}	m_{13}	m_{14}
A_2	m_{21}	m_{22}	m_{23}	m_{24}
A_3	m_{31}	m_{32}	m_{33}	m_{34}
A_4	m_{41}	m_{42}	m_{43}	m_{44}

Similarly，Comparative judgments matrix of A1 is shown in table 5, A2, A3, A4 can be of similar structure.

Table 5   Comparative Judgments Matrix of Object Risk

A_1	S_1	S_2	S_3	S_4	S_5
S_1	m_{11}	m_{12}	m_{13}	m_{14}	m_{15}
S_2	m_{21}	m_{22}	m_{23}	m_{24}	m_{25}
S_3	m_{31}	m_{32}	m_{33}	m_{34}	m_{35}
S_4	m_{41}	m_{42}	m_{43}	m_{44}	m_{45}
S_5	m_{51}	m_{52}	m_{53}	m_{54}	m_{55}

4.3 Single-level sorting of factor weight

Single-level sorting refers to sorting relative weight that the factors at lower layer to the factors at the next upper layer. Through calculating the largest feature value and the corresponding eigenvector of every comparison matrix, we can obtain the sorting values of each level, get the importance Data sequence that index layer is to the target layer, and obtain the final result.

Under the factor A, sorting weight calculation of A1、A2、A3、A4 can solve the maximum feature value λ max of matrix M, and satisfy the relation:

$$MW= \lambda \max W$$

W is the eigenvector corresponding to λ max. The component W1、W2、W3、W4 is the single-sort weights to the corresponding factors A1、A2、A3、A4.

Eigenvector can obtain through specialized software.

4.4 Consistency test

Due to the complexity of affecting factors and the diversity of knowledge and experience of the experts, when calculating the weight of every factor by AHP, the evaluation results will be different, and the comparison matrix is not necessarily consistent. So it is necessary to make consistency test for the matrix. When the comparison matrix is consistent or consistent completely, the AHP is effective.

When testing the consistency of Matrix, consistency index (CI) will be used:

$$CI= （ \lambda \max-n） / （n-1）$$

λ max is the largest feature value of matrix, n is the order of the matrix.

When CI=0 (λ max=n) , Matrix has a complete consistency. The larger the CI is, the worse the complete consistency of matrix is. In general, as long as CI <0.1, its consistency is acceptable. When CI> 0.1, we should be re-adjusted comparison matrix until a satisfactory consistency.

When all values of CI are in line with conditions, every comparison matrix has satisfactory consistency; the treated eigenvector is the weight of each factor.

5 Conclusions

AHP is simple and easy to operate. The results have some value for the loan risk management of commercial banks. Commercial banks should adopt various measures actively, prevent effectively and resolve loan risk, strengthen quality management of bank loans, enhance effective credit loan and be against non-performing loans.

References
[1] Gong rui, Lv Huirong, Lv Haowei. Analysis on Risk Factors of Individual Housing Loans[J]. Paper of Southwest Agricultural University (Social Sciences), 2004, 2(2): 27-29 (In Chinese)
[2] Yang Wendong. Study on Bank Loan Risk Evaluation[J]. Contemporary Economy, 2006, (3):85-86(In Chinese)
[3] YIn ZongCheng, Tian Feng, Wu Yonghui. Review on Credit Risk and Assessment Methods Application of Commercial Bank[J]. Paper of Anhui Agricultural University (Social Sciences), 2008, 17(5):24-29 (In Chinese)
[4] Li Pengyan, Xie Xiaochen. AHP-based Risk Assessment of Student Loans[J]. Paper of Harbin University of Technology, 2009, 41(12):301-304 (In Chinese)