Empirical Research on the Relations between Farmers' Income Increase and Economic Development in Henan Province

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Abstract   According to data of per capita net income of rural households and the per capita regional gross output from 1978 to 2008 provided by the *Henan Statistical Yearbook*, we know that both of the time series obey the unit root process, so they belong to non-stationary time series. The results of the Engle-Granger two-stage estimation method show that the two terms have long-term stable integration equilibrium relations. The results of Granger Causality Test show that there is only the one way Granger Causality relation from farmers' income increase to economic growth. Connecting with the reality of Henan Province, the possible reasons are analyzed. The population of rural residents is huge and the income level of the rural residents are low, and the marginal consumption tendency is bigger than urban and township residents, so the increase of farmers' income will promote economic growth. Notably, the income increase of farmers is even more helpful to expand domestic demand. Since 1978, the consumption level and structure of farmers in Henan Province is increasing gradually and the role played by of farmers' income increase in stimulating economic growth is increasing. Besides, the urban-rural double system which serves for economic development strategy is the historic root for the expanding gap of urban and rural income. In addition, the economic policy which gives priority to cities is the system root for the expanding gap of rural and urban income.

Key words   Farmers' income, Economic growth, Granger Causality Test, Co-integration analysis, Henan Province, China

As a granary province and the province with the largest population in China, the three problems concerning agriculture, countryside and peasants in Henan Province are the key point and difficult point for building a well-off society in an all-around way and realizing the rapid rise of Henan Province. So the problems of farmers' income increase are always the central task of rural problems. In 2009, the per capita net income of rural residences in Henan Province is 4 807 yuan, only account for 33.4% of the disposable income of urban residences at the same period. Obviously, the rapid increase of economic in Henan Province has not improved the economic status of the whole urban and rural areas at the same level. From the perspective of causality, there are many relations between the farmers' income increase and economic development：the farmers' income increase is the cause of the changes of economic development；the economic development is the cause of the farmers' income increase；the two series are independent and move along the different direction；the two series have the response of the same direction to the third party factor simultaneously. By using the metrology and inspection methods developed by Granger and some other scholars, it can be analyzed whether the two factors has the certain causal connection and research the direction of the influences[1]. On the strength of the data from the *Henan Statistical Yearbook* and by using the

Granger causality test, the relations between farmers' income increase and economic development in Henan Province are researched.

1   Data source and research method

1.1   Data source and processing   From the *Henan Statistical Yearbook* from 1979 to 2009, the following information can be obtained. the per capita net income of rural residences in each year in yuan terms；the GDP of the region in each year in yuan terms；the annualized link relative ratio of the CPI of rural residents；the fixed base index of the GDP of the region in the past year[2].

In order to conduct the direct comparative analysis on the data from different years, I apply the CPI to reduce and converse the nominal income of farmers in the very year into the data that can be used to compare. In the first place, I converse the CPI of the link relative ratio of the past years in Henan Province into the fixed base index, then I deflate the nominal income, the real income of the past years（INC）can be obtained. The economic development level of Henan Province applies the per capita GDP as the proxy variable and the level is deflated by using the gross product index of the very year. The two series are uniformly conversed to the comparable date which takes 1992 as the basic period.

Due to the huge variation on economic system before and after the reform and opening up, the year of 1978 is nearly the structural breakpoint of all the important economic variables, so the time period of the samples is after the reform and opening up, that is from 1978 to 2008. In order to do elastic analysis

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and eliminate the possible influence of time heteroscedasticity, the logarithmic transformation is conducted on the two time series by using the method that is frequently used in empirical analysis[3]. The new variables can be simplified as the $LINC$ and $LGDP$.

1.2 Research method The research uses the Granger causality test to analyze the relations between farmers' income increase and the economic development. As for the two time series y_t and x_t, if the conditional distribution of y_t determined by the lagged value of y_t and x_t is equal to the conditional distribution determined by the lagged value of y_t alone, then x_t does not have causality relations with y_t; contrarily, if the accuracy of predicting the y_t is improved significantly after adding the lagged value of t_t, then x_t has the causality relations with y_t.

According to that the test form can set as follows:

$$y_t = \sum_{t=1}^{k} \alpha_i \cdot y_{t-1} + \sum_{t=1}^{k} \beta_i \cdot x_{t-i} + \mu_t \qquad (1)$$

In the formula, k refers to the lagged period. If the evaluated value of the coefficient of x_{t-i} in each stage in formula(1) is insignificant, then x_t does not have Granger causality relations with y_t[4].

There are four possible results of the Granger causality test, which cover the bi-directional causality relations, one-way causality in two directions and the no causality. The Granger causality relation type of the two time series can be analyzed by using the standard F, only when one has chosen the suitable lag parameter k.

It is notable that the Granger causality test suits only for stable time series or for non-stable time series with the co-integration and equilibrium relationship, or else, the test result is invalid[5]. That means we should ensure that the two time series of $LINC$ and $LGDP$ are stable.

2 Results and analysis

2.1 Data analysis Fig. 1 is the line chart of the per capita net income of farmers in Henan Province ($LINC$) and the logarithm per capita gross domestic product($LGDP$).

It can be seen from Fig. 1 that both the $LINC$ and the $LGDP$ show obvious non-linear long-term increase trend, so the serious is typical unstable. Since the reform and opening up, the annual average growth of farmers' income is 6.3%, far less than the growth of GDP at the same period of time, and it varies obviously in different time period. In the middle of 1980s, the farmers' income increased not only relatively slow, but also fluctuated rapidly, and then it increased steadily. From 2006 to now, the farmers' income enters an new rapid growth stage whatever in the growth range or in the time duration.

At the same time, the GDP of Henan Province shows the growth feature of "step-type". Before the middle of 1980s, the growth was relatively rapid. In the following years, the GDP even showed the downward trend, but in 1990s, it rebounded back and achieved rapid growth, but affected by the Asian financial crisis, the GDP of Henan Province was hesitating to press forward for six years, and dropped slightly. Its growth pace did not increase obviously until 2003.

2.2 The test on the stability of the time series The test on the stability adopt the method of ADF(Augmented Dickey-
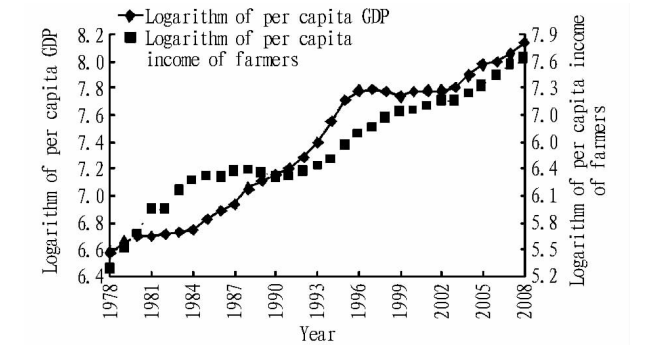

Fig. 1 The time series relations between $LGDP$ and $LINC$ in rural areas of Henan Province from 1978 to 2008

Fuller); the optimized lagged order is determined by the SC (Schwarz Criterion); and the t test apply the MacKinnon one-side critical point threshold to calculate the accompany probability, and the results are shown on Table 1.

Table 1 The ADF test on the stability of time series

Variables	Test form	t statistics	Accompany probability	Stable or not
$LINC$	$(c,t,1)$	−3.09	0.127 4	No
$LGDP$	$(c,t,1)$	−2.43	0.356 1	No
$\triangle LINC$	$(c,0,1)$	−3.08	0.039 4	Yes
$\triangle LGDP$	$(c,0,0)$	−3.09	0.003 1	Yes

Notes: $\triangle$ is difference operator; test form(c,t,k) refers to the constant intercept, deterministic time trend and lag order in the test equation respectively, and 0 means there is no such item.

It can be seen from Fig. 1 that the $LINC$ and $LGDP$ show obvious growth trend, so its instability can be seen directly. The researches on the one order timing difference all reject the null hypothesis at the 5% of significance level, so they are stable. At last, the horizontal time series $LINC$ and $LGDP$ are all one side integrated order, that is obey the I(1) process. Although the two sides are all the non-stable process, but once there is the co-integration relation, the Granger causality test can be conducted.

2.3 The test on the co-integration relations In view of the reduction of variables in the research, we apply the classic EG (Engle-Granger)two-stage test to test the existence of the co-integration relation[6].

In the first place, the least logarithm square method (OLS) is applied to estimate the linear regression equation of the two variables, the results are shown as equation (2). The number in the round brackets and square brackets are the standard deviation of the coefficient estimates and the t statistical value respectively. The coefficient estimates and whole regression equation are significant at the 1% level.

$LGDP_t = -1.474\ 5 + 1.095\ 9LINC_t$ (2)
s. e. $=(0.552)\ (0.074); t = [-2.668]\ [14.634]; F = 214.17;$
$A. R^2 = 0.876$

And then, the stability of the residual series mode is tested. If there is the co-integration relation, the residual should be the stable process without unit root. Conducting ADF test on the time series stability the test form should be $(0,0,1); t$ statistical value is −2.145; accompany probability is 0.033; the re-

sult of the test shows that the residual time serious obeys the I(0) process at the significance level of 5%. So the co-integration relation showed on equation (2) is really existed and meaningful. As for the non-stable time serious *LINC* and *LGDP* with the co-integration balance, the Granger causality test can be used to study the causality of them.

2.4 Granger causality test The Granger causality test of two directions is conducted independently. Usually, with the increase of the value in the lag period, the number of the sample will decrease relatively and the specific form of formula (1) will change, so it is inevitable that the test results will have some differences. Because the Granger causality test is sensitive to the value in the lag period, the test presents the results obtained when the lag parameter *k* equals 1,2,3 and 4(Table 2).

Table 2   Granger causality test of *LINC* and *LGDP*

Null hypothesis	Lagged differences	*F* statistics	Accompany probability	Test result
LINC is not the Granger causality of *LGDP*	1	7.347 1	0.011 5	Refuse
LGDP is not the Granger causality of *LINC*	1	0.073 9	0.787 8	Accept
LINC is not the Granger causality of *LGDP*	2	2.239 0	0.128 4	Accept
LGDP is not the Granger causality of *LINC*	2	1.450 5	0.254 2	Accept
LINC is not the Granger causality of *LGDP*	3	4.307 9	0.196 9	Accept
LGDP is not the Granger causality of *LINC*	3	0.328 2	0.804 9	Accept
LINC is not the Granger causality of *LGDP*	4	3.083 4	0.264 3	Accept
LGDP is not the Granger causality of *LINC*	4	0.531 5	0.714 3	Accept

Table 2 indicates that, when the lagged difference equals 1, it can refuse the null hypothesis that the *LINC* is not the Granger causality of *LGDP* at the 5% significant level, at the same time, accept that *LGDP* is not the Granger causality of *LINC*. But the relation is not so stable, with the march of time and in particularly in the stage 2 of lagged differences. The influence of *LINC* on *LGDP* is not so obvious rapidly. It further indicates that the *LINC* only has short term influence on *LGDP*.

Usually, the smaller the number of the lagged differences, the more reliable the tests result is. So I draw the conclusion that there is only one way causality relation between *LINC* and *LGDP*: *LINC* is the Granger causality reason that cause the change of *LGDP*, the latter response to the change of the former one after about one year. On contrary, it does not work.

3   Conclusions and discussions

3.1 Conclusions Investment, consumption and export are the troika for economic growth in China, among them consumption plays the determinant role. The consumption rate in China shows the downward trend, which is not only far lower than the world average level of 80.1%, but also lower than the average level of 74.3% in middle and low income countries[7]. The insufficient consumption demand has become the main choke

point for economic growth. The main reason for the persistently appeared production capacity surplus and high trade surplus is that the effective consumption demand of massive farmers is insufficient. The income is the basic factor that restricts the improvement of farmers' consumption level. The population of rural residents is large and they have low income level. The consumption demands of rural residents are larger than urban residents, so the increase of farmers' income will promote the increase of consumption; especially the increase of low-income farmers is conducive to expanding domestic demand. Since 1978, the consumption level and structure of farmers in Hebei Province has been increasing and its pulling function to the economic growth is increasing gradually. Therefore, it is easy to understand the conclusion that farmers' income increase is the Granger causality of the economic growth of Hebei Province.

Since the reform and opening up, Chinese economy increases by an annualized growth of 9.8%, which is regarded as the "Chinese miracle". But at the same time the income gap between urban and rural residents has being increasing sharply since the 1980s, and the speed of expansion increases obviously in recent years. The Gini coefficient is 0.329 in 1981, 0.329 in 1995, 0.458 in 2005 and 0.458 in 2005, far exceeding the national warning line[8]. In 1978, the ratio of urban and rural residents' income has come to 3.01. With the reform of economic system in rural area, the gap between the income of rural and residents has shrunken in a certain period of time. But as the reform hub is transferred from rural areas to urban areas, the income gap of urban and rural residents continues to expand, the maximum is 3.10 in 2003. Until the recent years, the income gap between urban and rural residents still lingers in a high position. In 2009, the ratio is 2.97. In the recent two years, the gap increases slowly. In fact, except for the currency income, there is great unfairness in the opportunities shared by rural and urban residents in terms of finance and social security and some other public wealth. The real income gap is far larger than statistics. The urban and rural double layer economic system, which served for the catching-up type economic development strategy is the historical root that leads to the income expansion in urban and rural areas. And the economic policies which tend to cities are the system root that leads to the consistently increased income gap of urban and rural residents[9]. The income of farmers is hard to increase with the pace of Henan economic growth, that is to say, in the process of improving the economic development, the farmers' income level is lagging behind. Therefore, it is easy to understand why the economic growth is not the Granger causality of farmers' income increase.

3.2 Discussions The increase of farmers' income is the Granger causality of economic growth, but the economic growth is not the Granger causality of farmers' income increase, which fully explains the importance of farmers' income increase in promoting economic development of Henan Province; in coordinating the rural and urban development and in narrowing the income gap of rural and urban residents. At present, affected by

the newly added dry land is used for growing wheat, 40% of it is used for growing corn, 60% of that is used for planting sweet potatoes, 70% of that is used for growing vegetable and the multiple-cropping index is 190%, and then the annual newly added net benefits got from the new dry land is 0.690 6 million yuan. In conclusion, the newly added net income after land consolidation is 0.723 6 million yuan. Therefore, it can be seen that the social benefits caused by the project is huge. Although the ecological benefits are prominent and economic benefits are mediocre, the project has achieved the unity of social benefits, economic benefits and ecological benefits on the whole. The project is in accordance with the target of land development and consolidation.

4　Conclusions

　　The practice shows that the land development and consolidation project in Fengjie County has realized the occupation-requisition balance of land use on the whole; smoothed the conflicts between population and land; improved the agricultural production situation and ecological environment. The project is an effective way for supplementing farmland. Meanwhile, the project is conducive to providing security for food safety; impro-

ving rural residents' living condition; accelerating the sustainable development of economy and promoting the construction of new socialist village.

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the inner adjustment demand of macro economy after experiencing the continuous high speed increase and the external trauma caused by the international financial crisis, the pressure of increasing farmers' income will become great, for the function of increasing the prices of agricultural products will be weaken and the space for political income increase is limited. The problems show that there are still some restriction factors in some systems need breaking, especially the cities-oriented economic policies implemented by our government. Otherwise, farmers' difficulty in increasing income, which has troubled Henan Province and China for many years can not be solved fundamentally.

　　In order to solve the problem of increasing farmers' income, the government should not only put forward the strategic thinking from a higher level and wider perspective, but also conduct the fundamental reform on the social and economic system in the macro layer of the nation. In addition, the government should combine the local situations that Henan Province is a granary province and the grain area of Chinese strategic engineering; establish and perfect the relevant facilities; and implement relevant policies. For example, carry out the strategy of " city helps the countryside and industry promotes agriculture " ; establish and refine rural social security system; foster the transference payment system which takes the public services as aim; establish and refine the rural financial organization system and rural insurance system.

　　According to the co-integration relation showed in formula (2), the elastic coefficient of farmers' income increase to economic growth of Henan Province has achieved 1.096, which means that if the farmers' income increase one percentage, then the economic growth will increase 1.096 percentage.

Apparently, farmers' income increase is highly sensitive to the improvement of the economic development of Henan Province. At present, the income of farmers in Henan Province is still lower than the national average level, but its potential of increase is great. With the gradual establishment of the long-effective mechanism on increasing farmers' income, the increase of farmers' income will inevitably play a significant role in pushing forward the economic growth of Henan Province.

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