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Relationship between Rural Financial Development and Farmer's Income Growth

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Abstract According to the research on the relationship between rural finance and farmers' income growth by domestic scholars, there are certain disadvantages in the stationary test, model design and data collection of time series data. According to the data from 1992 to 2005, per capita net income of farmers, rural credit investment, structure of rural employees and price index of agricultural products are selected as four indices. Eviews 5.0 software is used to analyze the relationship between rural financial development and income growth. OLS regression mode is established by Granger Causality Test, ADF test and co-integration relation test. Result shows that test statistic value is -2.8718 , which is smaller than the -1.9710 critical value at 5% significant level. Thus, the residual sequence is a stationary sequence, indicating that there is Co-integration relationship among per capita net income of farmers, rural credit investment, structure of rural employees and price index of agricultural products. Finally, it is put forward that we should accelerate the development of rural finance and reinforce the support for rural credit in order to improve farmers' income.

Key words Rural finance; Income growth of farmers; Granger Causality Test; Co-integration Test; China

Based on the sustained economic growth, income level of Chinese residents has increased gradually since the year 1978, which promotes the rapid development of rural economy, improves the life quality of farmers greatly and enhances the net income of farmers from 133.6 yuan in the year 1978 to 4761 yuan in 2008. However, analysis of structural changes of farmers' income shows that the proportion of agricultural income gradually declines. Wang Hu *et al.* find out that since the year 1992, nonagricultural income in China has played a continued and strong role in promoting the income of farmers^[1]. Zhang Chewei *et al.* argue that contribution of non-agricultural income to farmers' income growth has increased by 1.52 times in the year 2000^[2], indicating that the source of income growth of farmers has changed fundamentally. Practice has proved that economic growth is affected by the financial system and finance plays an important role in rural economic growth. Based on this, we discuss the important role of rural financial development in promoting the farmers' income growth, which provides references for policy making of rural economy.

1 Review of literatures

Scholars in China have paid great attention to the problem of farmers' income. Xu Xiaobo *et al.* have studied on the relationship between economic development and rural financial deepening. They first put forward the financial interrelation ratio (FIR) of rural China and analyze the relationship between rural credit capital and rural national income growth^[3]. Qu Shang *et al.* believe that insufficient agricultural credit capital at present is a very important restrictive factor affecting the income growth of farmers, and effective interactive mechanism for farmers' income increase and agricultural credit support is discussed^[4].

Wen Tao *et al.* carry out Co-integration analysis on the relationship between farmers' income growth and the development of rural finance and China's overall finance. They point out that financial development of China has significant negative impact on the income growth of farmers, and there is no Co-integration relationship between the rural financial development and farmers' income. The positive relationship between financial development and economic growth can be used to directly replace that between financial development and farmers' income growth, which does not correspond to the status of economic development in China^[5]. Xu Chongzheng *et al.* establish the Multiple Linear Regression Model by simple least square method according to the historical statistics, study on the support of rural finance to farmers' income by carrying out the regression analysis of related factors, analyze the farmers' credit investment, education degree, employment structure, and prices of agricultural products, and obtain that the credit investment can not promote the income increase of farmers and is at extremely low efficient state^[6].

Different from the existing conclusions, Wang Hu *et al.* use the data in the years 1980–2004 to research on the dependence relationship and influence mechanism between financial development and farmers' income. Result shows that financial development promotes the income of farmers, but also significantly widens the income gap between urban and rural areas. They also find out that effects of financial development on farmers' income can be realized through capital accumulation, rural human capital, industrial structure change, rural labor transfer, and state financial support^[1].

Although many domestic scholars have obtained some valuable conclusions through the research on the relationship between financial development and income growth, most of them use OLS analysis method without carrying out stationary test on

time series data. If the time series data are not stationary or are not treated properly, there might be a serious "spurious regression". During model design, financial development is taken as the single explanatory variable to analyze the impact on farmers' income. But in fact, factors influencing the farmers' income are complex, so that conclusion is somewhat distorted. In the aspect of data collection, most researches take the year 1978 as the initial stage. But non-agriculture income has played a promoting role in the farmers' income since the year 1992. It can be basically considered that non-agricultural income is driven by the development factor of rural finance. Taken the year 1978 as the research materials, analysis result is all in a mess and can not explain the positive or negative effects of financial development on the farmers' income. According to the 1993 – 2006 *China Statistical Yearbook*, empirical study on the relationship between financial development and income growth is carried out.

2 Index selection, data source and research method

2.1 Data selection The first index is per capita net income of farmers. Net income includes productive net income and non-productive net income, and data of net income collected belong to productive net income. The second is credit investment in rural areas. Rural credit investment data are the sum of township enterprise loan and agricultural loan. The third is structure of rural employees. Transfer of rural surplus labor force is a way to improve the income of the farmers. Nonagricultural workers and agricultural workers are used to evaluate the structural rationality of rural workers; and higher proportion indicates a more rational rural employment structure. The fourth is price index of agricultural products, which is expressed by the purchasing price index of agricultural products. Due to the limited data, price index of agricultural products is replaced by the rural price index after the year 2001. Taking the data in 1992 as the base period, price index in the year 1992 is defined as 1 for the convenience of calculation.

2.2 Data source Data are from the 1993 – 2006 *China Statistical Yearbook*. Since the year 1992, non-agricultural income has played a continued and strong role in promoting farmers' income. Through selecting the data in the years 1992 – 2005, effects of financial development on the farmers' income are analyzed.

2.3 Research method

2.3.1 Granger Causality. Test of rural finance and farmers'

income. Causation between rural finance and farmers' income growth is tested, which is shown in Table 1.

Table 1 Result of Granger Causality Test

Null hypothesis	F statistics	P value
LNI is not the Granger cause of LNY	9.747 4	0.009 5
LNY is not the Granger cause of LNI	1.245 9	0.344 5

Table 1 shows that credit investment in rural areas is the Granger cause of per capita net income of farmers at 5% significant level; while per capita net income of farmers is not the Granger cause of rural credit investment. Therefore, during the design of model, credit investment in rural areas is taken as the explanatory variable of per capita net income of farmers.

2.3.2 Design of model. Cobb – Douglas production function model is put forward by U. S. mathematician Cobb and economist Douglas at the 1930's, which is

$$Q = AL^\alpha K^\beta,$$

where Q is yield, L and K are labor and capital inputs, A is technological and structural factors, α and β are parameters and $0 < \alpha, 0 < \beta$.

Taking Cobb – Douglas production function model as the basis, per capita net income of farmers (y), rural credit investment (i), structure of rural employees (s) and price index of agricultural products (p) are introduced. The equation can be expressed as $y = A(p)^\alpha (i)^\beta (s)^\lambda$. Taking logarithm on both sides, we have $\ln y = c + \alpha \ln p + \beta \ln i + \lambda \ln s + \xi$, where C is constant, α, β and λ are regression coefficients, ξ is residual error, and $\ln y, \ln i, \ln s$ and $\ln p$ are per capita net income of farmers, credit investment in rural areas, structure of rural employees and price index of agricultural products respectively. This mode shows that financial development has greatly affected the income of farmers. Conducting OLS regression modeling without testing the stationarity of data may lead to spurious regression. Therefore, unit root test and Co-integration test on data are conducted in order to establish regression model.

2.3.3 Unit root test. Eviews 5.0 software is used to conduct ADF unit root test on first order difference and original data of variables. According to the broken line graph of $\ln y$, the sequence has shown significant upward trend. Thus, test equation has both constant and trend terms. After carrying out first order difference and ADF test, the new sequence $d\ln y$ shows no upward trend. Therefore, test equation select only the constant term. The same method of ADF test is used for other variables and the test result is shown in Table 2.

Table 2 Result of ADF test

Variable	Test type (c,t,m)	ADF test value	Critical value		Stationary or not	Integration order
			1%	5%		
$\ln y$	(c, t, 3)	-2.659 3	-5.295 4	-4.008 1	Non-stationary	-
$\ln i$	(c, t, 1)	-3.246 6	-4.992 2	-3.875 3	Non-stationary	-
$\ln s$	(c, t, 2)	-1.466 2	-5.124 8	-3.933 3	Non-stationary	-
$\ln p$	(c, t, 0)	-2.082 8	-4.992 2	-3.875 3	Non-stationary	-
$D\ln y$	(0, 0, 0)	-2.325 2	-2.792 1	-1.977 7	Stationary	1(1)
$D\ln i$	(0, 0, 0)	-6.854 9	-2.792 1	-1.977 7	Stationary	1(1)
$D\ln s$	(c, t, 2)	-3.956 2	-5.124 8	-3.933 6	Stationary	1(1)
$D\ln p$	(0, 0, 0)	-1.991 0	-2.771 9	-1.974 0	Stationary	1(1)

Note: $D\ln y$ stands for the first order difference of $\ln y$, the same as others. (c, t, m) means that the rest model has intercept term c, trend term t and lag-order number m.

Test result shows that the original lny , lni , lns and lnp are not stationary variables under 5% significant level. Difference method is used and first order difference values of $dlny$, $dlni$, $dlns$ and $dlnp$ are obtained. Sequence after first order difference is stationary under 5% significant level. According to the Co-integration theory, sequences at the same order passing the stationarity test can use Co-integration test to analyze their Co-integration relationship.

2.3.4 Co-integration relation test. Since per capita net income of farmers, rural credit investment, structure of rural employees and price index of agricultural products all belong to I (1) series, we conduct Co-integration analysis on these four variables. EG two-step method is adopted to study on the Co-integration relationship among the four variables.

(1) Co-integration regression on variables is conducted; regression analysis is carried out by using the least square method. Regression equation is established:

$$\begin{aligned} lny &= 0.9896 + 0.5484lns + 0.7757lnp + 0.03924lni \\ &\quad (0.4267) \quad (0.2227) \quad (0.1932) \quad (1) \\ t &= \quad (1.2862) \quad (3.4834) \quad (2.0308) \\ R^2 &= 0.9502 \quad \bar{R}^2 = 0.9353 \quad F = 63.6838 \quad S.E. = 0.1111 \end{aligned}$$

Regression equation shows that the constant term having not passed the T test is the most insignificant. According to the result of empirical research by Shao Dan, the constant term can be removed when it is not significant. And re-establishment of a new regression equation can obtain a better predictive effect^[7]. Therefore, this model should not have constant term. And regression model is reestablished by removing the constant term in the following OLS regression, the result of which can be expressed as

$$\begin{aligned} lny &= 0.3825lns + 0.8406lnp + 0.4611lni \\ &\quad (0.1347) \quad (0.1511) \quad (0.0940) \quad (2) \\ t &= \quad (2.8387) \quad (5.5610) \quad (4.9032) \\ R^2 &= 0.9494 \quad \bar{R}^2 = 0.9402 \quad S.E. = 0.1068 \end{aligned}$$

Result shows that all the variables in the model can pass the T test and the fitting goodness is extremely high after removing the constant term.

(2) ADF test on residual error in equation (2) is carried out. If there is no unit root in residual error, it can be concluded that there is Co-integration relationship among lny , lni , lnp and lns . Unit root test on residual error shows that under 5% probability level, statistic value of T test is -2.8718 , which is smaller than the -1.9710 critical value. Thus, the residual series is stationary series, indicating that there is Co-integration relationship among per capita net income of farmers, rural credit investment, structure of rural employees and price index of agricultural products, and using OLS to estimate regression equation (2) is also meaningful.

3 Conclusion and suggestion

3.1 Promoting the growth of farmers' income in China by the development of rural finance Analysis shows that development of rural finance has positive correlation with the farmers' income and can promote the growth the farmers' income in the long term. This indicates that development of rural finance can promote the growth of farmers' income in China and also verifies that development of finance can promote the growth of rural

economy and stimulate the growth of rural economy. However, the result is inconsistent with the research conclusion of Wen Tao, who finally obtains that development of rural finance has no Co-integration relationship with farmers' income; replacing the relationship between financial development and farmer's income growth by positive relationship between financial development and economic development is not consistent with the fact of China's economic development.

3.2 The lose relationship between rural credit investment and farmers' income growth

Equation (2) shows that lni , lnp and lns in regression equation are all significant, and have all passed the T test. Among them, flexibility of credit investment in rural areas is 0.4611, that is, every 1% growth of credit investment in rural areas will lead to 46.11% increase of per capita net income of farmers. Structural flexibility of rural employees is 0.3825, that is, every 1% structural increase of rural employees will lead to 38.25% increase of per capita net income of farmers. Flexibility of price index of agricultural products is 0.8406, that is, every 1% increase of price index of agricultural products will lead to 84.06% increase of per capita net income of farmers. Among them, price index of agricultural products has the maximum flexibility, indicating that both price rise of agricultural products and the minimum price of agricultural products have significant impact on the farmer's income growth. Analysis result also shows that there is close correlation between rural credit investment and farmers' income growth in the long term, which is not consistent with the research result of Xu Chongzheng, who obtains that credit investment can promote the income growth of farmers at an extremely inefficient state.

3.3 Paying attention to the effects of rural financial development on farmers' income

OLS regression mode can be established by Granger Causality Test, stationarity test on time series and Granger Co-integration relation test on variables. Result shows that rural credit investment has significant impact on the farmers' income, which explains why non-agricultural income has played a continued and strong promoting role since the transition of market economy in the year 1992. Therefore, Chinese government should strengthen the reform of rural financial system, actively guide the investment of rural credit, promote the income growth of farmers, and provide important guiding significance for the rural economic growth and income growth of farmers.

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to reduce the cycle of effect exertion of agricultural financial expenditure. On the other hand, we should enhance the use efficiency of agricultural financial expenditure and reduce the efficiency loss.

(3) Rural residents income in Guangdong Province has great impact on the income growth of rural residents, indicating that income growth of rural residents will form a mechanism with self-promotion, so as to promote the steady increase of income. This mechanism exerts its function through the following channels. Firstly, growth of income has increased the input of agricultural production, and leads to the income increase of the next period. Secondly, growth of income has strengthened the investment in human capital. According to the human capital theory, investment in human capital can play a role in the long term. Therefore, Guangdong Province should promote the formation of mechanism with self-promotion for rural residents from the aspects of finance, education and so on. Moreover, Guangdong Province should promote the subsidy and insurance systems in order to ensure the smooth operation of mechanism with self-promotion.

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广东省城镇居民收入,农业财政支出与农民收入的协整分析

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摘要 在简述前人研究成果的基础上,介绍了 ADF 检验法、Johansen 检验法以及误差修正模型。根据 1985~2006 年广东省的相关数据,运用协整分析、误差修正模型以及脉冲响应函数、方差分解技术研究了广东省城镇居民收入、农业财政支出对农村居民收入的动态影响。结果表明,虽然广东省城镇居民收入对农村居民收入有短暂的负向效应,但更主要的是其长期、稳定的正效应,城镇居民收入的增加总体上可以促进农村居民收入的增长;农业财政支出对农村居民收入增长的效应在短期较不稳定,而在长期,其对农村居民收入具有稳定而微弱的正效应;农村居民收入自身对农村居民收入增长的影响较大,这意味着当农村居民收入达到一定水平时,便可能产生一种自我增进机制,促进农村居民收入的持续增加。

关键词 农村居民收入;城镇居民收入;农业财政支出;协整分析;广东省

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我国农村金融发展与农民收入增长关系的实证研究

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摘要 通过国内学者对农村金融与农民收入增长关系的研究发现,在时间序列数据进行平稳性的检验、模型设计、在数据收集 3 个方面存在着一些不足。基于此,依据 1993~2006 年《中国统计年鉴》中 1992~2005 共 14 年的数据,分别选取农民人均纯收入、农村的信贷投入、农村从业人员的结构、农产品价格指数 4 项指标,采取统一规范的分析方法,采用 Eviews5.0 统计软件对农村金融发展与收入增长之间的关系进行计量分析,通过格兰杰因果关系检验、ADF 检验,以及协整关系检验,建立 OLS 回归模型。结果表明,检验统计量为 -2.8718,小于显著性水平 5% 时的临界值为 -1.9710,可以认为估计残差序列 e 为平稳序列,表明序列农民人均纯收入、农村的信贷投入、农村从业人员的结构、农产品价格指数之间具有协整关系,因而提出应该加大农村金融的发展,以及对农村信贷的支持力度,从而提高农民收入。

关键词 农村金融;农民增收;格兰杰因果关系检验;协整检验