CSCanada
Management Science and Engineering
Vol. 7, No. 2, 2013, pp. 60-63
DOI:10.3968/j.mse.1913035X20130702.3251

ISSN 1913-0341 [Print]
ISSN 1913-035X [Online]
www.cscanada.net
www.cscanada.org

The Research of Bank Risk Supervision Index System Based on the Internal Control and Financial Early-Warning

LIU Yue[a]; PENG Xiaoya[a],*

[a] Chongqing University of Posts and Telecomunications, Chongqing, China.
* Correspondingauthor.

Received 14 April 2013; accepted 25 May 2013

Abstract
The domestic commercial bank survived the financial crisis since 2008 under the protection of the government, but to boost their stable development, the state is striving to reform the commercial bank system. We, under the background of overall revolution of the commercial bank, established a bank risk evaluation index system based on internal control and financial early-warning. After the fuzzy clustering analysis method is employed on Industrial and Commercial Bank of China (ICBC), its comprehensive risk level between 2007 and 2011 is found to stay in the secure zone, but the interest rate risk is found relatively high.

Key words: Internal control; Financial early-warning; Risk supervision; ICBC

LIU Yue, PENG Xiaoya (2013). The Research of Bank Risk Supervision Index System Based on the Internal Control and Financial Early-Warning. *Management Science and Engineering, 7*(2), 60-63. Available from: http://www.cscanada.net/index.php/mse/article/view/j.mse.1913035X20130702.3251
DOI: http://dx.doi.org/10.3968/j.mse.1913035X20130702.3251

INTRODUCTION
The financial crisis, beginning in 2008, has pushed the U.S. commercial banks into the wave of collapse. Until October 2010, there has been more than 200 banks collapses or living hard, which shocked the world. In this context, risk warning about the financial industry is increasingly important. Banking, a core component of the financial industry, plays a role as the first transfer of the central bank's monetary policy and one of the modern social and economic hubs of operation. Its healthy development is relevant to the normal operation of the macro economy and of great significance in risk warning research in practice. Our country's commercial bank, in a very time when the financial system is in revolution and under a background where the state administration is powerful, is not sharp enough with market risk, for which the establishment of a comprehensive risk warning is urgent. As we all know, commercial banks is a high-risk industry. Since 1977 China's commercial banks have gone through the expansion stage of development when the government function and enterprise management are successfully separated and its nature, status and relationship with other financial market players were determined. A huge commercial banking system based on four state-owned commercial banks; keep supporting China's economic and social development. In deepening revolution stage, China's commercial banks started to pay attention to risk prevention and in revolution crucial stage, in order to improve the competitiveness of China's commercial banks and reduce the rate of non-performing assets, capital adequacy ratio, specific focus is on risk issues The commercial banks are in great need of establishing risk controlling system to alert risk ahead of time to avoid uncertainty that may results in danger.

Recent research about China bank risk warning mainly covers two aspects: the internal control and financial early warning. Zai Xu (2009) pointed out that the internal control is the most powerful means to ensure the stable operation of the bank. Lily Chow (2010) gives a viewpoint that a complete, reasonable and effective internal control system is key to maintain the stable operation of banks to achieve business objectives based analysis of the successful domestic commercial banks' internal control mechanisms. Considering the fact that financial risk has been accumulating all the time, Zhang Feng Huang (2011) recommends to strengthen the internal control audit team building, improve the

quality of personnel and introduce of the concepts and methods of risk-based audit. In the aspect of financial early warning, upon the current problems of widespread high bank non-performing assets ratio, too little capital, earnings surface, but actual loss. Chen Xiaokun (2005) pointed out the need to establish a financial early warning system to prevent and avoid the credit risk of banks. Fang Qin Huang (2009) pointed out that the bank must urgently establish a financial early warning system to cope with the risk of operating activities in order to correctly judge the operating conditions. ZHANG Guang (2011) suggested strengthening prevention of the bank's financial risk should be enhanced. Jiang Sheng Dan (2011) on the basis of the experience of the predecessor in the bank's risk control advocated that internal control and financial early warning should be combined meanwhile made a theoretical discussion upon the possibility and necessity. Zhao Ping-Ping (2011) discussed the strategy to combine the bank's internal control and financial early warning.

Table 1
Bank Risk Supervision System

First-level indexes	Second-level indexes	Explanation
Profitability Index	return on assets(ROA)	P;>=0.6%
	return on capital	P:>=11%
	net interest margins	P
	Bank interest margin rate	P
	interest margin	P
	Cost income ratio	N;=<35%
Security Index	non-performing loan ratio	N;=<5%
	net generated Non-performing loans rate	N;
	The subprime loan migration rate	N;
	The single biggest customer loan ratio	N;=<10%
	Core Capital Adequacy Ratio	P;>=4%
	Capital Adequacy Ratio	P;>=8%
	Interest risk sensitivity level	I;1
	Accumulated foreign exchange Open position ratio	N;=<20%
	asset-liability ratio	N
Liquidity early warning index	Borrow money ratio	N
	liquidity ratio	P
	The core debt ratio	P
	Medium and long term loan ratio	P
	deposit loan ratio	P
Other index	ratio of independent directors	-
	share ratio of the largest shareholder	-
	ratio of stock throw-over	-
	audit opinion	-

As can be seen from the above overview, a definite amount of research about the bank's internal control and financial early warning have been done, but researching risk prevention combining the two elements has not been adequately studied. Internal control focuses on internal risk and current risk control while financial early warning focuses on external risk and long-term risk control; internal control are now able to do things in control and be controlled in advance, but difficult to do that ahead of time. Financial early warning can do advanced warning.

In theory, a combination of both applied to bank risk prevention will be able to play a synergistic effect. Thus, this article will be based on the idea seeking to establish a more comprehensive scientific objective of the bank risk early warning index system.

1. ESTABLISH EVALUATION INDEX SYSTEM

To establish early warning indexes of bank risk, we refer to the New Basel Agreement and China's commercial banks risk monitoring core index (Trial)- Core Index for Risk Surveillance by Commercial Banks taking four elements, credit risk, liquidity risk, operational risk and capital risk into consideration. For commercial banks, internal control evaluation consists of process and outcome evaluation of which the former is biased in favor of the qualitative indexes, the other in quantitative indexes. This article has employed mathematical methodology in expressing bank's risk early warning, so qualitative index is the best choice for internal evaluation. We first establish profitability indexes based on the main source of income of China's commercial banks: Operating income, interest income, investment income, meanwhile, referring to principle of cost to income ratio, involve the cost-to-income ratio in. profitability indexes in the; security warning indexes are established to monitor changes in non-performing loans, the quality (credit) charge, secured loan assets as a whole. Commercial banks, through the reserve fund, provide precondition for usual operations. Security indexes function as monitor to credit risk, market risk and operational risk; commercial bank solve their own liquidity problems by deposits, financial services because of some objective factors, such as the policy environment, its liabilities pathway is limited.; other indexes, mainly referring to non-financial factors, into the bank's risk evaluation system, could restraint financial indexes static and lag, so that the warning result become more objective. In addition, studies have

demonstrated that significant impact on internal control is from bank ownership of the largest shares, thus it is under consideration. Considering the availability of data, the non-financial indexes in the existing bank risk warning mainly come from the financial report's financial statement and other disclosed information, including market information, bank announcement etc. They specified indexes as following Tab1:

In Table 1, P represents positive index, and N represents negative index, I represent comparative fit index. Among the indexes, bank's assets security is the premise of their normal development business, so more options heavily weighted in terms of indexes are to be established. Positive and negative indexes are mainly for the financial indexes, which refer to the relationship between its numerical size and risk. Valve-value determination of the risk early warning indexes is done with system analysis and of the Commercial Bank of China, some important valve-value of the indexes has been determined.

2. DATA PROCESSING

2.1 Non-Dimension Disposal Method

In order to eliminate the differences in indexes of unit dimensionless we take the range method. As it do not require the distribution and quantity of the raw data. In the index system, the bigger the value of the positive indexes, the better it is. Dimensionless quantity is implemented by a formula $y=\frac{x_i-x_{\min}}{x_{\max}-x_{\min}}$; for negative indexes the smaller the better. Dimensionless quantity by formula $y=\frac{x_{\max}-x_i}{x_{\max}-x_{\min}}$; formula $y=\frac{1}{1+|q-x_i|}$ * MERGEFORMATused for the comparative fit index, and q means the best value of the index. Also audit opinion needn't disposal.

2.2 Index Weight Method

The dimensionless indexes' values are distributed between 0 and 1, of which the high relevant variables are removed using SPSS 20.0. In order to facilitate further processing, the index should be attached to weight respectively. Among the many methods, the coefficient of variation method is objective as well as scientific, especially no special requirements for the examples. So we have adopted it.

2.3 Fuzzy Clustering Analysis Method for Risk Early Warning

In this paper, a multi-level fuzzy comprehensive evaluation method is employed to analyze early warning system involved with both internal control indexes and financial early warning indexes. Fuzzy clustering algorithm is of simple classification and high precision. In simple proportional analysis the comprehensive evaluation is derived by comparing the index value and the standard value. Different from the former, fuzzy clustering algorithm proposes distribution characteristics of different indexes and generates the composite index of bank risk by the comprehensive judgment vector, it's has four step:

Step 1 After correlation analysis, the final number of index is N, so what first is needed is to establish evaluation index domain X, it's X = {X1X2 .... Xn} .

Step 2 According to the needs of the bank risk warning, the risk itself is divided into four assessment class: Green (assets stay in good condition, the risk is small and in a safe state), Blue light (asset position is better, with less risk, in a relatively safe), Yellow (assets in poor condition, the risk is higher, dangerous), Red light (the poor condition of the assets, the risk is very high, very dangerous), thus establishing evaluation level domain $V=\{V_1,V_2,V_3,V_4\}$.

Step 3 Calculating Standard values and relative membership degree.We established N*4 standard matrix Y to calculate the actual value of each index relative to the different levels of membership:

For positive index, its numerical size is inversely proportional to the risk, that is $Y_{i1}>Y_{i2}>Y_{i3}>Y_{i4}$, the degree of membership is calculated using the following formula, and X_i (i = 1, 2, 3 ... N) represents actual value of the index.

$$R_{ij}=\begin{cases} R_{i1}=1,R_{i2}=R_{i3}=R_{i4}=0;X_i>Y_{i1} \\ R_{i4}=1,R_{i2}=R_{i3}=R_{i1}=0;X_i<Y_{i4} \\ \left.\begin{matrix}R_{i1}=(Y_{i1}-X_i)/(Y_{i1}-Y_{i2})\ \ R_{i3}=0\\ R_{i2}=(X_i-Y_{i2})/(Y_{i1}-Y_{i2}),R_{i4}=0\end{matrix}\right\}Y_{i1}>X_i>Y_{i2} \\ \left.\begin{matrix}R_{i2}=(Y_{i2}-X_i)/(Y_{i2}-Y_{i3})\ R_{i1}=0\\ R_{i3}=(X_i-Y_{i3})/(Y_{i2}-Y_{i3}),R_{i4}=0\end{matrix}\right\}Y_{i2}>X_i>Y_{i3} \\ \left.\begin{matrix}R_{i3}=(Y_{i3}-X_i)/(Y_{i3}-Y_{i4})\ R_{i1}=0\\ R_{i4}=(X_i-Y_{i4})/(Y_{i3}-Y_{i4}),R_{i2}=0\end{matrix}\right\}Y_{i3}>X_i>Y_{i4} \\ Y_{i1}>Y_{i2}>Y_{i3}>Y_{i4},j=1,2,3,4 \end{cases} \quad (1)$$

For negative index, its numerical size is proportional to the risk, that is $Y_{i1}>Y_{i2}>Y_{i3}>Y_{i4}$, the degree of membership is calculated using the following formula, and X_i (i = 1, 2, 3 ... N) represents actual value of the index.

$$R_{ij}=\begin{cases} R_{i1}=1,R_{i2}=R_{i3}=R_{i4}=0;X_i<Y_{i1} \\ R_{i4}=1,R_{i2}=R_{i3}=R_{i1}=0;X_i>Y_{i4} \\ \left.\begin{matrix}R_{i1}=(X_i-Y_{i1})/(Y_{i2}-Y_{i1}),\ R_{i3}=0\\ R_{i2}=(Y_{i2}-X_i)/(Y_{i2}-Y_{i1}),R_{i4}=0\end{matrix}\right\}Y_{i1}<X_i<Y_{i2} \\ \left.\begin{matrix}R_{i2}=(X_i-Y_{i2})/(Y_{i3}-Y_{i2})\ R_{i1}=0\\ R_{i3}=(Y_{i3}-X_i)/(Y_{i3}-Y_{i2}),R_{i4}=0\end{matrix}\right\}Y_{i2}<X_i<Y_{i3} \\ \left.\begin{matrix}R_{i3}=(X_i-Y_{i3})/(Y_{i4}-Y_{i3})\ R_{i1}=0\\ R_{i4}=(Y_{i4}-X_i)/(Y_{i4}-Y_{i3}),R_{i2}=0\end{matrix}\right\}Y_{i3}<X_i<Y_{i4} \\ Y_{i1}>Y_{i2}>Y_{i3}>Y_{i4},j=1,2,3,4 \end{cases} \quad (2)$$

After above calculating we get a N*4 fuzzy relation matrix $R_{n\times 4}$.

2.4 Risk Warning

The comprehensive judgment vector is calculated by formulation A=W*R, where W is weight and R is membership degree. As following:

$$B = W * R = (W_1 W_2 ... W_n) \begin{bmatrix} R_{11} R_{12} R_{13} R_{14} \\ ..... \\ R_{n1} R_{n2} R_{n3} R_{n4} \end{bmatrix} = (B_1 B_2 ... B_n) \quad (3)$$

According to maximizing principle, the risk level is acquired and in turn involving comprehensive judgment vector as weight calculate risk index of the same bank in various time.

3. CASE ANALYSIS

Industrial and Commercial Bank of China Co., Ltd. was established in 1984, who is the first of China big four stated-own banks, one of the Fortune 500 companies, owning the largest customer base in China. Having the largest scale of assets, China's Industrial and Commercial Bank has gone through 27 years of revolution and development, successfully entering the quality efficiency and scale coordinated development track. This paper selects the Industrial and Commercial Bank of china as a case study, and the data derive from each of the Industrial and Commercial Bank Annual Report. Finally we get ICBC's comprehensive risk index as following:

Table 2
Trends of Icbc's Comprehensive Risk Index

Year	2007	2008	2009	2010	2011
Comprehensive risk index	13.24	22.43	6.27	15.72	7.51

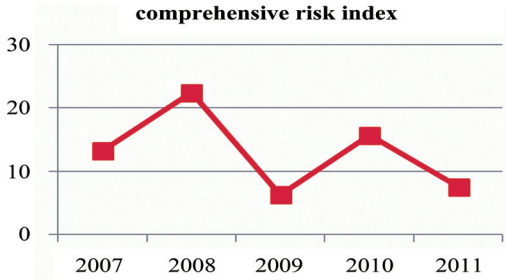

Figure 1
Comprehensive Risk Index

Figure 1 shows that the ICBC's risk showing a downward trend from year 2007 to 2011, which always in a safe place. In these years, due to the impact of the global financial crisis in 2008, it has a greatest risk. From 2008 to 2009, due to the improving of China's macroeconomic situation, the whole banking business stable, ICBC's risk has a significant reduction.

CONCLUSSION

In this article, we have established a bank risk index system based on internal control and financial early warning. From the perspective of case studies, the weight of safety index is relatively large in risk analysis, especially for the non-performing loan ratio and capital adequacy ratio, so banks must maintain the Non-Performance Loan ratio and capital adequacy ratio in a healthy area. What follows is liquidity risk. Profitability and other are relatively of smaller weight. As be seen from the membership Analysis, commercial banks' interest rate avoiding capability is relatively weak, so banks need to take appropriate measures to respond to interest rate risk. In addition, each bank, when doing risk analysis, can be adapted to local conditions, choosing different methods of data processing to enrich results.

REFERENCES

A. Saunders, E. Strock, N. G. Travlos (1990). Ownership structure, deregulation, and bank risk taking. *The Journal of finance*, *45*(2), 643-654.

A. N. Berger, I. Hasan, M. Zhou (2009). Bank ownership and efficiency in China: What will happen in the world's largest nation. *Journal of Banking & Finance*, *33*(1), 113-130.

Albert Park , Kaja Sehrt (2001). Tests of financial intermediation and banking reform in China. *Journal of Comparative Economics, 29*(4), 608–644.

Allen N. Berger, Gregory F. Udell (1990). Collateral, loan quality and bank risk. *Journal of Monetary Economics*, *25*(1), 21–42.

Cao Jun (2011). Effects of financial crisis on the us banking system and the enlightenment to China's banking sector. *Knowledge Economy*, (1), 56-57.

J. H. Boyd, G. De Nicolo (2005). The theory of bank risk taking and competition revisited. *The Journal of Finance, 60*(3), 1329–1343.

Matthieu Bussiere, Marcel Fratzscher (2006). Towards a new Early Warning System of Financial Crises. *Journal of International Money and Finance, 25*(6), 953–973.

Niu Fei (2004). *Research on banking risk early-warning system* (Master dissertation). Retrieved from Chinese National Knowledge Infrastructure. (UMI No. AAT 10459)

Pan Xuemo, Jiang Shengdan (2011). Theoretical discussion of employment uniting bank's internal control and financial risk warning. *Friends of Accounting*, (7), 79-80.

Roberto Ruozi, Pierpaolo Ferrari (2013). The impact of liquidity regulation in banks' strategies. *BANCARIA, 1*, 52-65.

Yang Zhi (2008). The selection of non-financial index in Financial early warning. *Communication of Finance and Accounting*, (6), 100-101.

Zhao Pingping (2012). Bank internal control combine with financial early-warning strategy. *China Foreign Trade*, *5*(10), 364-364.

Zhang Fenghuang (2011). Analysis and enlightenment of foreign commercial banks internal control. *Research of Finance and Accounting*, (24), 70-72.

Zai Xu, Li Ming (2009). Listed banks a substantial loopholes to disclose internal control research -based on the case analysis of China minsheng bank. *Accounting Research*, (4), 38-46.