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A Study of Chinese Commercial Banks' Credit Risk Assessment

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Abstract
It has been a long time that Chinese small and medium-sized enterprises (SMEs) have difficulties in dealing with financial problems. As a result of the imperfect financial environment in China, SMEs cannot find the effective way to obtain the funding, especially from Chinese commercial banks. In practice, the existing credit risk assessment and management policies cannot adapt to the requirements of SMEs, which means that developing new mechanisms and management policies is necessary. Based on the previous studies and the economic realities, this paper analyzes the credit status of commercial banks and sorts out the complex background to make a valuable conclusion. In the section of credit risk assessment mechanisms for SMEs, the author compares three classical models and introduces a parameter selection method which measures the financial and non-financial factors together. Besides the theoretical section, a case of Agricultural Bank of China will be studied

and the paper will focus on the credit rating system and explore the innovative service for SMEs.
Keywords: commercial banks, small and medium-sized enterprises, credit risk assessment, credit risk management, Agricultural Bank of China

Introduction

With the deepening of the economic reforms, China's economic structure has changed dramatically. The SMEs are generally becoming an important part of the national economy. In the past, in order to control potential risks, commercial banks tended to invest in large state-owned enterprises which are considered more stabile and SMEs frequently confronted themselves with difficulties in financing. However, with the development of social economy, profits obtained in large enterprises are increasingly decreasing and developing new profit growth opportunities has been the focal point of commercial banks. At the same time, China has introduced financial policies to support SMEs to finance. Therefore, many commercial banks generally focus on the financial demand of SMEs. The main aim of banks is to obtain profit which is in turn determined by the effective operation of banks (Egidijus and Bronius, 2008). Besides considerable profits, SMEs also bring credit default risks, so more effective ways are needed to assess the risk level of the enterprises.

Literature review

Foreign researchers paid attention to the commercial Banks earlier in terms of credit problems of SMEs. Berger and Udell (1998) point out the significance of the centralization of the banking industry for the development of enterprises after researching the financing environment of SMEs. Stein (2002) argues that the scale of the commercial banks have important influence on the credit of SMEs. Those small-scale and decentralized commercial banks are more sensitive to the "soft information" and willing to take risks, providing credit support for SMEs. However, large commercial banks keep relatively conservative attitudes toward SMEs because of higher risks. On the basis of former researches, Berger and Udell (2006) put forward that the "relational credit" is not the only financing theory model for commercial banks. Uchida, Udell and Yamori (2012) propose that the

"soft information", as a reference standard, is difficult to be quantified and collected. Canales and Nanda (2010) further study the bank credit risk and the generation of bad loans caused by information asymmetry, and warn the credit behaviour that ignore the risk. Torre, Peri and Schmukler (2010) put forward a new model of commercial banks financing for SMEs, arguing that banks should promote the development of enterprises, while at the same time increase the profit.

From the perspective of information asymmetry, the study of credit risk mainly focuses on two issues: moral hazard and adverse selection. Arrow (1964) formally introduces the concept of moral hazard in the research of management science. Stiglitz and Weiss (1981) study the problem of adverse selection in credit markets for the first time. Researchers turned to the loan contract since 1980s. Bester (l985) argues that a bad loan contract might be selected by lenders if they conduct favourable policies as incentives for the borrower. Seharfstein, David and Stein (1990) who study the motive forces of enterprises to repay the loan, may think a loan is a bank to terminate the business incentives, inducing it to repay the loan. Elizalde (2003) studies three credit models to research the probability of the default of enterprises. Altman (1969) analyses credit risk of borrowers through quantitative methods. Campbell and Dietrich (1983) examine the influential elements of the risk of mortgage loan through the logit model. Eisenbeis R. A. (1977) studies the relationship between credit risks and financial indicators by the method of econometric analysis. Corvoisier and Grop (2006) point out that the loan interest rate is influenced by multiple factors such as the interest rate on deposits, the extent of market concentration and operating costs. Dietsch (2002) assumes the bank economic capital is given and puts forward a method to measure the risk of loan portfolios. Saunder's and Wilson (1989) analyze the borrower's credit from the perspective of the macro-economic environment. Lack of experts in all sectors is the main problem in credit assessment (Bantiwalu, 2013). Lopze (2015) points out that risk expansion can lead to bankruptcy. The expansion of credit in house market by bank is the main cause of financial crisis (Martin, Ruano & Salas, 2013). The loan officer behaviour can be affected by the personal traits of borrowers (Cole, Kanz & Klapper, 2015). Mauro and Robert (2014) link the assessment criterion to the actual behavior of clients. Data-Mining-based application is introduced by Tello, Eslava and Tobias in 2013, to evaluate the level of credit risk. Mileris (2012)

argues that the ability of commercial banks to manage the credit risk affects banks' stability.

Domestic researchers also put forward different views and strategies from each aspect. Lin and Li (2001) analyze the basic situation and predicament of SMEs and put forward that the only way to solve the problem is to speed up the development of the system of financial institutions. After the 2008 financial crisis, Feng and Zhou (2011) point out that the financial crisis makes the situation more serious for SMEs as commercial banks invest less in SMEs during that time. Deng (2013) compares the financing pattern of Britain, Germany and France and studies the capital source, financing structure and credit time. Yang and Li (2007) put forward "multi-layer and weighted analysis" model to control and improve the credit system of commercial bank. Fu (2009) argues that "risk-oriented audit" has great application prospect. Yang (2009) examines different risk characteristics of SMEs and gives suggestions to improve the financial risk assessment for SMEs. Sun (2010) studies the case of Shanxi province and put forward "the customer-choose strategy" and "risk-prevention strategy". Lin (2011) argues the significance of the route for commercial banks to assess the credit risk. The correlation among the elements should be considered in terms of credit assessment (Li & Zhang, 2014). Fu, Pan and Wang (2014) apply the model of multiple decision trees to improve the level of assessment of the credit risk. Yin, Pu, Liu, Yu and Zhou (2014) point out that the data quality has been an important part in the construction of assessment system of credit risk.

Xue (1995) analyzes the credit risk problem from the perspective of property rights using qualitative analysis. Ran (2002) emphasized the necessity of control of the credit risk through legal means. Liang and Huang (2002) establishes the system of credit risk prevention through the study of the process of commercial banks' risk prevention. Jiang (2003) studies five aspects of commercial banks' risk management, including risk culture, the process, the mode of monitoring, risk measurement and risk transfer. Ke (2003) studies the relationship between advance selection and afterwards inspection in the process of establishing theoretical models. Zhang (2003) points out that the backward of quantitative management is the main problem of Chinese commercial banks' credit management. Jiang (2004) studies the commercial banks' credit from the perspective of the life cycle of enterprises. Zhang (2005) points out the defects of commercial banks'

credit system through the analysis of the internal control. Liu and Xu (2007) study the method for commercial banks to avoid credit risks. Fu (2007) argues that the lack of credit management system is the reason of the poor quality of credit assets. Yan (2008) compares the commercial banks' credit risk and point out that the emergence of the new situation would increase the credit risk of commercial Banks. Xue and Qu (2010) argue that China should alert the threat of the subprime crisis on the economy and strengthen the prevention of credit risk. Liu (2011) points out that the main risk of commercial banks is credit risk.

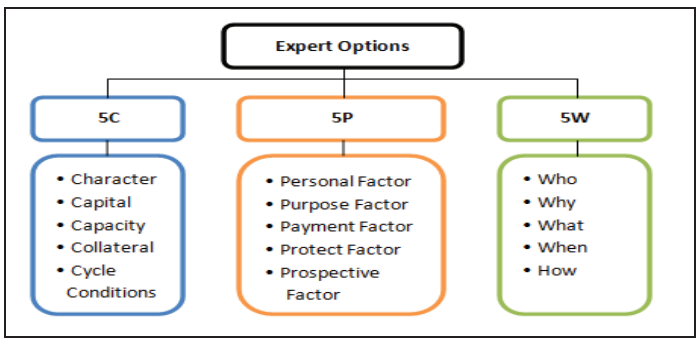
From the research of Chinese and foreign scholar, risk assessment and control are the core of credit for SMEs and how to control the risk as well as how to widen the channel of the funding for SMEs has become a major concern.

The classical theory of credit risk assessment

Expert Opinions Method

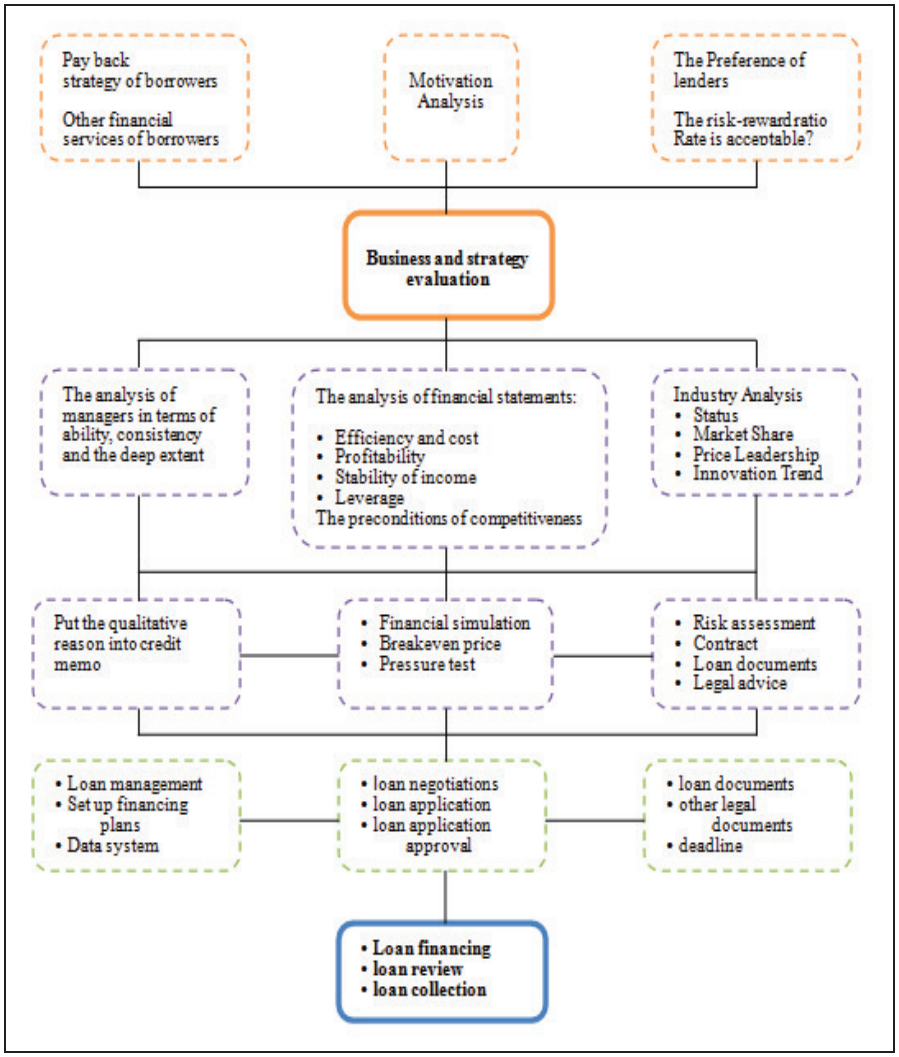
Expert Options Method refers to the subjective judgment of relevant qualitative and quantitative information by experts on the basis of their own experiences, which finally leads to a rating result (Lou, 2008). Under the Expert Options method, decisions are made by the experts of commercial banks, meaning that the professional skills and subjective judgment are crucial in the decision-making process. The "5C" method, "5P" method and "5W" method are the most common used methods (see Figure no.1). The credit analysis measurement is shown in figure no. 2.

Fig. no. 1. The Expert Options Method



Source: Compiled by the authors

Fig. no. 2. The diagram of Credit analysis measurement



Source: Altman, Haldeman and Narayanan (1977)

Logit Model

The Logit Model belongs to the category of the discriminant function model in Maths. Through the Logit transformation of the variables such as financial index, all values would fall within the effective set, which reduced the requirement of variables, thus is more widely applied. Logit Model is used to predict the possibility of credit

default. The event is divided into two categories: events with low credit risk and high credit risk. The criteria is: If P>0.5, the event is the first-kind event with low credit risk; If P<0.5, the event is the second-kind event with high credit risk. The general form is as follows:

$$P(x) = \frac{1}{1 + e^{\lambda}}$$

$$\lambda = b + a_1 x_1 + a_2 x_2 + \ldots + a_n x_n$$

where: a = the variable coefficient
P(x) = the probability of the first-kind event

Westgaard (2001) sets up the Logit Model with the indicators of short-term liquidity, asset scale, capital structure and asset return rate and the fitting rate is as high as 92%. With Logit Model for risk prediction, higher accuracy and better fitting could be achieved. However, as various assumptions are required in the regression model and more than 200 samples are needed, the model also has its limited application.

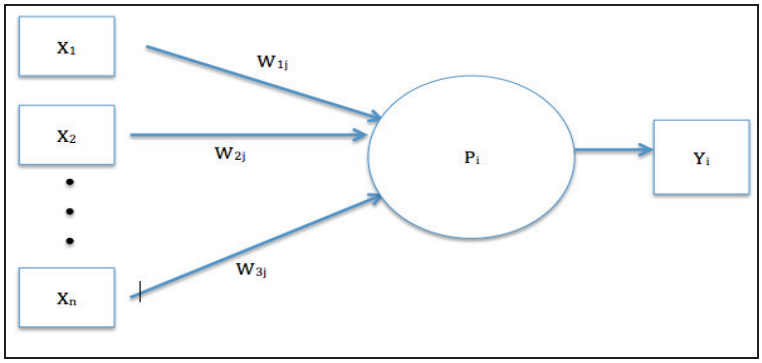
Neural Network Model

Neural network is composed of a large number of neurons, variables would be weighted and processed through equations and finally get the value of risk assessment of enterprises. The simplest simulation unit of neural network is shown in figure no. 3. The computational formula is as follows:

$$P_i = \sum_{j=1}^{n} W_{ji} \cdot X_j - S_i$$

where: P_i = the result of processed information
X_i = the input variable related to the company
W_{jt} = the weight of each variable
S_i = the threshold value that ensure the final results within a certain range

Fig. no. 3. The process of Neural Network Model



Source: Compiled by the authors

The Neural Network Model can process a large amount of data and has no requirement of the types of data. Especially when dealing with associated data, the neural network model can distinguish the complicated relationship among them and get the results with reference value. However, the computing capacity and efficiency are required to handle a large amount of data and the investment on the maintenance of the equipment would be higher. Moreover, the complex fitting process also impedes wide range of applications in the real life.

Objectives and Methodology

The method of normative analysis is used in this paper to study the credit risk management of state-owned banks from general background to the theoretical analysis. Thacher (2006) argues in support of the normative case study in which investigators use it to advocate specific issues. The object of this paper is to analyze the effective method in terms of credit rating for SMEs.

Moreover, the method of case analysis is also used to research the credit rating model of the Agricultural Bank of China, to analyse the process of credit risk management. The research method of case analysis is suitable for the type of problems with "how" and "why", for the objects which are happening currently and for the researchers who cannot or seldom control the events from happening (Yin, 2004). Stein (1952) argues that case analysis could highlight the crucial issue directly and effectively. Schramm (1971) points out that the core of the case analysis is to show a decision-making process.

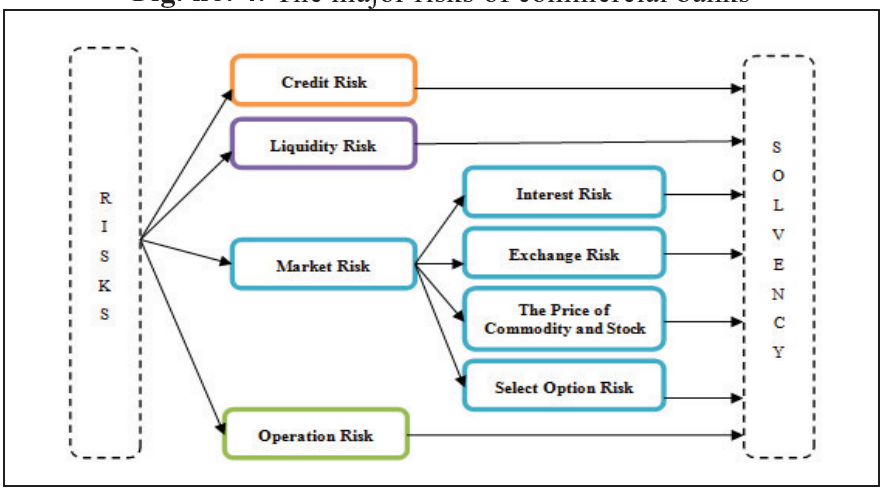
It can be found from the case that the credit assessment system of the Agricultural bank of China is relatively reasonable for SMEs. The article combines the theoretical arguments and empirical analysis. On the basis of the credit risk management theory of commercial banks and the actual conditions of the Agricultural Bank of China, the paper analyzes the credit rating system.

Case of the Agricultural Bank of China

The credit rating model of the Agricultural Bank of China would be analyzed in this section. The Agricultural Bank of China is one of four major state-owned banks in China and restructured to limited liability company in 2009. As one of China's leading integrated financial service providers, total assets of it amounted to 14.267738 trillion yuan and the total amount of loans and advances were 6.769873 trillion yuan by 2015. The Agricultural Bank of China is one of the most important and representative commercial banks in our country. This chapter will discuss the existing credit rating models.

The activity of banks is exposed to various risks (Ricards, 2011). The understanding of the risks is significant for bank management and the stability of the economy (Sieczka & Holyst, 2009). Credit risk is the determining factor in lending practices (Daniels & Ramirez, 2008). The major risks of commercial banks are indicated in figure no. 4.

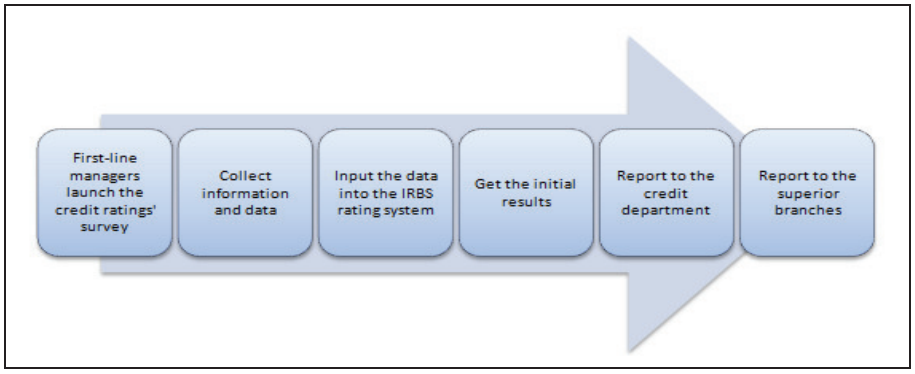
Fig. no. 4. The major risks of commercial banks



Source: Compiled by the authors

Grunert, Norden and Weber (2005) put forward the significance of a link between the credit rating and probability of default. Credit rating approach is used by the Agricultural Bank of China to measure the credit risk of the enterprises. First-line managers would launch the credit ratings' survey for enterprises with credit demand and then collect information and data according to the requirement of the rating model. After inputting the data into the computer system, the initial results would be created by the rating system IRBS which would be passed on to the bank president and credit management department to audit. Signed by the sub-branch president, the results would be finally obtained after submitted to branches. Figure no. 5 shows the process of the credit rating of the Agricultural Bank of China.

Fig. no. 5. The Process of the Credit Rating of the Agricultural Bank of China



Source: Compiled by the authors

Three rating methods, including the model rating, the pool rating and the expert rating, are currently used by the Agricultural Bank of China. The model rating is the most widely used method among three rating methods. The pool rating method, which is simple and through which the risk can be controlled easier, is specifically launched by the Agricultural bank of China for small and micro enterprises in terms of credit risk assessment.

The model rating is the most widely used method by the Agricultural Bank of China, which firstly assess customers' systemic risk and individual risk, and then analyse the initial result through qualitative and quantitative methods, finally getting conclusions with the aid of

IRBS data analysis system. In terms of the actual operation of the model rating system, classification for enterprises in the industry is the prior thing, because different industries have differing status and development prospect in the economy. All enterprises are divided into 3 categories with totally 19 industry models by the Agricultural Bank of China which set corresponding quantitative and qualitative indexes according to different industries. Detailed classification makes the result more accurate, and improves the effectiveness of the risk assessment. The manager needs to inspect the qualitative and quantitative data of enterprises in different industries. Management level, competition ability, financial risk and credit status are included in qualitative factors. The balance sheet, the income statement, the cash flow statement and other important financial statements of the past three years are required in quantitative analysis. After acquiring the required data, managers input the data into the IRBS system and start the assessment.

IRBS system is the core of the model rating system; the data would be processed by the system. Managers input the data of financial statements to C3 system and choose the rating model to start a rating. IRBS system would analyze the quantitative indicators automatically, while subjective grading is needed in qualitative analysis. Initial assessment results would be generated after those procedures.

Rating points pool is a method assess the credit according to the category and quality of collateral items. Compared to the method of model rating, pool rating is simpler, getting the result directly through the pool rating benchmark table. Table no.1 describes the assessment results of different ways of guarantee and different quality of collateral items. After getting the initial result from the table, managers ought to generate the final result on the basis of comprehensive inspect.

Table no. 1. The Benchmark Table of rating points pool

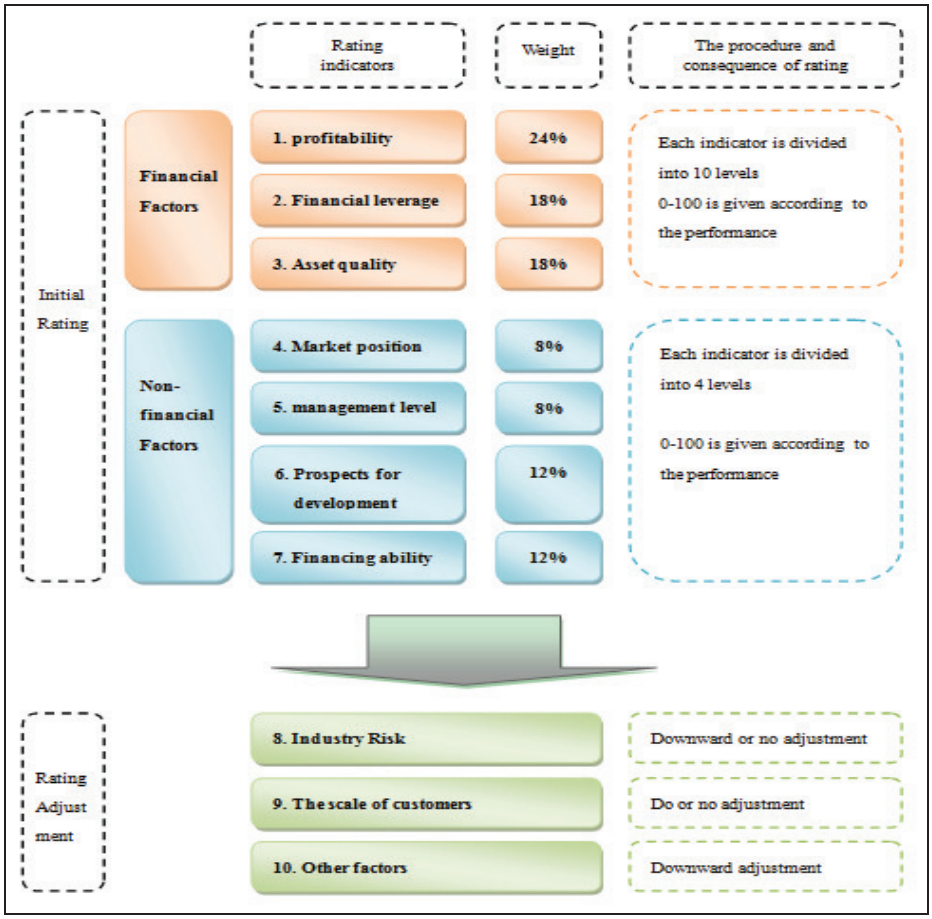
	Guarantee Items and Agencies	Rating Level
Mortgage Guarantee	The right of using state-owned land	A-
	The right of using collective constructive land and the buildings on the land	BBB-
	Residential real estate	AA-
	Commercial real estate	A
	Among them: industrial workshop	BBB
	Buildings under construction	BBB-
Pledge Guarantee	deposit receipt, certificate treasury bonds and bank bill (credit business with low risk)	AAA
Warranty Guarantee	Large and medium-sized corporate customers above AA+	The rating result of the guarantor

Source: Compiled by the authors

Rating point's pool is launched by the Agricultural Bank of China specifically for small and micro enterprises, because some of them cannot provide complete financial information. According to the method of pool rating, commercial banks abandon the complex rating process and only examine the quality of guarantee goods, which opens up a special way of rating. Moreover, on the basis of the collateral quality, the credit risk can be reduced effectively.

Qualitative and quantitative performance of enterprises would be considered by professional workers in the method of expert rating and the final result would generated by grading. Expert rating is divided into two steps ("initial rating" and "rating adjustments"). Figure no. 6 shows the rating indexes, weight and scoring method of the expert rating.

Fig. no. 6. The steps of expert rating



Source: Compiled by the authors

It can be clearly seen from figure no. 6 that both financial and non-financial factors are considered in expert rating, while the financial factors weight more (60%) and non-financial factors account for 40%. Profitability, financial leverage and asset quality are included in financial factors; grades are given according to the performance of the enterprises. Market position, management level, development prospects and financing ability are four main elements considered to be non-financial factors. Multiplying each component score and weighting them together it would get the final scores. Table no. 2 indicates the rating scores and corresponding levels.

Table no. 2. The relationship between the credit level and corresponding scores

Rating	The total result
AAA+	[98,100]
AAA	[96,98)
AAA-	[92,96)
AA+	[88,92)
AA	[84,88)
AA-	[80,84)
A+	[76,80)
A	[72,76)
A-	[68,72)
BBB+	[64,68)
BBB	[60,64)
BBB-	[52,60)
BB	[40,52)
B	[20,40)
C	<20

Source: Compiled by the authors

Conclusions

The credit assessment system of the Agricultural Bank of China is relatively reasonable for SMEs. It can provide enterprises with effective support in terms of credit products and financial services and at the same time control the credit risk as far as possible. The various characteristics of SMEs bring greater potential risks in financing, which means commercial banks as financial service institutions should be able to face the risk effectively.

The Agricultural Bank of China captures the main features of SMEs and sets up methods suitable for SMEs in the process of credit assessment. From the perspective of credit financing, SMEs can get a loan through the model rating system of banks and the Agricultural Bank of China also provides a special rating system for small and micro enterprises, so that these companies can satisfy different financing demands. The method of rating adapts to the various features of large enterprises and SMEs. The credit assessment system for SMEs should be based on the situation and regional environment of commercial banks,

providing SMEs with policies to support them in financing. Qualitative and quantitative analysis should be combined in credit rating rather than only focus on financial data. The balance between financial and non-financial indicators in risk assessment can make the rating results more reasonable for SMEs. The credit assessment is a comprehensive, dynamic and complex process, which requires commercial banks to explore an effective credit strategy for SMEs, at the same time controlling strictly the risk.

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