Comparative Analysis of Urban-rural Residents' Propensity to Consume in China's Four Regions

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Abstract According to the data in *China Statistical Yearbook* from 1992 to 2008, by using regression model, we adopt least square method and generalized least square method to conduct empirical analysis on the relationship between urban-rural residents' income and consumption in China's east, northeast, central region and west. The results show that the urban-rural residents' propensity to consume in China's four regions has prominent characteristics. In terms of region, urban residents' marginal propensity to consume takes on irregular fluctuation, while the rural residents' propensity to consume conforms to law of diminishing of marginal propensity to consume; in terms of time sequence, the rural residents' marginal propensity to consume in China's four regions takes on "multi-U-form" fluctuation trend, and the rural residents' marginal propensity to consume in different regions has certain difference, while the urban residents' marginal propensity to consume takes on low-frequency broad width fluctuation trend; the urban-rural residents' average marginal propensity to consume in China's four regions conforms to the law of diminishing. In order to increase consumption and promote the balanced rapid development of regional economy, in light of the urban-rural difference and characteristics of different regions, we should propound effective measures to promote urban-rural residents' propensity to consume, and formulate and implement regional policy in order to stimulate consumption.

Key words Urban-rural residents, Regression analysis method, Propensity to consume, Regional characteristics, China

Consumption, as a main macrocosmic economic variable, has become one of the major targets of macroeconomic regulation. With the increasing deepening of China's reform and opening up, the role of consumption demand in China's regional economic growth is prominently strengthened. According to Chenery's model of multinational industrialization, the standard of entering the initial stage of industrialization is that the final consumption rate is 87%, wherein the consumption rate of residents is 73%, and the consumption rate of government is 14%. In 2008, China's final consumption rate is 48.6%, wherein the consumption rate of residents is 35.33%, and the consumption rate of government is 13.27%, while the consumption rate of rural residents is quite low, only accounting for 8.87% of final consumption, clearly indicating that the consumption rate of China's government is close to the standard of Chenery's initial stage of industrialization, but the consumption rate of residents is quite low. China is populous country, and the residents' consumption has enormous growth space, therefore, we should research the status quo of urban-rural residents' consumption and its regional characteristics, which is of theoretical value and practical value in entrenching the consumption strategy in the process of China's economic growth and balanced development of regional economy.

1 Overview of literatures

As for the research of consumption problem, there have been a number of economists who make thorough study and put forward their own consumption theory. Keynes raised the absolute income and consumption theory in his classic *The General Theory of Employment, Interest and Money* which researches the effective demand theory. Keynes holds that the total consumption is the function of the total income. By the analysis of subjective and objective factors influencing consumption, Keynes points out that in the short term, the subjective factor influencing personal consumption is relatively stable, and consumers' spending hinges on income, increasing along with the increase of income, but consumption growth is lower than income growth, and consumption is completely reversible, thus it is the law of diminishing marginal propensity to consume[1]. J. S. Duesenberry proposed theory of relative income and consumption. He thinks that consumers' consumption spending is not only affected by their own income, but also by consumption behavior of others, and the interaction of income and consumption, namely that the consumption has characteristics of "exemplar' and "emulation"; at the same time, consumers' consumption spending is not only affected by their current income, but also by their past income and consumption level, especially the past income in "peak period", namely that the consumption has the characteristic of irreversibility, and this irreversibility will generate ratchet effect[2]. F. Modigliani proposed life cycle consumption theory. He believes that the consumers are rational, and they only use their lifetime income and arrange lifetime consumption according to the principle of utility maximization, so that lifetime income is equal to lifetime consumption. Therefore, consumers' current consumption is not only related with the current income, but also with consumers' future expected income, initial assets and age of individual. The present value of consumption spending flow in consumers' lifetime is equal to the present value of expected income flow in consumers' lifetime. Such behavior can be called "forward-loo-

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king behavior"[3]. M. Friedman proposed the permanent income consumption theory which holds that income can be divided into permanent income and temporary income, and consumers' consumption spending is not primarily determined by its current income, but by their permanent income. Here the "permanent income" refers to the stable income in consumers' lifetime, and such steady income can be understood as certain average of the sum of income in consumers' lifetime[4]. Precautionary savings theory holds that impacted by the uncertainty of future payment and income, the consumers will reduce the current consumption and increase current savings (Leland, 1968)[5]. Liquidity constraint hypothesis holds that the propensity to consume of consumers who are constrained by liquidity is lower than the propensity to consume of consumers who are not constrained by liquidity. Liquidity constraints may lead to precautionary savings (Zeldes and Jappelli, 1989)[6]. The above consumption theories are mainly to specify the impact of income on consumption, but there are many factors that affect consumption, such as interest rates, price levels, income distribution, consumer goods stocks, liquidity, fiscal policy, changes in consumers' preference, demographic size and structure and so on. The impact of these factors can not be ignored, but some of these factors have little effect, and the impact of some factors is difficult to determine, therefore, the research of taking income as the most basic factor determining consumption is feasible.

There are many researches on problems of China's urban-rural residents' consumption, the related researches are as follows: by analyzing the consumption gap between urban and rural residents in China, Jin Shubin *et al.* (2010) hold that there is certain gap of Chinese residents' consumption between urban areas and rural areas, among regions[7]; through the analysis of the consumption demand of rural residents and urban residents, Wang Hongmei *et al.* (2010) hold that in terms of total demand of consumption and structure of consumption, there is a gap between rural residents and urban residents[8]; through the establishment of consumers' intertemporal optimization model comprising the internal consumption habits of consumers, Li Ling *et al.* (2009) use inter-provincial dynamic panel data from 1991 to 2006 to calculate Chinese urban and rural residents' oversensitivity of consumption. The results show that the oversensitivity of consumption of urban residents is higher than the oversensitivity of consumption of rural residents[9]; by analyzing the data from 1984 to 2008 concerning rural residents' consumption and income in China, Li Shenheng (2009) hold that rural residents' marginal propensity to consume in China has experienced a process of increase progressively first and decrease progressively afterwards[10]; through empirical analysis of panel data, Zhang Hu *et al.* (2009) find out that the factors which cause difference of rural residents' consumer spending among regions in China are the level of current income, regional differences and potential factors changing with time[11]; Wang Jingang *et al.* (2009) hold that the rural consumption function had structural change in 1998, and the marginal propensity to consume, on the whole, tended to decline[12]; Hu Jingxian (2010) use time series data from 1949 to 2006 to conduct analysis, and hold that the marginal propensity to consume of China's rural residents takes on U-shape[13]. Most of the researches on rural residents' consumption problems in China stress that changes of rural residents' marginal propensity to consume in China takes on U-shape or inverted U-shape characteristic. There is devoid of researches on rural residents' average marginal propensity to consume in China, while researches on regional characteristics of rural residents' average marginal propensity to consume in China are less. There are many researches on urban residents' consumption problems and comparison between urban consumption and rural consumption, most of which focus on consumption structure and the relationship between the consumption and other economic variables. By the comparative analysis on consumption problems of urban-rural residents in China's four regions between urban areas and rural areas, among regions, this paper tries to winkle out some regularities, and takes them as breakthrough of expanding urban and rural residents' consumption demand, in order to promote balanced and coordinated economic development of China's four major regions.

2 Data source, model establishment and regional classification

2.1 Data source This paper uses the data in *China Statistical Yearbook* from 1992 to 2008[14].

2.2 Model establishment This paper takes the year 1978 as base period; uses urban consumer price index and rural consumer price index respectively to eliminate impact of price; selects the per capita consumption expenditure (yuan) of urban residents and rural residents respectively as the variables to be explained; correspondingly, selects discretionary income (yuan) of urban residents and per capita net income (yuan) of rural residents as explanation variables. The model is established as follows: $Y_t = \alpha + \beta X_t + u_t$, wherein, Y_t is per capita consumption expenditure of urban residents or rural residents in the region; X_t is discretionary income of urban residents or per capita net income of rural residents; α, β are parameters to be estimated; u_t is error term[15,16], We use software Eviews 6.0 to conduct unitary linear regression analysis (ordinary least squares estimation). As for auto-correlation existing in error terms, this paper uses LM (BG) test and generalized least square method to eliminate auto-correlation and estimate regression parameters.

2.3 Regional classification This paper adopts regional classification method in *China Statistical Yearbook*, divides China into eastern region, northeastern region, central region and western region. The eastern region includes Beijing, Shanghai, Tianjin, Hebei, Shandong, Guangdong, Hainan, Fujian, Jiangsu and Zhejiang; the northeastern region includes Liaoning, Jilin and Heilongjiang; the central region includes Hunan, Hubei, Henan, Anhui, Jiangxi and Shanxi; the western region includes Shaanxi, Sichuan, Chongqing, Gansu , Xinjiang, Tibet, Guangxi, Qinghai, Yunnan, Guizhou, Inner Mongolia and Ningxia. Due to shortage of data, this study does not include Taiwan, Hong Kong and Macau.

3 Results and analysis

3.1 Estimation of model Primarily this paper conduct unitary linear regression analysis (least squares OLS estimation) on the data concerning consumption and income of urban and rural residents in China's four areas, and the estimated results of model can be seen in Table 1.

Table 1 Estimated results of model

Region	Type			*t*	R^2	*F*	*DW*
Eastern region	Urban residents	α	194.84	13.18	0.998	8 395.40	1.59
		β	0.66	91.63			
	Rural residents	α	44.85	1.24	0.97	422.72	0.25
		β	0.68	20.56			
Northeastern region	Urban residents	α	96.46	7.99	0.998	6 404.85	1.46
		β	0.72	80.03			
	Rural residents	α	28.62	0.65	0.92	169.00	1.39
		β	0.68	13.00			
Central region	Urban residents	α	152.78	12.93	0.997	5 801.50	0.57
		β	0.65	76.17			
	Rural residents	α	72.85	3.09	0.96	409.20	0.29
		β	0.67	20.23			
Western region	Urban residents	α	127.36	7.28	0.995	3 123.67	0.51
		β	0.70	55.89			
	Rural residents	α	29.71	1.63	0.98	614.93	0.46
		β	0.78	24.80			

In the light of the statistic, the four regional models are fitted well, and all variables have significance, but the DW statistic of eastern, central and western models is low. Now we test whether the error term u_t has auto-correlation.

If the test level is 0.05, the sample size is 17, and we can get the following results after referring to DW test critical value table: $d_L = 1.13, d_U = 1.38$. Only DW value of eastern township model, northeastern township model and northeastern village model is bigger than 1.38, with no auto-correlation; DW value of eastern village model, central model and western model is smaller than 1.13, indicating that there is critical positive auto-correlation in error terms. We further use LM test to find that error terms have second-order auto-correlation, and LM auto-correlation test auxiliary regression estimated result can be shown in Table 2.

Table 2 LM(BG) auto-correlation test auxiliary regression estimated result

Region	Type			*t*	R^2	*LM*	*DW*
Eastern region	Rural residents	RESID(-1)	1.127 9	4.237 4	0.73	12.41	1.91
		RESID(-2)	-0.327 4	-1.134 0			
Central region	Urban residents	RESID(-1)	0.780 7	2.412 4	0.39	6.63	1.56
		RESID(-2)	-0.001 4	-0.004 0			
	Rural residents	RESID(-1)	1.003 0	3.495 2	0.70	11.90	1.75
		RESID(-2)	-0.327 9	-1.110 5			
Western region	Urban residents	RESID(-1)	0.865 7	3.100 0	0.50	8.50	1.83
		RESID(-2)	-0.065 1	-0.168 0			
	Rural residents	RESID(-1)	1.224 3	5.209 4	0.72	12.24	2.20
		RESID(-2)	-0.599 4	-2.471 1			

We use generalized difference method to eliminate auto-correlation, and estimate the regression parameters. The generalized difference transformation form under the conditions of second-order auto-correlation $u_t = \Phi_1 u_{t-1} + \Phi_2 u_{t-2} + v_t$ is $GDY_t = Y_t - \Phi_1 Y_{t-1} - \Phi_2 Y_{t-2}$ and $GDX_t = X_t - \Phi_1 X_{t-1} - \Phi_2 X_{t-2}$. After conducting generalized difference transformation on data concerning eastern, central and western regions, we use generalized least square method to conduct regression on the data, and the form of regression result is $GDY_t = C + \beta \times GDX_t$, and the intercept term is $\alpha = C/(1 - \Phi_1 - \Phi_2)$, thus we get estimated result of former model, which is shown in Table 3. The results indicate that error terms have eliminated auto-correlation, and each statistic has significance.

3.2 Analysis of estimated results

3.2.1 The urban-rural characteristics of residents' propensity to consume is prominent. The marginal propensity to consume of rural residents is higher than the marginal propensity to consume of urban residents in the western, central and eastern regions of China, but the marginal propensity to consume of urban residents is greater than the marginal propensity to consume of rural residents in northeastern region of China; the spontaneous consumption of urban residents in the western, central, northeastern and eastern regions of China is higher than the spontaneous consumption of rural residents in the western, central, northeastern and eastern regions of China, but the spontaneous consumption of urban residents in the northeastern region of China is prominently lower than the spontaneous consumption of urban residents in other regions of China. According to Keynes's absolute income hypothesis, there is the law of diminishing marginal propensity to consume

existing between consumption and absolute income. As can be seen from Table 4, the law of diminishing marginal propensity to consume has been confirmed in the consumption of urban and rural residents in the western, central and eastern regions of China. As the income of rural residents is lower than the income of urban residents in the western, central, northeastern and eastern regions of China, so the marginal propensity to consume of rural residents is higher than the marginal propensity to consume of urban residents. At the same time, due to the high living standard of urban residents, their consumption is higher than the consumption of rural residents, so the spontaneous consumption of urban residents is higher.

Table 3 The estimated result of model after eliminating auto-correlation

Region	Type			*t*	R^2	*F*	*DW*
Eastern region	Rural residents	C	7.38	1.24	0.91	130.11	1.78
		α	36.99				
		GDX	0.78	11.41			
Central region	Urban residents	C	50.75	6.53	0.99	1 034.90	2.26
		α	229.95				
		GDX	0.61	32.17			
	Rural residents	C	6.92	2.11	0.95	231.80	2.00
		α	21.30				
		GDX	0.73	15.22			
Western region	Urban residents	C	48.81	4.33	0.97	443.18	2.40
		α	244.78				
		GDX	0.63	21.05			
	Rural residents	C	9.22	1.63	0.95	225.23	2.25
		α	24.58				
		GDX	0.78	15.01			

Table 4 Urban-rural residents' marginal propensity to consume (MPC)

Region	Urban per capita discretionary income	MPC Urban residents' MPC	Urban residents' spontaneous consumption	Rural per capita net income	MPC Rural residents' MPC	Rural residents' spontaneous consumption
West	2 308.25	0.63	244.78	901.99	0.78	24.58
Central region	2 347.42	0.61	229.95	1 138.69	0.73	21.30
Northeast	2 317.19	0.72	96.46	1 315.70	0.68	28.62
East	3 389.69	0.66	194.84	1 645.59	0.78	36.99

Note: the data is from *China Statistical Yearbook* in 2009 and the above regression equation (the year 1978 is base year).

3.2.2 Regional characteristics of urban residents' marginal propensity to consume is not prominent, and regional characteristics of rural residents' marginal propensity to consume is prominent.

Marginal propensity to consume of urban residents in the western, eastern, central, northeastern regions takes on trend of irregular changes; marginal propensity to consume of rural residents in the western, central, and northeastern regions decreases progressively, but marginal propensity to consume of rural residents in the eastern region is relatively high. Table 4 shows that marginal propensity to consume of urban residents in the western, eastern, central, northeastern regions of China, does not comply with the law of diminishing marginal propensity to consume. In order to explore its causes, I find that marginal propensity to consume of urban residents in the eastern and northeastern regions of China is relatively high, significantly higher than marginal propensity to consume of urban residents in the western and central regions, while solely by researching marginal propensity to consume of urban residents in the western and central regions, we can find that the central and western regions comply with the law of diminishing marginal propensity to consume, which indicates that the eastern and northeast regions are responsible for that consumption of urban residents in China's western, eastern, central, northeastern regions does not comply with the law of diminishing marginal propensity to consume. At the same time, from Table 4, we can also find that the law of diminishing marginal propensity to consume has been confirmed in consumption of rural residents in the western, central and northeastern areas of China. In the light of per capita net income of rural residents in China's regions, residents' income increases progressively in the order of the western, central, northeastern regions, and correspondingly, the residents' marginal propensity to consume diminishes in the order of the western, central, northeastern regions, which is the embodiment of the law of diminishing marginal propensity to consume in China's regions. However, the eastern region violates this law. By probing into the root cause, we find that this is closely related with overall level of economic development, openness degree, consumption credit status, infrastructure and so on in eastern region. First, the holistic level of economic development of eastern region is high, and the urban and rural residents, not impacted by liquidity constraints, are optimistic about future income, thus the marginal propensity to consume of eastern region is higher than the marginal propensity to consume of regions which are impacted by liquidity constraints. Second, the economic development in the eastern region is amazing, and the urban and rural residents' expectancy on future income growth is high, thus the propensity to consume of

current income is high. Third, the rural residents in eastern regions are impacted by " demonstration effect" of higher propensity to consume of surrounding urban residents, thus the propensity to consume is also high. Fourth, the level of urbanization in eastern region is relatively high, the infrastructure is good and it is convenient for rural residents to go shopping in city, thus the marginal propensity to consume is also high.

3.2.3 The rural residents' marginal propensity to consume takes on " multi-U-form" fluctuation trend and the urban residents' marginal propensity to consume takes on low-frequency broad width fluctuation trend.

In the light of the marginal propensity to consume in each year, on the whole, the marginal propensity to consume of rural residents takes on variation trend of " multi-U-shape" , and the change of the marginal propensity to consume of rural residents in different regions has certain difference; the marginal propensity to consume of urban residents takes on trend of broad width fluctuation. It can be seen from Fig. 1 that from 1994 to 2000, the marginal propensity to consume of rural residents takes on U-shape; from 2001 to 2005, the marginal propensity to consume of rural residents takes on another U-shape; after the year 2005, the marginal propensity to consume of rural residents takes on another left side of U-shape. So, I think that the marginal propensity to consume of rural residents since 1992 shows continuous variation trend of " multi-U-shape'. At the same time, the marginal propensity to consume of rural residents in eastern region was down to a serious degree around the year 1998, and even to 0. According to the economic background at the time, as Asian financial crisis broke out in the year 1997, China's economic growth rate decreased from 9.6% in 1997 to 7.3% in 1998, and the decline of economic growth speed makes the income and the future income expectancy decline, thereby the propensity to consume falls. The state adopted a series of policies and measures to encourage and stimulate consumption in 1999, for instance, actively developing consumption credit, lowering interest rates, increasing the income level of low-income earners substantially, expanding consumption fields, increasing income and decreasing burdens, developing the rural market and as on. These policies have greatly stimulated the consumption, so that the residents' marginal propensity to consume is greatly promoted. The rural residents' marginal propensity to consume equaled 1 in the year 2000. Generally speaking, the consumption behavior of rural residents is greatly affected by the economic situation. Economic slump, slow growth of income levels, and especially slow growth of cash income by working elsewhere, directly affect the consumption of rural residents, which makes consumer spending have zero growth and even negative growth. Fig. 1 shows that from 2000 to 2007, the marginal propensity to consume of rural residents in Northeast China is lower than the marginal propensity to consume of rural residents in other regions in the same period; since 2005, the marginal propensity to consume of rural residents in eastern region is higher than the marginal propensity to consume of rural residents in other regions in the same period.

Fig. 2 shows that prior to the year 1995, the marginal propensity to consume of urban residents in China's four areas tended to rise; from 1995 to 2003, the marginal propensity to consume of urban residents in China's four areas took on the trend of small-frequency broad width fluctuation; after the year 2003, the marginal propensity to consume of urban residents in China's four areas took on diminished trend of fluctuation; after the year 2007, the marginal propensity to consume of urban residents in China's four areas took on increased trend of fluctuation again. The fluctuation of marginal propensity to consume of urban residents in eastern, central and western regions is basically synchronous, while the fluctuation of marginal propensity to consume of urban residents in northeastern region is not synchronized with the fluctuation of marginal propensity to consume of urban residents in eastern, central and western regions prominently. The outbreak of the Asian financial crisis in the year 1997 has little impact on the marginal propensity to consume of urban residents in eastern, central, northeastern and western regions.

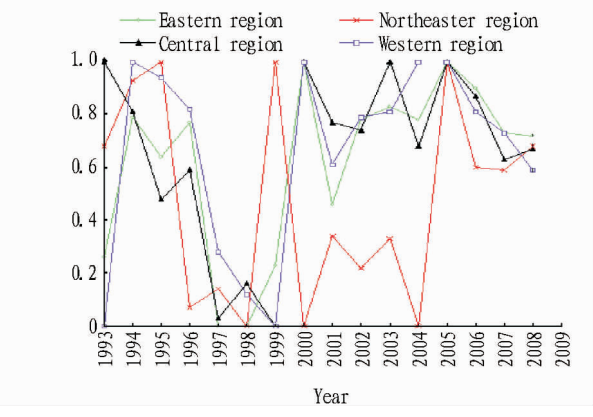

Fig. 1 Rural residents' MPC from 1993 to 2008

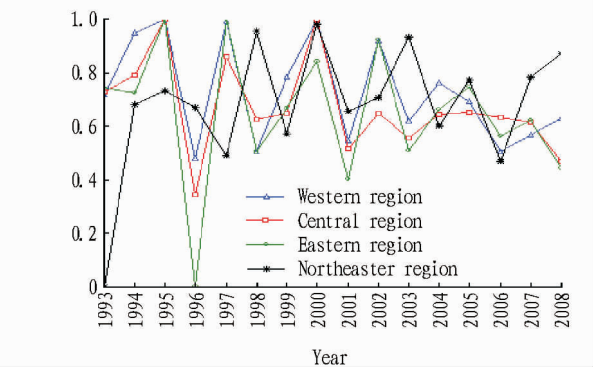

Fig. 2 Urban residents' MPC from 1993 to 2008

3.2.4 Urban-rural residents' average propensity to consume tends to decrease progressively.

The average propensity to consume of rural residents, on the whole, takes on wave-like trend of decline in the long term; the average propensity to consume of all regions in the same period decrease progressively according to the sequence of west, central region and east; the average propensity to consume of rural residents in northeastern region fluctuates greatly; the average propensity to consume of urban residents takes on prominent trend of decline in the long term, while the average propensity to consume of urban residents in northeastern

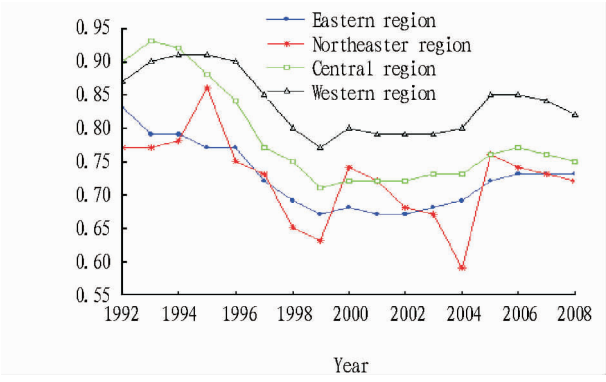

Fig. 3 Rural residents' average propensity to consume from 1992 to 2008

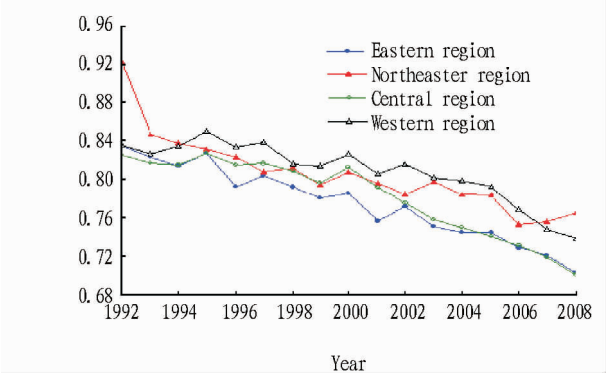

Fig. 4 Urban residents' average propensity to consume from 1992 to 2008

region declines slowly. According to Keynes's absolute income hypothesis, APC is equal to MPC and α/Y. According to the law of diminishing marginal propensity to consume, the average propensity to consume also tends to diminish progressively. It can be seen from Fig. 3 that on the whole, the average propensity to consume of urban residents and the average propensity to consume of rural residents in all regions tend to diminish in the long run, indicating that the average propensity to consume of urban-rural residents in China's regions is basically in line with Keynes's absolute income hypothesis. Meanwhile, the widening income gap among residents in China will also lead to decline of the average propensity to consume. From Fig. 3 and 4, we can also see that the average propensity to consume of urban residents and the average propensity to consume of rural residents in eastern, central and western regions have the identical variation. Moreover, the average propensity to consume of urban residents and the average propensity to consume of rural residents in eastern, central and western regions in the same period begin to decrease progressively according to the sequence of west, central region and east from the year 1994, while the income of urban residents and the income of rural residents in eastern, central and western regions in the same period begin to increase progressively according to the sequence of west, central region and east, indicating that the law of diminishing average propensity to consume has been verified in regional consumption in China.

4 Conclusion and suggestions

According to the relationship between income and consumption of urban and rural residents in China's eastern, central, northeastern, and western regions, the regression model is established. By positive analysis, we can find that there are prominent urban-rural difference and regional characteristics concerning residents' propensity to consume in China's eastern, central, northeastern, and western regions. In my opinion, in order to expand consumer demand of China's residents and promote rapid and balanced growth of China's regional economy, we will take appropriate measures as follows: on the one hand, take effective measures to promote urban and rural residents' propensity to consume, for instance, quicken the pace of perfecting social security system and promote urban and rural residents' marginal propensity to consume; improve income distribution status, increase income of low-income residents, bridge the income gap, and promote average propensity to consume; vigorously develop consumption credit, ease liquidity constraints, actively cultivate hot spot of consumption, promote residents' propensity to consume, expand consumer demand, and so on. On the other hand, formulate pertinent regional consumption policies, including the differentiated consumption policies among four regions and differentiated consumption policies of urban areas and rural areas. For example, conduct regulation and guidance on rural residents' consumption mode in central and western regions, and optimize the consumption structure. Due to historical and socio-economic reasons, the residents in central and western areas form some bad behaviors and habits of consumption, for instance, leading a frugal life, and guzzling and boozing in weddings and funerals. We will strengthen consumer education, foster modern concept of consumption, mode of consumption and habit of consumption of residents in central and western regions, master consumption knowledge, improve consumption skills and thus promote quality of consumption.

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and the second one is the external potential. The internal potential of crop yield refers to the highest yield that can be probably obtained through changing the internal genetic factors and genetic mechanism. The external potential refers to the highest yield obtained probably through overcoming the blocking factors in the growth environment. Through variety cultivation and genetic engineering, the yield of crops can be improved obviously. So far, it is regarded as the most effective way for improving yield potential of crops.

The significances of improving the variety of high yield wheat rely on improving the yield per unit and stabilizing features of yield. Through many years' planting, the high yield feature of a variety will separate from each other, which will lead to the low yield. The improved seeds and advanced cultivation should support each other. An improved seed should go with advanced cultivation technology to get high yield. Cultivation technology is the external appearance of high yield feature. No matter what seed improving approaches (for example cloning) or cultivation technology(for example controllable temperature), the yield per unit potential of crops is limited, for the solar radiation on each area of field is limited. The low yield and high quality is twin legacy of crops, but the high yield and high quality is a contradictory pair. Quality is the restriction factor of quantity to a certain degree, or else. It is the natural law that should be obeyed. It is undeniable that under special situation, there might be the typical of high yield wheat, but it can not last long. This kind of variety and cultivation technology can not be use widely. So, when making the aim of improving and cultivating wheat yield, the natural laws should be obeyed with science and reason.

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