

# Study on the Liquidity Risk of Deposit and Loan Maturity Mismatch in Commercial Banks

*Baosheng Shi, Huangjin Liu\**

School of Economic and Management in Nanjing University of Science and Technology,  
China

\*Corresponding author: Huangjin Liu, Associate Professor, liuhuangjin@hotmail.com

## **Abstract**

Commercial banks must maintain a certain degree of mismatch to improve the efficiency of the use of money, but excessive maturity mismatch may cause liquidity risk. Based on that, this paper introduced the latest rules of the Basel III, analysis the term structure of assets and liabilities and the liquidity situation. We create a model of liquidity gap to give evaluation of the liquidity risk, referring to the requirements of the net stable funding ratio. According to the result of liquidity risk measurement, combining with the relevant conclusions of qualitative analysis, this paper gives some advices for commercial banks' liquidity management.

**Key words:** *commercial bank; maturity mismatch; liquidity risk; risk management; liquidity gap*

## **1 Introduction**

Commercial banks encountered serious liquidity crisis in 2013 and suffered serious shortage of money. All of the study show that the crisis mainly due to the term structure mismatch between bank assets and liabilities in the banks. Commercial banks must maintain a certain degree of mismatch to improve the efficiency of the use of money, but excessive maturity mismatch may cause liquidity risk. In the pursuit of profit, the trend of long-term loans and short-term deposits in banking institutions is very obvious, which adds the degree of maturity mismatch and causes liquidity risk. Commercial banks must attach great importance to the liquidity risk management, keep their term structure within a reasonable range to avoid excessive mismatch and reduce liquidity risk.

Normal stable operation of commercial banks must ensure adequate liquidity assets. Liu<sup>1</sup> summarized the formation mechanism of liquidity risk and pointed that the trend of the short-term deposit and long-term loan was common in commercial banks. Banks applying liquid assets to higher-yielding long-term loans, leading to a difficult liquidity and liquidity risk. Zhu<sup>2</sup> and Fu<sup>3</sup> argues that the liquidity risk of commercial Banks can be reflected by the term structure of deposit and loan. If the period of deposit is shorter than the loan's, it will form the maturity mismatch. If the degree of mismatch. In general, current deposit and long-term loans accounted for a high proportion in commercial banks, which added the degree of maturity mismatch.

About liquidity risk's evaluation, many scholars adopt empirical researches<sup>4,5</sup>. The research results show that the liquidity management of 5 major state-owned commercial banks is better than the others, for the strong financial asset strength and dominant market position. The liquidity risk is lowest. The liquidity risk in city commercial banks is relatively low because of its positive risk management. Other joint-stock banks don't have great management ability, thus exist higher liquidity risk.

The Basel committee promulgated the Basel III Accord, made the liquidity risk of the latest international regulatory framework, introducing liquidity coverage ratio (LCR) and net stable funding ratio (NSFR)<sup>6</sup>. The LCR addresses liquidity risk and is designed to ensure banks have adequate liquidity to survive 1 month of stressed funding conditions. The NSFR addresses funding risk and is designed to promote structural changes in the risk profiles of banks away from short-term funding mismatches and toward more stable, longer-term funding of assets. Banks that do not meet the NSFR need to reduce assets requiring stable funding and to increase stable sources of funding. Peng<sup>7</sup> argued that the application of the two indicators has certain limitation. High quality liquid reserved assets refers to bonds or central bank bonds which liquidity is poor in the secondary market. The available stable funds are primarily a stable part of the deposit, but can't accurately estimate. The special items of assets and liabilities that the two indicators covered are too detailed which can't be found in annual report. So the new international indicator needs to adjust and reform according to the situation of our country to ensure its implementation.

Based on previous studies, this paper will study the liquidity risk caused by the maturity mismatch of assets and the liabilities in commercial banks, referred to the Basel III. The first chapter introduces the background of this paper and the related research. The second chapter introduces the term structure of commercial banks in our country and the liquidity level. And then take an example of ICBC (Industrial and Commercial Bank of China) and evaluate its liquidity risk, using the liquidity gap model. The final section concludes.

## 2 The situation of maturity mismatch and liquidity risk in commercial banks

### 2.1 Maturity structure of assets and liabilities

The deposit in commercial banks is mostly the current account while the loan mostly reflected by medium and long term loans. Once medium and long term loans failed to be recycled, commercial banks will encounter serious liquidity crisis. This paper studied the maturity mismatch of depository financial institutions. The data of term structure was shown in figure 1.

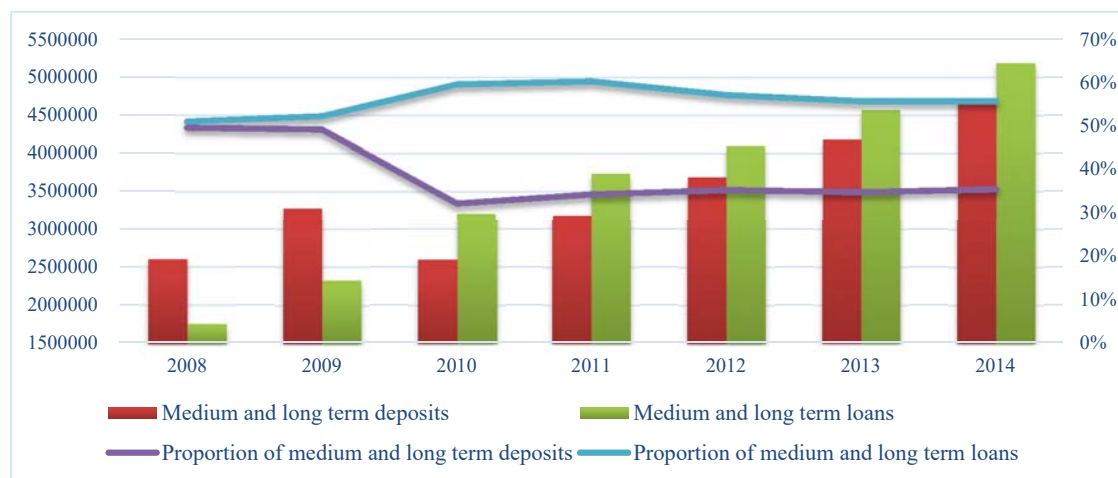


Fig. 1 – Condition of maturity mismatch in depository financial institutions

We can reach a conclusion that the commercial banks performed a certain degree of mismatch. Long-term sources of funds can't meet the long-term supply of funds. And the long-term loans are more than the long-term deposits significantly which means a certain

degree of maturity mismatch. Deposits demanding need be supposed by the current deposits in commercial banks. And then we analysis the data from the 13 commercial banks and come to the same conclusion. Commercial banks all have the phenomenon of maturity mismatch. After that we found that the situation of ICBC is more obvious than other banks, so we will choose ICBC as sample to study the relation of maturity mismatch and liquidity risk.

## 2.2 Situation of liquidity risk

Currently the liquidity supervision indicators mainly include loan-to-deposit ratios, liquidity ratios, non-performing loan ratio, capital adequacy ratio. We can find the data from commercial banks' annual report between 2007 and 2014 to study the situation of liquidity.

We can find that the liquidity ratio performed well in these years, state-owned commercial bank better than joint-stock commercial banks and city commercial banks. LDR in state-owned commercial banks and city commercial bank is also satisfied. Part of the joint stock system commercial bank in some years showed the data more than 75%, which means potential liquidity risk. Non-performing loans were in accordance with specified requirements, in addition to the agricultural bank because of the historical reason and the nature of the bank. The capital adequacy ratios are in line with the regulatory requirements. Five state-owned commercial banks' capital adequacy ratio is higher, showing it stronger risk-response ability, while the joint stock system banks' capital adequacy ratio is low, and large state-owned commercial Banks, risk coping ability is weak.

But the perspective of these liquidity regulation indicators for liquidity risk evaluation is relatively single, which can't reflect the liquidity status of the commercial Banks. In practical application, we tend to use the Dynamic indicators, such as liquidity gap, net current assets, etc. These indicators can predict the supply and demand of bank's capital in a certain period of time. Therefore, this paper adopted the liquidity gap model, referred to the relevant provisions of the Basel III, to study the liquidity risk in ICBC which performed obvious maturity mismatch.

## 3 Evaluation on liquidity risk under maturity mismatch

### 3.1 Model and data

The assets and liabilities in commercial banks mainly includes deposits and loans. So this paper narrowed the scope of assets and liabilities to study the maturity mismatch of deposits and loans and its liquidity risk. Set up models as follow.

Referred to the rules about high quality deposits and long trend of short-term deposits, optimize the traditional liquidity gap model. We put the stable part of short-term deposits and the long-term deposits as liquidity supply, the long-term loans as liquidity demand. The updated liquidity gap model is as follow.

$$\begin{aligned} \text{Liquidity gap} = & (\text{Long-term capital supply} + \text{Stable part of short-term deposits}) \\ & - \text{Long-term capital demand} \end{aligned} \quad (1)$$

If the liquidity gap is more than zero, which means liquidity supply can meet the liquidity demand, there is no liquidity risk; If the gap is less than zero, then the bank will face a certain degree of liquidity risk.

In addition, we put a indicator of liquidity gap's proportion for comparing the liquidity level in different banks and years.

$$\text{Gap's proportion} = \text{Liquidity gap/assets in banks} \quad (2)$$

### 3.2 Maturity mismatch

Sort ICBC's data of short-term deposits, long-term deposits and long-term loans as table 1. We can see that situation of maturity mismatch in ICBC didn't appear serious before 2007 from table 1. However, starting in 2007, long-term deposits began to decrease, while the medium and long-term loans increased gradually, and much lower than the medium and long-term loans. This means that the medium and long-term deposits in ICBC can't meet the demand of the medium and long-term loans so that bank need to divert part of current deposits to support long-term loans, leading to relatively serious maturity mismatch, existing potential liquidity risk.

Table 1 – Term structure in ICBC

Years	Long-term available deposits	Short-term stable deposits	Application of long-term capital
2005	1,761,063	2,522,892	2,277,396
2006	2,052,916	3,292,288	1,538,957
2007	476,394	4,060,472	1,788,142
2008	596,221	4,819,051	2,098,799
2009	665,201	5,561,699	3,572,251
2010	786,187	6,284,894	4,632,574
2011	1,088,578	6,986,786	5,249,921
2012	1,560,498	7,671,646	5,535,666
2013	1,668,058	8,346,610	6,159,558
2014	1,995,312	9,017,660	6,914,703

According to the above analysis, we put the stable part of the short-term deposits as another source of funds for the long-term bank loans. If the stable part of short-term deposits can meet the balance between the long-term deposits and loans, it will not produce liquidity risk. If the balance can't be offset by the stable short-term deposits, it will produce liquidity risk. Now we will evaluate ICBC's liquidity risk.

### 3.3 Liquidity gap

The HP filter method is adopted to estimate the long-term trend of short-term deposits. According to the stable short-term deposits, we get the number of liquidity gap estimated as shown in table 2.

Table 2 – Liquidity gap in ICBC

Years	Liquidity gap	Gap's proportion
2005	2,006,559	0.311
2006	3,806,247	0.507
2007	2,748,724	0.317
2008	3,316,473	0.340
2009	2,654,649	0.225
2010	2,438,507	0.181
2011	2,825,443	0.183
2012	3,696,478	0.211
2013	3,855,110	0.198
2014	4,098,269	0.194

ICBC's liquidity gap show the positive results and is greater than zero, which means that the effect of liquidity management is apparent with no significant liquidity risk. Although the

phenomenon of maturity mismatch in ICBC is obvious, there is no risk shown up because the stable short-term deposit covered a big proportion and can fill the gap.

From the number of liquidity gaps between 2005 and 2014 we can find the liquidity gap appear to decrease in 2007 and 2009. According to the background, subprime mortgage crisis in the U.S. evolved into a global financial crisis, influencing banking industry in our country. In response to the debts and non-performing loans, the bank's liquidity began to decrease. Financial crisis made our country banking industry suffer a serious dilemma, leading to a serious trust crisis, liquidity crisis and subsequent impact which didn't be eliminated until 2011.

Compare the gap's proportion in different years. The proportion in 2008 decreased for the financial crisis that banks didn't have enough liquidity assets. Also, commercial banks suffered a liquidity crisis in 2013 for money shortages events and the liquidity gap and the proportion reduced obviously.

#### **4 Conclusion**

We see from above research that ICBC's liquidity risk is not exposed because its stable part of the short-term deposits can fully make up for the gap, although there is serious maturity mismatch condition. We can also find that the financial crisis in 2008 and the "money shortage" event in 2013 caused a certain influence for the commercial Banks' liquidity management, and have a long-term impact. Observing other bank's annual report, large state-owned commercial Banks' liquidity gap are mostly high levels of positive which means the strong coping capacity of liquidity risk. Joint-stock commercial Banks and city commercial bank shows negative gap in some years for its weaker financial strength. In order to avoid negative gap of liquidity risk, banks have to rely on current deposits, including the obvious unstable fluctuation part in current deposit. if meeting financing difficulties, banks are likely to face a liquidity crisis.

Besides, research shows that commercial banks' maturity mismatch of assets and liabilities can leading to serious liquidity risk. In this paper we also found that the maturity mismatch can't fully reflect the liquidity risk level. For example, although the maturity mismatch of assets and liabilities in ICBC is obvious, there is no liquidity risk exposed due to its stable part of the short-term deposits can fully make up for the gap. Instead, some banks, such as Bank of Communications, show negative liquidity gaps and face serious liquidity risk, while their maturity mismatch degree is low. Therefore, commercial banks must do strictly liquidity risk management, formulate appropriate liquidity risk regulation and prevention strategy according to the requirement of the relevant indicators, ensuring their liquidity and risk-coping ability, so as to guarantee the normal operation and profitability.

As a result of this paper, here are some recommendations:

- (1) Strengthen the supervision on liquidity risk of maturity mismatch. Banking regulatory commission (CBRC) should develop a suitable regulatory system according to the actual situation of the bank. In the process of the implementation of the Basel agreement, the regulatory index need to adjust to be more targeted according to the status quo of China's banking industry. In addition, commercial bank, central bank, and the banking regulatory commission and other departments should jointly set up deposit insurance system to

relieve the pressure on central Banks and other departments when facing the liquidity crisis.

- (2) Attach great importance to the management of liquidity risk. Banks must strengthen the management of maturity structure: optimize the term structure of assets and liabilities, adjust the proportion of current deposit, mid-term and long-term loan; strengthen the monitoring of loan quality, control the non-performing loan ratio. Commercial banks should also attach importance to liquidity risk management, improve their risk management system according to the Basel III and relevant provisions of the liquidity management indicators. In addition, commercial Banks should regularly conduct stress tests to discover problems, preventing the liquidity risk.

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