Research on the Measurement and Influencing Factors of Commercial Bank's Capital Mismatch--Take listed banks for example

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Abstract

Taking the financial data of 26 listed banks in China as an example, this paper chooses liquidity gap, loan concentration, foreign exchange exposure and other indicators to analyze the actual performance of capital mismatch.The results show that among the three types of capital mismatch, term mismatch is more significant, while credit mismatch and currency mismatch are less obvious.Based on this, the influencing factors of term mismatch are empirically studied by establishing panel data model.The research shows that: firstly, with the change of our country's economic environment, the factors influencing the term mismatch of funds have shifted to some extent; secondly, the current liquidity is the dominant factor of significant fund mismatch in some commercial banks, mainly manifested in the shortage of short-term deposit sources; thirdly, in recent years, the relatively loose monetary policy reflected by the monetary growth rate has played a role in term mismatch.It has alleviating effect.Therefore, in order to control the liquidity risk caused by term mismatch, commercial banks should start from expanding short-term sources of funds, actively develop off-balance sheet business, increase active liabilities to expand sources of funds, and reasonably carry out interbank lending when necessary.

Keywords

Commercial Bank; Capital Mismatch; H-P Filtering; Panel Data Model.

1. Introduction and Literature Review

The mismatch of funds means that the source and use of funds are not matched properly, which is usually caused by the diversification of the fund structure in the income and expenditure activities of economic entities.In theory, capital mismatch includes term mismatch, credit mismatch, currency mismatch and so on.According to the data of China Regional Financial Operation Report (2018), the weighted term of fixed deposits of local banks in China is 15 months shorter than that in 2013, while assets are mostly used for long-term bonds or long-term assets with relatively high yields. The problem of term mismatch has begun to appear in local regional banks.At the same time, under the guidance of relatively loose monetary policy, some commercial banks are inclined in the choice of loan paths, which has led to the phenomenon that credit funds have not flowed to the real economy in recent years, and "capital idling" has appeared, which has triggered some scholars' thinking on credit mismatch.In addition, the continuous improvement of China's economic opening up and the expected appreciation effect of RMB may lead to changes in the currency structure of commercial banks, and currency mismatch can not be ignored.Because of the strong pro-cyclicality of capital misallocation, under the good macroeconomic situation, a certain amount of capital misallocation will help commercial banks to expand credit scale and meet their profitability needs; however, once commercial banks blindly pursue profit maximization and make more than a certain amount of capital

misallocation, it will lead to the inefficiency of capital utilization and economic depression. When it comes to the stage of economic depression, it will cause a series of operational risks.Therefore, under the background of the slowdown of economic growth in recent years in China, it is of great practical significance for the stable operation of commercial banks to analyze the performance and causes of capital mismatch of commercial banks and put forward corresponding risk control suggestions.

With the emergence of misallocation of funds, academia has paid close attention to it. Xiong Meizhen and Sun Dehua think that the mismatch of funds may come from the role of the government, imperfect financial system, low interest rate marketization, inadequate structural control of monetary policy and so on[1]. In the study of the term mismatch of funds, Li Chen used liquidity gap model and H-P filtering method to make an empirical analysis of the term mismatch of Bank of Communications[2]. From a dynamic perspective, Zhao Qian estimates the short-term fund mismatch gap within one month by using the liquidity gap model with the help of assets and liabilities data due within one month of commercial banks[3]. Tian Yanfen and Shao Zhigao analyzed the long-term equilibrium relationship between the change of deposit and loan maturity errors of domestic banks and the influencing factors by constructing the index of total deposit and loan amount and weighted index[4]. On the issue of credit mismatch, Yang Changyan and Hu Dongsheng argue that under the support of relatively loose monetary policy, some commercial banks tend to make a certain degree of credit mismatch between enterprises and individuals[5]. In view of currency mismatch, Shi Yan believes that under the economic environment in which the U.S. dollar is the world's general currency, other economic entities except the United States are facing exchange rate risk caused by currency mismatch. And because of the particularity of the operation mode of banking institutions, when there is a large-scale currency mismatch among their loan customers, banks themselves are also difficult to get rid of indirect risks[6].

2. Measurement and Performance of Mismatch of Funds

2.1 Mismatch of time limit

When estimating the term mismatch gap of commercial banks, we usually use the liquidity gap model commonly used in academic circles, that is, liquidity gap of commercial banks = medium and long-term source of Funds - medium and long-term use of funds + short-term deposit stability.The long-term source of funds and the medium-term and long-term use of funds can be obtained through the information disclosed by commercial banks, while the short-term deposit stability part needs to be calculated by H-P filtering method. H-P filtering method can decompose the total short-term deposits into growth trend component and fluctuation component.According to the normal distribution of short-term volatility components with expectation of 0 and variance of 0, the fluctuation interval of short-term volatility components at a certain confidence level is obtained. Distribution function

$$F(C) = \phi(\frac{C}{\sigma}) = 1 - \frac{\alpha}{2}.$$

Since α is set to be known, C can be obtained from the standard normal distribution function table. Finally, the stable component of the total short-term deposit after deducting the fluctuation part moves downward C, and the lowest limit of the stable part of the short-term deposit under the confidence level of $1-\alpha$ can be obtained.

In this paper, 26 commercial banks listed on A-share are selected as research samples. Using liquidity gap model and H-P filtering method, calculating the volatility interval of short-term deposits with normal distribution $N(0, \sigma^2)$ and confidence level of 0.99. In this way we can find the lowest limit of long-term trend component, that is, the stable part of short-term deposits. The calculation results of medium and long-term capital sources and operation data, short-term deposit stability and liquidity gap of sample banks are shown in Table 1.

Table 1 Sample Bank Liquidity Gap Estimation   Unit: RMB Million Yuan

commercial bank	Liquidity gap			commercial bank	Liquidity gap		
	2015	2016	2017		2015	2016	2017
Industrial and Commercial Bank of China	2869137	2210819	1797434	Huaxia Bank	145805	173000	6517
Bank for economic construction	1805969	1783285	1010013	Bank of Shanghai	131028	89794	72747
Bank of China	1959171	1676636	1338988	Bank of Jiangsu	666453	275772	146843
Agricultural Bank	3096239	2590373	1591949	Bank of Nanjing	76075	66297	46980
China Merchants Bank	965177	715761	580518	Bank of Ningbo	195455	136968	112659
Bank of Communications	-519840	-833964	-1171601	Bank of Hangzhou	60253	57397	32063
Industrial Bank	-225899	-726482	-1279375	Bank of Guiyang	-20281	-30663	-120235
Minsheng Bank	-218007	-347046	-967923	Bank of Chengdu	107613	69567	59977
Pudong Development Bank	-81265	-140772	-815746	Bank of Changshu	62135	20277	16160
CITIC Bank	1444862	962089	230458	Bank of Wuxi	57451	36704	44147
Everbright Bank	195714	172027	74994	Bank of Wujiang	50384	34459	28638
Ping An Bank	393095	405680	209523	Zhangjia Hong Kong	23355	21762	20751
Bank of Beijing	-9344	-63029	-348947	Bank of Jiangyin	48060	27301	35184

Data Source: Based on sample banks' annual reports for 2015-2017

From Table 1, we can see that six of the 26 listed banks in China from 2015 to 2017 have negative liquidity gap, which indicates that the stable part of their short-term deposits is not enough to make up for the difference between medium-term and long-term sources of funds and the use of medium-term and long-term funds, and there is a clear problem of term mismatch.While other listed banks have larger medium and long-term capital sources than medium and long-term capital utilization, there are also cases where the source and duration of funds do not correspond, but the stability of short-term deposits is enough to compensate for their liquidity needs.Among the six commercial banks with obvious term mismatch, there are 4 national joint-stock commercial banks and 2 urban commercial banks, while the four major state-owned commercial banks have good liquidity and relatively matched capital term.

2.2 Credit mismatch

Credit mismatch can be understood as the uneven distribution of credit lines provided by commercial banks to customers.This paper illustrates the degree of credit mismatch between enterprises and individuals by calculating the proportion of loans granted by commercial banks between individuals and enterprises, and the degree of credit mismatch between enterprises and enterprises, individuals and individuals by the concentration of borrowers.Taking the cross-sectional data of 26 listed banks in 2017 as an example, the ratio of enterprise loans to individual loans and the loan concentration degree are calculated. The loan concentration degree is expressed by the single largest customer loan ratio. The results are shown in Table 2.As can be seen from Table 2, 26 sample banks have issued higher corporate loans than individual loans.Empirical data show that the ratio of corporate loans to personal loans is considered to be good in the range of 2 to 5, so there is no obvious credit mismatch between enterprises and individuals in the sample banks except Jiangyin Bank.In addition, the single largest customer loan ratio of all sample banks is less than 10%. There is little pressure to meet the national regulatory requirements.Therefore, synthesizing the two indicators, the problem of credit mismatch of listed commercial banks in China is not obvious.

3. Analysis of the Influencing Factors of Term Mismatch

From the analysis of the above-mentioned measurement results of various types of capital mismatch, we can see that the credit mismatch and currency mismatch of 26 listed commercial banks in China do not show significant performance, but the term mismatch is widespread, and six listed banks have appeared obvious liquidity gap.Therefore, the influencing factors of liquidity gap are further explored in view of term mismatch, and the panel data model of liquidity gap is established.

3.1 Panel Data Model Establishment

Taking the absolute value of liquidity gap as the explanatory variable, this paper chooses financial data of six commercial banks with negative liquidity gap from 2015 to 2017, establishes panel data model, and analyses the influencing factors of liquidity gap.The variables affecting the liquidity gap of commercial banks are divided into "public variables" determined by market factors and "special variables" determined by the operation of commercial banks themselves.Therefore, the preliminary form of panel data model should be:

$$LG_{it} = C + \alpha CV_t + \beta SV_{it} + \mu_{it}$$
$$i = 1,2\ldots6; \ t = 1,2,3.$$

Among them LG_{it} (unit: RMB Ten Billion YUAN) is the absolute value of liquidity gap of the i-th bank in the t-th period, CV_t represents the public variable that affects the liquidity gap size of all commercial banks in the t-th period, and SV_{it} represents the special variable that influences the liquidity gap of the i-th bank in the t-th period. μ_{it} represents the random error term of the i-th bank in the t-th period; C is a constant term.

When choosing public variables and special variables, this paper argues that the market public factors affecting the size of liquidity gap may include GDP growth rate (*GDP-GR*), consumer price index (*CPI*), currency growth rate (*CGR*), statutory deposit reserve ratio (*SRR*).The factors affecting the liquidity gap of commercial banks may include deposit-loan ratio (*LTD*), liquidity ratio (*LR*) and asset size (*LNA*, unit: RMB Ten Billion YUAN).These indicators basically cover the basic elements of macroeconomic development level, the speed of monetary and credit expansion, the intensity of banking supervision, and the financial situation of commercial banks themselves. They can explain the liquidity gap comprehensively.Therefore, the complete form of panel data model should be:

$$LG_{it} = C + \alpha_1 GDP - GR_t + \alpha_2 CPI_t + \alpha_3 CGR_t + \alpha_4 SRR_t + \beta_1 LTD_{it} + \beta_2 CR_{it} + \beta_3 LNA_{it} + \mu_{it} \ \ i = 1,2\ldots6; \ t = 1,2,3.$$

3.2 Empirical process

In order to select the appropriate panel data model for regression, the F test and Hausman test are used to test the panel data.F test results show that P value is 0.0000, so the individual fixed effect model should be selected in the individual random effect model and the individual fixed effect model.The results of Hausman test show that Prob>chi2=0.0013, so it can not reject the original hypothesis of choosing the random effect model, so the individual random effect model should be chosen in the individual random effect model and the individual fixed effect model.

Considering that there are many preliminary selected indicators and there may be strong correlation between some indicators, in order to simplify the calculation and avoid multiple collinearity phenomenon, a stepwise regression method is adopted to screen and eliminate the indicators.The stepwise regression process of random effect model by Eviews software is shown in Table 3.

Table 3 Stepwise regression process of stochastic effect model

variable	Model 1	Model 2	Model 3	Model 4
C	-22.7943*	-150.4074***	-95.0731**	47.8787
LNA	-0.0459**	-0.089741***	-0.1102***	-0.0900***
CGR	-	-13.53133***	-13.0487***	-10.7369***
CR	-	-	-0.7837*	-1.5190***
LTD	-	-	-	1.2699**
R2	0.0518	0.7431	0.7941	0.8484

Note: *,** and *** are significant in 10%, 5% and 1% respectively.

Selecting model 4 as the final estimation result, the remaining variables in the equation are asset size (*LNA*), currency growth rate (*CGR*), liquidity ratio (*CR*), deposit-loan ratio (*LTD*), and the estimation results of the coefficients of each variable are shown in Table 3.

3.3 Analysis of results

Further analysis of the above empirical results shows that the impact mechanism of each variable on liquidity gap is in line with the expectations of economic theory.Under the relatively loose monetary policy embodied by the monetary growth rate in recent years, monetary expansion is conducive to increasing the source of liquidity of commercial banks.Therefore, the current macroeconomic policy of our country is conducive to alleviating the misallocation of funds of commercial banks as a whole, and provides policy assistance for the liquidity of commercial banks.From the perspective of the impact mechanism of commercial banks' financial situation on liquidity gap, compared with Zhu Mengnan and Hou Zhe's research results[7], the index of deposit-loan ratio is still significantly positively correlated with liquidity gap, while the impact of asset size and liquidity ratio on liquidity gap has changed significantly.This reflects that with the change of China's economic environment, the factors affecting the mismatch of the term of funds will shift to a certain extent.In recent years, under the comprehensive influence of macroeconomic policies, changes in financial market system and other factors, the factors that can significantly affect the maturity mismatch of commercial banks have shifted from asset size to liquidity ratio, reflecting the important role of current liquidity sources in alleviating the maturity mismatch.

Based on the above empirical results, the factors that can significantly affect the liquidity gap of commercial banks include asset size (*LNA*), currency growth rate (*CGR*), deposit-loan ratio (*LTD*), liquidity ratio (`).Accordingly, we can summarize the reasons for the time-limit mismatch of sample banks as follows.

Firstly, the scale of assets is an important factor to restrict the liquidity of commercial banks; secondly, compared with the rapid growth of loan quantity, the deposit source of commercial banks is slightly

insufficient; secondly, in the deposit source, the liquidity source is an important factor affecting the term mismatch.

4. Suggestions on Risk Control

Based on the above empirical research conclusions, expanding medium and long-term capital sources and reducing medium and long-term capital utilization can certainly enhance the liquidity of commercial banks. However, in the current economic situation, with the increasingly fierce competition in the banking industry and the deepening of market-oriented reform of interest rates, the space for commercial banks to broaden their long-term capital sources has become very limited, shrinking long-term loans and pursuing profitability.Operating objectives are conflicting, and it is difficult to effectively alleviate the problem of mismatching the term of funds only by the above two ways.Therefore, according to the influencing factors of the current liquidity gap of commercial banks, this paper argues that the focus of mitigation of term mismatch should be properly shifted to broadening the sources of short-term funds. Suggestions on liquidity risk control for commercial banks are as follows.

4.1 Actively develop off-balance-sheet business and expand short-term sources of funds

When estimating the liquidity gap of commercial banks, this paper uses the commonly used calculating method in academic circles for reference, estimates the medium and long-term capital sources and utilization with long-term assets and liabilities, expresses the short-term capital sources with short-term deposits, and ignores the sources and utilization of off-balance sheet business.However, in fact, innovating financial products and actively developing off-balance sheet business can also provide considerable financial resources for commercial banks.And because of the flexible period of portfolio innovation and strong liquidity of financial products, it helps commercial banks to control liquidity risk.

4.2 Increasing active liabilities and issuing bonds flexibly

Issuing financial bonds is one of the important ways for commercial banks to obtain funds.Commercial banks can prevent liquidity risk by increasing active liabilities and issuing more flexible bonds when liquidity is tight.Because bonds have the advantages of both yield and liquidity, they are attractive to investors.And commercial banks have the initiative to issue bonds in terms of time, quantity and duration.In addition, the source of funds obtained by issuing bonds does not need to pay deposit reserve to the central bank, breaking through the bond relationship between deposit and loan.

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