Analysis of the impact of China's deposit reserve policy on the liquidity of local legal person financial institutions

Feng Shenghua

Shenwan Hongyuan Securities Co., Ltd Hefei, China
m15212776845_1@163.com

Abstract: The deposit reserve policy is a monetary policy tool established under the central banking system.Since the People's Bank of China performed its duties as the Central Bank in the 1980s, China's deposit reserve system has been established and gradually improved.At present, China has basically formed a "three files and two excellent" deposit reserve framework.As one of the three major monetary policy tools of the central bank, the deposit reserve policy affects the liquidity of financial institutions and the banking system through the excess reserve ratio and the monetary multiplier effect, and the liquidity of the banking system is related to the financial stability of a country and the prevention of systemic financial risks.Therefore, it is important to study the impact of deposit reserve policy on liquidity. In this paper, the monthly data of 16 legal person financial institutions in a certain region from January 2017 to May 2021 were selected as the study sample, To carry out empirical research on the impact of China's deposit reserve ratio changes on the liquidity of financial institutions in a certain region, And the capital adequacy ratio, interbank lending rate and other indicators are introduced as internal and external influencing factors, The results show that the legal deposit reserve ratio has a certain impact on the liquidity of financial institutions, However, different types of financial institutions and different influencing factors make the impact of the legal deposit reserve ratio on liquidity different, And the impact of the legal deposit reserve ratio on liquidity has a certain time lag.Through carrying out empirical research, this paper hopes to further enrich the theoretical achievements in the field of deposit reserve and liquidity, and provide a reasonable basis for the central bank to better play the market regulation role of deposit reserve policy.

Keywords: deposit reserve policy; liquidity; legal person financial institution

1. Literature review

1.1. Overview of the deposit reserve system

The initial deposit reserve was originated in the UK.In the 18th century, many of the British commercial banks deposited the funds in the Bank of England to meet the need of clearing the funds and withdrawing the cash[1]. The modern statutory deposit reserve system originated in the United States, which has been widely adopted in Germany, Britain and many developing countries since the 20th century[2]. With the transformation of the central banking system and functions, the deposit reserve system presents different functional characteristics at different periods (Li Hongjin, 2020)[3]. The initial deposit reserve system was used as a clearing function to prevent liquidity risks; after World War I, the deposit reserve system became a regulation of the amount of credit and money, and the number of money theory of Friedman (1953) was also proposed during this period[4]; Subsequently, the deposit reserve system became a means of auxiliary liquidity management under the interest rate policy regulation mode[5]Central banks in major developed economies have also begun to implement lower statutory reserve requirements or even zero reserves; while many emerging economies have made useful attempts to use deposit reserves as a macro-prudential policy tool[6].

1.2. Research on the liquidity of financial institutions

"Liquidity" was first proposed in Keynes in Employment, Interest, and Money in 1936[13]. Depending on the level, liquidity can be divided into market liquidity, institutional liquidity and macro liquidity. Financial institution liquidity refers to the ability to act as a financial intermediary to meet the

capital needs of depositors' withdrawal and lenders[14], Financial institutions can create liquidity through their on-sheet and off-balance-sheet businesses. For the measures of liquidity, there are mainly two categories: static measures and dynamic measures. Static measure measures liquidity by the deposit and loan status at the time of financial institutions, and the main index is the deposit-to-loan ratio[15], Excess deposit reserve ratio, liquidity ratio[16]And cash ratio; dynamic measures mostly use the framework index system to analyze liquidity, commonly used indicators include liquidity gap indicators[17], Cash flow index and duration analysis index.

1.3. Study on the impact of deposit reserve policy on the liquidity of financial institutions

As an important monetary policy tool to regulate the liquidity of financial institutions and markets, it is of great significance to study the degree and mechanism of deposit reserve on liquidity. Zhan Xiangyang et al. (2011) pointed out that the differential deposit reserve policy adopted by China not only enriches the content of the macro-control "toolbox", but also improves the effect of liquidity control to a certain extent[23]. Ren Kangyu (2012) pointed out that adjusting the reserve ratio will directly impact commercial banks, resulting in the reduction of resources that can be used to invest in lending and investment in bank assets and increasing the uncertainty in bank liquidity management[24].

Some literature has conducted extensive research on deposit reserve policy and the liquidity of financial institutions respectively, and a large number of scholars have studied the mechanism of monetary policy affecting liquidity from an overall perspective, and verified the impact of bank asset scale and capital adequacy ratio on the effect of monetary policy on liquidity through empirical research. However, for the impact of deposit reserve policy on liquidity, some documents have focused on the research and exploration of relevant mechanisms, and there is no clear conclusion on the impact of deposit reserve policy on the liquidity of financial institutions. Based on this, this paper will sample 16 financial institutions in a region, the deposit reserve ratio changes in a region of financial institutions liquidity to carry out empirical research, and M2, PPI, capital adequacy ratio as comparison, measure the degree of deposit reserve ratio changes on liquidity, to enrich the theoretical results in the field of deposit reserves and liquidity.

2. Empirical analysis of deposit reserve ratio on excess reserve adjustment

2.1. Variable indicators and model construction

In analyzing the changes in the overall excess reserve, since the relationship between the statutory reserve ratio and the excess reserve is studied, one of the variables is necessarily the statutory reserve ratio, which can be expressed in capital English der.In addition, considering the magnitude and frequency of reserve changes, referring to the 2017 and April 2021 over the years, the monthly data between 2017 can better reflect the law of the change. The monthly deposit reserve ratio is weighted average by the days of implementation of the deposit reserve ratio.For the index of excess reserve, the deposit reserve ratio index is used to represent here, in the English letter dasset, considering the length of the study time and the amount of data available, only this index is considered for the study.

The statutory deposit reserves of one variable is also indispensable when analyzing the excess reserves of commercial banks of different properties.

In terms of model selection, in the analysis of the overall excess reserves of commercial banks, because the deposit reserve ratio and the deposit reserve rate are both time series, so you can test the stability of the variable parameters, establish an error correction model, to investigate whether there is a long-term and stable equilibrium relationship between the two variables and how to adjust in the short term, and then return to the equilibrium state.In addition, the interrelationship between the variables was determined by the Granger causal test and tested by a pulse response function based on the vector autoregression (VAR) model.For different analysis of excess reserves of commercial Banks, because the number of samples is relatively large, suitable for panel data analysis, and the study is only the sample effect as the condition, so the fixed utility model, through the fixed utility intercept of each bank to reflect the difference of excess reserve change.

2.2. Empirical analysis of overall excess reserve ratio

2.2.1. Unit root and coconsolidation inspection

Both the variables of statutory and deposit reserve rates are time series, and before modeling, we need to know whether the stochastic process of the time series does not change over time. If the stochastic features of a stochastic process does not change over time, i. e., the process is stationary, the equation with a stability coefficient can be used to model the time series. Therefore, it is necessary to test whether the two variables are stable. The ADF test principle of ADF is to reject the null hypothesis if the t-statistical value is less than the ADF test the critical value, indicating that there is no unit root in the sequence; if the t-statistical value is greater than or equal to the ADF test critical value, the original hypothesis is accepted to show that the sequence has a unit root. In the EVIEWS6, ADF tests of the reserve and deposit reserve rates, respectively, The test results are shown in Table 1, First, it can be judged from the graph of both variables that there are intercept and trend terms, The lag order selects the default order in EVIEWS6 according to the SIC principle, Under the horizontal conditions, At the top of the 1%, 5%, At 10% of the three significance levels, The ADF statistical values for the unit root tests were all greater than the corresponding cutoff values, Thus, the original hypothesis cannot be rejected, It indicates that the unit root is present in a non-stationary sequence; Then by a first order difference, The resulting graphs of the two variables fluctuate up and down around the zero axis, Therefore, choose no intercept items and trend items, The results were stable, The final results show that, Both der and dasset are first-order single whole time series.

Table 1 Unit root test results of statutory reserve ratio and deposit reserve ratio

	Test form	ADF statistics	1%	5%	10%	result
der	(C,T,5)	-4.777772	-3.969295	-3.415312	-3.129869	Unsmooth
first order der	(N,N,7)	-17.24453	-3.969254	-3.415292	-3.129857	steady
dasset	(C,T,6)	-2.880845	-3.969295	-3.415312	-3.129869	Unsmooth
first order dasset	(N,N,3)	-21.97119	-3.969295	-3.415312	-3.129869	steady

Source: Data in this table are compiled according to the Eviews software test results.

To analyze whether there was a coconsolidation relationship between the reserve ratio and the deposit reserve ratio, the regression between the two variables was performed first, and then the stationarity of the regression residuals was tested. Co-consolidation test was performed using the EG two-step method.

In the first step, the regression equation was established with dasset and d e r as the explanatory variable, and the regression results are shown in Table 2,

Table 2 Results of reserve and deposit reserve ratio return

Variable	Coefficient	Std.Error	t-Statistic	Prob.
Y	2.20E-05	1.68E-06	13.09632	0
R-squared	-8.464534	Mean dependent var		8.741877
Adjusted R-squared	-8.464534	S.D.dependent var		2.709729
S.E.of regression	8.33634	Akaike info criterion		7.080328
Sum squared resid	57680.49	Schwarz criterion		7.086011
Log likelihood	-2940.876	Hannan-Quinn criter.		7.082508
Durbin-Watson stat	0.084874			

Source: Data in this table are based on the Eviews software test results.

A function between the deposit reserve and the deposit reserve ratio can be obtained from Table 2, i. e

Deposit assets =72.31788—0.396129 der +et

The equation says when the reserve ratio changes a unit, the reserve ratio index will change in the opposite direction, in real life, when the central bank raise the legal reserve ratio, commercial bank loans will reduce, so the reserve ratio will decline accordingly, shows that the excess reserves show downward trend, this equation accord with the real economic phenomenon.

In the second step, the unit root test of the residual equation, excluding constant and trend terms. In Table3 below, th et-statistics-4.057718 is less than each critical value, indicating that the residual sequence has no unit root and is a stable sequence, indicating a cointegration relationship between der

and dasset.

Table 3 Results of the unit root test for the residue e t

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-26.69268	0.0000
Test critical values:	1%level	-3.969146	
	5%level	-3.415239	
	10%level	-3.129826	

Source: Data in this table according to Eviews software

2.2.2. Error correction model

There is a long-term and stable coconsolidation relationship between deposit reserve and deposit reserve ratio, but I do not know whether there is a deviation in the short term, so in order to enhance the accuracy of the test, you can regard the error term et in the coconsolidation regression type as an equilibrium error, by establishing an error correction model to link the relationship between short-term behavior and long-term behavior.The above model reflects the dynamic impact of the balance error et-i on the short-term deposit-to-loan ratio of commercial banks. The coefficient of the error correction term is-0.379415, which conforms to the opposite correction mechanism. The change of the deposit reserve ratio can be divided into two parts: one part is the law of short-term change, and the other part is the impact of short-term deviation and long-term deviation.The error correction term coefficient-0.379415 reflects the strength of pulling back to equilibrium when short-term fluctuations deviate from the orbit of long-term equilibrium.

2.2.3. Granger causality test and pulse response function

According to the coconsolidation test, it is shown that there is a long-term balance relationship between deposit reserve ratio and deposit reserve ratio, but whether there is a causal relationship between the two requires the Granger causal test.The AIC principle selects the lag order, and the lag order is 1,2,3 respectively, and the Eviews software can find the results not found in Table4, Table5 and Table6.Table 4 Table does not is the case when the lag order is 1.Table5 is not the case of lag order 2, and Table6 indicates the case of lag order is 3. According to the following three tables, the AIC value is 4.964732 * when the lag order is selected 1, the smallest of this, and of all results, the most * values are obtained by each lag order 1, so the lag order is chosen in the Granger causal test.

Table 4 The lag order is the result of the order selection of 1

R-squared	0.067653	Mean dependent var	61587.12
Adjusted R-squared	0.066528	S.D.dependent var	160728.0
S.E.of regression	155289.5	Akaike info criterion	26.74637
Sum squared resid	2.00E+13	Schwarz criterion	26.75774
Log likelihood	-11111.12	Hannan-Quinn criter.	26.75073
F-statistic	60.15369	Durbin-Watson stat	0.485105
Prob(F-statistic)	0.000000		

Source: Data in this table according to Eviews software

Table 5 The lag order is the result of the order selection of 2

Variable	Coefficient	Std.Error	t-Statistic	Prob.
C	-70528.90	18169.65	-3.881687	0.0001
X(1)	13922.73	7886.458	1.765397	0.0779
X(2)	1037.007	7886.458	0.131492	0.8954
R-squared	0.065010	Mean dependent var		60310.15
Adjusted R-squared	0.062746	S.D.dependent var		158773.3
S.E.of regression	153711.5	Akaike info criterion		26.72715
Sum squared resid	1.95E+13	Schwarz criterion		26.74424
Log likelihood	-11075.41	Hannan-Quinn criter.		26.73371
F-statistic	28.71583	Durbin-Watson stat		0.500329
Prob(F-statistic)	0.000000			

Source: Data in this table according to Eviews software

Table 6 The lag order is the result of the order selection of 3

Variable	Coefficient	Std.Error	t-Statistic	Prob.
C	-71609.58	18333.30	-3.905984	0.0001
X(1)	14019.89	7918.562	1.770510	0.0770
X(2)	341.3536	11500.14	0.029683	0.9763
X(3)	690.0289	7918.562	0.087141	0.9306
R-squared	0.065701	Mean dependent var		60061.82
Adjusted R-squared	0.062299	S.D.dependent var		158708.1
S.E.of regression	153685.0	Akaike info criterion		26.72802
Sum squared resid	1.95E+13	Schwarz criterion		26.75081
Log likelihood	-11061.40	Hannan-Quinn criter.		26.73676
F-statistic	19.31483	Durbin-Watson stat		0.500766
Prob(F-statistic)	0.000000			

Source: Data in this table according to Eviews software

When the lag order is first order, the Granger causality test results are shown in Table 7. Under the first hypothesis, the P value is 0.9915, thus accepting the null hypothesis that dasset is not the Granger cause of der and the P value is 0.0041 under the second hypothesis, thus accepting the null hypothesis that der is the Granger cause of dasset.This shows that China's frequent adjustment of the legal reserve ratio in China has caused the adjustment of the deposit reserve ratio of commercial banks, improved the legal reserve ratio, reduced the available funds of commercial banks, and the loan scale decreased, which plays a role in inhibiting the economy.

Table 7 Results

Null Hypothesis:	Obs	F-Statistic	Prob.
X does not Granger Cause Y	827	2.56031	0.0779
Y does not Granger Cause X		1.01246	0.3638

Figure 1 reflcts the response function of the commercial bank deposit reserve ratio caused by the reserve impact, and after a positive impact on the reserve, the response function on the deposit reserve ratio is obtained in this period.Solid line represents the reserve ratio response value, horizontal axis represents the external impact lag, vertical axis represents the deposit reserve ratio, can be obtained by the figure, in the first six periods, reserve on the reserve ratio fluctuations, after the sixth period, the change of the reserve ratio tends to be stable.During the first four periods, the external impact of the reserves will give the deposit reserve ratio positive results, and will have negative results after the first four periods.In the first period of the reserve increase, the deposit reserve ratio still maintained the previous trend due to the time delay. However, with the external impact, the reserves gradually acted on the deposit reserve ratio of commercial banks, making the deposit reserve ratio have a downward trend and return to a new equilibrium state.
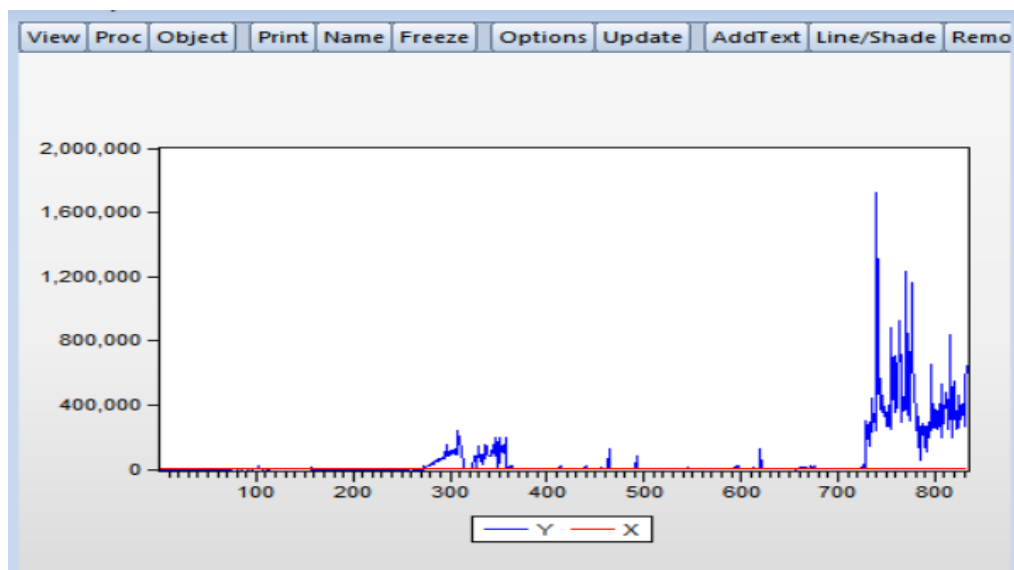

Figure 1. Stroke response function

3. Empirical analysis of the reserve ratio on the excess reserves of banks of different nature

Under Eviews 7.2 software, the fixed-effect panel model run yielded the following results, as shown in Table 8, from the model as a whole, R2=0.89, indicating that the goodness of fit of the whole model is very high and the model is relatively stable, with a DW test of 1.2, proving that there is no sequence autocorrelation.Although the model is relatively stable as a whole, the deposit reserve ratio varies greatly for commercial banks of different properties.From the result, in addition to private banks, financial banks, the intercept of other banks are positive, that the deposit reserve ratio adjustment on the other seven commercial Banks deposit reserve ratio, namely deposit reserve ratio higher, commercial bank deposit reserve ratio, commercial bank excess reserves.

Table 8 Fixed-utility intercept items

Variable	Coefficient	Std.Error	t-Statistic	Prob.
C	-73282.22	18204.58	-4.025482	0.0001
der ?	15427.96	1989.195	7.755881	0.0000
Fixed Effects(Cross)				
finance company	-952.0053	214.5292	-4.437649	0.0000
Private banks	-18520.93	1751.304	-10.57551	0.0000
Rural commercial bank	-280.3998	810.3324	-0.346031	0.7296
village banks	-1632.433	263.6184	-6.192410	0.0000
city bank	-21484.04	9098.545	-2.361261	0.0201
	Effects Specification			
Cross-section fixed(dummy variables)				
R-squared	0.051829	Mean dependent var		412061.0
Adjusted R-squared	0.042533	S.D.dependent var	243689.5	0.066496
S.E.of regression	238450.7	Akaike info criterion		27.62076
Sum squared resid	5.80E+12	Schwarz criterion		27.67161
Log likelihood	-1434.279	Hannan-Quinn criter.		27.64136
F-statistic	5.575554	Durbin-Watson stat		1.619194
Prob(F-statistic)	0.020113			

This chapter mainly studies the impact of the deposit reserve ratio on the excess reserves of commercial banks through empirical analysis, which can have a certain role on the overall excess reserves of commercial banks. There is a long-term and stable relationship, and the change of the reserve ratio is the reason for the excess reserves.Through the cross-sectional data, commercial banks of different properties are inconsistent about the changes in reserves, and small and medium-sized commercial banks are keen about the changes.

4. Conclusions

4.1. Change the concept of liquidity management of commercial banks, and strengthen the management of liquidity position.

We will improve the liquidity management mechanism of commercial banks, change the liquidity management concept, and take the initiative to adjust the excess deposit reserves.According to the commercial bank excess deposit reserves to the legal reserve ratio of different elasticity coefficient to carry out differentiation management, especially for rural Banks, private Banks and financial companies flexibility coefficient, to take the initiative to strengthen the liquidity position management, when necessary to carry out quarterly stress test, regular liquidity gap, formulate lack of liquidity emergency plan, strengthen liquidity management.

4.2. Detailed liquidity regulatory indicators, and monitor liquidity effectively in real time.

According to the different priorities of liquidity management of commercial banks, formulate liquidity monitoring indicators in line with the reality of commercial banks, and focus on monitoring core regulatory indicators such as liquidity assets, liquidity liabilities, liquidity ratio and liquidity coverage rate.Taking into account the changing trend of capital adequacy ratio, net asset profit margin, non-performing loan ratio and other indicators, to enhance the effectiveness of commercial banks in managing liquidity risks.At the same time, we will introduce macroeconomic indicators to reflect the market supply and demand signals, such as PPI, CPI, etc., and adopt diversified economic and financial

indicators to enrich the connotation of the liquidity monitoring indicators and refine the liquidity monitoring indicators, so as to achieve the purpose of preventing and controlling the liquidity risks.

4.3. Continue to promote the differentiated deposit reserve system, and improve the legal deposit reserve policy.

Implement differential deposit reserve system, for different types of commercial banks, according to different levels of deposit reserve ratio, continue to improve the differentiated deposit reserve system, directional adjustment liquidity of small and medium-sized legal person bank deposit reserve ratio, gradually expand the difference between the deposit reserve ratio and large commercial Banks, promote the steady development of small and medium-sized legal person bank, form a multi-level, wide coverage of financial institutions system.It is suggested that different different deposit reserve rates should be implemented for commercial banks with different elastic coefficients of the legal deposit reserve rate, so as to smooth the overall impact of the deposit reserve policy on the whole banking system.

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