Analysis of Bank's Behavior on Capital Adequacy Supervision and Capital Idiosyncrasy[1]

ANALYSE DU COMPORTEMENT DE LA BANQUE SUR LA SUPERVISION ADÉQUATE CAPITALE ET L'IDIOSYNCRASIE CAPITALE

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Abstract: Capital adequacy supervision is the main trend of the current global finance supervision. This paper, based on the evaluation of the related reference papers, had constructed a utility function of commercial bank, introduced inter-period return and interest rate to discuss the influence of capital idiosyncrasy to commercial bank's risk preference and credit scope through portfolio management theory, and also come up with some suggestions to the in-depth reform of China's commercial bank. This paper believes that the bank with different capital idiosyncrasy will represent different actions and options while facing the same capital adequacy requirement. So, it might not be enough to be adapt with restriction index of Basel Accord passively, the key point of introducing capital supervision system of our commercial banks is to improve the related banks' capital idiosyncrasy and undertake deeper reforms.

Key words: Capital Constrain, Capital Idiosyncrasy， Risk Preference, Lending Behavior

Résumé: La supervision adéquate capitale est la principale tendance de celle de la finance mondiale actuelle. Cette mémoire, basée sur l'évaluation des mémoires référentielle connexe, avait construit une fonction utile de la banque commerciale, introduite le retour de l'inter-période et le taux d'intérêt afin de discuter de l'influence de l'idiosyncrasie capitale pour la préférence risquée et les possibilités du crédit de la banque commerciale par la théorie de la gestion de portefeuille, et aussi de fournir d'idées la réforme en détail de la banque commerciale de la Chine. Cette mémoire croit que la banque avec différentes idiosyncrasies capitales représentera différentes actions et options en faisant face à la même condition adéquate capitale. Aussi ne

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peut-elle pas être suffisant d'être adaptée avec un index restreint de l'accord Bâle passivement, le point clé de l'introduction du système de la supervision capitale de nos banques commerciales est à améliorer l'idiosyncrasie capitale de la banque connexe et à entreprendre les réformes profondes.

Mots-Clés: contrainte capitale, idiosyncrasie capitale, préférence risquée, comportement dirigent

1. INTRODUCTION

With the successive implementation of 1988 and 2004 Basel Accord, capital adequacy supervision has become the main trend of current global financial supervision, at the same time, risk capital supervision system has become the core of bank supervision.

Generally speaking, capital supervision would induce credit crunch in commercial banks. Koehn and Santomero（1980[4]）, Kim and Santomero（1988[5]）believed that fixed capital adequacy ratio would limit the risk return frontier and compel banks to choose a portfolio of higher risk to compensate for their loss, consequently, banks' credit scale declined. The static model designed by Holmstrom and Tirole（1997[6]）indicated that a high level of asset caused by capital supervision would decrease credit scale and deteriorate economic depression. Blum and Hellwig（1995[7]）argued that, asset of banks would affect the increase of loans. Diamond and Rajan（2000[8]）、Chami and Cosimano（2001[9]）believed that capital supervision could cause credit crunch.

Unfortunately, the data show something different from models. Some scholars insist that capital supervision would induce credit crunch. According to their empirical study of banks in the United States, Hancock and Wilcox（1998[10]）found that banks' credit supply was reduced by capital adequacy supervision. G. Choi（2000[11]）'s study on Korea indicated that if the supervision were carried out after financial crisis, loan supply of banks would be reduced By analyzing statistics from 15 developing countries, Chiuri, Ferri and Majnoin（2001[12]）concluded that capital adequacy supervision was indeed a handicap to banks in developing countries, especially those with weaker capital ratio However, some scholars hold different opinions to the effect of capital supervision. Keely and Furlong（1990[13]）, studying on statistics

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of America and some other western countries, found that credit crunch was not obvious to banks which were supervised between 1981 and 1986.

Whether capital supervision would induce credit crunch or not? Current research cannot give us a satisfactory answer. As far as we are concerned, the contradiction between models and data lies in the hypotheses which regarded all the banks as the same type and had the same reaction to the capital supervision. However, since Capital Idiosyncrasy existing, banks should have distinct reactions and lending behaviors when facing capital supervision. This effect would be more obvious when inter-period factors involved.

This paper, based on the framework of analysis of Kopechy and VanHoose（2004[14]）, Liu Bin（2005[15]）, and Huang Xian(2005[16]), sets up a new utility function, introduces inter-period return and interest structure, analyzes factors and reasons that may affect the real return with NPV, classifies commercial banks into different capital type, discusses the risk preference when capital idiosyncrasy banks facing capital supervision

2. ASSUME

Bank's balance sheet is

$$F + L = D + E .$$

F is risk-free asset, mainly made up of government bond, of which the risk rated ratio is 0%. L is loan, of which the risk rated ratio is 100%. According to Basel Accord, capital adequacy ratio of banks (represented by Φ) should be higher than 8%, but banks usually have different capital adequacy ratios due to capital idiosyncrasy. Capital adequacy ratio equals to $\frac{E}{F \times 0\% + L \times 100\%} = \frac{E}{L} = \Phi$.

Assume banks could invest in inter-period. At t=0, portfolio is F_0 and L_0, and capital is E_0. This investing situation couldn't be changed at t=0, however, the bank could change it at t=1, and the new portfolio is F_1 and L_1, and capital is E_1. Generally, banks are not willing to change their portfolio which can bring return, because these changes will increase their costs, but sometimes, capital supervision would compel banks to change it because of the poor capital ratio.

The utility function of a bank is

$$\Theta = r_L L_1 + r_f F_1 - r_E E_1 ,$$

r_f is return of risk-free asset. Assume F_1 is a government bond with one year maturity. Then the risk-free rate is $\delta(r_1 + 1) - 1$, where r_1 is the interest rate, and δ is the discount rate.

In the utility function, net gain of L_1 is r_L. L_1 is a loan that should pay each month equally,

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with an interest rate of r_2, a period of n years, and a discount rate of δ. Suppose there are two risks. The first one is default risk， and the second one is market risk. If x% is default rate, the loss caused by default risk is $(1-x)r_2L_2$. And if r_f is return of risk-free asset, the loss of loan caused by risk market is $\beta_L(r_m-r_f)L_1$, in it, β_L is the risk of bank, r_m is average gain of market portfolio. Because NPV of bank loan is nominal gain subtracting default risk and market risk, we can get

$$r_L L_1 = \left\{\left[xr_2 - \beta_L(r_m - r_f)\right]\frac{\delta}{1-\delta} - 1\right\}L_1$$

Ignored cost of operation management, utility function can be written as follows,

$$\Theta = \left\{\left[xr_2 - \beta_L(r_m - r_f)\right]\frac{\delta}{1-\delta} - 1\right\}L_1 + [\delta(r_1+1)-1]F_1 - r_E E_1$$

3. MODEL AND CONCLUSIONS

In face of Capital Adequacy Regulation, different types of banks may pose different reactions. With the purpose of explaining this phenomenon, we use the basic analytical structure of K＆V（2004）and Liu Bin（2005）for references. We divide the banks into three categories: Type A is fluid capital idiosyncrasy banks with low capital adequacy ratio, called FCL-Banks. For this kind of bank, their capital adequacy ratio doesn't meet the requirements of Capital Adequacy Regulation, while through self-adjustment, the ratio could increase above the requirement within a short period; Type B is rigid capital idiosyncrasy banks with low capital adequacy ratio, called RCL-Banks. For this kind of bank, their capital adequacy ratio doesn't meet the requirements of Capital Adequacy Regulation, and the ratio can't reach the requirement in a short time. Type C is selective capital idiosyncrasy banks with high capital adequacy ratio, called SCH-Banks which is equal to or above the capital adequacy regulation.

3.1 Type A, FCL-Banks

Under the strict capital adequacy regulation, FCL-Banks intend to maximize their profits. This process can be mathematically expressed as: calculate the maximum of Θ, subject to $\frac{E_1}{L_1} \geq \Phi$. In this line programming, banks' new capital adequacy ratio $\frac{E_1}{L_1}$ should be at least equal to or above the requirement of the regulatory authorities. ε ($\varepsilon > 0$) represents the extra capital adequacy ratio above the requirements of the regulatory authorities. And then the line programming is as follows:

$$\begin{cases} \Theta = \left\{\left[xr_2 - \beta_L(r_m - r_f)\right]\frac{\delta}{1-\delta} - 1\right\}L_1 \\ \qquad + [\delta(r_1+1)-1]F_1 - r_E E \\ st \bullet \frac{E_1}{L_1} = \Phi + \varepsilon \end{cases}$$

Set up the Lagrange function, achieve the maximum:

$$\Theta=\left\{\left[xr_2-\beta_L(r_m-r_f)\right]\frac{\delta}{1-\delta}-1\right\}L_1$$
$$+[\delta(r_1+1)-1]F_1-r_E E_1+\lambda[E_1-(\Phi+\varepsilon)L_1]$$

Therefore， the maximum of the banks' utility will achieve in the following equations:

$$\begin{cases}\left[xr_2-\beta_L(r_m-r_f)\right]\dfrac{\delta}{1-\delta}-1-\lambda(\Phi+\varepsilon)=0\\ -r_E+\lambda=0\\ E_1-(\Phi+\varepsilon)L_1=0\end{cases}$$

By deduction, achieve equation（1）:

$$\frac{\partial L_1}{\partial E_1}=\frac{r_E}{\left[xr_2-\beta_L(r_m-r_f)\right]\dfrac{\delta}{1-\delta}-1}$$

Observing from equation（1）: the dividend on the right hand side is above zero， so when the denominator is greater than zero， then $\frac{\partial L_1}{\partial E_1}>0$, that is to say: as E_1 increases, L_1 has the tendency to go up, when the denominator on the right hand side of equation is smaller than zero， and then $\frac{\partial L_1}{\partial E_1}<0$ ，that is to say: as E_1 grows ，L_1 has the tendency to decrease. Meanwhile，because the denominator on the right side of the equation can not be equal to zero, $\frac{\partial L_1}{\partial E_1}$ must be either greater or smaller than zero, which means E_1 will either go up or go down when L_1 changes.

Investigating the economic meaning of equation（1）: the denominator of equation（1） will be smaller than zero, which leads to adverse movement of E_1 and L_1 on the following conditions: when the economy is in recession, the loan recovery rate is low (x is small), the interest rate of loan is low(r_2 is small), the operational risk of commercial banks increases (β_L increases), the yield of risk-free security which is secured by the state is low (r_f is low), the discount rate of future cash flows is low (δ is low) and so on. All of these mean that when economy is in recession, the regulatory authorities will heighten the standard of capital adequacy regulation, this will lead to the credit contraction of FCL-Banks. In the same way we could deduct and explain that when denominator of equation（1）is greater than zero, the movement of E_1 and L_1, their economic meaning. Based on these, we conclude that:

Proposition1: When economy is in recession, facing the requirement of increasing the capital adequacy ratio of the regulatory authorities, FCL-Banks are less willing to lend. It will lead to credit contraction.

Proposition2: When economy is in boom, facing the requirement of increasing the capital adequacy ratio of the regulatory authorities, FCL-Banks are more willing to lend. It will lead to the expansion of credit. [17]

[17] If there are many banks with the same capital idiosyncrasy, will they have individual differences? We can simply bring in two banks to discuss. If there are two FCL-Banks, and they have different risk preference. Assume bank A's risk coefficient is greater than Bank B's ($\beta_1>\beta_2$). When economy is in recession, FCL-Banks will decrease their

3.2 Type B, RCL-Banks

In the context of requirements of heightening the capital adequacy requirement, how do RCL-Banks on one hand increase the capital adequacy ratio; on the other hand, maximize their profit? In mathematics, this can be demonstrated as follows:

$$\begin{cases} \Theta = \left\{ \left[xr_2 - \beta_L (r_m - r_f) \right] \dfrac{\delta}{1-\delta} - 1 \right\} L_1 \\ \qquad + [\delta (r_1 + 1) - 1] F_1 - r_E E \\ st \bullet E_1 \ \ is \ \ Rigid \end{cases}$$

To solve this problem, for E_1 is rigid and can't adjust in response to the change of L_1, so we can't make use of Lagrange function to calculate $\frac{\partial L_1}{\partial E_1}$ or analyze the relationship between E_1 and L_1. Under this circumstance, banks, as a rational entity, have three ways to increase profits Θ: First, banks could make more loans (increase L_1), While just increasing loans, with capital E staying the same could only reduce to the decline of capital adequacy ratio, so this method is invalid. Second, banks could make more investment on risk-free securities which will generate more profits, but it fails to heighten the capital adequacy ratio. Third, banks could make adjustment of their asset portfolio. The banks decrease their loan activities and make more investment on risk-free asset(F_1). The revenues generated from the risk-free assets will make up for the losses of decline of loan activities. Thus, the capital adequacy ratio will increase at the expense of loss of qualified customers, substantial cost of adjustment, as well as the negative impact on the macro-economy. We conclude that:

Proposition 3: For RCL-Banks, the heightening of the capital adequacy ratio will lead to credit contraction.

3.3 Type C, SCH-Banks

In our above-mentioned division of the banks, for the last type of banks (type C), what will be their reactions to the heightening of the capital adequacy requirement and how will they maximize their profit? And what will these behaviors affect the credit activities? Mathematically, this process can be expressed to achieve the maximum of $\Theta = r_L L_1 + r_f F_1 - r_E E_1$

In accordance with the linear feature of the utility function, in order to achieve the

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lending, and then if $\beta_1 > \beta_2$, we cam deduce $\left| \dfrac{r_E}{\left[xr_2 - \beta_1 (r_m - r_f) \right] \frac{\delta}{1-\delta} - 1} \right| < \left| \dfrac{r_E}{\left[xr_2 - \beta_2 (r_m - r_f) \right] \frac{\delta}{1-\delta} - 1} \right|$, it demonstrates that when E_1 goes up, though Bank A and Bank B will both conduct credit contraction, while Bank A with greater risk coefficient β_1 has smaller degree of credit contraction in comparison with Bank B. In the similar way, we can achieve that when economy is in boom, FCL-Banks will be more willing to lend, banks with large risk coefficient will have larger degree of credit expansion compared to banks with small risk coefficient. In this way, for RCL-Banks and SCH-Banks, we can also conclude their individual features with different risk coefficient. The process is omitted here. In brief, capital adequacy requirement will bring a variety of changes to the commercial banks, theoretical research will make the empirical investigation and conclusions more meaningful

maximum, in context of lack of sources for investment in bank industry, rational behaviors for banks are: on basis of maintaining or shrinking scale of capital, make adjustment on asset portfolio to increase revenues. The adjustment can be realized by enlarging the percentage of loan activities or improving the shares of investment on risk-free assets. It is decided by the risk preference of the senior management whether to take the former or the latter. If the managers believe in their ability and would like to take the risk, they will conduct more loan activities; if the managers are risk-adverse , the bank will choose risk-free asset. The banks can also design a portfolio making a balance between the former and latter. These choices can not only meet the requirements of regulatory authorities, but also maximize the profit. They are incentive compatibility. While, currently in China, on one hand, the bank industry has not cultivated a scientific sense of risk; on the other hand, the government continuously implements credit policies, accompanying the potential political indicators of achievement to the senior management of the banks. Therefore, the impacts of the capital adequacy regulations on the credit behaviors of these banks are uncertain.

Proposition 4: For SCL-Banks, the impact of capital adequacy regulation is uncertain.

4. SUGGESTIONS

From the conclusions above we can see that it is truly a complicated subject to discuss the influence of capital adequacy supervision on commercial banks' credit scope. Our research shows that, although capital adequacy supervision will surely affect the investment behavior of commercial banks, but the directions are still uncertain. Capital Idiosyncrasy usually fluctuates with macroeconomic, and banks with different capital idiosyncrasy will represent different actions and options while facing the same capital adequacy requirement. It might be the empirical literature aiming at different areas that makes their conclusion distinct.

By analyzing the model, we also find out that, in the process of capital supervision, the more flexible the capital in banks with a low capital adequacy ratio is and the more selectivity banks with a high capital adequacy ratio have, the better can this policy accordant with its original intention. From the analysis we can see that scientific logos and managing mechanism of risk might be the key point of commercial banks' reform. The reform about risk managing mechanism should be carried out initiatively, rather than being compelled to adjust to some international pact passively. The impact of administrative orders is much less effective than improving the Capital Idiosyncrasy of rigid capital and the formation mechanism of capital in banks with a low capital adequacy ratio. Credit and macro-control policy will be more effective if most of banks in our country are able to adjust their capital elastically or own a high capital adequacy ratio.