***Original Research Article***

# A Study of the Coupling Degree between the Profitability and Risk Management Capability of Commercial Banks


## ABSTRACT

Based on the study of profitability and risk management capability index of commercial banks, this paper establishes a coupling model for profitability and risk management capability of commercial banks and conducts an empirical research based on data contained in 2012 annual reports of commercial banks listed in the form of A Shares in china, with results showing that the profitability and risk management capability of domestic listed commercial banks are at the stage of moderate coupling, upon which relevant suggestions are concluded.



*Keywords: Chinese commercial banks; Profitability; Risk management capability; Coupling degree; Entropy weighting method.*


## 1. INTRODUCTION

Profitability of commercial banks refers to the capability of the commercial banks to gain profits from offering monetary funds lending and flowing services by using a variety of methods and approaches. As the core of their business goals, profitability underlies the survival and growth of the commercial banks. Risk management capability of commercial banks refers to the capability of the banks to minimize losses resulting from risks at lowest costs by recognizing, measuring and controlling such risks. As the commercial banks take financial assets and liabilities as the operation object and derive their operating funds mainly from liabilities, such kind of business model with high financial leverage endows the bank's operation with high profitability, as well as with high exposure to risks. Therefore, during the operating process, the commercial banks should not only secure profits, but more importantly, they should also value risk management; meanwhile, how to deal with the relationship between the profitability and risk management capability of commercial banks serves as the key to promoting their core competitiveness.

As indicated by a large amount of research conducted by scholars both in china and abroad, there exists a significant relationship between the profitability and risk management capability of a bank. Berger (1995) had pointed out that capital was positively correlated with revenues in American bank, while the bank's asset structure and other factors also affected profits [1]. Huizinga and Demirguc-Kunt (1999) in his paper concluded that the asset-liability structure of a bank affected its profitability. More interest-free earning assets the bank had, less capable it was to gain profits [2]. Brock and Suarez (2000) in his paper suggested that the non-performing loan ratio of a bank was negatively correlated with its interest margin in Latin America [3]. Fry (1994) believed that the deposit-loan structure of a bank tended to affect its profitability. If a bank maintained a high proportion of deposits, it would secure cheap funds sources for lending. If the bank used other funds to satisfy lending demands, however, it would

incur a huge amount of fund costs [4]. Abreu and Mendes (2000) suggested that the Loan-to-deposit ratio of a bank was positively related with bank profitability [5].Bashir and Hassan (2003) showed that high capital and loan-to-asset ratios lead to higher Islamic bank profitability [6]. Fu Qiang (2004) claimed the profitability of China commercial banks was correlated negatively with such indexes as their bad debt reserve funds ratio, expanse-to-asset ratio, time variable and state-owned dummy variable, but positively with indexes such as net interest rates, asset ratio, fixed assets ratios, deposit ratio [7]. Chen Zhongyang (2007) showed that only financial institutions capable to bear high risks can obtain the opportunity for investment with high profits, and that financial institutions were supposed to effectively combine risk management with profit growth [8]. Zhang Qiwen (2012) had summarized chief factors affecting the profitability, as asset size, business structure, bank risks and other factors, and carried out a quantitative analysis of the extent to which these factors affected the profitability [9].Zhao Rui and Yang Youzhen (2009) showed that the capital adequacy ratio of Chinese commercial banks was positively related with its rate of return on total assets [10]. Jing Jian and Zhao Yang (2012) found that capital adequacy had a significant positive effect on profitability by data of commercial banks in China for 2004-2009 to make a regression test of capital adequacy and return on assets of 36 commercial banks [11]. Xu Yan and Xu Yang(2005) showed that the non-performing assets of Chinese commercial banks was correlated negatively with profitability, and made concrete suggestion to the development intermediate business of bank and to reduce the proportion of non-performing assets on the basis of conclusion[12].Lu Jing(2013) analyzed 144 Chinese commercial banks empirically and found that the profitability of Chinese commercial banks were related to the percentage of non-performing loan, the amount of bad debt, the bankruptcy probability and other risk indicators significantly and negatively[13]. These research shows a significant impact between the profitability and risk management capability of commercial banks, which embeds and penetrates into the profitability and risk management capability through common index and thus further affects the profitability or risk management capability, but there is no reasonable explanation for the interaction mechanism of commercial bank's profitability and risk management. As the coupling theory of Physics can interpret such effect more easily, so this paper establishes a coupling evaluation model to analyze the coupling relation between the two, and proposes suggestions based on the analysis of relevant data about China's listed banks.

## 2. ANALYSIS OF THE COUPLING MECHANISM BETWEEN THE PROFITABILITY AND RISK MANAGEMENT CAPABILITY OF COMMERCIAL BANKS

Coupling refers to a phenomenon that two or more physic systems or exercise forms affect each other or one another through a variety of interactions [14]. Coupling relation refers to a kind of dynamic correlation that allows mutual promotion, coordination and impact under benign interactions among respective sub-systems. In the field of social sciences, a coupling phenomenon is the phenomenon of interactions that occur under certain conditions. In this article, the phenomenon of interactions between and mutual impacts of profitability and risk management capability subsystems of commercial banks arising through their respective coupling elements in the market economy is defined as the coupling between the profitability and risk management capability of commercial banks.

According to this article, the relation between the profitability and risk management capability

of commercial banks is a relation of interactive coupling, and as both are uniform on one side, the risk management capability of commercial banks directly affects their profitability. Generally, risk management capability of commercial banks mainly includes credit risk management capability, liquidity risk management capability, market risk management capability and other risk management capability. Credit risk refers to the possibility that debtors of the bank are unable to pay accounts payable on time and in full. If the bank is weak in the management over credit risk, a result will be substantial increase in bad loans and higher provision coverage, which directly affects its profitability; Liquidity risk refers to the possibility of imbalance between cash inflows and outflows of the bank. If the bank undergoes liquidity imbalances, customer deposits, withdrawal and granting of loans can not be guaranteed on time, so that the bank will lose main spread income; Market risk refers to the possibility that changes occur to the market value of bank assets or liabilities due to changes in interest rate, exchange rates or security price. If China interest rates are marketized, a direct result will be narrower spreads and decreased profitability of banks. Meanwhile, contradiction also exists between the profitability and risk management capability of commercial banks. For example, profitability requires the banks to maximize the application of funds, for instance, to increase bank loans, while risk management requires the banks to strengthen the management over liquidity risks and maintain a certain loan-to-deposit ratio, requiring the loans to be controlled within a certain proportion; in terms of liability structure, the banks usually prefer demand deposits to reduce interest payments and increase revenues, while in terms of liability structure, the banks are required to increase time deposits to prevent from liquidity crisis, which also results in profit reductions of the banks. Normally, when a commercial bank is weak in risk management, it is also less capable to gain profits, as bad loans and other factors of the commercial bank tend to erode its profits. As the commercial bank grows more capable to manage risks, its bad loans will be recovered and vitalized and its profitability will also be escalated, which contributes to a positive correlation. However, if the bank's risk management is highly demanding, much attention is required to be paid to the building of risk management capability, which will affect its profitability. Therefore, it is especially important to identify the coupling degree between the profitability and risk management capability of commercial banks. In addition, over time, a coupling status graph featured by interactive rise will present between the profitability and risk management capability curves of commercial banks, while the intersection point of the above two curves represents the optimum coupling point for the development of commercial banks.

## 3. THEORY AND MODEL OF COUPLING BETWEEN THE PROFITABILITY AND RISK MANAGEMENT CAPABILITY OF COMMERCIAL BANKS

### 3.1 The functional model of coupling

The coupling theory defines the coupling function through the power function. In the power function, $u_i$ ($1 \le i \le n$) is the order parameter of the profitability and risk management capability of commercial banks; $u_{ij}$ is the No. j index of the No. i order parameter; the value is $x_{ij}$ ($1 \le j \le m$); $\alpha_{ij}$ and $\beta_{ij}$ are the upper and lower limit values of the stable order parameter of this coupling system; namely, $\alpha_{ij} = \max(x_{ij})$, $\beta_{ij} = \min(x_{ij})$. The power function

is:

$$u_{ij}=\begin{cases}\left(x_{ij}-\beta_{ij}\right)/\left(\alpha_{ij}-\beta_{ij}\right) & u_{ij}\text{has a positive effect, a positive effect on the system from}\\ \left(\alpha_{ij}-x_{ij}\right)/\left(\alpha_{ij}-\beta_{ij}\right) & u_{ij}\text{has a negative effect, negative effect on the system from}\end{cases} \quad (3.1)$$

$u_{ij}$ is the contribution size of the variable $x_{ij}$ to the system power. When $u_{ij}$ approaches 0, $x_{ij}$ would be the most unsatisfied with system contribution. When $u_{ij}$ approaches 1, $x_{ij}$ would be the most satisfied with system contribution. Therefore, $0\leq u_{ij}\leq 1$. The profitability and risk management capability in the system of coupling between the profitability and risk management capability of commercial banks are supported by their respective subsystems. The contributions of various order parameters in the subsystems can be realized through the integration method. Usually, the method of linear weighting summation is adopted:

$$u_i=\sum_{j=1}^{m}\lambda_{ij}u_{ij}\ ,\ \sum_{j=1}^{m}\lambda_{ij}=1 \quad (3.2)$$

$u_i$ denotes the contribution of the subsystem to the system, with the index weight being $\lambda_{ij}$. In this article, we define it through the entropy weighting method.

After defining the power of order parameter, we derive the coupling degree function between the profitability and risk management capability of commercial banks through the capacity coupling concept and capacity coupling factor model of physics:

$$C_2=\left\{\left(u_1\cdot u_2\right)/\left[\left(u_1+u_2\right)\left(u_1+u_2\right)\right]\right\}^{1/2} \quad (3.3)$$

According to this coupling function, coupling degree $C\in[0,1]$. When C=0, various order parameters are unrelated with one another, the system can achieve a negative emergence and go toward a disorderly state, and the core competitiveness of commercial banks would not rise along with the development of their profitability and risk management capability. When $0<C\leq 0.33$, the profitability and risk management capability of commercial banks are in a coupling period of lower degree, there is no effective risk management security for the profitability of commercial banks, or the measures of risk management measures are so strong that the profitability of commercial banks has weakened. When $0.33<C\leq 0.66$, the profitability and risk management capability of commercial banks are in a coupling period of medium degree, the profitability and risk management capability are still in the run-in period, and both parties need to further match themselves with each other in such aspects as scale and structure. When $0.66<C<1$, the profitability and risk management capability of commercial banks are in a coupling period of high degree, the profitability and risk management capability of commercial banks are relatively high, and the banks have basically achieved a situation of benign coupling development marked by the mutual promotion of the two, the development of the two assumes a trend of spiral escalation, and the competitiveness of banks has been rising rapidly. When

C=1, the coupling degree between the profitability and risk management capability of commercial banks reaches its peak, and a state of benign resonant coupling has been reached among various order parameters, the system has achieved benign emergence, and the core competitiveness of commercial banks has risen tremendously.

### 3.2 The index evaluation system of coupling degree

In order to quantify the coupling degree between the profitability and risk management capability of commercial banks, according to the major supervisory indexes of China Banking Regulatory Commission over commercial banks and the indexes of operation and management over commercial banks which disclose information according to requirements of listed companies, and according to the index selection principles of “scientific and reasonable”,“comprehensive and objective”and“operable”, this article has set up an evaluation index system of coupling degree which reflects the coupling degree relations between the profitability and risk management capability of commercial banks. During the index evaluation of the profitability of commercial banks, the evaluation indexes which reflect the comprehensive profitability of commercial banks are selected, chiefly including the rate of return on total assets, weighted return on equity, the cost-to-income ratio, the percentage of non-interest income and net interest margin. The risk management capability of commercial banks chiefly includes the credit risk management capability, liquidity risk management capability and capital risk management capability. We have respectively selected such indexes as non-performing loan ratio, provision coverage, top ten customers’ loan ratio, liquidity ratio, loan-to-deposit ratio, and the adequacy ratio of core capital to evaluate the risk management capability of commercial banks (cf.Table 1).

**Table 1. The index system for the coupling degree between the profitability and risk management capability of commercial banks**

| Targets | System order parameter | Subsystem order parameter | Definition of order parameter indexes |
|---|---|---|---|
| Core competitiveness of commercial banks | Profitability | The rate of return on total assets | The ratio between the total return obtained in a certain period and the average total assets. The higher this rate is; the higher the asset utilization efficiency of commercial banks would be, and the stronger the profitability would be. |
| | | Weighted return on equity | The ratio between after-tax net profit and average net assets. The higher this rate is; the higher the economic efficiency of the self-investment of commercial banks would be, and the stronger the profitability would be. |
| | | The cost-to-income ratio | The ratio between operating expenses plus discount and operating revenue. The lower the ratio is, the lower the cost expenditure/unit income of commercial banks would be, and the stronger the income-earning capability would be. |
| | | The percentage of non-interest income | The ratio between the sum of the net income of handling charges and commission, other business incomes and the non-interest income from investment on the one hand and the operating revenue on the other hand. This percentage is an important index for measuring the comprehensive profitability of commercial banks. The higher this index is; the stronger the profitability of commercial banks would be. |
| | | Net interest margin | The ratio between net interest income and all interest-bearing assets of commercial banks. Interest margin income is a traditional and also the most |

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| | | | important profit source of commercial banks. The higher the index is; the stronger the profitability of commercial banks would be. |
| | Risk management capability | Non-performing loan ratio | The ration between non-performing loans and total loans of commercial banks. This ratio is an important index for evaluating the safety of credit assets of banks. The higher the ratio is, the higher the loan recovery of commercial banks would be, and the weaker the risk management capability would be. |
| | | Provision coverage | The ratio between the actual provision for loan losses and non-performing loans. This ratio is an important index for measuring the adequacy of the provision for loan losses of commercial banks. The higher the index is, the more controllable the risks of commercial banks would be. |
| | | Top ten customers' loan ratio | The ratio between the total deposit balance of the ten largest deposit customers and total deposits, which reflects the concentration of the credit asset risks of commercial banks. According to the principle of risk diversification, loans need to be diversified to avoid risks. The higher the index is, the weaker the risk management capability would be. |
| | | Liquidity ratio | The ratio between the balance of liquid assets and the balance of liquid liabilities. The higher this ratio is, the stronger the commercial banks' capability of repaying short-term debts would be and the stronger the risk management capability would be. |
| | | Loan-to-deposit ratio | The ratio between the total loans and the total deposits. In terms of risk management of commercial banks, the lower the deposit-to-loan ratio is; the better. The lower the deposit-to-loan ratio is, the stronger the liquidity of commercial banks would be and the stronger the risk management capability would be. |
| | | The adequacy ratio of core capital | The ratio between core capital and risk weighted assets, which reflects the credit level of commercial banks. It is an important index for measuring the economic strength of commercial banks. The higher the index is, the stronger the risk management capability of commercial banks would be. |

### 3.3 Judging the weight of order parameter through the entropy weighting method

As an objective weighting method, the entropy weighting method aims to judge the effectiveness and value of coupling degree evaluation indexes by using the subjective factors. In the process of entropy weighting, we have conducted standardization and normalization processing to data through the power function (3.1) [15], thus deriving a matrix $U = (\mathrm{u}_{ij})_{n\times m}$.In order to avoid taking the logarithm meaninglessly while deriving the entropy, we have ordered $X = (u_{ij}+1)_{n\times m} = (x_{ij})_{n\times m}$ , $(1 \le \mathrm{i} \le n; 1 \le j \le m)$ (3.4) and horizontally moved the data, and transformed the actual value of evaluation indexes into the evaluation value through the formula $P_{ij} = \frac{x_{ij}}{\sum_{j=1}^{m} x_{ij}}$ , $(1 \le \mathrm{i} \le n; 1 \le j \le m)$ (3.5), namely: calculating the percentage of the No. i bank in this index under the No. j index. Through the formula $e_j = k\left/\sum_{j=1}^{m} p_{ij}\ln(p_{ij})\right.$ , $\mathrm{k} \succ 0$ , $k = \frac{1}{\ln(\mathrm{n})}$ , $e_j \succ 0$ (3.6), we have calculated the entropy of the No. j index. Through the

formula $g_j = \frac{1-e_j}{m-E_e}$ , $E_e = \sum_{j=1}^{m} e_j$ , $0 \le g_j \le 1$ , $\sum_{j=1}^{m} g_j = 1$ (3.7), we have derived the diversity factor of the No. j , and eventually derived the weight to be $W_j = \frac{g_j}{\sum_{j=1}^{m} g_j}$ , $(1 \le j \le m)$ (3.8).

## 4. THE EMPIRICAL STUDY OF THE COUPLING DEGREE OF CHINESE LISTED COMMERCIAL BANKS

By April 2014, 16 commercial banks had been listed in the form of A Shares in China, including 5 large state-owned commercial banks: Industrial and Commercial Bank of China, China Construction Bank, Bank of China, Bank of Communications and Agricultural Bank of China; 8 joint-stock commercial banks: China Merchants Bank, Shanghai Pudong Development Bank, Minsheng Bank, Ping An Bank, Industrial Bank, Hua Xia Bank, Everbright Bank and China Citic Bank; and 3 urban commercial banks: Bank of Beijing, Bank of Nanjing and Bank of Ningbo. Through the Wind Database, we have obtained the 2012 coupling evaluation indexes of these 16 listed commercial banks (cf. Table 2). Listed commercial banks are more normalized in such aspects as corporate governance, operating management and information disclosure, representing the overall operating strength and future development direction of domestic banking. By studying, analyzing and evaluating the coupling degree between the profitability and risk management capability of listed banks, we can promote the overall competitiveness of commercial banks under more guidance.

**Table 2. Indexes for the coupling degree between the profitability and risk management capability of listed commercial banks (at the end of 2012)**

| Order parameter / Commercial banks | Profitability capability | | | | | Risk management capability | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rate of return on total assets | Weighted return on equity | Net interest margin | Cost-to-income ratio | The percentage of non-interest income | Non-performing loan ratio | Provision coverage | Liquidity ratio | Loan-to-deposit ratio | Top ten customers' loan ratio | The adequacy ratio of core capital |
| Industrial and Commercial Bank of China | 1.75 | 23.02 | 2.66 | 28.56 | 22.20 | 0.85 | 295.55 | 32.50 | 64.10 | 17.90 | 10.62 |
| Agricultural Bank of China | 1.41 | 20.74 | 2.81 | 36.76 | 18.97 | 1.33 | 326.14 | 44.75 | 59.22 | 15.76 | 9.67 |
| China Construction Bank | 1.79 | 21.98 | 2.75 | 29.57 | 23.34 | 0.99 | 271.29 | 56.73 | 66.23 | 14.76 | 11.32 |
| Bank of China | 1.47 | 18.10 | 2.15 | 31.81 | 29.80 | 0.95 | 236.30 | 49.80 | 71.99 | 16.90 | 10.54 |
| Bank of Communications | 1.42 | 18.43 | 2.59 | 29.71 | 18.46 | 0.92 | 250.68 | 37.93 | 72.71 | 14.22 | 11.24 |
| China Merchants Bank | 1.74 | 24.78 | 3.03 | 35.98 | 22.04 | 0.61 | 351.79 | 52.29 | 71.37 | 14.24 | 8.49 |
| Shanghai Pudong Development Bank | 1.42 | 20.95 | 2.58 | 28.71 | 11.56 | 0.58 | 399.85 | 37.57 | 0.72 | 13.97 | 8.97 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Minsheng Bank | 1.57 | 25.24 | 2.94 | 34.01 | 25.17 | 0.76 | 314.53 | 36.01 | 0.72 | 17.39 | 8.13 |
| Ping An Bank | 1.09 | 16.78 | 2.37 | 39.41 | 16.88 | 0.95 | 182.32 | 51.31 | 69.61 | 15.60 | 8.59 |
| Industrial Bank | 1.42 | 26.65 | 2.64 | 26.73 | 17.60 | 0.43 | 465.82 | 29.06 | 67.79 | 21.81 | 9.29 |
| Hua Xia Bank | 1.15 | 18.50 | 2.71 | 39.95 | 11.14 | 0.88 | 320.34 | 33.95 | 69.51 | 27.38 | 8.18 |
| Everbright Bank | 1.38 | 22.54 | 2.54 | 29.97 | 16.11 | 0.74 | 339.63 | 51.25 | 71.52 | 23.73 | 8.00 |
| China Citic Bank | 1.40 | 16.70 | 2.81 | 31.51 | 15.59 | 0.74 | 288.25 | 48.85 | 73.59 | 20.98 | 9.89 |
| Bank of Beijing | 1.31 | 18.00 | 2.48 | 25.78 | 11.48 | 0.59 | 419.96 | 37.57 | 68.19 | 36.36 | 10.90 |
| Bank of Nanjing | 1.44 | 17.35 | 2.49 | 29.86 | 15.56 | 0.83 | 316.74 | 36.60 | 58.63 | 21.96 | 12.13 |
| Bank of Ningbo | 1.36 | 19.97 | 3.48 | 34.13 | 10.89 | 0.76 | 275.39 | 41.99 | 67.74 | 16.10 | 11.49 |

**The data are quoted from the Wind Database. In September 2012, the former Shenzhen Development Bank and the former Ping An Bank were merged as the present-day Ping An Bank.*

Cost-to-income ratio, non-performing loan ratio, loan-to-deposit ratio and top ten customers' loan ratio are negative power indexes, playing a negative role in reflecting their respective subsystems of competitiveness of commercial banks. Rate of return on total assets, weighted return on equity, net interest margin, percentage of non-interest income, provision coverage, liquidity ratio and core capital adequacy ratio are positive power indexes, playing a positive role in reflecting their respective subsystems of competitiveness of commercial banks. According to the formula of power function (3.1), we have set up a matrix and conducted normalization and optimization processing to the positive and negative power indexes respectively, thus deriving a matrix $U_{11\times16}$. In order to avoid taking the logarithm meaninglessly while deriving the entropy, we have horizontally moved the data according to the formula (3.4), and transformed the actual value of evaluation indexes into the evaluation value according to the formula (3.5), and worked out the entropy of the No. j index through the formula (3.6). Through the formula (3.7) and (3.8), we have derived the weights of various indexes by working out the diversity factor of No. j (cf. Table 3).

**Table 3. Indexes weight for the coupling degree between the profitability and risk management capability of commercial banks**

| **Order parameter** $u_i$ | **Weight** $\lambda i$ | **Evaluation indexes** | **Weight** $\lambda_{ij}$ |
|---|---|---|---|
| Profitability capability $u_1$ | 0.4539 | Cost-to-income ratio $u_{11}$ | 0.2007 |
| | | Rate of return on total assets $u_{12}$ | 0.2003 |
| | | Weighted return on equity $u_{13}$ | 0.1994 |
| | | Net interest margin $u_{14}$ | 0.2004 |
| | | The percentage of non-interest income $u_{15}$ | 0.1992 |
| Risk management | 0.5461 | Non-performing loan ratio $u_{21}$ | 0.1670 |

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| capability $u_2$ | | Loan-to-deposit ratio $u_{22}$ | 0.1663 |
| | | Top ten customers' loan ratio $u_{23}$ | 0.1680 |
| | | Provision coverage $u_{24}$ | 0.1662 |
| | | Liquidity ratio $u_{25}$ | 0.1664 |
| | | The adequacy ratio of core capital $u_{26}$ | 0.1662 |

According to the power function formula (3.1), we have set up a matrix and respectively conducted normalized optimization to the positive and negative power indexes, thus deriving the contribution value of the order parameters of subsystems: $u_{ij}$. Through the order parameter weight derived by the formula (3.2) and the entropy weighting method, we have worked out the order parameters $u_1$ and $u_2$, and eventually derived the coupling degree C of their respective systems through the formula (3.3) (cf. Table 4)

**Table 4. Coupling degree between the profitability and risk management capability of listed commercial banks (at the end of 2012)**

| **A shares of china listed commercial banks** | **Order parameter $u_1$** | **Order parameter $u_2$** | **Coupling degree C** | **Coupling stage** |
|---|---|---|---|---|
| China Construction Bank | 0.6747 | 0.659 | 0.5774 | moderate coupling stage |
| China Merchants Bank | 0.6542 | 0.583 | 0.5552 | moderate coupling stage |
| Industrial Bank | 0.6256 | 0.5588 | 0.5433 | moderate coupling stage |
| Industrial and Commercial Bank of China | 0.6728 | 0.5255 | 0.5432 | moderate coupling stage |
| Bank of Ningbo | 0.4256 | 0.5955 | 0.4982 | moderate coupling stage |
| Minsheng Bank | 0.6621 | 0.3916 | 0.4960 | moderate coupling stage |
| Bank of China | 0.4513 | 0.4928 | 0.4854 | moderate coupling stage |
| Agricultural Bank of China | 0.4023 | 0.5602 | 0.4839 | moderate coupling stage |
| Shanghai Pudong Development Bank | 0.4107 | 0.5385 | 0.4827 | moderate coupling stage |
| Bank of Nanjing | 0.3565 | 0.6574 | 0.4808 | moderate coupling stage |
| Everbright Bank | 0.4551 | 0.4529 | 0.4764 | moderate coupling stage |
| Bank of Communications | 0.4202 | 0.4757 | 0.4723 | moderate coupling stage |
| China Citic Bank | 0.3572 | 0.482 | 0.4529 | moderate coupling stage |
| Bank of Beijing | 0.3455 | 0.5045 | 0.4528 | moderate coupling stage |
| Hua Xia Bank | 0.1402 | 0.3138 | 0.3113 | low coupling stage |
| Ping An Bank | 0.1055 | 0.428 | 0.2909 | low coupling stage |

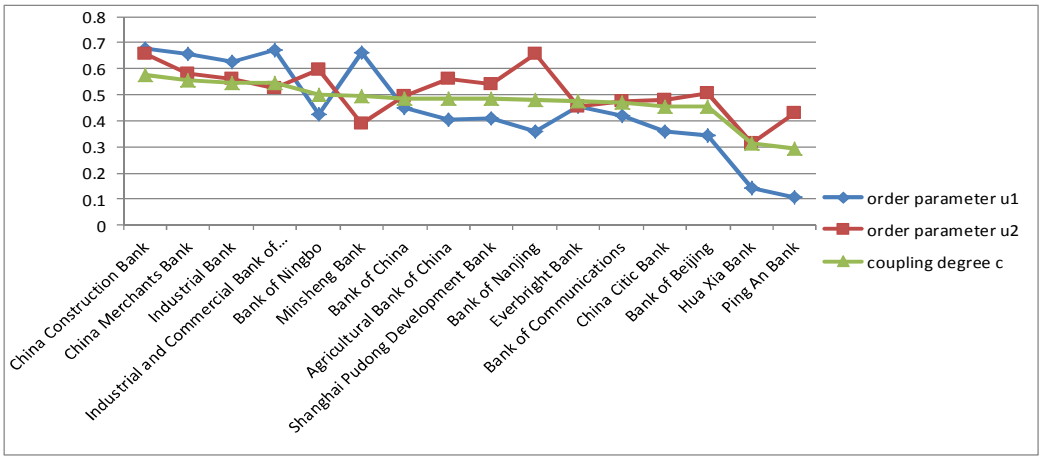


**Fig. 1. The Tendency Chart of the Order Parameters and Coupling Degree of the Profitability and the Risk Management Capability of Commercial Banks**

## 5. CONCLUSION

Based on the calculation and analysis of the coupling degrees between the profitability and risk management capability of 16 China commercial banks listed in the form of A Shares in the year of 2012, we have found out the following characteristics.

As reflected by Table 3, rate of return on total assets, cost-to-income ratio and net interest margin have greater influence on the profitability of commercial bank, while top ten customers' loan ratio, non-performing loan ratio and liquidity ratio have greater influence on the risk management capability of commercial bank. Rate of return on total assets, liquidity ratio, net interest margin are positive power indexes, cost-to-income ratio, non-performing loan ratio and top ten customers' loan ratio are negative power indexes. So commercial banks should focus on the improvement of Rate of return on total assets, net interest margin and liquidity ratio, and focus on the reduction of cost-to-income ratio, non-performing loan ratio and top ten customers' loan ratio, in order to improve the profitability and risk management capability of Chinese commercial banks.

As reflected by Table 4, the coupling degrees between the profitability and risk management capability of Chinese commercial banks are on the low side as a whole. China Construction Bank has the highest coupling degree: 0.5774, but has not yet reached the coupling period of high-degree. Ping An Bank and Hua Xia Bank are in the coupling period of low-degree. The other banks are in the coupling period of medium-degree. The overall low coupling degrees indicate that Chinese listed commercial banks still lack a benign interactive coupling mechanism to coordinate their profitability and risk management capability. While developing their profitability and risk management capability, commercial banks should formulate relevant policies according to their own reality, instead of showing any preference for either of them.

As reflected by fig. 1, the order parameters of profitability of only China Construction Bank, China Merchants Bank, Industrial Bank, Minsheng Bank and Everbright Bank are higher than the order parameters of their risk management capability. The order parameters of profitability of most listed commercial banks lag behind those of their risk management capability. This indicates that most Chinese commercial banks attach importance to the construction of risk

prevention and control. At present, China is exactly in an important period of economic transformation and upgrading. Therefore, commercial banks should pay close attention to the coupling relations between their profitability and risk management capability, and should try to enhance their core competitiveness by promoting the coordinated and interactive development between the two.

By presenting the coupling degree between the profitability and risk management capability of commercial banks, we can not only evaluate commercial banks from the perspective of bank profit, scale, capital adequacy ratio and other single factors, but also interpret the core competition ranking among commercial banks from another perspective. In terms of ranking, large-scale commercial banks do not always have a strong coupling degree between the profitability and risk management capability. Just as fig.1shows, the coupling degree of Industrial Bank is higher than that of such large-scale banks as Industrial and Commercial Bank of China, Agricultural Bank of China and Bank of China. The rapid development of Industrial Bank and other joint-stock or urban commercial banks in recent years also illustrates the brilliant development prospect of these banks.

Based on a systematic analysis of the internal links and interactive relations between the profitability and risk management capability of commercial banks, this article has demonstrated the interactive coupling relations between the two, set up the model for the coupling degree between the profitability and risk management capability of commercial banks, and evaluated the coupling degree between the profitability and risk management capability of 16 Chinese listed commercial banks in the year of 2012. As indicated by the result of calculation, the coupling degrees between the profitability and risk management capability of Chinese commercial banks are on the low side as a whole. The profitability of most commercial banks lags behind their risk management capability. Commercial banks should try to further promote their profitability, and develop their profitability and risk management capability in a coordinated way according to their respective reality, so as to achieve the mutual coordination between the two and promote their core competitiveness.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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