

## Research Article



## Consumption Structure and Net per Capita Income: The Case of Rural Households in Hebei Province China

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**Abstract** | This study is conducted to examine the per capita consumption and per capita net income of the rural households using statistical data of Hebei province China for the period 2000-2014. The descriptive statistical analysis, correlation test, Extend Linear Expenditure System (ELES) model, Gray relational analysis and the residual test have been used in this study. The results of the study indicates that all the rural households consumption have the increasing trend except the Engel coefficient shows the declining trend from 39.508% to 29.355%. The study of regression analysis, MPC (marginal propensity to consume) and APC (Average propensity to consume) clearly shows that in the study area with the rise of rural households income, their consumption demand also increases. The relative co relational analysis shows, that the food consumption ranks first, household consumption has second, clothing consumption third, family equipment consumption fourth have highest close relation with the per capita income of rural households. Lastly the healthcare, transport communication, education and other consumptions have a relatively lower correlation with the rural households' per capita income. The prediction accuracy grade is good for all per capita income and rural households' consumption except the educational consumption grade that is just qualified. Finally we can forecast the future development trend of rural households' consumption structure and income level. By means of the positive analysis, the countermeasures and recommendations have been proposed to develop the rural economy and consumer market in Hebei Province.

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### Introduction

The consumption structure refers to the certain kinds of social economic conditions and the proportional relation by which the people consume

various types of consumer goods in the process of consumption. The consumption structure generally reflects in a certain period of time that individuals and society possess, the various consumption quantities which have already entered into the real con-

sumption process and also the accomplished part of the consumption demand structure. The transformation and evolution of consumption structure is the specific form of consumption level concerning consumption theory (Keynes, 1936). Number of Scholars have conducted the empirical tests on the theory of consumption functions, which is considered as the part of macroeconomic theory. On one hand, the Keynes theory of consumption function states that consumption increases with the increase in income. On the other hand, the absolute income hypothesis of diminishing MPC is inconsistent with the subsistent economic facts. Kuznets (1955) studied the phenomenon of Kuznets mystery, that in the short run MPC is less than APC and in the long run the MPC or APC is stable.

In the 21<sup>st</sup> century along with the gradual improvement of China's socialist market economic system, the rural economy has been developed rapidly, per capita rural households consumption expenditures is growing continuously and consumption structure has changed significantly. At present livelihood issues have been paid more attention in all circles. The report of the 16<sup>th</sup> national congress emphasized on the increasing level of farmers' income, improving the environment of rural living and balancing the development between urban and rural economy should be considered as the significant goal. The rural households are huge consumer groups. It is essential to realize the law which has shown by the promotion of rural households consumption structure, because it is not only relates to the policy implementation of the construction of a rich society, but also reflects the progress which is combined with China's national condition to economic theory research. As for the hot spots about the problems of the rural households' consumption, the domestic scholars have also conducted the empirical research. Bing et al. (2008) and Yu et al. (2006) applied the method of GRA to analyze the trend prediction of rural households consumption based on the prediction of the per capita net income and consumption. The study finds out that at present and in future, the rural households consumption shows the subsistence form on emphasizing the physical consumption and also the favorable policies still needs to be strengthened, and pointed out that income played weaker role in the expenditure of hedonic consumptions such as household equipment, healthcare and transport communication. Linjie et al. (2006) empirically analyzed the income elasticity of rural house-

holds consumption in Hebei province from 1983-2004 and got various kinds of income elasticity of consumption coefficient. Therefore they pointed out that somehow the overall income elasticity of consumption reduced in this period. The growth rate of most of the consumption demand was lower than per capita incomes. So what are the characteristics of rural households' consumption structure in Hebei province and what is the trend of it. There is a doubt that the total per capita consumption expenditure and the total per capita net income can reflect the stability of the consumption function theoretically. The literature shows the rural households consumption of Hebei province should belong to the lower income group, so what is the relationship between general income and the consumption. According to Thomas (1966), it couldn't get both reality and precision in economics. Based on the analysis and research mentioned above, this study has applied descriptive statistics, Extend linear expenditure system, Gray relational analysis etc. to make a research systematic based on the historical data of the rural households consumption index and per capita net income in Hebei province. Moreover, by means of residual test to qualify the results, we can forecast the rural households' consumption structure and income level from 2015 to 2017 in Hebei province in order to get more accurate results.

## Materials and Methods

### Data sources

The data on the rural households consumption expenditures such as food, clothing, residents, household, healthcare, transport, education, others consumptions and the net per capita income of the rural households of Hebei province are taken from the Hebei Province Statistical Yearbook 2004-2014.

### The extend linear expenditure system model

The ELES model is used in this research study. The model can be described as  $X_i$  is the households consumption expenditure on the class  $i$  products and make  $X_i = p_i Q_i = p_i q_i + b_i (I - X_B)$ , ( $i = 1, 2, m$ ). Therefore,  $Q_i$  is the households' demand for the class  $i$  products,  $p_i$  is the price of the class  $i$  products,  $q_i$  is the basic demand,  $b_i$  is the marginal propensity to consume,  $I$  is the income level and  $X_B = \sum p_i q_i$  is the total basic demand expenditure. When the basic demand  $X_B$  assumes not changing, according to the model  $X_i = p_i Q_i = p_i q_i + b_i (I - X_B)$ , sets  $a_i = p_i q_i - b_i X_B$ ,  $a_i$  is the constant, then a linear model of a consumption demand can

be written as  $X_i = a_i + b_i I$ . The ELES model not only directly reflects the composition of various residential consumptions expenditure, but also can be used to calculate the MPC, income and price elasticity of demand.

### Estimating coefficient of ELES model

Assumed that a linear model of a rural consumption demand in Hebei province as  $X_i = a_i + b_i I + u_i$  and  $u_i$  as the random disturbance term. We can use the panel data of per capita income and various consumptions in the statistical yearbook of Hebei province (2000-2014) to estimate the undetermined parameters  $a_i$  and  $b_i$  of the linear model. Then we can calculate the current basic demand and various income elasticities.

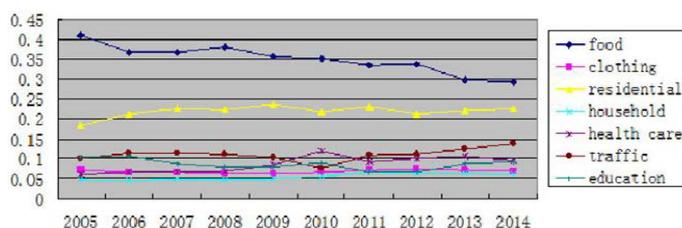
1. Utilizing the least square method to estimate the linear regression model.  $X_i = a_i + b_i I$ .  $a_i = p_i q_i - b_i X_B$ ,  $i=1, 2, \dots, m$ ;
2. Calculating the total basic expenditure:  $X_B = \sum a_i / (1 - \sum b_i)$
3. Calculating each basic expenditure:  $p_i = a_i + b_i X_B$
4. Calculating income elasticity:  $I \cdot b_i / X_i$

### The grey relational analysis for the prediction of the rural households

**Consumption structure in Hebei Province:** GRA is a method of raw data generation, processing, analyzing the similarity and differences of factors of a system in terms of their developing trends, aiming to seek the system's fluctuation rule. Using the generated data which are of strong regularity to establish the corresponding differential equation model, so that we can predict the status of the development trend in the future.

## Results and Discussions

The following figure indicates the per capita consumption expenditure of rural households in Hebei province for the proportion of the total consumption expenditure.



**Figure 1:** The trend of properties of per capital consumption to total consumption expenditure.

In **Figure 1**, the people in Hebei province, basic life consumption such as food and household consumption are the main aspects of the total living consumption expenditure. Therefore, the food consumption has increased from 539.33 RMB in 2000 to 2421.2 RMB in 2014, but the proportion to the total consumption expenditure is on the declining trend from 39.508% to 29.355% means the Engel coefficient is decreasing, which indicates that the Hebei province rural households are at the stage of improving the food consumption quality. The proportion of household consumption is the second, also has shown the increasing trend from 2000 to 2014 and the proportion to the total living consumption expenditure varies from 23.589% to 22.533%. However the consumption on clothing, household, health care, transport, education and other miscellaneous goods have varied 481.61%, 408%, 688.71%, 1046.52%, 658.74% and 84.72%. And the proportion of these goods to the total living consumption expenditure varies from 7.679%, 4.791%, 5.734%, 6.193%, 9.574% and 2.935% to 7.052%, 6.159%, 9.562%, 13.901%, 9.199% and 2.240% respectively. Food consumption expenditure accounts for the largest proportion of the total expenditure, and the Engel coefficient is considered as the general standard of judging the stage of life quality. The life quality consumption stage of rural households moved towards the wealthy well-off society from the basic well-off society.

The above **Table 1** represents the statistics of the Hebei Province rural households' main consumption demand over 15 years. In a long period 2000-2014, the per capita income of the rural households has a close relation with the total consumption (the correlation coefficient is 0.991). Similarly the proportion of pure income to food, clothing, residence, household, healthcare, transport and educational consumptions are 0.996, 0.988, 0.987, 0.992, 0.981, 0.961 and 0.929, respectively. There regression calculation shows, that consumption growth is indeed faster than the income growth, marginal propensity to consume is greater than the average propensity to consume. All these prove that the level of rural households' income and consumption is still lower in Hebei province. The average trend of APC shows, that APC in 2005-2014 is 22.135 percent higher than one in the recent 10 years from 2000-2004, which obviously indicates that the income level of rural households has improved. APC of each consumption unit shows that the proportion of food, clothing, family equipment, housing, health care,

**Table 1:** The analysis of the consumption demand and the income elasticity from 2000–2014.

Index	Definition	I	$\Sigma X_i$	$X_1$	$X_2$	$X_3$	$X_4$	$X_5$	$X_6$	$X_7$						
APC		2000-2004	0.558	0.224	0.041	0.118	0.026	0.038	0.045	0.053						
APC		2005-2014	0.681	0.237	0.047	0.149	0.038	0.059	0.077	0.059						
Correlation index		of I and X	0.991	0.996	0.988	0.987	0.992	0.981	0.961	0.929						
Regression equation	$X = a_i + bI$		-10.55+0.24I	(-32,40.52)	-64.89+0.06I	(-47,23.21)	-3.02+0.19I	(-65,22.50)	-103.37+0.06I	(-636,27.49)	-78.99+0.096I	(-04,18.09)	-19.66+0.12I	(-16,12.54)	-48.62+0.07I	(-116,9.03)
			$R^2 = 0.99$		$R^2 = 0.98$		$R^2 = 0.97$		$R^2 = 0.98$		$R^2 = 0.96$		$R^2 = 0.92$		$R^2 = 0.86$	
Income elasticity	$bI/X_i$ (average)		1.009		1.272		1.298		1.535		1.589		1.583		1.166	

Source: Author's Calculation

**Table 2:** The correlation between the rural households consumption index and the net per capita income in Hebei Province from 2005–2014.

Consumption index	$X_1$	$X_2$	$X_3$	$X_4$	$X_5$	$X_6$	$X_7$	$X_8$
Association	0.833	0.809	0.583	0.618	0.509	0.656	0.710	0.581
Ranking	1	2	6	5	8	4	3	7

Source: Author's Research

transport communication and cultural entertainment are increasing. Among these, the propensity to consume of transport communication and health care are increasing sharply to 56.806% and 71.524% respectively, in the given period. The analysis of the income elasticity of demand represents the response of the consumer to the changes between demand of certain commodities and income. It is also able to measure the sensitive degree to the changes of consumers' income and products demand. The analysis of MPC shows as income increases, the MPC of rural households' food, clothing and other main consumer goods are all positive in Hebei province, means that with the improvement of rural households' income, the consumption demand of rural household also increases. Meanwhile, according to the numerical value of the individual consumption function MPC among all kinds of goods, food consumption ranked as the first, living ranked second, the third is the transportation consumption. The data shows that the rural households' basic living consumption is still an important position (both the values of MPC and income elasticity are rising). Consumption structure is low as a whole. However with the increase of income, the demand for safety and the quality of the life consumption are gradually improving, especially the consumption of transport and communication, which has already become the hot spot of the rural households consumption. The values of rural households' income elasticity of demand to various consumptions are all greater than 1. The food is 1.009 which indicates that

food consumption of the rural in habitants is lack of income elasticity with the increasing of income. The clothing is 1.272 and family equipment 1.298. These have become the necessities in rural consumption without large income elasticity, which represents the main demand for commodities of the rural households in the consumer market. Therefore if the household appliances sold in the rural areas, the wide market would come into being. The most sensitive income elasticity is the transport and communication as 1.583 which shows that the demand of modern industrial and high technological information products are rising in rural households life, less profit and high revenue contribute to the development of agricultural modernization. The income elasticity of health care is 1.589, which means that all the rural households need to pay more and more attention on their health with the increasing income.

*Co relational analysis*

Correlation refers to the mean value of correlation coefficient between the consumption of the rural households and the net per capita income written for  $r_i$ . In Table 2, the correlation order  $r_1 > r_2 > r_7 > r_6 > r_4 > r_3 > r_8 > r_5$  reveals that food consumption stands first, household consumption has second and thirdly the clothing consumption have highest close relation with the per capita income of rural households. This indicate that with the improvement of rural households' consumption especially after meeting the rural households subsistence level and household consumption,

**Table 3:** Related indicators of the value of residual test from 2005–2014.

	$I = X_0$	$\Sigma X_i$	$X_1$	$X_2$	$X_3$	$X_4$	$X_5$	$X_6$	$X_7$	$X_8$
The original data variance $S_1^2$	5456793	4325126	287317	23189	224621	22046	60901	95487	34002	3082
Residual variance $S_2^2$	21668	96319	4158	459	5915	417	2722	7498	5057	129
Posteriori error ratio C	0.063	0.149	0.120	0.141	0.162	0.138	0.211	0.280	0.386	0.205
Low frequency error p	1	1	1	1	1	1	1	1	0.9	1
Prediction precision grade	good	good	good	Good	good	good	good	good	qualified	good

Source: Author's Research.

**Table 4:** Forecast of per capita net income and consumption expenditure of rural households in Hebei Province from 2015–2017.

	$I = X_0$	$\Sigma X_i$	$X_1$	$X_2$	$X_3$	$X_4$	$X_5$	$X_6$	$X_7$	$X_8$
2015	11661.82	9453.02	2718.56	684.54	2103.55	643.39	1050.01	1221.57	785.73	239.65
2016	13256.35	11175.59	3090.47	819.32	2484.92	786.10	1283.79	1524.39	939.07	288.80
2017	15068.90	13212.06	3513.26	980.65	2935.44	960.47	1569.63	1902.29	1122.35	348.04
2015Consumption propensity	0.8106	0.2331	0.0587	0.1804	0.0552	0.0900	0.1048	0.0674	0.0206	
2016Consumption propensity	0.8430	0.2331	0.0618	0.1875	0.0593	0.0968	0.1150	0.0708	0.0218	
2017Consumption propensity	0.8768	0.2331	0.0651	0.1948	0.0637	0.1042	0.1262	0.0745	0.0231	

Source: Author's Research.

they have paid more attention on the improvement and promotion of life quality. Fourthly the family equipments are closely related to per capita income of the rural people. Lastly healthcare, transport communication, education and other consumptions have a relatively lower correlation with the rural households' per capita income. So we should improve the construction of basic facility about rural transport and communication, fasten the development of rural health insurance system and also need to focus for the improvement of the educational system in rural areas of Hebei province. At the same time, the rural areas of the study province need to invest from other places which regards as a difficult task and focus to carry out on the overall planning of urban and rural development in agriculture.

*The residual test*

In Table 3, the prediction accuracy grade is good for all cases such as the rural households per capita income, total per capita living consumption, food, clothing, residential, family equipment and appliance, transport communication and health care's consumptions except the educational consumption grade that is just qualified. The eight are all passed in the test

that can be applied in the prediction analysis.

*Grey prediction analysis*

Generally that the prediction accuracy of the model is inversely proportional to the length of prediction. Therefore, this paper will predict three periods (2015, 2016 and 2017). And the predicted values are shown in Table 4.

The data in Table 4 shows that up to 2017, the prediction value of rural households per capita income and various consumption expenditures are increasing, while consumption propensity are also increasing, while food consumption propensity remains the same.

*Trend analysis*

The correlation calculated between the consumption index of the rural households and the per capita income in Hebei province is shown in Table 5. The correlation order between 2005–2014 is different from the predicted correlation order between 2015–2017. The analysis shows that the trend of educational consumption is not very sharp. According to the survey, the scientific and technological quality of rural households is still low in Hebei province. However,

**Table 5:** *The correlation between the rural households consumption index and the net per capita income in Hebei Province for 2015–2017.*

Consumption index	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	X <sub>7</sub>	X <sub>8</sub>
Association	0.999	0.581	0.627	0.531	0.530	0.497	0.585	0.562
Ranking	1	4	2	6	7	8	3	5

Source: *Author's Research.*

to develop the modern agricultural system, it should be on the basis of cultivating new type of varieties who have a quality of culture, technology and management to increase the rural households' income and to develop the economy. The correlation of transportation is basically unchanged, shows that it still have a large space to improve. With the development of agricultural economy, the basic facilities of transportation, communication, broadcasting, etc. have been improved successively. More and more young rural households' buy computer to surf the internet, which will encourage the rural households to improve the speed of information from various channels. So the transportation and communication consumption will gradually increase.

### Conclusions and Suggestions

According to the above prediction analysis, the rural households per capita food consumption expenditure accounts for 23.3% of per capita living consumption expenditure in Hebei for 2015-2017, which shows that rural households have been basically achieved the well-off standard of living with the rise of income, rural households have paid more attention on the quality of their consumption in Hebei province, especially the basic material of life such as quality of food, clothing and family equipment facilities. And they will attach constantly their increasing importance to health care and cultural education. But they are relatively insufficient about transport communication and residential consumption, both of which have a large opportunity to improve. We need to take various measures to stimulate the consumption demand in order to exploit the rural consumption market in Hebei province and accelerate the process of the construction of new socialist countryside. The following counter measures and suggestions are recommended.

#### Industrially financed agriculture and coordinated urban and rural development

Through the above analysis of rural households' consumption structure, the proportion of consumption

survivability is tending to decline, while development consumption is to rise. The rural resident's consumption structure is changing regularly. But the level of rural households' consumption is still low in the study area. The potential demand is very high. From now onward we should expand the rural commodity market. Meanwhile need to strengthen the industrial financed agriculture in order to promote the rural economic growth. We should clearly realize the demand of industrial and technological goods which have currently presented a strong trend to grow, namely the demand structure of the rural people towards a town. According to the adjustment direction of the rural market consumption demand, we should broaden the service delivery, expand the consumption of health care and transport communication in the rural areas and accelerate the process of the rural town construction.

#### The development of rural economy and the rural households' income

The standard of rural households' income directly determines the ability for payment in the consumption market. Currently the rural households' income of Hebei province is very low, which determines its insufficient ability of consumption. Increasing the rural households' income cause to raise the various consumption expenditures. Therefore, the development of economy, the increasing of the rural households' income and the payment ability of the rural households are the fundamental measures to keep the development of the rural households' consumption and improving the consumption structure continuously.

#### Improving the rural health care system

Health care expenditure has a small proportion of rural households' consumption. But the improved health care system is the premise of rural households' good basic life and the necessary demand of improving rural households' physical quality. At the meanwhile, we should lay the ground for residents to build consumer confidence foundation and remove the trouble to back home the residents' consumption, which

can promote the consumption growth. Establishing and perfecting the social security system, we should gradually establish and adapt the new situation and requirement of the rural minimum living security system, rural old age security system, rural medical treatment of a serious illness insurance and big diseases a whole system. Then it can form a security system of a diversified fund sources, security system standardization and management service socialization. Whereas it can reduce the future uncertain expenditures of farmers to increase farmer's immediate consumption.

### *The concept and guidance for the scientific investment on consumption*

When the demand of basic life consumption can be satisfied by the rural households' they will gradually turn to the highest level of development and the entertainment consumption. We should guide the rural households to convert their consumption idea and transit from self cumulative consumption to credit support consumption. We should exploit the new type of consumption field by increasing the input of rural basic public health, to eliminate the poor health of rural households. The development of rural education as one of the important goals of expanding domestic demand and public spending, we should increase the rural education consumption to ensure that all children get better education opportunities. We should also optimize the investment direction, expand fiscal financial support, promote the implementation policy of home appliances to the countryside, develop the rural transportation and communication, strengthen the basic construction of modern agriculture, enhance the level of rural urbanization and develop the overall rural households' consumption structure.

### Author's Contribution

Wang Jian designed the study, wrote the protocol and prepared the first draft of the manuscript. Abdur Rehman did the data analysis, model modification and rectification. Noor. Khan helped in giving valuable suggestions about the model usage and data analysis. Wang Zhengjia helped in data editing. Ji Peng-fei helped in data collection and data analysis. Xie Cong helped in collection of review of literature. Muhammad Niamatullah Khan Babar helped in synthesizing the literature and Raheel Saqib worked in technical proof reading of the manuscript.

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