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# Empirical Study on the Relationship between Income and Consumption of Rural Residents in Hebei Province

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**Abstract** Based on the relevant data of the actual income and consumption of rural residents in Hebei Province from 1983 to 2007, the relationship between actual income and consumption of rural residents was tested by applying the co-integration theory and Granger causality test. The result shows that there is long-term stable equilibrium relationship between the net income per capita and consumption expenditure per capita of rural residents in Hebei Province from 1983 to 2007; the result of Granger causality test shows that the actual income of rural residents in Hebei Province has significant impact on the actual consumption, but the impact is weakened gradually; in short term, the impact of the actual consumption on the actual income is not so significant, but the impact will become significant gradually as time goes on. During the process of the mutual impact and function of the actual income and consumption of rural residents in Hebei Province, the impact of the actual income of rural residents on the actual consumption is mainly represented in short term; in middle term, the interactions between the actual income and actual consumption are significant; in long term, the impact of the actual consumption on the actual income is mainly displayed. According to the result, in short term the government in Hebei Province can expand consumption through increasing the income of rural residents, while in long term the government can drive the economic growth by expanding domestic demands.

**Key words** Income of rural residents, Consumption of rural residents, Hebei Province, Empirical study, China

Income is the basic factor which determines the consumer demand of residents. With the improvement of income level and the adjustment of consumption structure, the interaction between the income and consumption of rural residents in Hebei Province is changing. Taking the Hebei Province as an example, the interaction between the income and consumption of rural residents is studied by applying the co-integration theory and Granger causality test so as to find the internal laws and provide reference for the government policy.

## 1 Data source and research methods

**1.1 Data source and processing** The data is from *Hebei Economic Yearbook* in 2008, including the two indicators of the disposable income per capita ( $sr$ ) and the consumption expenditure per capita ( $xf$ ) of rural residents in Hebei Province from 1983 to 2007. Taking the consumption price index ( $p$ ) of rural residents in Hebei Province in 1983 as the base period, the disposable income per capita and the consumption expenditure per capita of rural residents can be adjusted. Suppose  $Y_t(\%) = (sr/p) \times 100$ ,  $C_t(\%) = (xf/p) \times 100$ , then the data of the actual income and the consumption after excluding the factor of price can be obtained (Table 1).

**1.2 Research methods** According to relevant data, the actual income and consumption curve of rural residents in Hebei

Province from 1983 to 2007 can be drawn by using the Eviews3.1 software (Fig. 1). It can be seen from Fig. 1 that the actual income and consumption of rural residents in Hebei Province have shown the trend of continuous growth since 1983, but the growth went slow in 1980s, after the middle 1990s, the actual income and consumption of rural residents grew fast again. The two variables have obvious tendency of time, so they may belong to non-stationary time series. Direct analysis of the two variables may produce spurious regression phenomenon, so the author applies the co-integration theory, Granger causality test and Eviews3.1 to analyze the relationship between them<sup>[1]</sup>.

**Table 1** The actual income and consumption of rural residents in Hebei Province during 1983–2007

			yuan		
Year	Actual Income	Actual consumption	Year	Actual Income	Actual consumption
1983	298.070 0	221.000 0	1996	673.533 3	509.242 9
1984	337.904 0	255.631 7	1997	724.567 4	542.313 8
1985	357.025 0	295.644 1	1998	777.163 2	559.127 6
1986	358.496 0	313.104 7	1999	808.176 1	596.954 7
1987	363.964 0	346.437 3	2000	827.942 6	617.234 5
1988	380.125 2	387.343 5	2001	864.409 0	634.827 4
1989	335.458 2	331.815 6	2002	895.949 3	662.996 3
1990	354.227 9	344.729 3	2003	933.362 8	667.844 3
1991	368.693 2	378.575 4	2004	989.719 1	676.342 1
1992	368.310 8	393.416 1	2005	1 063.421 0	748.136 8
1993	387.560 3	400.675 0	2006	1 141.688 0	818.318 3
1994	444.857 4	402.169 5	2007	1 227.008 0	883.082 8
1995	584.084 7	456.982 8			

Note: The data is from *Hebei Economic Yearbook* in 2008<sup>[2]</sup>.

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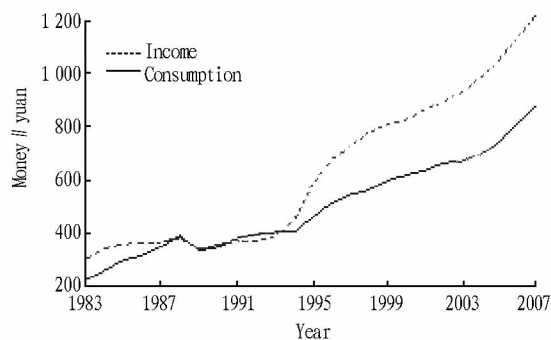


Fig. 1 The actual income and consumption curve of rural residents in Hebei Province

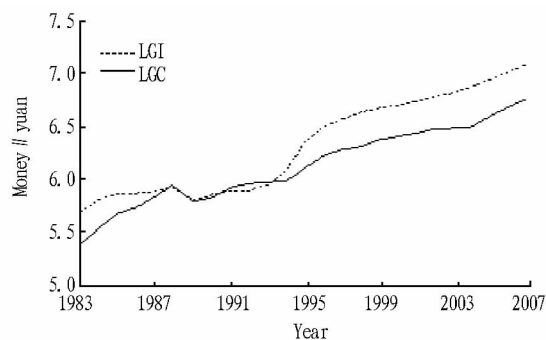
## 2 Empirical tests on the relationship between the actual income and consumption of rural residents in Hebei Province

**2.1 Unit roots test** To ensure the smooth of the time series and give convenience to the further study, the smooth test on the series of the actual income and consumption of rural residents in Hebei Province is needed. The unit roots test which is used to test the smooth of time series is chosen to test the smooth of the actual income and consumption series.

In order to eliminate the possible heteroscedasticity, the logarithms of the actual income and consumption series of rural residents in Hebei Province are taken, then the curve chart of it can be drawn by the use of Eviews3.1 (Fig. 2). It can be seen from the Fig. 2 that during the sample period, the logarithm series of the actual income ( $\ln I$ ) of rural residents and the logarithm series of consumption ( $\ln C$ ) all represents significant growth trend. Taking the difference of the two series, the corresponding difference series are named  $\Delta \ln I$  and  $\Delta \ln C$ , then the curves of  $\Delta \ln I$  and  $\Delta \ln C$  can be obtained (Fig. 3). Fig. 3 indicates that there is no obvious growth trend of the two series. By using ADF test, the logarithm series of actual Income and the actual consumption of rural residents in Hebei Province are tested and the lagging number equals 1 by Schwarz Criterion. The results show that as for  $\ln I$ , when the lagging coefficient equals 1, the ADF statistics is  $-2.4948$ , more than the critical value under the 5% significance level and can not refuse the null hypothesis, which indicates that the  $\ln Y$  is non-stationary; as for  $\ln C$ , when the lagging number equals 1, the ADF statistics is  $-3.4856$ , more than the critical value under the 5% significance level and can not refuse the null hypothesis, which indicates that the  $\ln C$  is non-stationary. However the differential series of the two series  $\Delta \ln I$  and  $\Delta \ln C$  are all stationary series (Table 2).

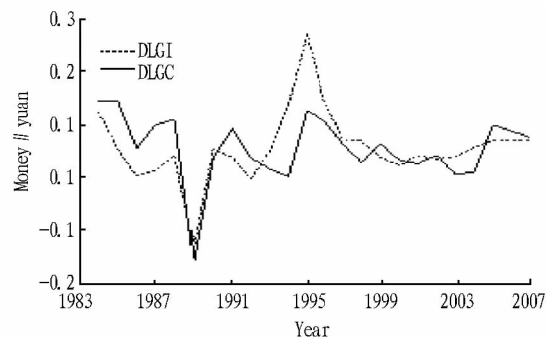
Table 2 Results of unit root test

Variable	Test types	ADF value	Critical value of the test	Conclusion
$\ln I$	(c, t, 1)	-2.787 4	-4.441 5	Non-stationary
$\ln C$	(c, t, 1)	-3.507 1	-4.416 7	Non-stationary
$\Delta \ln I$	(0, 0, 1)	-1.697 1	-1.623 8	Stationary
$\Delta \ln C$	(c, t, 1)	-4.389 3	-3.766 7	Stationary



Note: LGC stands for the logarithm curve of actual consumption; LGI stands for the logarithm curve of actual income.

Fig. 2 Logarithm series curve of actual Income and consumption in Hebei Province



Note: DLGC stands for the differential curve for the logarithm of actual consumption; DLGI stands for the differential curve for the logarithm of actual income.

Fig. 3 The curve of  $\Delta \ln I$  and  $\Delta \ln C$  series

**2.2 The co-integration test of the  $\ln I$  and  $\ln C$  series** The variables  $\ln I$  and  $\ln C$  have the same order, so the co-integration relationship between them can be taken into account. According to the relevant theory of Engle-Granger' co-integration test, suppose the co-integration equation  $\ln C = \alpha + u \ln I + e_t$ ,  $\hat{\alpha}$  and  $\hat{u}$  stand for the estimated value of regression coefficient, then the residual estimated value is  $\hat{e}_t = \ln C - \hat{\alpha} - \hat{u} \ln I$ , if  $\hat{e}_t \rightarrow 0$ , then  $\ln I$  and  $\ln C$  have co-integration relation<sup>[3]</sup>. By applying the data from 1983 to 2007 and the co-integration regression and integration test by using the Engle-Granger test, the following result can be obtained:

$$\begin{aligned} \ln C &= 1.3625 + 0.7532 \ln I + e_t \\ (4.7603) \quad (16.6555) \\ R^2 &= 0.9265, F = 277.4046, DW = 1.5672 \end{aligned} \quad (1)$$

If the  $\ln I$  and  $\ln C$  have co-integration relation, then the  $e_t$  in equation (1) is stationary. Conducting unit roots test on the residual series  $e_t$ , then the ADF value of  $e_t$  is  $-3.3094$ , 1% threshold level is  $-2.6756$ , 5% threshold level is  $-1.9574$ , 10% threshold level is  $-1.6238$ . The ADF statistics of residual  $e_t$  are less than 1%, 5% and 10% the three critical value under significant level, so the residual  $e_t$  is stationary and it accepts the co-integration hypothesis of the variables  $\ln I$  and  $\ln C$ .

**2.3 Granger-Sims causality test** Co-integration test is used to test whether there is the long-term equilibrium relationship among variables, but whether this kind of relationship can constitute the cause-effect relationship or not still needs further

test. The causality test raised by Granger can be used to solve this problem. Because the result of test sensitively depends on the choice of lag period, so the choice of the lag period should follow the following principles; at first, choosing the lag period according to the AIC criterion and SC criterion, but under the

uncertain situation, the lag period can be determined by the likelihood ratio (LR) raised by Neyman-Person. The result of Granger-Sims causality test of the relationship between  $\Delta I_g$  and  $\Delta I_g C$  is shown on Table 3.

**Table 3 The results of Granger-Sims causality test of the relationship between  $\Delta I_g$  and  $\Delta I_g C$**

Null hypothesis	Lag period	F test value	Probability	Conclusion
$\Delta I_g$ is not the Granger cause of $\Delta I_g C$	1	2.900 5	0.104 0	Refuse
$\Delta I_g C$ is not the Granger cause of $\Delta I_g$	1	18.557 6	0.312 6	Accept
$\Delta I_g$ is not the Granger cause of $\Delta I_g C$	2	1.246 1	0.000 3	Refuse
$\Delta I_g C$ is not the Granger cause of $\Delta I_g$	2	7.818 2	0.003 9	Refuse
$\Delta I_g$ is not the Granger cause of $\Delta I_g C$	3	1.053 0	0.400 1	Accept
$\Delta I_g C$ is not the Granger cause of $\Delta I_g$	3	4.240 9	0.025 0	Refuse
$\Delta I_g$ is not the Granger cause of $\Delta I_g C$	4	1.664 2	0.227 7	Accept
$\Delta I_g C$ is not the Granger cause of $\Delta I_g$	4	2.888 4	0.073 6	Refuse

It can be seen from Table 3 that when the lag period equals 1, the actual consumption of rural residents in Hebei is not the Granger cause of the actual income, but the actual income is the Granger cause of the actual consumption; when the lag period equals 2, the Granger causality between them is hard to determine; when the lag period equals 3 and 4, the actual income of rural residents in Hebei is not the Granger cause of the actual consumption, but the actual consumption is the Granger cause of the actual income. The implication of this conclusion is that in short term, the actual income of rural residents in Hebei Province has significant impact on the actual consumption, but the impact will diminish gradually until disappear two years later; in contrast, the impact of the actual consumption of rural residents in Hebei on the actual income is not so significant in short term, but as time goes on, the impact will be obvious gradually. Therefore during the process of mutual impact and functions of the actual income and the actual consumption, in short term the impact of the actual income of rural residents on the actual consumption is mainly represented; but in long term, the impact of the actual consumption of rural residents on the actual income is mainly represented.

### 3 Conclusions

In summary, during the process of mutual impact and functions of the actual income and the actual consumption, in short term the impact of the actual income of rural residents on the actual consumption is mainly represented; in the middle term the mutual impact of them are all significant; from the long term, the impact of the actual consumption of rural residents on the actual income is mainly reflected. In view of the above fea-

tures, necessary measures should be taken by Hebei Province. The government can expand consumption through increasing the income of rural residents in short term, while the government can push the economic growth by expanding domestic demand in long term.

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and the analysis from multi-dimensional perspectives will play an important role in the tracking monitoring and cross-regional regulation of the rural labor flow.

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