

Rural Financial Development and Rural Economic Efficiency Improvement Based on Granger Causality Test

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Abstract Based on the co-integration test theory, Financial Interrelation Ratio (*FIR*), level of financial efficiency (*LFE*), level of financial development (*LFD*) and other indices evaluating the rural financial development are selected by Granger Causality Test. The rural loan balance (*RLB*), rural deposit balance (*RDB*), total rural output (*TRO*), fixed assets investment (*FAI*), Financial Interrelation Ratio (*FIR*), economic efficiency (*EE*), level of financial efficiency (*LFE*), and level of financial development (*LFD*) in the years 1979 – 2007 are collected. Graphical method intuitively reflects the development trend and historical track of relevant indices; and Granger Causality Test verifies the relationship between rural financial development level and rural economic efficiency in the years 1979 – 2007. Result shows that rural financial development level has significant impact on rural economic growth, but rural economic growth has no significant impact on rural financial development; and rural financial development also has insignificant promotion impact on rural economic efficiency. Thus, conclusions are obtained. Although rural financial development has made certain contribution to the development of rural economy, this kind of contribution is only reflected in total quantity, but not efficiency. Therefore, government should further strengthen the promotion function of financial development for economic efficiency, and gradually establish a virtuous circle system for rural finance and economic development.

Key words Rural finance, Economic efficiency, Granger Causality Test, China

Since the reform and opening up, financial development has made enormous progress with the rapid growth of economy in China. However, economic efficiency, particularly the rural economic efficiency, does not change accordingly. Relevant data show that GDP has increased from 364.52 billion yuan in the year 1978 to 30 067.00 billion yuan in 2008, an annual increase of 9.8%^[1]. Financial asset has increased from 115.10 billion yuan in the year 1978 to 83 800 billion yuan in 2007. Employees in financial circles have grown from 760 thousand people in 1978 to 3 700 thousand people in 2007. Proportion of financial asset in GDP has gone up from 31.7% in 1978 to 3.4 times in the year 2007^[2]. Rural loan and rural deposit have increased from 16.07 billion yuan and 17.49 billion yuan in 1978 to 2 254.10 billion yuan and 3 558.17 billion yuan in 2007, respectively, up by 139 and 202 times. However, rural total output has only increased by 86 times in the year 2007, compared with that in the year 1978, and its proportion in GDP shows a tendency to decline^[3]. It can be concluded that economic growth in rural areas is far slower than that the national average and the rural areas have low efficiency of economic growth. Therefore, research on the relationship between rural finance development and economic efficiency is of important practical significance to promoting rural economic development and to minimizing the urban and rural gap.

1 Research method, variable selection and data collection

1.1 Research method This research aims to study on the causality between rural financial development level and rural economic efficiency mainly by Graphic Method and Granger Causality Test, because Graphic Method can directly reflect the relationship between rural financial development level and rural economic efficiency and Granger Causality Test can further verify the causality between the two by quantitative method.

1.2 Variable selection According to the research results of domestic and foreign scholars, indices are selected to evaluate the rural financial development based on the operational and practical principles, considering the availability of data.

(1) Financial Interrelation Ratio (*FIR*), reflecting the scale of financial assets. *FIR* is the ratio of total financial asset to GDP, a basic index to evaluate the financial development level of a country (region). This research selects deposit and loan balances in rural financial institutions as the numerator of *FIR* and a index reflecting rural economic development level as the denominator^[4-5].

(2) Level of financial efficiency (*LFE*), representing the proportion of loan balance in deposit balance. Rural deposit balance reflects the total volume of finance; and the impact of rural finance on rural economy is achieved mainly by a transmission mechanism, which changes loan into investment^[4].

(3) Level of financial development (*LFD*), representing the proportion of rural loan balance in total rural output. It is reflected by the credit ratio of rural financial institutions. And total rural output is denoted by the sum of output values of agricul-

ture, forestry, animal husbandry and fishery^[4].

According to the method of Odedokun (1997), increased output-capital ratio is adopted to reflect the economic efficiency. Hence, economic growth and economic efficiency have the following relationships:

$$dY/Y = (dY/dK) \times (dK/Y) = EE \times (dK/Y), \quad (1)$$

where dY/Y is economic growth or output growth rate, dY/dK is the increased output-capital ratio, that is economic efficiency, dY is the increased output, dK is the investment expenditure or increased capital, dK/Y is the proportion of investment expenditure in total output. According to the equation and relevant data, index value of economic efficiency can be obtained. Investment in the sense of macroeconomics refers to the expenditure flow for the increase of physical capital stock, usually

including fixed assets investment, housing investment, and investment in newly-added stock. Due to the incomplete data of housing investment and investment in newly-added stock in China, we select fixed assets investment in rural areas to carry out analysis. In fact, the proportion of fixed assets investment in total investment usually occupies more than 90%^[6].

1.3 Data collection and explanation According to the definition and calculation method of indices mentioned above, Table 1 reports the rural loan balance (*RLB*), rural deposit balance (*RDB*), total rural output (*TRO*), fixed assets investment (*FAI*), Financial Interrelation Ratio (*FIR*), economic efficiency (*EE*), level of financial efficiency (*LFE*), and level of financial development (*LFD*) in the years 1979–2007.

Table 1 Relevant data about rural financial development level and economic efficiency in the years 1979–2007

Year	<i>RLB</i> // $\times 10^8$ yuan	<i>RDB</i> // $\times 10^8$ yuan	<i>TRO</i> // $\times 10^8$ yuan	<i>FAI</i> // $\times 10^8$ yuan	<i>FIR</i>	<i>EE</i>	<i>LFE</i>	<i>LFD</i>
1979	180.77	222.01	1 414.76	167.30	0.28	0.82	0.81	0.13
1980	242.92	270.67	1 572.71	186.54	0.33	0.85	0.90	0.15
1981	279.39	335.98	1 804.40	244.14	0.34	0.95	0.83	0.15
1982	327.48	409.17	2 062.81	301.8	0.36	0.86	0.80	0.16
1983	389.06	502.42	2 443.96	409.59	0.36	0.93	0.77	0.16
1984	702.14	650.80	3 132.08	538.85	0.43	1.28	1.08	0.22
1985	716.29	699.10	3 584.12	620.00	0.39	0.73	1.02	0.20
1986	1 029.20	956.78	4 262.89	770.11	0.47	0.88	1.08	0.24
1987	1 323.02	1 204.76	5 083.78	988.87	0.50	0.83	1.10	0.26
1988	1 420.79	1 246.21	5 742.62	1 112.77	0.46	0.59	1.14	0.25
1989	1 656.95	1 479.66	6 419.76	1 081.69	0.49	0.63	1.12	0.26
1990	2 340.25	2 167.51	8 635.30	1 195.51	0.52	1.85	1.08	0.27
1991	2 878.14	2 868.76	10 139.87	1 486.02	0.57	1.01	1.00	0.28
1992	3 638.44	3 586.56	12 342.65	1 880.06	0.59	1.17	1.01	0.29
1993	4 215.34	4 053.88	15 762.13	2 413.98	0.52	1.42	1.04	0.27
1994	3 740.45	4 737.47	19 442.26	2 826.6	0.44	1.3	0.79	0.19
1995	4 949.19	6 312.38	25 768.32	3 736.59	0.44	1.69	0.78	0.19
1996	6 573.50	8 342.20	32 343.91	4 936.56	0.46	1.33	0.79	0.2
1997	8 122.96	10 374.71	37 521.04	5 590.27	0.49	0.93	0.78	0.22
1998	10 105.04	12 287.30	41 147.03	5 962.53	0.54	0.61	0.82	0.25
1999	11 109.23	13 533.06	43 114.56	6 209.66	0.57	0.32	0.82	0.26
2000	10 906.18	14 938.41	45 268.72	6 669.20	0.57	0.32	0.73	0.24
2001	12 040.22	16 787.19	48 222.53	7 162.14	0.60	0.41	0.72	0.25
2002	13 807.30	18 316.57	59 681.14	8 075.71	0.54	1.42	0.75	0.23
2003	15 882.31	22 802.38	64 824.52	9 639.23	0.60	0.53	0.70	0.25
2004	17 239.97	25 305.49	75 092.02	11 019.54	0.57	0.93	0.68	0.23
2005	19 088.10	30 265.37	83 449.26	13 436.64	0.59	0.62	0.63	0.23
2006	19 142.86	34 388.18	94 491.04	16 383.65	0.57	0.67	0.56	0.20
2007	21 508.59	33 952.00	104 012.98	18 949.90	0.53	0.50	0.63	0.21

(1) Rural loan balance is the sum of agricultural loan balance and loan balance of township enterprises. In the years 1978–1984, loan balance of township enterprises is the sum of loan balance of township enterprises and institutions from the People's Bank of China and from rural credit cooperatives, according to the 1990 *China Finance Yearbook*^[7]. In the years 1985–2007, data of loan balance of township enterprises are directly from *China Statistical Yearbook*^[7]. Besides, agricultural loan balance is the sum of the agricultural loan balance from the People's Bank of China, the collective agricultural loan balance from rural credit cooperatives, and the household loan balance from rural credit cooperatives. In the years 1985–

2007, data of agricultural loan balance are directly from the *China Finance Yearbook*^[7].

(2) Rural deposit balance is the sum of household deposit balance and agricultural deposit balance. Household deposit balance in rural areas is directly from the *China Finance Yearbook*, and the *Statistical Yearbook of Agricultural Bank of China*^[7–8]. And agricultural deposit balance refers to the deposit balance of rural collective economic organizations and township enterprises.

(3) Total rural output is the product of national GDP and the proportion of rural GDP in national GDP. National GDP is directly from the *China Statistical Yearbook*^[9–10]; and the pro-

portion rural GDP in national GDP is from the *Green Paper on China Rural Economy* ^[10-11].

(4) Due to the continued fast development of economy after the reform, China has experienced several serious inflations and price level has risen sharply. Therefore, rural loan balance, rural deposit balance, total rural output, and rural fixed assets investment should be divided by the price level at the same year, which are called the true values.

2 Graphical analysis

Graphical method is adopted in order to more intuitively reflect the development trend and historical track of relevant indices. Based on Table 1, Fig. 1 and 2 show the change trends of total rural output (*TRO*), rural loan balance (*RLB*), rural deposit balance (*RDB*), Financial Interrelation Ratio (*FIR*), level of financial efficiency (*LFE*), and level of financial development (*LFD*).

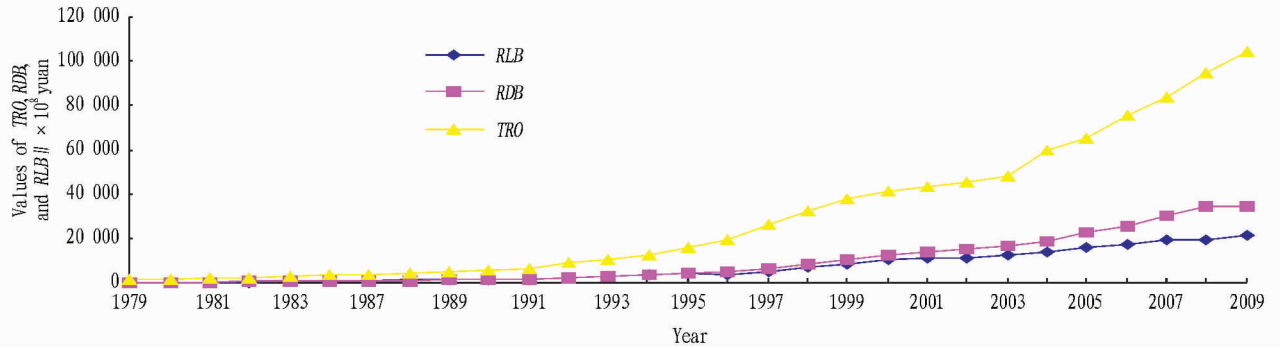


Fig. 1 Change trends of *TRO*, *RDB*, and *RLB*

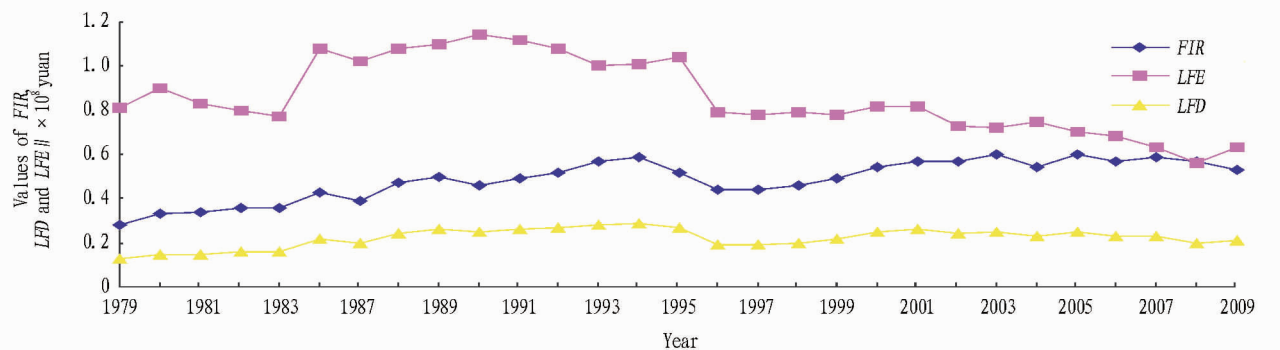


Fig. 2 Change trends of *FIR*, *LFD* and *LFE*

Fig. 1 illustrates that total rural output (*TRO*), rural loan balance (*RLB*), rural deposit balance (*RDB*) have significant positive correlation, which basically accords with the actual situation of rural economy in China. Fig. 2 illustrates that Financial Interrelation Ratio (*FIR*) shows relatively smooth change, except the rapid increase from 0.43 in the year 1984 to 0.59 in the year 1993. And market degree of rural financial institutions has improved rapidly. During this stage, rural financial institutions have just restored the "three natures" and state-owned specialized banks have developed rapidly, establishing a large state-owned financial system in a short time, which enhances the financial development level of rural financial institutions. However, due to the prominent structural contradictions among banks, market degree of rural financial institutions gradually decreases after the year 1993, and reaches the lowest level in history in the year 1995. After the year 1996, rural credit cooperative is separated from the agricultural bank. State-owned commercial banks are out of urban and rural markets and rural credit cooperatives dominate a monopoly position, which again stabilizes the market degree of finance to about 0.5. *LFD* and *FIR* of rural financial institutions have high correlation degree

with same change trend. *LFE* increases rapidly after the year 1984, mainly due to the new force of rural enterprises. Rural financial institutions have enhanced the loan intensity of township enterprises and the financial efficiency has been improved. After the year 1992, the assets diversification of financial institutions, the development of capital market, and the control of overexpansion of banks have caused the decline of deposit and loan ratio.

The above analysis shows that the financial interrelation ratio, the rural credit ratio, and the deposit-loan ratio are used as the indices reflecting the development level of rural finance, which is basically consistent with the development level of rural finance at different stages. Thus, the indices are representative.

3 Empirical analysis

3.1 Unit root test Eviews6.0 software is used to test the unit root of variables in order to determine the stationarity of variable. Growth rate of rural total output, rural economic efficiency, rural financial interrelation ratio, rural financial efficiency, rural financial development level are denoted by *GRTO*, *EE*, *FIR*, *LFE* and *LFD*, respectively. Hence, Table 2 reports

the test result.

Table 2 Test result of unit root of variables

Variable	ADF test	Test type	5% critical value	Lagging order	Stationarity of sequence
<i>GRTO</i>	-2.389 2	Linear trend term and constant term	-3.587 6	1	No
<i>EE</i>	-2.176 0	Linear trend term and constant term	-3.595 0	2	No
<i>FIR</i>	-2.041 2	Linear trend term and constant term	-3.587 6	1	No
<i>LFE</i>	-1.792 2	Linear trend term and constant term	-3.587 5	1	No
<i>LFD</i>	-1.851 5	Linear trend term and constant term	-3.587 5	1	No

Table 2 reports that all the *ADF* of index variables are bigger than the critical value of 5% significant level, indicating that the time sequence formed by the 5 indices is non-stationary. Before testing the cointegration relationship of variable se-

quence, we should first test whether the sequence of original variables is integrated series or not, because only the integrated series may have cointegration relationship. The test result is shown in Table 3.

Table 3 Test result of unit root of variables

Variable	ADF test	Test type	5% critical value	Lagging order	Stationarity of sequence
Δ <i>GRTO</i>	-5.089 4	Linear trend term and constant term	-3.595 0	1	Yes
Δ <i>EE</i>	-8.017 3	Linear trend term and constant term	-3.595 0	1	Yes
Δ <i>FIR</i>	-3.135 4	Constant term	-2.981 0	1	Yes
Δ <i>LFE</i>	-3.817 6	Constant term	-2.981 0	1	Yes
Δ <i>LFD</i>	-2.984 1	Constant term	-2.981 0	1	Yes

Table 3 indicates that under 5% confidence level, all the five variable sequences are integrated of order 1, that is $I(1)$. Thus, cointegration test can be applied. Cointegration system test based on VaR, which is put forward by Johansen and

Juselius, is tested. According to the *SC* guideline, cointegration equation shows a linear trend and has the model of intercept term. Table 4 reports the result of cointegration test.

Table 4 Result of cointegration test among variables

Number of cointegration variables under 0 hypothesis	Eigenvalue	Trace statistics	5% critical value	Probability
None *	0.702 3	73.367 5	69.818 9	0.025 3
At most 1	0.653 0	41.862 2	47.856 1	0.162 6
At most 2	0.286 2	14.342 0	29.797 1	0.820 9
At most 3	0.173 1	5.577 1	15.494 7	0.744 8
At most 4	0.024 2	0.635 9	3.841 5	0.425 2

Table 4 reports that there is a unique and stable cointegration relationship among the 5 variables sequences, indicating that within sample interval in the years 1979-2007, *GRTO*, *EE*, *FIR*, *LFE* and *LFD* have long-term equilibrium relationship. Whether the equilibrium relationship has causality relationship or not should be verified by the Granger Causality Test.

3.2 Granger Causality Test The key to Granger Causality

Test is the determination of the length of lag time. Effectiveness of test in actual analysis is determined by the optimal lag phase. If the lag phase is determined at random, it will lead to the error in test result. In this research, the optimal lag phase is determined by Schwarz *SC*. Causality among variables is analyzed by Eviews6.0. Table 5 shows the result of Granger Causality Test.

Table 5 Result of Granger Causality Test

Null hypothesis	Optimal lag phase	Number of samples	F value	P value
<i>GRTO</i> is not the Granger causality of <i>LFE</i>	2	27	0.149 3	0.862 2
<i>LFE</i> is not the Granger causality of <i>GRTO</i>	2	27	3.712 0	0.040 8
<i>GRTO</i> is not the Granger causality of <i>FIR</i>	1	28	0.572 3	0.456 4
<i>FIR</i> is not the Granger causality of <i>GRTO</i>	1	28	0.368 8	0.549 2
<i>GRTO</i> is not the Granger causality of <i>LFD</i>	1	28	0.106 8	0.746 6
<i>LFD</i> is not the Granger causality of <i>GRTO</i>	1	28	0.001 1	0.973 7
<i>EE</i> is not the Granger causality of <i>LFE</i>	1	28	0.556 9	0.462 5
<i>LFE</i> is not the Granger causality of <i>EE</i>	1	28	0.910 3	0.349 2
<i>EE</i> is not the Granger causality of <i>FIR</i>	1	28	0.010 6	0.918 7
<i>FIR</i> is not the Granger causality of <i>EE</i>	1	28	0.208 4	0.652 0
<i>EE</i> is not the Granger causality of <i>LFD</i>	1	28	0.034 6	0.854 0
<i>LFD</i> is not the Granger causality of <i>EE</i>	1	28	0.008 8	0.925 9

Table 5 reports that under 5% significant level, *LFE* is the one-way Granger causality of the change of *GRTO*; there is no causality among *GRTO*, *LFD* and *FIR*; there is also no causality among *EE*, *FIR*, *LFD* and *LFE*. The result verifies that there is one-way causality between rural financial development level and rural economic growth rate; but rural financial development level shows no significant correlation with rural economic efficiency.

4 Conclusion and policy implication

4.1 Conclusion The following conclusions can be obtained according to the above analysis and test:

(1) Since the rural economic development is not the Granger causality of rural financial development, rural economy has not fundamentally promoted the development of rural finance and rural financial development has clearly lagged behind the growth of rural economy, although rural financial system has experienced more than 30 years' reform and development with Agricultural Bank of China, Agricultural Development Bank of China, and rural credit cooperative as the main bodies.

(2) Since rural financial development is the Granger causality of economic growth, rural financial system reform and development have certain positive effect on rural economic development. Correspondingly, the backward reform and development of rural financial system will inevitably restrict the agricultural restructuring, rural development and farmers' income to a certain extent. Accelerating the reform of rural financial system and promoting the rural economic development have already become the inevitable choice to solve the "Three Agricultural Problems" at present.

(3) Since rural financial development is not the Granger causality of rural economic efficiency, support of rural finance to rural economy is realized through the promotion of investment and deposit, which has not effectively enhance the economic efficiency. According to the research by Beck *et al.*, finance supports the economic growth mainly through economic efficiency^[12]. On the contrary, financial development path in China is completely different from that in other countries with normal market economy, where economic growth is supported by capital accumulation. If remaining the current financial development path unchanged, China should pay a large amount of resources to improve the output level. However, resources are scarce, so this situation certainly can not be sustained. Therefore, financial development in China must take the promotion of economic efficiency as the core, so does the development rural finance.

4.2 Policy implication To sum up, the long-run equilibrium relationship between rural financial development and economic growth is consistent with the mainstream view of financial development theory, indicating that rural economic growth in China has already abandoned the extensional growth mode simply relying on human and material inputs, and has gradually turned into endogenous growth mode relying on the input of financial factors. It is of great significance for rural economic growth to accelerate rural financial system reform and to improve the development level of rural finance^[13]. Affected by various factors,

development scale of rural finance is seriously backward and can not help to enhance the rural economic efficiency. Based on this, government should further strengthen the promotion function of financial development for economic efficiency, change the current path of financial development, and gradually establish a virtuous circle system for rural finance and economic development.

References

- [1] ZHANG MW. Reform and opening up is the inevitable choice for the construction and development of socialism with Chinese characteristics[J]. Education Exploration, 2010(3):122–123. (in Chinese).
- [2] LI D. The achievements of China's financial industry during the past three decades of reform and opening up (I)[EB/OL]. (2008-07-01). <http://active.zqjrw.com/News/200871/Finance/297330220801.html>. (in Chinese).
- [3] Department of Rural & Social Economic Survey, National Bureau of Statistics of China. China rural statistical yearbook:1979–2008[M]. Beijing: China Statistics Press, 1979–2008. (in Chinese).
- [4] WANG JQ, ZONG YX, ZHAO BH. Empirical analysis on the financial developing level of rural co-ops and rural economical increase—taking Hebei Province as an example[J]. Xinjiang State Farms Economy, 2009(4):50–55. (in Chinese).
- [5] YUE CJ. Empirical analysis of the effects of rural financial development on the rural economic growth in Henan Province[J]. Journal of Anhui Agricultural Sciences, 2008(13):5636–5637, 5640. (in Chinese).
- [6] LU LJ, WAN GF, ZHAO MY. Empirical analysis on China's investment accelerator model[J]. Journal of Qujing Normal College, 2003(6):75–78. (in Chinese).
- [7] The Editorial Department of China Finance Yearbook. China finance yearbook:1986–2008[M]. Beijing: China Financial Publishing House, 1986–2008. (in Chinese).
- [8] Agricultural Bank of China. The statistical yearbook of Agricultural Bank of China:2000–2008[M]. Beijing: China Statistics Press, 2000–2008. (in Chinese).
- [9] National Bureau of Statistics of China. China statistical yearbook:1979–2008[M]. Beijing: China Statistics Press, 1979–2008. (in Chinese).
- [10] YAO YJ, HE PC. Rural financial development and economic growth in China (1978–2001): empirical research[J]. Journal of Northwest A&F University: Social Science Edition, 2004(6):1–6. (in Chinese).
- [11] Rural Development Institute Chinese Academy of Social Science, Department of Rural & Social Economic Survey, National Bureau of Statistics of China. The green paper on China rural economy[M]. Beijing: Social Sciences Academic Press, 1979–2008. (in Chinese).
- [12] BECK T, LEVINE R, LOAYZA N. Finance and the sources of growth[J]. Journal of Financial Economics, 2000, 58:261–300.
- [13] LI Z. Empirical research on rural economic growth and financial support[J]. Market Modernization, 2009(1):372–374. (in Chinese).
- [14] KAN XX, HAN XL. Empirical analysis on rural financial support situations and farm's income increase[J]. Journal of Anhui Agricultural Sciences, 2010, 38(10):405–406, 440. (in Chinese).
- [15] LIANG JX, GUO P. Empirical analysis on the efficiency of rural financial service in Heilongjiang Province[J]. Science-Technology and Management, 2010, 12(1):11–15. (in Chinese).
- [16] DENG L, WANG YP. Supervision of foreign banks with the opening of rural financial market[J]. Journal of Anhui Agricultural Sciences, 2009, 37(15):408–410. (in Chinese).