# Changes of Consumption Expenditure of Urban and Rural Residents in Ningxia, China

## ——Based on the Expanded Linear Expenditure System Model

**CHEN Li-yu[1*], WEI Li[2]**

1. School of Mathematics and Computer Science, Ningxia University, Yinchuan 750021, China; 2. Xinhua College, Ningxia University, Yinchuan 750021, China

**Abstract** Per capita GDP and rural and urban consumption expenditure in Ningxia are analyzed and compared with the average national levels of China. Principles, methods and advantages of Expanded Linear Expenditure System Model (ELES) are introduced. According to the relevant sample survey data in Ningxia in the years 1996 and 2006, eight variables of consumption expenditures are selected, which are food, clothing, housing, household equipment and supplies, transportation and communication, education and entertainment, medical care, other commodities and services. ELES Model is used to analyze the consumption expenditure of rural and urban residents in Ningxia in the years 1996 and 2006. Result shows that within ten years, consumption level of urban residents in Ningxia has developed from well off to affluence; and the consumption concept of rural residents is increasingly upgraded. At the same time, consumption level of rural residents has changed from having enough food and clothing to the well-off level, along with the sharp decrease in consumption expenditure of food, clothing and housing. Based on this, suggestions are put forward to expand the consumption level of rural and urban residents and to promote the sustained economic growth in Ningxia, China.

**Key words** ELES; Consumption expenditure; Ningxia, China

Affected by the global economic crisis, economic growth in China has reduced significantly since the third quarter of 2008. Taking the expansion of urban and rural consumption as the basic foothold, promoting economic growth has changed from relying on investment and exports to stimulating by the consumption and investment and the domestic and external demands. According to the experience of changes in international economic growth, consumption of urban and rural residents has entered into a rapid growth stage when GDP exceeds 2000 U. S. Dollars. In the year 2008, per capita GDP in China has broken 3000 U. S. Dollars, consumption of urban and rural residents has entered into the stage of scale enlargement and structural improvement[1]. Therefore, we conduct quantitative research on the consumption characteristics and change trends of rural and urban residents in Ningxia, in order to offer references for the enhancement of consumption ability and the upgrading of consumption structure of rural and urban residents in Ningxia.

## 1 Status of per capita GDP and consumption level of Ningixa[2]

In the years 2002 - 2007, both the per capita GDP of Ningxia and the consumption level of urban and rural residents have been increased year by year. But they are lower than the national average levels, and the gap between the two is increasing (Table 1). In the year 2007, consumption level of urban residents in Ningxia ranks the last but five in China and takes the third place in the five northwest provinces. But in the years 2002 - 2007, the growth speed of per capita GDP of Ningxia and the proportion of rural and urban consumption in per capita GDP are higher than the national average level (Table 2). In the year 2007, total GDP of Ningxia is 83.4 billon yuan, up by 12.4% compared with that in the year 2006. Per capita GDP is 13 743 yuan, per capita consumption expenditure of urban residents is 7 817 yuan in Ningxia, increasing by 8.5% compared with that in the year 2006 and accounting for 57.0% in the total per capita GDP and 72.0% in per capita disposable income, respectively. Per capita consumption expenditure of rural residents in Ningxia is 2 529 yuan, up by 12.5% compared with that in the year 2006 and accounting for 18.0% of per capita GDP and 80.0% of per capita disposable income. Therefore, it can be concluded that the driving effect of rural and urban consumption in Ningxia on economic growth is more significant than that in China.

## 2 Research method, variable definition and data source

**2.1 Principle of ELES model**[3] Extend Linear Expenditure System, short for ELES, is a demand function system. In order to further research on the quantitative relation between residents' consumption structure, Linear Expenditure System of demand function is put forward based on utility function. Its basic form is

$$V_i = P_i Q_i = P_i X_i + b_i (V - \sum_{k=1}^{n} P_k X_k) (i = 1, \cdots, n), \quad (1)$$

where $V_i$ is the per capita consumption expenditure of the ith commodity, $V = \sum_{i=1}^{n} V_i$ is total consumption expenditure, $P_i$ is the price of the $i$th commodity, $Q_i$ is the per capita demand of the

Received: November 15, 2009 Accepted: November 26, 2009
* Corresponding author. E-mail: ycsbjlcy_640908@163.com

*i*th commodity, $X_i$ is the basic demand of the *i*th commodity, $P_iX_i$ is the expenditure for the basic demand of the *i*th commodity, $b_i$ is the percentage of expenditure for the *i*th commodity in exceeded expenditure for basic demand ($0 < b_i < 1$), that is, marginal budget ratio, and $\sum_{k=1}^{n} P_kX_k$ is the basic consumption expenditure of various commodities. Consumption expenditure of the *i*th commodity is divided into two parts by Model (1). The part of $P_iX_i$ is the basic consumption expenditure of a given commodity, and the part of $b_i(V - \sum_{k=1}^{n} P_kX_k)$ is the remainder for the *i*th commodity after removing the basic consumption expenditure for all commodities from total budgeted expenditure *V*. But there are two defects in linear expenditure model. One is that total budget expenditure *V* is endogenous variable and can not be given by exogenesis; the other is that a lot of time series data are needed for parameter estimation, but there is often a lack of historical data in practice, which brought great difficulty in the establishment of model. In order to solve this problem, the model is improved without changing its basic principles, that is, income *y* takes the place of total consumption expenditure *V* and marginal budget ratio $b_i$ is replaced by marginal consumption $\beta_i$. Thus, the extended linear expenditure system is formed and its equation is

$$V_i = P_iX_i + \beta_i(y - \sum_{k=1}^{n} P_kX_k) \quad (i = 1, \cdots, n). \tag{2}$$

Let $\beta = \sum_{i=1}^{n} \beta_i$, we have the consumption equation

$$V = (1 - \beta)\sum_{k=1}^{n} P_kX_k + \beta y, \tag{3}$$

where $\beta$ is the total marginal consumption propensity.

Let $\alpha_i = P_iX_i - \beta_i \sum_{k=1}^{n} P_kX_k$, we have:

$$V_i = \alpha_i + \beta_i y. \tag{4}$$

In this linear regression model, per capita income *y* is independent variable and per capita consumption expenditure of the *i*th commodity $V_i$ is dependent variable. According to the data of section, $\alpha_i$ and $\beta_i$ are obtained by least square method. $\sum_{k=1}^{n} P_kX_k = \frac{\alpha}{1 - \beta}$ can be obtained by the method of summation on two sides of $\alpha_i = P_iX_i - \beta_i \sum_{k=1}^{n} P_kX_k$, where $\alpha = \sum_{i=1}^{n} \alpha_i$ and $\beta = \sum_{i=1}^{n} \beta_i$. Hence, $P_iX_i = \alpha_i + \beta_i \frac{\alpha}{1 - \beta}$.

Extended linear expenditure system has significant advantages compared with Engel function model and other mathematical models. Section data can be directly used in the parameter estimation, the marginal consumption tendency, the demand income elasticity and the basic demand analysis. Therefore, extended linear expenditure system is a more advantageous method.

**Table 1 Comparison of per capita GDP and consumption level between Ningxia and China from the year 2002 to 2007** yuan/people

| Year | GDP per capita | | Per capita consumption of urban resident | | Per capita consumption of rural resident | |
|---|---|---|---|---|---|---|
| | China | Ningxia | China | Ningxia | China | Ningxia |
| 2002 | 9 398 | 6 647 | 6 030 | 5 105 | 1 834 | 1 418 |
| 2003 | 10 542 | 7 734 | 6 511 | 5 330 | 1 943 | 1 637 |
| 2004 | 12 336 | 9 199 | 7 182 | 5 821 | 2 184 | 1 926 |
| 2005 | 14 103 | 10 239 | 7 943 | 6 404 | 2 555 | 2 094 |
| 2006 | 16 084 | 11 847 | 8 679 | 7 206 | 2 829 | 2 247 |
| 2007 | 18 665 | 13 743 | 9 997 | 7 817 | 3 224 | 2 528 |

Note: Data are from the 2003 – 2008 *China Statistical Yearbook*.

**Table 2 Proportions of urban and rural resident consumption per capita of Ningxia and China in GDP from the year 2002 to 2007** %

| Year | Proportion of urban resident consumption in GDP per capita | | Proportion of rural resident consumption in GDP per capita | |
|---|---|---|---|---|
| | China | Ningxia | China | Ningxia |
| 2002 | 64 | 77 | 20 | 21 |
| 2003 | 62 | 69 | 18 | 21 |
| 2004 | 58 | 63 | 18 | 21 |
| 2005 | 56 | 63 | 18 | 20 |
| 2006 | 54 | 61 | 18 | 19 |
| 2007 | 54 | 57 | 17 | 18 |

Note: Data are from the 2003 – 2008 *China Statistical Yearbook*.

**2.2 Variable definition and data source** *C*1, *C*2, *C*3, *C*4, *C*5, *C*6, *C*7 and *C*8 are per capita expenditures of eight living consumer commodities, which are food, clothing, housing, household equipment and supplies, transportation and communication, education and entertainment, medical care, other commodities and services of rural and urban residents, respectively. Data are from the sampling survey on 1 050 urban residents and 550 rural residents in the year 1996, 950 urban residents and 600 rural residents in 2006 by the Comprehension Office of Ningxia Investigation Group, the National Bureau of Statistics of China[4].

## 3 Result and analysis

Calculation result of ELES model is reported in Table 3 and 4. Correlation coefficient of the model is between 92.0 % and 99.6%; and there is close correlation among the expenditures. Errors between estimated value and actual value of consumption expenditure of rural and urban residents are all below 3%, indicating that ELES model has high fitting precision and its result is tally with the actual situation.

**3.1 Consumption analysis of Ningxia urban residents** Consumption of Ningxia urban residents shows the trend of pursuing modern prosperous and civilized fashion. Table 3 reports that the descending order of consumption expenditures in the year 1996 is *C*1, *C*2, *C*6, *C*3, *C*5, *C*4, *C*8 and *C*7. Therefore, it can be concluded that food, clothing, education, housing and transportation and communication account for a large proportion

in total consumption of urban residents in 1996. In the year 2006, consumption expenditure from high to low is in the order of *C*1, *C*2, *C*3, *C*6, *C*5, *C*7, *C*4 and *C*8, indicating that food, clothing, housing, education, and transportation and communication account for a large proportion of consumption expenditure in the year 2006. At the same time, Engel Coefficients of Ningxia in the year 1996 and 2006 are 45% and 35%, respectively. According to the standards of FAO, consumption level of urban residents in Ningixa has changed from the well off to affluence within the 10 years and becomes close to the level of the most affluence.

**Table 3 Comparison of consumption parameters of Ningxia urban residents in the years 1996 and 2006**

| Consumption item | $\beta_i$ | | $P_iX_i$ | | $V_i$ Estimated value | | $V_i$ Actual value | |
|---|---|---|---|---|---|---|---|---|
| | 1996 In 1996 | 2006 In 2006 | 1996 In 1996 | 2006 In 2006 | 1996 In 1996 | 2006 In 2006 | 1996 In 1996 | 2006 In 2006 |
| *C*1 | 0.212 | 0.129 | 1 224.490 | 1 897.460 | 1 368.905 | 2 708.008 | 1 377.25 | 2 760 |
| *C*2 | 0.132 | 0.074 | 427.869 | 520.506 | 517.788 | 985.472 | 526.53 | 994 |
| *C*3 | 0.063 | 0.059 | 169.154 | 525.258 | 212.070 | 895.974 | 214.49 | 911 |
| *C*4 | 0.010 | 0.035 | 170.001 | 253.84 | 176.813 | 473.756 | 171.77 | 481 |
| *C*5 | 0.050 | 0.083 | 171.075 | 334.348 | 205.135 | 855.865 | 209.98 | 859 |
| *C*6 | 0.078 | 0.061 | 208.181 | 481.052 | 261.315 | 864.335 | 262.57 | 863 |
| *C*7 | 0.018 | 0.036 | 88.541 | 401.587 | 129.860 | 627.787 | 132.50 | 646 |
| *C*8 | 0.059 | 0.024 | 107.008 | 161.627 | 147.199 | 312.427 | 143.87 | 302 |
| Total | 0.622 | 0.501 | 2 566.319 | 4 575.678 | 3 019.085 | 7 723.624 | 3 038.96 | 7 816 |

**Table 4 Comparison of consumption parameters of Ningxia rural residents in the years 1996 and 2006**

| Consumption item | $\beta_i$ | | $P_iX_i$ | | $V_i$ Estimated value | | $V_i$ Actual value | |
|---|---|---|---|---|---|---|---|---|
| | 1996 In 1996 | 2006 In 2006 | 1996 In 1996 | 2006 In 2006 | 1996 In 1996 | 2006 In 2006 | 1996 In 1996 | 2006 In 2006 |
| *C*1 | 0.193 | 0.067 | 638.699 | 792.89 | 720.346 | 1 021.265 | 729.68 | 1 019 |
| *C*2 | 0.047 | 0.023 | 71.905 | 105.747 | 91.788 | 184.144 | 94.44 | 184 |
| *C*3 | 0.027 | 0.029 | 54.208 | 353.492 | 65.630 | 452.341 | 66.72 | 450 |
| *C*4 | 0.031 | 0.011 | 40.724 | 70.538 | 53.838 | 108.032 | 55.42 | 109 |
| *C*5 | 0.020 | 0.021 | 21.781 | 193.164 | 30.242 | 264.744 | 31.32 | 266 |
| *C*6 | 0.056 | 0.016 | 55.791 | 138.868 | 79.482 | 193.405 | 78.77 | 192 |
| *C*7 | 0.158 | 0.023 | 96.048 | 163.561 | 162.888 | 241.958 | 156.20 | 239 |
| *C*8 | 0.014 | 0.014 | 13.584 | 18.158 | 19.507 | 65.878 | 21.08 | 68 |
| Total | 0.546 | 0.204 | 992.74 | 1 836.418 | 1 223.721 | 2 531.767 | 1 233.63 | 2 527 |

Marginal consumption level of Ningxia urban residents is 0.501 in the year 2006, indicating that 50.1 percent of one unit income increase is used for living consumption. Descending order of marginal consumption is *C*1, *C*5, *C*2, *C*6, *C*3, *C*7, *C*4 and *C*8, showing that urban residents are in pursuit of the optimization of food structure. They pay attention to the brand of clothes, comfortable apartment, cultural life, tourism recreation, knowledge accumulation and disease prevention.

**3.2 Consumption analysis of Ningxia rural residents** Living consumption of farmers in Ningxia has changed into development type and entertainment type. Table 4 reports that the consumption expenditure from high to low is in the rank of *C*1, *C*7, *C*2, *C*6, *C*3, *C*4, *C*5 and *C*8 in the year 1996, indicating that food, medical treatment, clothing, education and housing account for a large proportion of consumption expenditure in rural residents. In the year 2006, descending order of consumption expenditure is *C*1, *C*3, *C*5, *C*7, *C*6, *C*2, *C*4 and *C*8, showing that food, housing, transportation and communication, medical care, and education account for relatively great proportion in consumption expenditure. In the years 1996 and 2006, Engel Coefficients of Ningixa are 59% and 40%, respectively. According to the standards of FAO, consumption level of rural residents in Ningixa has changed from enough food and clothing to well off within the 10 years.

In the year 2006, marginal consumption level of Ningxia rural residents is 0.200, indicating that 20.0 percent of one unit income increase is used for living consumption. Descending order of marginal consumption is *C*1, *C*3, *C*2, *C*7, *C*5, *C*6, *C*4 and *C*8. Table 4 shows that proportions of food, clothing and housing in the year 2006 have greatly decreased compared with those in the year 1996. With the gradual improvement of informational and electrization family, household appliances are upgraded rapidly and expenditure for education, transportation and communication, and medical care is greatly enlarged.

## 4 Countermeasures and suggestion

Based on the increasing rural and urban income in Ningxia, consumption expectation of rural and urban residents should be stimulated, which can change the potential consumption demand to the actual consumption behavior. We should accelerate the dilapidated housing renovation in rural areas and the construction of new rural comfortable dwelling project, speed up the construction of affordable housing and ensuring housing in cities, promote the establishment of industrial bases for Chinese wolfberry, beef and mutton, milk, potato, and vegetable, make efforts in the breeding of hig-quality rice, wheat, freshwater fish, grape, jujube, and apple, develop tourism resources along the mountains and rivers. At the same time, we should

also improve the service quality, recreational facility, traffic condition, food quality and construction level of " Farm Tourism" and " Red Education Base" , implement the subsidy polices for household appliances, farm machinery, and farm vehicles, exert the driving effect of Regional Centre of Yinchuan City and urban and rural integration city of Shizuishan on consumption, strengthen the fairness of the law enforcement and safety protection in residents' living consumption, and speed up the construction of social security system for urban and rural residents.

## References

[1] WANG Y, LIU Z. China's GDP per capita exceeded 3000 US dollars[N]. Ningxia Daily, 2009-03-07. (in Chinese).
[2] Ningxia Hui Minority Autonomous Region Statistical Bureau, Ningxia Survey Organization, National Bureau of Statistics. Statistical communique on the 2007 national economic and social development in Ningxia Hui Autonomous Region[N]. Ningxia Daily, 2008-04-06. (in Chinese).
[3] LU QC, FAN L, ZOU P. Trend of the change of consumption structure of residents in rural area in Yunnan——based on the analysis of ELES[J]. Technoeconomics & Management Research, 2008(1):125-127. (in Chinese).
[4] Ningxia Survey Organization, National Bureau of Statistics. Ningxia survey data of 1997 and 2007[M]. Yinchuan: Ningxia Press and Publication Bureau, 1997:32-37, 2008:69-76, 86-87, 90-106. (in Chinese).

# 宁夏城乡居民消费支出变化分析——基于扩展线性支出系统模型

陈丽宇[1],魏丽[2]
(1.宁夏大学数学计算机学院,宁夏银川 750021;2.宁夏大学新华学院,宁夏银川 750021)

**摘要** 分析了宁夏地区人均GDP及城乡居民消费水平的现状,并将其与全国平均水平进行了比较。介绍了扩展线性支出系统模型的原理、方法和优点。根据1996、2006年宁夏地区的相关抽样调查数据,选择了食品、衣着、居住、家庭设备及用品、交通和通讯、文化教育娱乐、医疗保健、其他商品和服务8项消费支出变量,运用扩展线性支出系统模型对1996、2006年宁夏城乡居民消费支出的变化进行了对比分析。结果表明,1996~2006年10年间,宁夏城市居民生活消费水平由小康变为富裕,并接近最富裕水平,城市居民消费理念不断升级;宁夏农村居民生活消费水平由温饱变为小康,其食品、衣着、居住等方面的消费支出所占比重大幅下降。基于此,提出了扩大宁夏城乡居民消费水平、推动经济持续增长的相关建议。

**关键词** ELES;消费支出;宁夏

(From page 15)

in rural areas is to strengthen the rural infrastructure, establish the rural economy and talent flow and introduction mechanism, ameliorate the rural labor market, improve the adaptability of the rural education system reform to the economic construction, enhance the competiveness of the rural labor force and improve the level of the agricultural science and technology.

## References

[1] Research Department of Rural Economy, Development Research Center of the State Council of China. The gains from education in rural China: an empirical study[J]. Journal of Agrotechnical Economics, 2007(4):4-10. (in Chinese).
[2] WANG SM. Input-output research in education[M]. Shijiazhuang: Hebei Education Press, 1996. (in Chinese).
[3] AN XH. Analysing the method of measuring the personal rate of return in the educational investment[J]. Journal of Northwest Normal University:Social Sciences, 2002(3):96-100. (in Chinese).
[4] PSACHAROPOULOS G, PATRINOS HA. Returns to investment in education: a further update[J]. Education Economics, 2004, 12(2):111-134.

# 农村教育对农村劳动力收入分配影响的实证分析——以重庆永川为例

朱建勇 (重庆文理学院,重庆永川 402160)

**摘要** 以永川区乡镇从业劳动人员为调查对象,依据2009年7~9月对永川区的1 000份问卷调查数据,采用明瑟收益率模型,通过相关分析、回归分析、估计值分析探讨了农村教育对农村劳动力收入分配的影响。结果表明,被调查对象的年总收入与受教育程度在0.01水平上呈显著的线性正相关,与工龄在0.05水平上呈显著负相关,受教育程度与工龄分别在0.01、0.05平上呈显著的正相关;从不同文化程度劳动力的个人收入构成来看,受教育程度越高农业收入呈下降趋势,经营性收入呈W型,工资性收入呈递增趋势;各级各类教育明瑟收益率存在明显差距,教育总体收益率为5.2%,从小学到大专的不同教育程度的教育个人相对收益率呈上升趋势,且均通过显著性检验,其中,大专文化程度的教育收益率最高,小学文化程度的教育收益率最低,工龄及工龄平方对教育个人收益没有较大影响。

**关键词** 县域;农村教育;劳动力;收入分配