On the Influences of China Commercial Banks’ Innovations on the Risks of the Banks

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Abstract: An analysis on the influences of financial innovations in China’s commercial banks on the risks of banks. This paper conducted quantitative analysis with the panel data of 27 commercial banks in China, and the study shows that: first, the financial innovations depicted with the proportion of the non-interest income of commercial banks has a positive effect on financial risks, and the empirical results remain stable after the item of lag of financial risks is introduced; second, improving the deposit-to-loan ratio, the profitability, the asset-liability ratio and the asset size of commercial banks help to reduce the operational risks of commercial banks; third, the return on assets and the growth rate of net profit of commercial banks are positively correlated with financial risks.

Introduction

This paper analyzes the influences of the financial innovations of commercial banks in China on the risks of banks. Through designing relevant empirical models and variable indicators, this paper conducted quantitative analysis on the panel data of 27 commercial banks in China from 2008 to 2017; it also analyzes the influences of the financial innovations in China’s commercial banks on the risks of banks from such perspectives as weakening survey and contagion of liquidity risks.

I. Theoretical analysis of the influences of financial innovations of commercial banks on the risks of banks

(I) Fundamental assumption

The analysis of this paper on the influences of the financial innovations of commercial banks in China on the risks of banks mainly draws lessons from the analytical thinking of P. Guo and Y. Shen (2015)\textsuperscript{1}, F.G. Quan and X.F. Wang (2016)\textsuperscript{2} and Y.C. Wang (2019)\textsuperscript{3}. This paper assumes that commercial banks are homogeneous and risk-neutral continuity, and that their initial assets $i \in [0,1]$ and that their initial assets are only investment projects. If a project is successful, the return $R>1$, and the success of projects mainly depends on the initial capital of the enterprise and the efforts that the entrepreneur puts into it. Table 1 shows the rate of return of the projects:

<table>
<thead>
<tr>
<th></th>
<th>Non-robust projects</th>
<th>Robust projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial capital $&lt;1$</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Initial capital $=1$</td>
<td>0</td>
<td>$R$</td>
</tr>
</tbody>
</table>

(II) Financing Market

We now make $D$ the financing demand of the bank, and $R$ the returns of investment projects. And the following constraint is set: $x > R/D$, which indicates that if the game is successful, the return on investment of the speculative banks is big enough. In this case, speculative banks will
always participate in the game, it can be known through backward induction that the optimal choice for the banks in the first step is:

\[
E[\pi_i] = \begin{cases} 
q_i(R - RD) + (1 - q_i) pD(x - r) - c q_i^2, & R - RD \geq e + \max \{0, pD(x - r)\} \\
q_i(e) - c q_i^2, & \text{Others}
\end{cases}
\]  
(1)

There is a condition here:

\[
R - RD \geq e + \max \{0, pD(x - r)\}
\]  
(2)

Liquidity problem of the financing market means that banks cannot access to fund in the financing market by raising deposit interest rate. Suppose that the financing market is running well, the financing interest rate of the banks is:

\[
r = \frac{1}{q^* + (1 - q^*)p}
\]  
(3)

In which \(q^*\) is the optimal overall intensity of supervision of the banking industry at equilibrium, because at the equilibrium, the probability of the fund providers of getting returns is \(q^*\), at the same time, there is a probability of \(1 - q^*\) that they may face a speculative bank participating in the game, and the probability of recovering their fund is \(P\).

Suppose that the financing interest rate is given by the above equation, the precondition of the liquidity problem not happening in the financing market is:

\[
q^* > \hat{q} = \max \left\{ \frac{1 - px}{x(1 - p)} \frac{d}{R - 1 + d(1 - px)} - \frac{p}{1 - p} \right\} \in (0, 1)
\]  
(4)

It can be known from equation (4) that the optimal intensity of supervision of the banks must be higher than a certain critical value in order to make the financing market run. If the intensity of supervision is too low, the problem of adverse selection will lead to failure of the financing market. And the economic intuition of the determinant of the critical value of the intensity of supervision is also very obvious, when \(R\), the rate of return of the projects, rises or when \(d\), the financing demand, declines, the critical value of the operation condition of the financing market decreases, for in this case, returns from robust project seem more attractive than participating in the game. If condition (2) is true, i.e., the capital markets runs well, the optimal intensity of supervision of an individual bank is:

\[
\max \{q_i(R - rD) + (1 - q_i) pD(x - r) - cq_i^2\}
\]  
(5)

And the solution of the above problem is:

\[
q_i^* = \frac{R - d \left[ r(1 - p) + px \right]}{2c}
\]  
(6)

\[
q_i q_i^* = \frac{1 + \frac{1 - p}{(1 - p)q^* + p} + px}{2c}
\]  
(7)

The above equation provides the standard for an individual bank when choosing the optimal intensity of supervision when the overall intensity of supervision of the banking industry is given, therefore, equation (7) is also called the optimal supervision response function of individual banks.

(III) The Influences of Financial Innovations on Game Equilibrium

In this paper, the financial innovations of banks are divided into two categories so as to study the influences of different categories of financial innovations on game equilibrium. Suppose that it can be known that \(x\), the return on investment, is the function of the level of financial innovations.
Because financial innovations can change the returns of banks, increasing \( x \), the return on investment can change \( R \), the rate of return on projects. Suppose that there are three returns of projects, respectively \( R_1 > R_2 > R_3 \), at this time, the returns of projects without considering the influences of financial innovations. When the return of projects slightly lowers to \( R_4 \), the optimal choice for banks is to give up on the supervision of credit projects. And the economic logic behind this is: when the rate of return of projects is lower than the critical value, the optimal choice for banks is to give up on the supervision and save the cost of supervision.

II. Empirical Model, Variables and Data

(I) Setting of the Model

This paper first constructs the general panel data model:

\[
RISK_{i,t} = C_1 + \theta_1 CREATE_{i,t} + \theta_2 DEBT_{i,t} + \theta_3 PROFIT_{i,t} + \theta_4 ALR_{i,t} + \theta_5 ROA_{i,t} + \theta_6 INCOME_{i,t} + \theta_7 SIZE_{i,t} + v_i + u_t + \xi_{i,t}
\]  

(8)

In equation (1), \( C_1 \) is the constant term; \( RISK \) is the risk of the banks; \( CREATE \) is the financial innovations of commercial banks. At the same time, the control variables introduced in this paper are loan-to-deposit ratio, profitability, asset-liability ratio, return on asset, growth rate of net profit and asset size, respectively expressed with \( DEBT \), \( PROFIT \), \( ALR \), \( ROA \), \( INCOME \) and \( SIZE \). \( \Theta \) stands for the estimation coefficient of the explanatory variables; \( i \) stands for individual commercial banks, \( t \) stands for the year; \( v_i \) and \( u_t \) respectively stand for individuals and time effect; \( \xi_{i,t} \) is the random error term. Basis of Model (8), this paper introduces the first-order lag of the risk level as the explanatory variable:

\[
RISK_{i,t} = C_2 + \alpha_{1} RISK_{i,t-1} + \alpha_{2} CREATE_{i,t} + \alpha_{3} DEBT_{i,t} + \alpha_{4} PROFIT_{i,t} + \alpha_{5} ALR_{i,t} + \alpha_{6} INCOME_{i,t} + \alpha_{7} SIZE_{i,t} + v_i + u_t + \xi_{i,t}
\]  

(9)

In equation (9), \( C_2 \) is the constant term; \( RISK_{i,t} \) stands for the first-order lag of the risks of banks, and the meanings of the other variables are the same as in equation (8). This paper conducted estimation of the model with the generalized method of moments (GMM) of dynamic panels.

(II) Choice of Variables

1. Explained Variables

\( RISK \), This paper takes reference from the measurement of risks of banks of Delis et al (2010) and W.Y. Zhang and N. Ma (2019), and chose the ratio of non-performing loans to represent the risk of bankruptcy of banks.

2. Core Explanatory Variable

Financial innovations (\( CREATE \)). This paper tries to use the proportion of non-interest income to depict the level of financial innovations of commercial banks.

3. Control Variables

\( DEBT \), the loan-to-deposit ratio refers to the total loans/total deposits of banks.

\( PROFIT \), this paper mainly chose the ratio of the annual net profits and gross revenues of listed commercial banks as the main indicator that depicts the profitability of commercial banks.

\( ALR \), the asset-liability ratio is expressed with the following equation:

\[
\text{Asset-liability ratio} = \text{total liabilities} / \text{total assets}
\]  

(3)

\( ROA \), \( ROA \) is expressed with the following equation:

\[
\text{Return on assets} = \text{earnings before interest and tax} / \text{total assets}
\]  

(4)

\( NET \), this paper mainly chose the annual growth rate of net profit of listed companies as the main indicator that depicts the performance of companies.

\( SIZE \), this paper also uses the total assets to measure the size of commercial banks.
(III) Sources of Data and Explanation

The time span of the panel data chosen by this paper is 2008-2017, all data information came from such sources as the WIND, CSMAR, RESSET and the annual financial reports of listed companies. The descriptive statistics of specific variables are as shown in Table 2:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Sta.Dev.</th>
<th>Min</th>
<th>Max</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Risks</td>
<td>1.2652</td>
<td>0.8019</td>
<td>0.3800</td>
<td>9.8100</td>
<td>270</td>
</tr>
<tr>
<td>Financial Innovations</td>
<td>17.3301</td>
<td>9.4628</td>
<td>-5.3440</td>
<td>47.8392</td>
<td>270</td>
</tr>
<tr>
<td>Loan-to-deposit Ratio</td>
<td>0.6859</td>
<td>0.1025</td>
<td>0.3897</td>
<td>1.0516</td>
<td>270</td>
</tr>
<tr>
<td>Profitability</td>
<td>37.2509</td>
<td>6.6233</td>
<td>4.2309</td>
<td>53.2368</td>
<td>270</td>
</tr>
<tr>
<td>Asset-liability Ratio</td>
<td>93.7113</td>
<td>1.2466</td>
<td>87.8924</td>
<td>96.8153</td>
<td>270</td>
</tr>
<tr>
<td>Return on Assets</td>
<td>0.9415</td>
<td>0.2879</td>
<td>0.1230</td>
<td>1.7600</td>
<td>270</td>
</tr>
<tr>
<td>Net Profits</td>
<td>25.8093</td>
<td>57.2989</td>
<td>-76.8280</td>
<td>719.2903</td>
<td>270</td>
</tr>
<tr>
<td>Assets Size</td>
<td>3.5300</td>
<td>5.4500</td>
<td>0.0268</td>
<td>26.1000</td>
<td>270</td>
</tr>
</tbody>
</table>

III. Empirical Results and Analysis

(I) Empirical Results and Discussions

The results of Model (1), Model (2), Model (3) and Model (4) show that in general, under the significance level of 5% or 10%, the influence of the financial innovations of commercial banks on the financial risks is positive, and the coefficient estimates are respectively 0.0251, 0.0320, 0.0190 and 0.0304. This implies that financial innovations of commercial banks will aggravate the operational risks of commercial banks.

Secondly, in terms of control variables, the influence of the loan-to-deposit ratio, the profitability, the asset-liability ratio, the return on assets, the growth of net profit and the asset size on financial risks is consistent with the direction of the coefficient value estimated by the above model.

Finally, the regression result of Model (5) shows that under the significance level of 10%, the influence of the financial innovations of commercial banks on financial risks is positive, and the estimated coefficient value is 0.0132, which is consistent with the above conclusions of research.

Table 3 Empirical Results

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>12.8411***</td>
<td>14.3516**</td>
<td>7.4191</td>
<td>-2.2362</td>
<td>6.2881*</td>
</tr>
<tr>
<td>CREATE</td>
<td>0.0251*</td>
<td>0.0320**</td>
<td>0.0190</td>
<td>0.0304**</td>
<td>0.0132*</td>
</tr>
<tr>
<td>DEBT</td>
<td>-1.4151*</td>
<td>0.5643</td>
<td>-1.2276</td>
<td>1.3901</td>
<td>-0.0204</td>
</tr>
<tr>
<td>PROFIT</td>
<td>-0.0530***</td>
<td>-0.0651***</td>
<td>-0.0328**</td>
<td>-0.0502***</td>
<td>-0.0433***</td>
</tr>
<tr>
<td>ALR</td>
<td>-0.0764</td>
<td>-0.0481</td>
<td>-0.0282</td>
<td>-0.0246</td>
<td>-0.0625**</td>
</tr>
<tr>
<td>ROA</td>
<td>0.3681</td>
<td>-0.2686</td>
<td>0.4909</td>
<td>0.0913</td>
<td>0.2204**</td>
</tr>
<tr>
<td>NET</td>
<td>0.0028</td>
<td>0.0027</td>
<td>0.0022</td>
<td>0.0025*</td>
<td>0.0003</td>
</tr>
<tr>
<td>LNSIZE</td>
<td>-0.0843</td>
<td>-0.2917</td>
<td>-0.0562</td>
<td>0.2558</td>
<td>-0.0560</td>
</tr>
<tr>
<td>RISK&lt;sub&gt;i,t-1&lt;/sub&gt;</td>
<td>0.3000***</td>
<td></td>
<td></td>
<td></td>
<td>(5.54)</td>
</tr>
</tbody>
</table>
Summary

This paper conducted quantitative analysis on the panel data of 27 commercial banks in China from 2008 to 2017. The research shows that: financial innovations depicted by the proportion of the non-interest income of commercial banks have positive effect on financial risks, that is: the higher the proportion of non-interest income, the greater the financial risks, and when the term of lag of financial risks is introduced, the empirical results obtained are still steady. It means that the financial innovations of commercial banks also increased the accumulation of risks and increased the contagion effect, because financial innovations might bring considerable income for banks, people “in office” tend to take risks due to the pressure of all kinds of appraisals and indicators, the result of which might be a delay of the crisis, but the probability of risks is not lowered.

References


