Research on the Performance Evaluation of Small and Micro Businesses Microfinance of Commercial Bank based on Balanced Scorecard and Principal Components Analysis

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***Abstract*—According to the principals of Balanced Scorecard (BSC), we designed the performance evaluation system from five dimensions and evaluated the performance of small and micro businesses microfinance of 8 branches of HARBIN BANK by using Principal Components Analysis (PCA). The effectiveness and practicability of our method were verified by the empirical results and suggestions were recommended to improve the performance of microfinance.**

Keywords-performance evaluation; balanced scorecard; principal components analysis; microfinance

I. INTRODUCTION

In China, the banking industry has an intense competition because of the establishment of many small and medium sized banks. The large-scale commercial banks have advantages in capital, big clients and other aspects, so it is difficult to challenge them. What's more, small and medium-sized banks have no differences in customers, business features, so the competition between them are very intense. How to become the winner in the competition becomes the main point of banks' strategy development.

Microfinance becomes one of the most important businesses and the strategy center of many Chinese small and medium-sized joint-stock banks. Effective performance evaluation can help banks to evaluate the current situation and provide useful information for future development. Therefore, it is an important research subject for many small and medium-sized joint-stock banks.

II. LITERATURE REVIEW

Many performance evaluation systems can be used to evaluate banks' performance, such as "CAMEL" rating system, the standard & poor's bank rating system, EVA and BSC. Evaluation method like Factor analysis, Data Envelopment Analysis (DEA) and PCA are widely used. Xiong Weiping, Zhu Shuhong [1] pointed that all indicator convert to positive indicators before PCA can get more scientific and effective results. Qin Wanshun, Ouyang Jun [2] evaluated Chinese banks' efficiency using DEA and found that Chinese banks' efficiency is poor and state-owned banks are the poorest. Tan Zhongming [3] used factor analysis to evaluate 12 banks' performance of 1992. Serpil Canbas, Altan Cabuk, Suleyman Bilgin Kilic [4] evaluated more than 40 Turkey's banks by using PCA and built a risks warning system. Chen Zonghua [5] built a performance evaluation model based on profitability, security and liquidity and used PCA to analyzed Chinese banks and found that state-owned banks' performance are lower than average. Guo Linyan [6] used Factor analysis to evaluate performance of Chinese commercial banks of 2011. Thagunna, Poudel [7] used DEA to evaluate the performance of Nepal Bank from 2007 to 2011 and found that its performance has improved these years. Peng Wanlu, Huang Jun [8] used PCA to evaluate 20 banks' competiveness and found that Chinese banks are better than foreign banks in operating performance and comprehensive competitiveness and foreign banks are much better in risk management and business innovation.

We can conclude that BSC can build a comprehensive and effective performance evaluation system, which is used enterprise value maximization as the target and evaluates the performance from finance, customer, internal process and learning and growth dimension. What's more, it can be adjusted according to bank's own situation. PCA is widely used in performance evaluation, which dimension reduction technology to convert all indicators into several comprehensive indicators and make the evaluation more objective and comparable. Therefore, we use the principal of BSC to build the evaluation performance system of small and micro businesses microfinance of Chinese small and medium-sized banks and use PCA to analyze and rank the performance results.

III. CONSTRUCTION OF PERFORMANCE EVALUATION MODEL

BSC often evaluates the performance of companies or banks from 4 dimensions which are finance, customer, internal process and learning and growth. However, it does not mean that it only has four dimensions. According to the industry condition and strategy of the company, it is necessary to add one or more new dimensions. Small and micro businesses microfinance is one of the important source of profit of small and medium-sized banks and it is also the social responsibility of banks to support small and micro businesses. Many small and micro businesses are

high-tech, clean energy or companies in emerging industry supported by government. It also reflects banks social responsibility by supporting them with financing. Therefore, we designed a BSC performance evaluation model with five dimensions which are finance, customer, internal process, learning and growth and social responsibility.

"Table I" is the performance evaluation model.

TABLE I. PERFORMANCE EVALUATION MODEL.

First Class Indicator	Second Class Indicator	Third Class Indicator
Finance	Security	RAROC x_1
		The impairment loss x_2
		Asset quality x_3
		Non-performing loan ratio x_4
	Development	Profit growth rate x_5
		EVA x_6
		Percentage of revenue in total revenue x_7
		Importance of microfinance x_8
		Growth rate of loan x_9
		Loan concentration x_{10}
	Profitability	Return on total assets of microfinance x_{11}
		Return on equity of microfinance x_{12}
		Net interest rate x_{13}
		Net profit rate x_{14}
	Efficiency	Before tax profit per person x_{15}
		Cost to revenue x_{16}
		Net profit to cost x_{17}
		Amount of lending per person x_{18}
		Amount of lending per Sub-branch x_{19}
Customer	Satisfaction	Growth rate of customers x_{20}
		Percentage of the regular customers x_{21}
		Retention rate x_{22}
	Coverage	Share of the stock market x_{23}
		Share of the new market x_{24}
		Business success rate x_{25}
	Improvement	Customer income growth rate x_{26}
		Customer accession rate x_{27}
Internal process		Percentage of professionals x_{28}
		Growth rate of professionals x_{29}
		Customers to staff x_{30}
		Approval time x_{31}
		Efficiency of process improvement x_{32}
		Corrective rate x_{33}
Learning and growth		Training investment rate x_{34}
		Average training hour x_{35}
		Knowledge level of staff x_{36}
		Staff turnover rate x_{37}
		Staff induction rate x_{38}
		Quantity of service innovation x_{39}
		Products utilization rate x_{40}
Social responsibility		Percentage of customer supported by government x_{41}
		Percentage of industries supported by government x_{42}
		Tax contribution of customers x_{43}
		Growth rate of tax contribution x_{44}
		Percentage of innovative companies x_{45}
		Employment contribution x_{46}

IV. EMPIRICAL ANALYSIS OF PERFORMANCE EVALUATION OF SMALL AND MICRO BUSINESSES MICROFINANCE

Our research object is HARBIN Bank. Microfinance is the most important business and the strategy center. Loan balance of microfinance takes 69.1% of total loan. Interest income from microfinance is 67.9% of total customer interest income. Microfinance becomes HARBIN Bank's core business and the number of small and micro businesses microfinance is over 33,000. Our purpose is to establish effective performance evaluation model to evaluate the development of banks' microfinance by empirical analysis of HARBIN Bank and provide information for future development and improvement.

A. Eigenvalue, percentage of variance, and cumulative variance

After applying dimensionless method, we get standardized indicators and use the factor analysis function of SPSS17.0 to obtain eigenvalue, variance and cumulative variance. "Table II" is the total variance explained.

According to the result in "Table II," the percentage of cumulative variance reaches to 87.401% which is greater than 80%, when there are 5 condition satisfied eigenvalues. It means that extracting these 5 components from 46 indicators can explain the performance of 8 branches efficiently and the target of dimension reduction is met.

B. Analysis of component score coefficient matrix

"Table III" is the component score coefficient matrix. We can get the formula of each component by multiplication of coefficient and corresponding indicator and add all together. This formula can be used to evaluate all samples.

TABLE II. TOTAL VARIANCE EXPLAINED.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.375	22.554	22.554	10.375	22.554	22.554
2	9.561	20.784	43.338	9.561	20.784	43.338
3	7.842	17.047	60.385	7.842	17.047	60.385
4	6.561	14.264	74.649	6.561	14.264	74.649
5	5.866	12.753	87.401	5.866	12.753	87.401
6	3.601	7.828	95.23	3.601	7.828	95.23
7	2.194	4.77	100	2.194	4.77	100

TABLE III. COMPONENT SCORE COEFFICIENT MATRIX.

	Component				
	1	2	3	4	5
Zscore(X_1)	0.053	–0.057	–0.061	–0.019	0.063
Zscore(X_2)	–0.003	0.01	0	0.151	0.012
Zscore(X_3)	0.032	–0.021	–0.049	0.046	–0.017
Zscore(X_4)	–0.004	0.003	–0.054	0.134	0.03
Zscore(X_5)	–0.069	–0.003	0.033	0.03	0.1
Zscore(X_6)	0.061	0.008	0.084	0.048	0.037
Zscore(X_7)	–0.078	0.04	0.013	0.025	–0.042
Zscore(X_8)	0.057	0.081	–0.012	0.005	0.019
Zscore(X_9)	0.013	0.09	–0.026	0.03	0.035
Zscore(X_{10})	0.05	–0.004	0.101	0.043	0.025
Zscore(X_{11})	0.072	0.024	0.002	–0.052	–0.01
Zscore(X_{12})	0.051	-0.011	0.099	0.029	0.025
Zscore(X_{13})	0.083	0.028	–0.033	–0.033	–0.042
Zscore(X_{14})	0.087	–0.01	0.003	0.042	0.015
Zscore(X_{15})	0.067	0.056	0.028	0.041	0.028
Zscore(X_{16})	–0.046	0.032	–0.075	–0.066	0.058
Zscore(X_{17})	0.011	0.049	–0.057	–0.101	0.008
Zscore(X_{18})	0.05	0.079	–0.037	0.031	0.022
Zscore(X_{19})	0.032	0.069	–0.033	0.032	0.003
Zscore(X_{20})	–0.013	0.099	–0.008	–0.019	0.036
Zscore(X_{21})	0.002	0.062	0.04	–0.068	0.097
Zscore(X_{22})	0.004	0.079	–0.04	–0.061	0.052
Zscore(X_{23})	0.052	–0.023	0.088	–0.003	0.058
Zscore(X_{24})	0.017	–0.046	–0.002	–0.059	–0.044
Zscore(X_{25})	–0.04	0.061	0.036	0.085	–0.048
Zscore(X_{26})	0.001	0.003	–0.06	0.075	–0.016
Zscore(X_{27})	0.037	–0.033	–0.09	0.029	0.044
Zscore(X_{28})	–0.077	0.03	0.022	–0.045	0.006
Zscore(X_{29})	–0.04	0.052	–0.089	0.007	–0.04
Zscore(X_{30})	0.001	0.009	0.09	0.073	0.068
Zscore(X_{31})	–0.064	0.028	0.007	0.042	–0.099
Zscore(X_{32})	0.004	–0.011	0.011	0.009	–0.165
Zscore(X_{33})	–0.036	0.061	0.071	0.02	–0.065
Zscore(X_{34})	0.018	–0.065	–0.059	–0.029	0.094
Zscore(X_{35})	–0.016	–0.061	–0.012	0.001	–0.127
Zscore(X_{36})	–0.014	–0.067	0.055	–0.033	–0.029
Zscore(X_{37})	0.055	0.024	–0.015	–0.045	–0.104
Zscore(X_{38})	0.013	–0.033	–0.015	–0.086	–0.008
Zscore(X_{39})	–0.028	–0.007	–0.101	0.077	0
Zscore(X_{40})	0.015	0.004	0.076	–0.114	–0.031
Zscore(X_{41})	0.011	0.047	0.061	0.004	–0.111
Zscore(X_{42})	–0.051	0.069	0.034	–0.058	–0.013
Zscore(X_{43})	–0.066	0.005	0.037	0.036	0.097
Zscore(X_{44})	0.068	0.052	–0.002	0.011	–0.041
Zscore(X_{45})	0.025	0.074	–0.013	–0.049	–0.013
Zscore(X_{46})	–0.057	0	0.033	–0.066	0.102

According to the component score coefficient matrix, we can get the expressions of the 5 components.

$$f_1 = 0.053 \times Zscore(X_1) + ... + (-0.057) \times Zscore(X_{46}) \quad (1)$$

$$f_2 = (-0.057) \times Zscore(X_1) + ... + 0.000 \times Zscore(X_{46}) \quad (2)$$

$$f_3 = (-0.061) \times Zscore(X_1) + ... + 0.033 \times Zscore(X_{46}) \quad (3)$$

$$f_4 = (-0.019) \times Zscore(X_1) + ... + (-0.066) \times Zscore(X_{46}) \quad (4)$$

$$f_5 = 0.063 \times Zscore(X_1) + ... + 0.102 \times Zscore(X_{46}) \quad (5)$$

TABLE IV. THE FACTOR SCORE OF FIVE COMPONENTS.

Branch	C1	C 2	C 3	C4	C5
Mudanjiang	–0.30678	0.3474	0.59848	–2.28889	–0.44792
Shuangya-shan	–0.33306	–1.10776	0.0429	0.5329	–1.95682
Suihua	–0.24364	0.80285	–0.72213	0.44902	–0.09517
Dalian	0.73753	1.62392	–0.58979	0.17261	0.01111
Harbin	1.2342	–0.13525	1.95864	0.65401	0.44266
Hegang	–1.90934	–0.22783	0.43373	0.3742	1.27786
Jixi	0.99608	–1.50342	–1.22416	–0.52665	1.03107
Shenyang	–0.17499	0.20009	–0.49767	0.63282	–0.2628

TABLE V. THE RANKING OF PERFORMANCE EVALUATION.

Branch	C1	Ranking	C2	Ranking	C3	Ranking
Mudanjiang	–0.3067	6	0.3474	3	0.59848	2
Shuangyashan	–0.3330	7	–1.1077	7	0.0429	4
Suihua	–0.2436	5	0.8028	2	–0.7221	7
Dalian	0.7375	3	1.6239	1	–0.5897	6
Harbin	1.2342	1	–0.1352	5	1.9586	1
Hegang	–1.9093	8	–0.2278	6	0.4337	3
Jixi	0.9960	2	–1.5034	8	–1.2241	8
Shenyang	–0.1749	4	0.2000	4	–0.4976	5
Branch	C4	Ranking	C5	Ranking	Total score	Ranking
Mudanjiang	–2.2888	8	–0.4479	7	–0.2785	7
Shuangyashan	0.5329	3	–1.9568	8	–0.4715	8
Suihua	0.4490	4	–0.0951	5	0.0407	3
Dalian	0.1726	6	0.0111	4	0.4293	2
Harbin	0.6540	1	0.4426	3	0.7338	1
Hegang	0.3742	5	1.2778	1	–0.1877	5
Jixi	–0.5266	7	1.0310	2	–0.2401	6
Shenyang	0.6328	2	–0.2628	6	–0.0259	4

C. The factor score of five components

To analyze the performance of 8 branches, the standardized indicators should be substituted into the expression (5) to (9) and the factor score of each component can be calculated. "Table IV" is the score of five components of each branch.

To eliminate the influence of subjective factors, we choose objective weight method to calculate the comprehensive score. From "Table II," we can get the weight of Component 1 is 22.55%, Component 2 is 20.75%, Component 3 is 17.05%, Component 4 is 14.26%, Component 5 is 12.38%.

We assume that f1, f2, f3, f4, f5 is the score of each component and F is the expression of the comprehensive score. The expression is:

$$F = 22.55\% \times f_1 + 20.75\% \times f_2 + 17.05\% \times f_3 + 14.26\% \times f_4 + 12.38\% \times f_5 \quad (6)$$

The comprehensive score can be calculated by expression (10) and the ranking of the performance evaluation can be also obtained. "Table V" is the ranking of performance evaluation.

From the "Table V," Harbin branch has the greatest comprehensive score, so its performance evaluation is best. The second to fifth is Dalian, Suihua, Shenyang, Hegang, Jixi, and Mudanjiang. Shuangyashan is the last.

V. Conclusions

This article built the performance evaluation model of small and micro businesses microfinance based on BSC for small and medium-sized commercial banks and used PCA to evaluate the performance of small and micro businesses microfinance of 8 branches of HARBIN Bank in 2013. Finally, analyzed the empirical results from 5 components.

We made suggestions, such as developing new customers, increase the loan to promising and innovative companies, improving the efficiency of business process and increasing the investment in staff training, to the branches who performed worst in each component based on the analysis results.

Our search method and conclusions can provide useful suggestions to improve the performance of small and micro businesses microfinance for Chinese commercial banks.

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