Dynamic Analysis of Interaction between Rural Residents' Consumption and Income

Wei ZHANG *

Zhongbei College, Nanjing Normal University, Nanjing 210097, China

Abstract In recent years, the income and consumption level of farmers is lower than that of urban residents, and in the context of current grave international economic environment, it is very unfavorable to expanding domestic demand and stimulating economic growth. Based on the empirical analysis of rural residents' income and consumption, this paper explores the reasons for lagging consumption of rural residents in China, and finally puts forth the recommendations for increasing farmers' income, promoting farmers' consumption and expanding the rural market.

Key words Rural residents, Consumption, Income, Rural consumer price index

1 Introduction

Presently the growth of China's economy is low, the role of investment and export in promoting economic growth significantly declines, and the importance of consumption has become increasingly prominent. The report of the 17th National People's Congress of the Communist Party of China pointed out that it was necessary to achieve the steady increase in household consumption rate and formation of growth pattern of coordinated development of consumption, investment and export, which elevated the consumption to the leading position in "troika" for the first time[1]. The report of the 18th National People's Congress of the Communist Party of China further pointed out that it was necessary to firmly grasp the strategic basis for expanding domestic demand, accelerate the establishment of long-term mechanism of expanding consumer demand, release the consumer potential, maintain reasonable investment growth and expand domestic market size[2]. Since 2008, driving the domestic demand has always been an important issue that the government and academia are concerned about. The key to stimulating domestic demand lies in the household consumption. At present, the urban residents' consumption is subject to the rigid constraints of housing, health and education, and the growth of rural residents' consumption thus becomes a top priority.

2 Literature review

The research findings of foreign scholars mainly include absolute income hypothesis, relative income hypothesis, permanent income hypothesis, life cycle hypothesis, precautionary savings hypothesis, and liquidity constraints hypothesis. Keynes (1936) argues that the household consumption depends on their income level, consumption increases as income increases, and the current level of consumption depends on current level of income[3]. Dusen Bailey (1949) proposes the relative income hypothesis, changing the preconditions of individual decisions of consumers, and believes that personal spending habits and the surrounding environment have a significant impact on consumer spending levels, namely there is "ratchet effect" and "demonstration effect"[4]. The life cycle hypothesis of Franco Modigliani (1954) believes that consumers will plan their consumer spending in all their life, to achieve the best configuration of their consumption over the entire life cycle, rather than determine the consumption level based on the current level of income[5]. Milton Friedman (1957) proposes the permanent income hypothesis, and this theory maintains that the consumer's income can be divided into permanent income and temporary income, and the consumer spending is not determined by the current income of consumers but the permanent income[6]. The precautionary savings hypothesis of Leland (1968) holds that due to the future income uncertainty, consumers reduce current consumption to increase savings[7]. Domestic studies are focused on the empirical test of Western consumption theory using the Chinese data. Li Yining (1984) criticizes the absolute income theory of Keynes in his book Consumer Economics, and at the same time, points out that there is the content that we can draw upon in the consumption function of consumer goods stock hypothesis, relative income theory, permanent income theory and life cycle theory[8]. Wu Jiapei and Zhang Shouyi (1986) review the representative Western consumption function theory, and use Chinese data to establish the urban resident consumption function in line with the situation of China[9]. Zhu Xianchen (1993) makes a convincing test of permanent income framework of life cycle hypothesis[10]. Jian Xuheng (1994) compares the constraints on Chinese urban and rural residents' consumption behavior in different periods to sum up the basic framework of consumer behavior hypothesis, and establish the Chinese urban and rural residents' consumption function model[11]. In macroeconomic system, He Juhuang (2000) examines the Friedman life cycle consumption function, and studies the life cycle consumption function theory in the macroeconomic context[12]. Du Changle (2002) points out that farmers' consumption lag is mainly caused by low income levels or slow income growth[13]. Shi Qinghua and Zhuo Jianwei (2003) believe that the

Received: July 28, 2014 Accepted: September 9, 2014

* Corresponding author. E-mail: chxj415@126.com

Chinese rural residents' consumption is in line with the characteristics of the precautionary savings hypothesis, and farmers' expectation of future uncertainty is enhanced, with strong precautionary saving propensity, thereby inhibiting the current consumption[14]. Hang Bin and Shen Chunlan (2005) believe that the liquidity constraints also significantly reduce current consumption of farmers[15]. Wang Xuhui and Gu Jing (2009) believe that farmers have a strong desire for consumption, but the lack of income restricts the consumption level; the wage income and household operating income have a significant impact on the farmers' consumption; the increase in household operating income has the greatest impact on the consumption growth[16].

3 Data sources, variable selection and model establishment

3.1 Data sources This paper uses the historical data on Chinese per capita net income of rural residents, per capita consumption expenditure of rural residents and rural consumer price index from 1990 to 2011 as the sample data. Data come from China Rural Statistical Yearbook. To eliminate the effects of price level, this paper uses 1990 as the base period and rural consumer price index in 1990 as a benchmark for deflation of annual per capita income and per capita consumption expenditure, to get the actual data of income and consumption.

3.2 Variable selection and data processing We select the Chinese rural residents' per capita consumption expenditure, rural residents' per capita net income and rural consumer price index as the basic indicators. In order to ensure the linear relationship between data series and eliminate possible presence of heteroscedasticity, we first take the natural logarithm of indicator data. We denote per capita consumption expenditure as *RC*, per capita net income as *RI*, and rural consumer price index as *CPI*. After taking the natural logarithm, the variables are ln*RC*, ln*RI* and ln*CPI*.

3.3 Model establishment Granger and Weiss developed Granger theorem in 1983: If there is cointegration relationship between dependent and independent variables, then the relationship between the two can be expressed using error correction model. To determine whether the error correction model is suitable for the description of relationship between the Chinese rural residents' per capita consumption expenditure and per capita net income, it is necessary to first conduct unit root test of two variable series in theory, and then perform the cointegration test. Here we assume that the two variable series meet the above requirements, and the process and results of unit root test and cointegration test are given in the fourth part of the article.

Assuming the long-run equilibrium relationship between and as:

$$Y_t = \alpha_0 + \alpha_1 X_t + \mu_t \quad (1)$$

In the real economy, X and Y are rarely at the equilibrium point, and what we actually observe is often the short-term non-equilibrium relationship between X and UY.

Assuming there is the following distributed lag form:

$$Y_t = \beta_0 + \beta_1 X_t + \beta_2 X_{t-1} + \beta_3 X_{t-2} + \cdots + \mu_t \quad (2)$$

This model shows that the value of Y in period t is not only related to changes in X, but also related to the state value of and in period $t-1$, $t-2$, ···. In the time series data, the lagged variables are highly correlated, and the multicollinearity of variables will produce large errors in the estimation results. To solve the problem of multicollinearity, we consider the adoption of distributed lag estimation method developed by Koyck in the empirical analysis part.

4 Empirical results

4.1 Statistical description of data Fig. 1 shows the kernel density of rural residents' consumption, rural residents' income and rural consumer price level. We can see the dynamic changes in the distribution density of the three variables from Fig. 1.

Table 1 Basic description of data

	RC	RI	CPI
Mean	6.877	7.044 558	0.045
Median	6.795	6.992 276	0.030
Maximum	7.584	7.759 875	0.210
Minimum	6.371	6.531 315	-0.015
Std. Dev.	0.365	0.361 136	0.057
Skewness	0.397	0.375 106	1.558
Kurtosis	2.064	2.152 097	4.916
Jarque - Bera	1.383	1.174 945	12.268
Probability	0.501	0.555 730	0.002
Sum	151.292	154.980 3	0.995
Sum Sq. Dev.	2.798	2.738 801	0.067

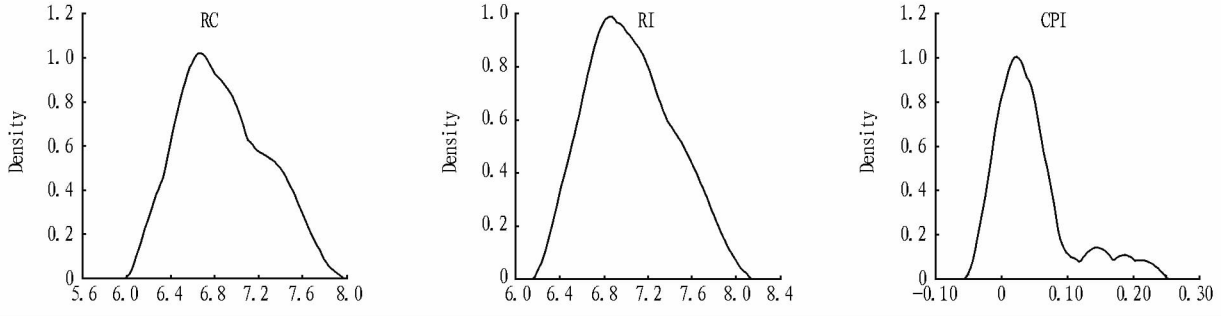

Fig. 1 The kernel density of ln*RC*, ln*RI* and ln*CPI*

From Table 2, we know that the main factor influencing rural residents' consumption is the rural residents' income level, and rural residents' consumer price level has little effect on consumption, so in the regression analysis, the regression model between consumption and income is first established, and in the robustness test, the price level variable is then introduced.

4.2 Unit root test and cointegration test

4.2.1 Unit root test. Using ADF test and Eviews 6.0, we perform the unit root test on ln*RC*, ln*RI* and ln*CPI*, respectively, and the results are shown in Table 4.

Table 2 Correlation and covariance

Correlation	Covariance		
	RC	RI	CPI
RC	0.127		
	1.000		
RI	0.125	0.124	
	0.996	1.000	
CPI	-0.005	-0.006	0.003
	-0.273	-0.299	1.000

Table 3 Unit root test of variables

Variables	(C, T, K)	D-W value	ADF value	5% critical value	Conclusions
lnRC	(C, 0, 1)	1.331	2.325	-3.012	Non-stationary
ln*RI*	(C, 0, 1)	1.829	2.074	-3.020	Non-stationary
ln*CPI*	(C, 0, 1)	1.744	-2.852	-3.021	Non-stationary
*d*ln*RC*	(C, 0, 1)	1.715	-2.252	-3.020	Non-stationary
*d*ln*RI*	(C, 0, 1)	2.194	-1.693	-2.650	Non-stationary
*d*ln*CPI*	(C, 0, 1)	1.657	-3.046	-3.809	Non-stationary
*dd*ln*RC*	(0, 0, 1)	2.081	-4.390	-3.052	Stationary
*dd*ln*RI*	(0, 0, 1)	1.868	-7.208	-3.030	Stationary
*dd*ln*CPI*	(0, 0, 1)	2.092	-5.213	-3.040	Stationary

As can be seen from Table 3, ADF statistic value of original series and first-order difference series of , and is higher than the corresponding critical value at the 5% significance level, indicating that there is unit root in the per capita income, per capita consumption and rural consumer price index without a difference, as well as the first-order difference per capita income, per capita consumption and rural consumer price index, which are all non-stationary. ADF test value of series after the second-order difference is less than the corresponding critical value, and all are stationary, indicating that , and are all the second-order integrated series.

4.2.2 Cointegration test. The variable series ln*RC*, ln*RI* and ln*CPI* are all the second-order integrated series, in line with the requirements of cointegration. We use Johansen cointegration test, to give trace test and the maximum eigenvalue test results, as shown in Table 4.

Table 4 Johansen cointegration test results

Hypothesized No. of CE(s)	Unrestricted Cointegration Rank Test (Trace)			
	Eigenvalue	Trace statistic	0.05 critical value	Prob. **
None *	0.749	47.721	29.797	0.000
At most 1 *	0.536	20.052	15.495	0.009
At most 2 *	0.209	4.683	3.841	0.031
Hypothesized No. of CE(s)	Unrestricted Cointegration Rank Test (Maximum Eigenvalue)			
	Eigenvalue	Trace statistic	0.05 critical value	Prob. **
None *	0.749	27.670	21.132	0.005
At most 1 *	0.536	15.369	14.265	0.033
At most 2 *	0.209	4.683	3.841	0.031

From the above test results, it can be found that there is a cointegration relationship among ln*RC*, ln*RI* and ln*CPI*.

4.2.3 Granger test. The above test process shows that there is a long-term dynamic equilibrium relationship among China's rural per capita consumption expenditure, per capita net income, and rural consumer price index. Now we use Granger causality test to further examine the causal relationship between the two.

Table 5 Granger test results

Pairwise Granger Causality Tests (Lags: 2)		
Null Hypothesis:	F-statistic	Prob.
RI does not Granger cause RC	3.789	0.049
RC does not Granger cause RI	3.655	0.051
CPI does not Granger cause RC	8.653	0.003
RC does not Granger cause CPI	0.841	0.451
CPI does not Granger cause RI	4.21	0.035
RI does not Granger cause CPI	1.834	0.194

The optimal lag determined by AIC is 2. The above results show that when the lag is 2, rural residents' income does Granger cause rural residents' consumption expenditure, while rural residents' consumption expenditure does not Granger cause rural residents' income; rural consumer price index does Granger cause rural residents' consumption expenditure, while rural residents' consumption expenditure does not Granger cause rural consumer price index; rural consumer price index does Granger cause rural residents' income, while rural residents' income does not Granger cause rural consumer price index.

4.3 Regression results

4.3.1 Only considering the relationship between rural residents' consumption and income. From Table 6, it is found that the constant term is not significant, and there is autocorrelation in the regression model, failing to pass the test. According to the theoretical relationship between consumption and income, consumption is

not only affected by current income, but also affected by the previous consumption level. To this end, we consider the introduction of distributed lag model of lagged variables.

Table 6 The regression results

Variable	Coefficient	Std. Error	t-statistic	Prob.
RI	1.007	0.019	52.538 01	0.000
C	-0.218	0.135	-1.609 774	0.123
R-squared	0.993	Mean dependent var		6.877
Adjusted R-squared	0.992	S.D. dependent var		0.365
S.E. of regression	0.032	Akaike info criterion		-3.977
Sum squared resid	0.020	Schwarz criterion		-3.878
Log likelihood	45.747	Hannan - Quinn criter.		-3.954
F-statistic	2760.243	Durbin - Watson stat		0.812
Prob (F-statistic)	0.000			

4.3.2 Introducing Koyck model of lagged variables. Assuming the corrected model has second-order lag, namely:

$$\ln RC_t = \alpha_0 + \beta_1 \ln RI_t + \lambda_1 \ln RC_{t-1} + \lambda_2 \ln RC_{t-2} + \varepsilon_t$$

By the unit root test and cointegration test, it can be found that we can establish Koyck model between variables ln*RC* and ln*RI*, and the second-order lag form is used. The regression results are shown in Table 7.

Table 7 The regression results of Koyck model

Variable	Coefficient	Std. Error	t-statistic	Prob.
RI	1.113	0.208	5.3462 76	0.000
RC(-1)	0.755	0.194	3.885 583	0.001
RC(-2)	-0.904	0.167	-5.426 396	0.000

Note: In the regression process, it is found that the constant term is not significant, so the final regression equation does not contain the constant term.

Adjusted R-squared = 0.996 Durbin - Watson stat = 2.202
F-statistic = 1687.750 Prob(F-statistic) = 0.000.

As shown in Table 7, F test shows the model as a whole is significant, and the coefficients of variables of regression model pass T test, with good goodness of fit, namely:

$$\ln RC_t = 1.113 \ln RI_t + 0.755 \ln RC_{t-1} - 0.904 \ln RC_{t-2}.$$

4.3.3 Normality test, heteroscedasticity test and autocorrelation test of regression model (Koyck model).

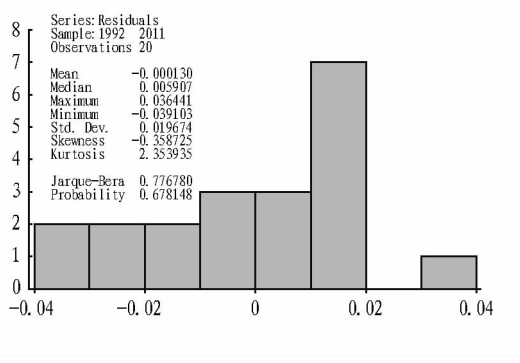

Fig. 2 Normality test of residuals

The probability of J - B statistic is 0.776780, greater than 0.05, supporting the hypothesis that the random disturbance term is normal.

Table 8 White test for heteroscedasticity

Heteroskedasticity Test: White			
F-statistic	0.998	Prob. F(3,16)	0.419
Obs * R-squared	3.153	Prob. Chi-square(3)	0.369
Scaled explained SS	1.553	Prob. Chi-square(3)	0.670

The corresponding probability of Obs * R-squared is 0.369, greater than 0.05, indicating that there is no heteroscedasticity.

Table 9 Autocorrelation test results

	Breusch - Godfrey Serial Correlation LM Test:			
First-order autocorrelation	F-statistic	0.353	Prob. F(1,16)	0.561
	Obs * R-squared	0.431	Prob. Chi-square(1)	0.512
	Breusch - Godfrey Serial Correlation LM Test:			
Second-order autocorrelation	F-statistic	0.768	Prob. F(2,15)	0.482
	Obs * R-squared	1.856	Prob. Chi-square(2)	0.395

From the above results, we know that there is neither first-order autocorrelation nor second-order autocorrelation in the regression model.

4.3.4 Robustness test. Robustness test adopts the method of adding rural consumer price index as the control variable, and if there is no change in the direction of regression results after adding the explanatory variables, and the explanatory variables in the original model are still significant, then the original model is believed to be robust.

By comparing the regression results in Table 7 and Table 10, the consumer price level in rural areas is not significant, but the first and second order lag regression coefficients of rural residents' income and rural residents' consumption basically remain unchanged, with the same direction, indicating that the regression results of Table 7 are robust.

Table 10 Robustness test results

Variable	Coefficient	Std. Error	t-statistic	Prob.
RI	1.075	0.217	4.944	0.000
RC(-1)	0.774	0.199	3.896	0.001
RC(-2)	-0.883	0.171	-5.156	0.000
CPI	0.061	0.083	0.740 368	0.470

Adjusted R-squared = 0.996 Durbin - Watson stat = 2.337
F-statistic = 1333.735 Prob(F-statistic) = 0.000

5 Conclusions and recommendations

5.1 Conclusions (i) There was a cointegration relationship between real per capita consumption expenditure and real per capita net income of rural residents during 1990 – 2011, namely the long-term dynamic equilibrium relationship. (ii) The main factor influencing the actual per capita consumption level of rural residents is the current income and previous consumption level. The previous consumption level has a positive effect on current consumption, indicating that the actual per capita consumption level of rural residents is not only affected by current income, but also affected by the previous consumption level. (iii) The consumption level in the period before last period has a reverse effect on the current consumption level, indicating that rural residents' earlier consumption expenditure has a certain restraining effect on the current consumption, and rural residents' consumption is planned within a certain period (e.g. three years).

5.2 Recommendations

5.2.1 Increasing input to agricultural infrastructure and improving agricultural productivity. At present, China's agricultural infrastructure is still very weak, and the ability to resist natural disasters is not strong. Only by increasing agricultural infrastructure construction can the agricultural production capacity be consolidated and improved. With the expanding scope of international competition, China's agricultural products are bound to join the increasingly competitive international market, so it is imperative to increase the support for agriculture.

5.2.2 Improving the supply of public goods in rural areas and creating a good consumption environment for farmers. Here the public goods are quasi-public goods, including electricity, telecommunication, radio and television, tap water and other products. Power companies should renovate the power grids in rural areas, and drop the rural electricity price to the level of urban electricity price, which will certainly stimulate the rural consumption of electricity and household appliances. Water supply companies should improve rural water facilities and water quality, promote the tap water and improve farmers' access to water. Radio and television departments should improve the signal coverage in rural areas, which can not only promote farmers' consumption of household appliances, but also guide the farmers to establish a correct concept of consumption via these media. Transportation, communications and other departments should also improve the quality of services in rural areas, such as opening the urban and rural passenger lines and laying fixed telephone lines in remote rural areas.

5.2.3 Building the new agricultural operation system and resolutely promoting integration of urban and rural areas. With the continuous development of urbanization in rural areas, there are more old people and left-behind children in rural areas, and the agricultural production lacks orderly organization and appropriate size. Therefore, it is necessary to enhance agricultural structure adjustment and optimization, develop the characteristic agriculture, green agriculture and ecological agriculture, and build a new agricultural operation system. Since the 16th National Congress of Communist Party of China, the infrastructure in rural areas has experienced rapid growth, but relative to the development of the city, it lags behind, and the inequality between urban and rural areas is very prominent. The Third Plenary Session of the 18th Central Committee of the CPC points out that it is necessary to establish and improve the coordinated urban-rural infrastructure and public services building mechanism, which provides policy support for the urban-rural integration, so we must seize this opportunity to give more preferential policies to rural areas to ultimately achieve urban and rural equalization.

References

[1] The report on the 17th national congress of the Communist Party of China by Hu Jintao[2007. 10. 24]. http://news. xinhuanet. com/newscenter/2007 – 10/24/content_6938568. htm. (in Chinese).

[2] Move along the Chinese characteristic socialist road without move or retrea , strive to build a well-off society in an all-round way[2012. 11. 8]. http://www. xj. xinhuanet. com/2012 – 11/19/c_113722546. htm. (in Chinese).

[3] Keynes JM. General theory of employment, interest and money[M]. Atlantic Publishers & Dist, 2006.

[4] Duesenberry JS. Income, saving, and the theory of consumer behavior[M]. Cambridge, Harvard University Press, 1949.

[5] Modigliani F, Brumberg R. Utility analysis and the consumption function: An interpretation of cross-section data[J]. FRANCO MODIGLIANI, 1954: 1.

[6] Friedman M. A theory of the consumption[M]. Princeton: Princeton University Press, 1957.

[7] Leland HE. Saving and uncertainty: The precautionary demand for saving[J]. The Quarterly Journal of Economics, 1968, 82(3): 465 – 473.

[8] LI YN. Consumption economics[M]. China Renmin University Press, 1984. (in Chinese).

[9] WU JP, ZHANG SY. Study on China's macro-economic model[M]. Anhui: Anhui People's Publishing House, 1986. (in Chinese).

[10] ZHU XC. The rational expectations – permanent income hypothesis (REPIH) and testing method[J]. The Journal of Quantitative & Technical Economics, 1993(3): 30 – 33. (in Chinese).

[11] JIANG XH. Analysis on Chinese consumption function[M]. Shanghai: Shanghai People's Publishing House, 1994. (in Chinese).

[12] HE JH. Consumption function research[M]. Beijing: Social Sciences Academic Press(China), 2000. (in Chinese).

[13] DU CL. An analysis of potential rural consumption market and expanding rural consumption demand countermeasures[J]. Journal of Zhongnan University of Finance and Economics, 2002(5): 71 – 75. (in Chinese).

[14] SHI QH, ZHUO JW. A case analysis of saving and loan activities of 203 peasant households in Shanxi rural areas[J]. Contemporary Economic Research, 2003(8): 52 – 58. (in Chinese).

[15] HANG B, SHEN CL. An empirical study of precautionary saving in rural China[J]. Chinese Rural Economy, 2005(3): 44 – 52. (in Chinese).

[16] WANG XH, GU J. An empirical study on the relationship between consumption and income of Chinese rural residents[J]. Journal of Beijing Technology and Business University: Social Science, 2009, 24(1): 58 – 63. (in Chinese).