



The attack from economic fluctuations to non-performing loan ratio of commercial banks

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ABSTRACT

Based on Hodrick-Prescott filter for non-performing loan ratio of commercial banks and economic growth ratio, this paper set up VAR model, also analyze the impact from economic growth to the fluctuation of non-performing loan ratio of commercial banks. The result shows that the attack from economic growth to non-performing loan ratio achieves maximum after three quarters. From the conclusion, some measures for preventing and controlling banks' systemic risk should be implemented, such as implementing counter-cyclical mechanism for the central bank, improving the export competitiveness for government, strengthening internal credit mechanism for commercial banks.

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Introduction

Banking non-performing loan is "sword of Damocles" that is in the head of banking, which can lead to financial turmoil, even economic crisis. Non-performing loan was one of reasons causing the Asian financial crisis at the end of the last century. According to the statistics released by China Banking Regulatory Commission, although in recent years, the non-performing loan ratio of commercial banks showed downward trend all the way, amount of non-performing loan had been at a high level, which had a great relationship with the method of our non-performing loan ratio calculation. So when studying banking asset quality, only referring to the non-performing loan ratio is unscientific and studying the volatility of non-performing loan ratio excluded the downward trend of non-performing loan ratio has the great significance.

At present stage, there are a number of domestic research about relationship between non-performing loan and macro-economy. Zhou Xunqian (2005) considered that, due to the reason of history, it was not consistent between non-performing loan ratio of China's state-owned commercial banks in early and the change of economic cycle, but there is showing a correlation gradually in the 90's, then the non-performing loan ratio of China's banks, whether state-owned banks or joint-stock banks, changed along with economic changes. Wang Shuang and Wu Guandan(2010) thought that the economic fluctuation had a significant impact on the change of sub-prime scale. Banking credit activities are pro-cyclical: it can increase banks' earning in short term, but in the long-term, banking capital will be corrupted by up and down over of credit supply. It will increase the systemic risk of banking. When the economic situation has drastic changes, it will have a tremendous impact on the financial market, which is disadvantage to the development of the real economy.

Although they had analyzed that there is closely relationship between non-performing loan ratio and economic fluctuation, many scholars did not demonstrate the specific interaction between economic fluctuation and the pure fluctuation of non-

performing loan ratio. It, studying the relationship between economic fluctuation and the pure fluctuation of non-performing loan ratio, can be more depth studying the specific relationship between them, which helps to analyze economy and market situation in recent years and which has practical significance to prevent and control the systemic risk of the banking industry. For deeply analyzing the specific relationship between economic fluctuation and the pure fluctuation of non-performing loan ratio, in this paper, we take data of non-performing loan ratio published by China Banking Regulatory Commission and data of economic growth ratio announced by National Bureau of Statistics. First decompose the trend of change from the data by using the Hodrick-Prescott filter, then conduct unit root test and build VAR model. After AR root test, we can establish the impulse response function. At last, we can draw conclusions and make some recommendations.

Vector auto regression (VAR) model

VAR model, based on the data's statistical properties, is built, which also be constructed by regarded function of all endogenous variables' lagged values with each of endogenous variables of system, thus can extend single variable' regression model to vector regression model consisted by multivariate time series. C.A.Sims introduced VAR model to the economics in 1980 and promoted widespread application of dynamic analysis of the economics. VAR model is used to predicting systems of interconnected time series and analyzing dynamic impact on variables from random disturbance, to explain the impact on economic variables from various economic shocks.

The mathematical expression of VAR(p) model is:

$$y_t = \Phi_1 y_{t-1} + L + \Phi_p y_{t-p} + Hx_t + \varepsilon_t \quad t = 1, 2, \dots, T$$

y_t is k -dimensional column vector of endogenous variables, x_t is d -dimensional column vector of exogenous variables, p is lag order, T is number of samples, $k \times k$ -dimensional matrix Φ_1, L, Φ_p and $k \times d$ -dimensional matrix

H are the coefficient matrix to be estimated, ε_t is disturbance column vector, which can be correlation between them for the same period, but not be correlation with their own lagged value and not be related to the variables associated with right-hand side.

In practical applications, for it is a non-theoretical model, the VAR model do not need to make any priori constraints for variables, so there often do not be analyzing how one variable affects another variable, but be analyzing some dynamic impacts on the system when an error term changes or the model be subjected to some shocks. This analysis method is called the impulse response function (IRF). Two-variable model presented here illustrate the basic idea of the impulse response function.

The empirical analysis of China’s economic volatility and the volatility of commercial banks’ non-performing loan ratio

Selection of variables and sources of datas

The growth ratio of GDP is the results of the combined effects of internal factors and external factors of economic operation in one year, which can reflect objectively the actual progress of economic operation. Since it contains expectation of economic trend made by the main body of economic, the growth ratio of GDP can be used as display elements of economic fluctuations in the model. Thus, in the paper we will select the quarter growth ratio of GDP (GGR) as the proxy variable for economic growth, the datas of which can be got from the China Statistical Yearbook.

According to level of loan risk, there is implementing standard five-category classification for loans since 1998, such as normal special mention substandard doubtful and loss. The non-performing loan is constituted by the latter three items. In the paper, non-performing loans ratio (NPL) is the ratio that non-performing loans accounted for the total loans each quarter, the datas of which can be got from the China Banking Regulatory Commission.

Given the economic significance and availability of data, we make the datas from the first quarter of 2004 to the second quarter of 2010 as the object researched in this paper, study the relationship between the volatility of NPL and the volatility of GGR in China at recent years and draw conclusions of practical significance accordingly.

Hodrick-Prescott filter

From analysis of datas, we can see the trends of NPL and GGR clearly. To avoid the trend to affect the analysis of fluctuation, in which we use Hodrick-Prescott filter, we will decompose trend from the sequence and get another group of data on the basis of the original data. The new group of data only show its own volatility.

Unit Root test(ADF)

According to the theory of Granger and Newbold (1974), the winner of the 2003 Nobel, the result of regression estimates to non-stationary time series is likely to be false. So firstly there must be carrying on the stability test for data of the time series and making ADF test for data of CNPL and CGGR. The results are shown in table 1.

We can see from table 1: the first difference of CNPL and CGGR, non-stationary time series, both are first-order entire sequence, being stationary. Although the result of the test shows that they are stable, there is ignoring the long-term information contained in the original sequence to the first difference of the two variables, using which can miss or cover the long-term

relationship between the two variables, so we still choose the two level values of the variables.

The establishment of VAR model

$$\begin{pmatrix} CNPL \\ CGGR \end{pmatrix}_t = \begin{pmatrix} a_{10} \\ b_{10} \end{pmatrix} + \begin{pmatrix} a_{11} & a_{21} \\ b_{11} & b_{21} \end{pmatrix} \begin{pmatrix} CNPL \\ CGGR \end{pmatrix}_{t-1} + L + \begin{pmatrix} a_{1p} & a_{2p} \\ b_{1p} & b_{2p} \end{pmatrix} \begin{pmatrix} CNPL \\ CGGR \end{pmatrix}_{t-p} + \begin{pmatrix} \mu_{1t} \\ \mu_{2t} \end{pmatrix}$$

From above equation, μ_{1t} and μ_{2t} are subject to the white noise of zero mean、 σ_1^2 and σ_2^2 variance respectively. They are independent each other.

The lag selection

Given the restriction of datas and stability, we examine the lags 1、 2、 3、 4. According to the minimum principle of AIC and SC, the best lag of VAR model is 1, which can be seen clearly from the result of the Lag Length Criteria test.

Build VAR model

Through the empirical analysis of the relationship between the two variables by using measurement software Eviews, we can get matrix as following:

$$\begin{pmatrix} CNPL \\ CGGR \end{pmatrix} = \begin{pmatrix} 0.4061 & 0.0972 \\ -0.1044 & 0.7963 \end{pmatrix} \begin{pmatrix} CNPL(-1) \\ CGGR(-1) \end{pmatrix} + \begin{pmatrix} -0.0009 \\ 0.0007 \end{pmatrix}$$

From the above equation, we can see that the coefficient of CGGR(-1) in CNPL equation is 0.0972, which means that the economic volatility of one lag has significant positive impact on the volatility of non-performing loan ratio of commercial banks.

AR root test

VAR model can be seen whether it is stable by using AR root test. From table 2, all the reciprocal of roots’ modulus in the VAR model estimated is less than 1 and it satisfies the stability condition, which also means that the standard error is valid while to use the impulse response.

Can be seen from the above analysis, there is some influence of lag and long-term equilibrium relationship between the economic volatility and the volatility of non-performing loan ratio. To further analyze the relationship between them, we carry on the impulse response analysis following.

The impulse response analysis

In order to analyze the dynamic response trajectory between the economic volatility and the volatility of non-performing loan ratio, we establish the impulse response model. The result is shown in figure 1.

From the left of figure 1, we can see that CNPL firstly has an upward positive response immediately to a standard deviation of CGGR, that when economic fluctuation occur, there is having growing wave for non-performing loan ratio. The response in the third period arrives maximum, then it is smaller and smaller and tend to zero over time, achieving long equilibrium.

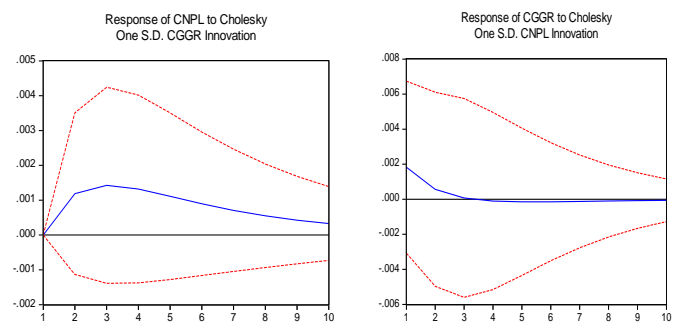


Figure 1. The impulse response function between CNPL and CGGR

From the right of figure 1, we can see that CGGR has a weak upward positive response to a standard deviation of CNPL. However, the response is smaller and smaller and the scope of attack is not big, that the volatility of non-performing loan ratio has little effect on economic fluctuations.

Conclusion and Suggestion

Conclusion

Firstly we decompose trend from the sequence of economic growth ratio and the non-performing loan ratio using filtering method, only leaving the data of volatility of GGR and NPL, named CGGR and CNPL. The result is that when economic fluctuation occur, there can be causing fluctuation up and down of non-performing loan ratio of commercial banks by building VAR model and the impulse response function, this fluctuation will become stronger and stronger and it will reach maximum in the next third quarter, and then be smaller and smaller. The relationship between them reaches long-term stability.

When the economy fluctuate upward, GDP rise steadily. Under the circumstance of the favorable macro-economy, the profit ability will be stronger and the profitability of enterprise will increase, which will promote the total social investment and the total output increasing, which will stimulate more individuals and businesses to increase investments.

To ensure good economic situation in short time, the monetary authorities will keep a stable interest rate. So relative interest rate will decrease and the net cash flow will increase for enterprise, which leads that there are sufficient funds to repay loans. This led to the non-performing loans relatively declining and the total loans relatively increasing, which will cause the non-performing loan ratio fluctuating downward in a large scope.

Meanwhile some projects with high-risk and low return are also obtain financing easily under this loose credit supply policy. With the continued growth of the total investment and output, the total social supply is over-strong, leading to over demand in the production factor market, price increasing and eventually leading to the consumer price index CPI rising.

To maintain stable price and limit non-performing assets, the monetary authorities will increase borrowing costs by raising interest rates and other means, which will enable those companies with poor credit breaking contract under pressure, resulting in the default ratio of banks rising and non-performing loans increasing. Because the total loans remain stable over time, the non-performing loan ratio will tend to a small rise, until to reach a long-term equilibrium.

With reality, it has large relationship with export business "Made in China". The emergence of situation changes in recent years, such as increasing of labor costs and RMB exchange rate the adjustment of export policy, make many Chinese export enterprises facing tremendous pressure to survive.

When economic growth occur, some Chinese export enterprises increase export efforts due to credit guarantees of loan repayment for getting more state loans, but it will stop or even go bankrupt due to change of outside policy and lack of own competitiveness after about two or three quarters, while a large number of defaults will occur.

It is obvious that in the subsequent third quarter, the non-performing loan ratio down to the smallest fluctuations, but it is also at the point that quality of bank assets is the most hidden danger. The monetary authorities should develop a series of monetary policy, taking preventive measures to make bad loans ratio remaining at low level as possible.

Suggestion

Through above analysis, in order to control effectively the long-term negative effects from the economic growth to non-performing loan ratio and try to avoid shocks or to maintain its impulse response in the first three quarters, we make the following recommendations:

Strengthening macro-economic adjustment, improving the policy guidance

For pro-cycle between banking credit expansion and the economic fluctuation, in order to iron out the economic fluctuation, the central bank should focus on building appropriate reverse mechanism. To restrain the impulse response from overheating economy to non-performing loan ratio, when economy rise, the central bank should adopt a relatively tight monetary policy in the next three quarters, such as increasing the statutory reserves for bank deposits improving the rediscount rate and raising interest rate (we also learn the corresponding inflationary pressures). We can also conduct the direct credit controls, the direct intervention and control measures from the central bank to the credit activities of commercial banks, to control and guide the credit activities of commercial bank. It makes the pulse arriving minimize and weakens the impact on the volatility of non-performing loan ratio from economic fluctuation.

Under the unchange external short-term circumstances of the labor costs increasing the RMB exchange rate and so on, our government should make further good mechanisms basic on the original export policy. To some export enterprises with national economy and people's livelihood, our government should carry on some fiscal and monetary such as rebating export tax decreasing the banks' lending rates increasing the repayment period and so on. In addition, it also can be compensating the percentage of the loss made by the RMB exchange rate increasing. Improving the international competitiveness of our export enterprises to ensure making both ends need and that the repayment credit of our export enterprises is not harmed, it will reduce the negative impact on non-performing loan ratio of commercial banks from the economic volatility to a large extent.

Strengthening the internal credit mechanism, playing the banks' function

Commercial banks should analyze promptly the economic situation. They can conduct computer simulation to non-performing loan ratio and macroeconomic indicators (such as the intensity of economic fluctuations and so on) and establish their own internal analysis and forecasting model, to handle properly the relationship between the long-term interests and the short-term interests. Meanwhile, they should establish perfect rating agencies of bank loans develop the complete and rigorous indicators of credit issued train rational loan officer for analyzing the market and strengthen credit examining before loan and controlling in the loan. For a variety of economic entities, commercial banks should analyze specific issues and ensure loans reasonable delivery and effective recovery by resisting some assets with high risk and low return, which make non-performing loan ratio to resist outside interference, tending to the long-term lower level of steady state. This works should be ensured to carried on fastly and effectively in the first three quarters of economic fluctuations.

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Table 1. Unit root test (ADF)

Variable	ADF test	Marginal value	Conclusion
CNPL	-3.5407	-3.7241	Unstable
CGGR	-1.6205	-3.7241	Unstable
DCNPL	-5.9948	-3.7379**	Steady
DCGGR	-4.1236	-3.7379**	Steady