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Research on the Influencing Factors of Non-Performing Loan Rate of Agricultural Commercial Bank based on Multiple Regression Model

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ABSTRACT. *Based on theoretical analysis, this paper chooses explanatory variables from macroeconomic situation and bank micro-operation behavior, establishes a multi-linear regression model of influence factors of non-performing loan rate of rural commercial banks on the basis of quarterly data from 2014 to 2019, modifies the model through multiple collinearity, heteroscedasticity, autocorrelation and other quantitative tests. The results show that the loan rate is positively correlated with the profit margin of bank assets, the ratio of deposit to loan, and negatively correlated with the reserve coverage. On this basis, combined with the actual situation, this paper puts forward reasonable suggestions on how to prevent the increment of non-performing loans and how to dissolve the stock of non-performing loans from the perspective of market, government and bank, aiming at promoting rural commercial banks to better serve the development of agriculture, countryside and farmers, and creating favorable conditions for the comprehensive implementation of rural strategy.*

KEYWORDS: *Rural Commercial Bank; non-performing loan rate; Multivariate linear regression model.*

1. Introduction

China's economic development has entered a new normal. By the end of 2018, the growth rate of China's GDP has dropped to 6.6%, and the growth rate of macro-economy has declined. The structural reform on the supply side and the elimination of low-end excess capacity have brought huge pressure on the development of real enterprises, and the risk of enterprise credit default has increased accordingly. Commercial banks have seen a "double rise" in the amount of non-performing loans and the rate of non-performing loans. The non-performing loan rate of rural commercial banks is the highest, up to 3.96%. As an important part of the rural financial system, its credit investment has a significant impact on the

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development of small and medium-sized enterprises, "agriculture, rural areas and farmers". This paper analyzes the influencing factors of the non-performing loans of rural commercial banks, studies the measures to resolve the stock and increase the amount of non-performing loans, and ensures the healthy operation of the rural financial system and promotes the rural economy under the new normal background Economic development is of great practical significance.

2. Literature Review

With the continuous deepening of the implementation of the Rural Revitalization Strategy, the demand for rural financial services is increasing. As the main force of financial support for agriculture, the problem of high non-performing loan rate of rural commercial banks has caused extensive research by experts and scholars at home and abroad. The research results mainly include the following two aspects: first, the analysis of the influencing factors of non-performing loan ratio. Liang Qiuxia believes that the formation of non-performing loans is not only related to the internal factors of banks, such as competition between banks, decision-making errors, but also affected by external factors such as imperfect financial market system, information asymmetry, economic cycle and other factors [1]; Chen Yulu and Ma Yong believe that the high risk faced by agricultural finance is closely related to the vulnerability of agricultural production, and It is not entirely caused by the moral hazard of rural residents [2]; on the basis of theoretical analysis and empirical analysis, Li Meifang points out that the non-performing loan rate has a negative correlation with GDP growth rate, money supply increment rate, bank capital adequacy rate, bank relative scale, provision coverage rate and net interest margin, and a positive correlation with the ratio of loans to total liabilities[3] Zouke and Cai Xiaochun, through the combination of two-way fixed effect model and dynamic panel model, come to the conclusion that loose monetary policy and economic development level will inhibit the growth of non-performing loan rate, while too fast credit growth will accelerate the growth of non-performing loan rate [4].

Secondly, it is about how to prevent the increment of non-performing loans and how to resolve the stock. Han Wei thinks that the separation of some non-performing loans has a positive effect on enhancing the competitiveness of banks, preventing and resolving financial risks [5]; Chen Lu proposes that the effective management of non-performing loans of commercial banks can be realized by developing economy, increasing financial revenue and improving the external credit environment of commercial banks [6]; Guo Minle believes that the improvement of the quality of credit assets cannot be separated from the perfect credit industry Internal control system, and proposed to build a perfect credit rating credit system, loan granting, loan approval and loan supervision separate measures [7]; Dai Yuzan analyzed the impact of asset securitization on bank stability from both positive and negative sides, pointed out that asset securitization is conducive to increase the liquidity of bank assets, diversify business risks, promote the stability of the banking industry and reduce the non-performing loan rate Low [8].

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3. Empirical Analysis

3.1 Variable

On the basis of theoretical analysis, combined with the actual development of rural commercial banks in China under the background of Rural Revitalization Strategy, this paper selects the following variables from the macro-economic situation and micro operation behavior as Table1 shows, and the samples contained 21 sets of quarterly data from the first quarter of 2014 to the first quarter of 2019.

Table 1 data description

Time	Y	X_1	X_2	X_3	X_4	X_5	X_6
2019	4.05	1.4	1.03432419	1.07	72.22	128.5	12.97
2018	3.96	1.5	1.01389515	0.84	74.34	132.54	13.2
	4.23	1.6	1.01778759	0.98	73.55	125.6	13.01
	4.29	1.8	1.01742606	1	72.3	122.25	12.77
	3.26	1.4	1.03762651	1.2	71.18	158.94	13.39
2017	3.16	1.6	1.01272485	0.9	70.55	164.31	13.3
	2.95	1.7	1.0149574	1.06	70.01	177.57	13.37
	2.81	1.7	1.01981745	1.09	69.12	179.91	13.21
	2.55	1.3	1.03193342	1.19	67.74	194.6	13.26
2016	2.49	1.7	1.02225032	1.01	67.61	199.1	13.48
	2.74	1.8	1.01735022	1.13	67.27	183.92	13.14
	2.62	1.8	1.030632	1.13	67.22	185.51	12.98
	2.56	1.1	1.03871292	1.22	67.01	185.83	12.97
2015	2.48	1.6	1.02390057	1.11	67.24	189.63	13.34
	2.35	1.8	1.01979901	1.26	66.39	199.73	13.18
	2.2	1.7	1.04555791	1.32	65.8	206.38	13.09
	2.03	1.3	1.03820104	1.4	65.67	219.98	13.36
2014	1.87	1.5	1.02705252	1.38	65.09	236.52	13.81
	1.86	1.9	1.02179001	1.52	64.17	239.62	13.61
	1.72	2	1.01790334	1.55	65.4	253.14	13.32
	1.68	1.5	1.06334717	1.6	65.89	257.69	13.29

Data comes from the Chinese National Bureau of statistics

3.2 Model Establishment

In order to quantitatively study the influencing factors of non-performing loan rate of rural commercial banks, this paper establishes a preliminary multiple linear regression model based on sample data:

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$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + \mu$$

The sample data is imported into the Eviews software, and the unknown parameters in the model are estimated by the ordinary least square method. The regression results of the parameters are shown in Table 2:

Table 2 Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.275148	4.789975	0.057443	0.955
X1	0.162399	0.156183	1.039797	0.3161
X2	-2.324902	3.45963	-0.672009	0.5125
X3	0.796106	0.280436	2.838816	0.0131
X4	0.105631	0.022378	4.720298	0.0003
X5	-0.015908	0.00245	-6.493307	0
X6	-0.043463	0.164609	-0.26404	0.7956
R-squared	0.987806	Mean dependent var		2.755238
Adjusted R-squared	0.98258	S.D. dependent var		0.811607
S.E. of regression	0.107119	Akaike info criterion		-1.368547
Sum squared resid	0.160643	Schwarz criterion		-1.020373
Log likelihood	21.36974	Hannan-Quinn criter.		-1.292984
F-statistic	189.0198	Durbin-Watson stat		1.898184
Prob(F-statistic)	0			

The final regression equation results are as follows:

$$Y = 0.275148 + 0.162399X_1 - 2.324902X_2 + 0.796106X_3$$
$$+0.105631X_4 - 0.015908X_5 - 0.043463X_6$$

3.3 Model Inspection and Modification

3.3.1 Economic Significance Test

The result of the equation shows that the non-performing loan ratio of rural commercial banks in 2014-2019 has a negative correlation with the growth rate, provision coverage and capital adequacy ratio of M_2, and a positive correlation with the deposit loan ratio of asset profit ratio. It shows that the higher the growth rate, provision coverage and capital adequacy ratio of M_2 in a country, the lower the asset profit ratio and deposit loan ratio, the better the ability of banks to resist capital risk and deal with losses The stronger, the smaller the incidence of non-performing loans, in line with the actual. However, the non-performing loan rate is positively correlated with GDP growth rate, which is obviously not in line with the reality, so we need to further test and modify the model.

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3.3.2 Statistical Inference Test

The multiple decision coefficient R^2 = 0.987806, the modified decision coefficient R^2 = 0.982580, the F statistic is 189.0198, and the residual analysis chart of the model (see Figure 1) all have a good overall fitting degree of the model. The common influence of the explanatory variables on the explanatory variables is significant. Given the significance level α = 0.05, look up the t distribution table with 14 degrees of freedom, and the critical value is 2.1448, Compared with the t-statistics of each explanatory variable, only X_1, X_2, X_3, X_4, X_5 passed the t-test, that is to say, asset profit ratio, loan to deposit ratio and provision coverage ratio had a significant impact on the NPL rate of banks, while other explanatory variables failed the t-test, so it was speculated that there might be multiple collinearity among explanatory variables.

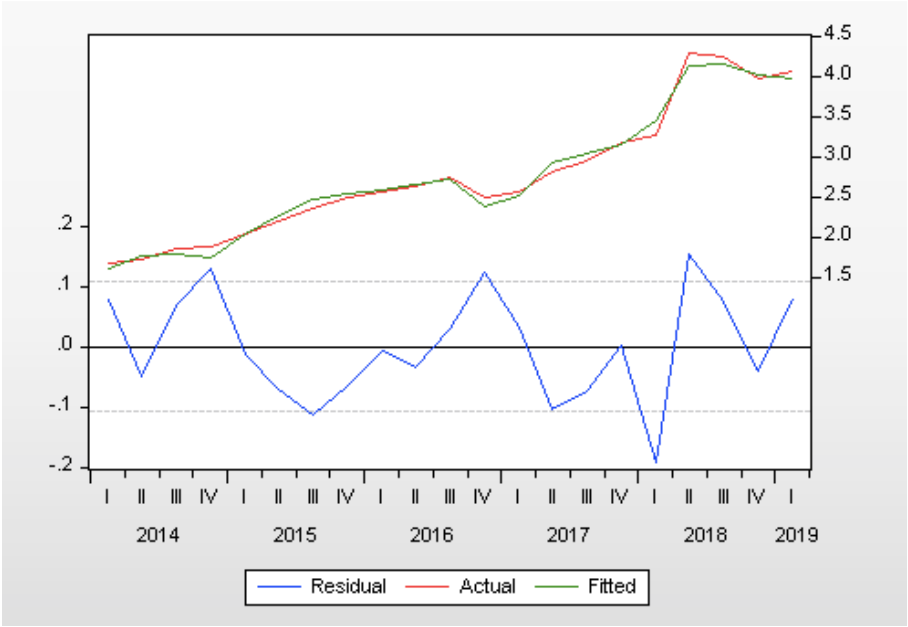

Figure 1 residual analysis

3.3.3 Econometric Test and Amendment

(1) Model multicollinearity test and correction

The test results show that the correlation coefficient between the explanatory variables is high, and there is serious multicollinearity between the explanatory variables. Table 3 shows specific results:

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Table 3 correlation coefficient matrix

Variable	Y	X1	X2	X3	X4	X5	X6
Y	1.0000	-0.1251	-0.3907	-0.8144	0.9578	-0.9779	-0.5963
X1	-0.1251	1.0000	-0.4808	0.0921	-0.1722	0.1764	0.0408
X2	-0.3907	-0.4808	1.0000	0.5667	-0.3643	0.3936	-0.0295
X3	-0.8144	0.0921	0.5667	1.0000	-0.8082	0.8728	0.3994
X4	0.9578	-0.1722	-0.3643	-0.8082	1.0000	-0.9232	-0.4769
X5	-0.9779	0.1764	0.3936	0.8728	-0.9232	1.0000	0.6157
X6	-0.5963	0.0408	-0.0295	0.3994	-0.4769	0.6157	1.0000

In this paper, after eliminating the explanatory variable x_1that does not meet the economic significance test, we use the Eviews software to control the significance level of T statistics to 0.05, and use the stepwise least square method to automatically select variables from the set of remaining explanatory variables to establish a new model. The goodness of fit of the modified model is good, the F-test is also very significant, and the significance level of a single explanatory variable has also passed the t-test, so the new modified model will be tested for heteroscedasticity and autocorrelation in the following. Table 4 shows the regression results of the modified model:

Table 4 regression results of modified model parameters

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.079107	1.807779	-1.150089	0.266
X3	0.648993	0.246825	2.629369	0.0176
X4	0.102602	0.02218	4.625837	0.0002
X5	-0.015729	0.001981	-7.940896	0
R-squared	0.983457	Mean dependent var	2.755238	
Adjusted R-squared	0.980537	S.D. dependent var	0.811607	
S.E. of regression	0.113226	Akaike info criterion	-1.349213	
Sum squared resid	0.217943	Schwarz criterion	-1.150256	
Log likelihood	18.16673	Hannan-Quinn criter.	-1.306034	
F-statistic	336.8689	Durbin-Watson stat	1.878762	
Prob(F-statistic)	0			

(2) Heteroscedasticity test and correction

In this paper, the white test is used to test whether the model has heteroscedasticity. Given the significance level α = 0.05, the critical table of χ ^ 2 distribution table is$\chi^2(9) = 16.919$. From table 5, $nR^2 = 9.148978 < \chi^2(9) = 16.919$, and the adjoint probability p value is greater than 0.05. Therefore, the model has no heteroscedasticity.

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Table 5 white test results

F-statistic	0.943554	Prob. F(9,11)	0.5269
Obs*R-squared	9.148978	Prob. Chi-Square(9)	0.4236
Scaled explained SS	6.400984	Prob. Chi-Square(9)	0.6992

(3)Autocorrelation test and correction

DW test: given the significance level α = 0.05, when the sample size is 21 and there are three explanatory variables, the DW statistical table is checked to get $d_L = 1.03, d_U = 1.67$. According to the results of Table 4, $d_U < \mathrm{DW} = 1.878762 < 4 - d_U$. Therefore, the first-order autocorrelation of the model is not considered.

Correlation graph and -statistic test: from Figure 2, it can be seen that the p-value of Q-statistic of each stage lag is greater than 0.05, which shows that under the given 5% significance level, the model does not have first-order, second-order and high-order autocorrelation.

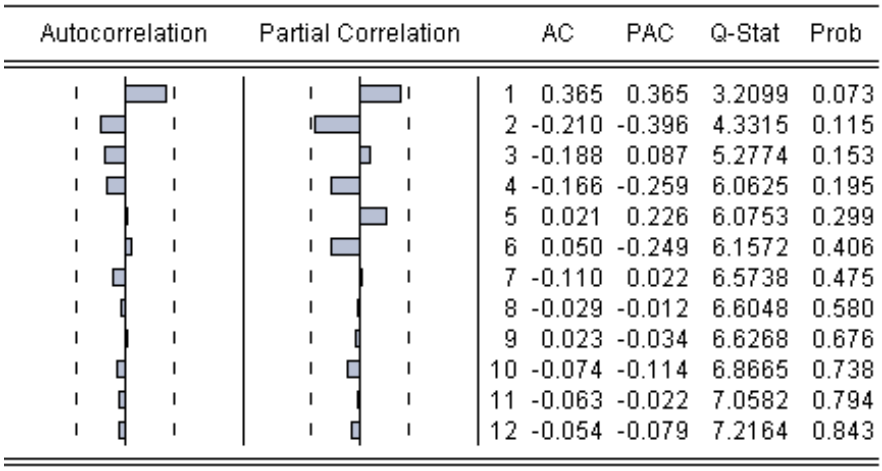

Figure 2 correlation coefficient and partial correlation coefficient

After the economic significance test, statistical inference test, multicollinearity test, heteroscedasticity test and autocorrelation test of the initial multiple linear regression model, and a series of amendments based on the test results, the model of influencing factors of non-performing loan rate of rural commercial banks in China is finally obtained as follows:

$$\mathrm{Y} = -2.079107 + 0.648993X_3 + 0.102602X_4 - 0.015729X_5$$

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4. Conclusions and suggestions

Through the above empirical analysis, we can see that the asset profit ratio, deposit loan ratio and provision coverage of rural commercial banks have a significant impact on their non-performing loan ratio. Among them, the non-performing loan ratio will increase by 0.648993% for each percentage point increase in the asset profit ratio; the non-performing loan ratio will increase by 0.102602% for each percentage point increase in the deposit loan ratio; and the non-performing loan ratio will decrease by 0.015729% for each percentage point increase in the provision coverage ratio. In addition, many factors, such as the level of macro-economic development, monetary policy, the level of bank operation and management, also affect the non-performing loan rate of rural commercial banks. In order to reduce the non-performing loan rate of rural commercial banks and the influence of the above unstable factors on their operation stability, this paper puts forward the following suggestions from the perspectives of market, government and bank:

(1) Improve the development of multi-level embrittlement of capital market

At present, compared with the capital market system of western developed countries, the outstanding characteristics of China's capital market are simple structure, single investment and financing channels for residents and enterprises. By vigorously developing the multi-level mature capital market system, we can expand the proportion of direct financing of residents and enterprises, reduce their excessive dependence on the bank credit, thus reducing the possibility of non-performing loans, and also provide efficient platform and diversified means for banks to dispose of non-performing assets.

(2) Optimizing macro environment and supporting rural development

First of all, the government should actively promote the education of residents' integrity, and create a good credit environment in the whole society, which will help to reduce the non-performing loans due to moral hazard from the source. Secondly, the implementation of discretionary fiscal policy and stable monetary policy, to maintain the stable and healthy development of China's economic level, to provide a good macro environment for the operation of enterprises, is conducive to the improvement of the operation level of enterprises, reduce the probability of default. Finally, the government can give the rural commercial banks appropriate preferential tax policy and interest rate policy, through the way of financial injection to divest part of the rural commercial banks of non-performing loans related to agriculture, to alleviate the problem of excessive non-performing loans in rural commercial banks.

(3) Improve the credit management system, establish and improve the internal risk control system of the bank

With the acceleration of the global economic integration process, the risk sources of banks are becoming more and more diversified. In addition, due to the vulnerability of rural economy, rural commercial banks should pay more attention to the risk management, establish and improve the internal risk control system. In the

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process of operation, banks should not only focus on improving the immediate operating profit without considering the future development of banks, but also should build a bank in the loan granting process Establish prudent and objective auditing standards, fully disclose the potential risks of loan projects, conduct comprehensive and dynamic inspection, analysis and evaluation of loan quality and changes on a regular basis after loan issuance, strengthen the supervision and collection of loans, and effectively control the generation of non-performing loans.

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