Quantitative analysis of resident consumption structure in Sichuan Province

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Abstract. Based on the data of residents' income and consumption from Sichuan Statistical Yearbook and China Statistical Yearbook from 2014 to 2018, this paper makes a descriptive analysis on the current situation of residents' consumption in Sichuan Province from three aspects: income expenditure comparison, Engel coefficient and the proportion of each consumption spending. Based on the income and consumption data of urban and rural residents in Sichuan Province, the consumption structure of urban and rural residents in Sichuan Province is analysed from two aspects of marginal propensity to consume and income elasticity of demand by using the results of ELES model. At last, the paper puts forward relevant suggestions from four aspects: exploring ways to increase residents' income, reducing residents' housing cost, strengthening infrastructure construction and improving rural medical insurance coverage.

1. Introduction
In recent years, with the continuous improvement of the level of social development, residents' consumption level has been greatly improved. After basic food, clothing, housing and transportation are guaranteed, the consumption of residents begins to tilt to entertainment and leisure, and all kinds of enjoyable consumption expenditures begin to increase. The proportion of various types of consumption of residents is also changing constantly, which promotes the overall consumption upgrade [1-2]. The upgrading of consumption not only has a driving effect on economic development, but also can optimize the market structure and promote the transformation and upgrading of the market. By analyzing the change of consumption of residents in a region in a period of time, on the one hand, it can be understood the change of the local residents living standards, on the other hand can also have a basic understanding of economic development in the region. The comparative analysis of the consumption structure between urban and rural residents can help us realize the reasons for the differences between urban and rural areas, and provide a reference path for narrowing the gap between urban and rural areas.

2. Material and method

2.1. Keynes' theory of consumption
In The General Theory (1936), Keynes examined the relationship between consumption and income, which is expressed as:

\[ C = C(Y-T) = \alpha + \beta(Y-T) \]  

\[(1)\]
Where, \( C \) represents household consumption (expenditure), \( Y \) represents household income, \( T \) represents tax on household income, \( \alpha \) represents spontaneous consumption, and \( \beta \) represents marginal propensity to consume [3]. Keynes believed that household consumption was mainly determined by the current (disposable) income, and with the increase of household income, both the average propensity to consume and the marginal propensity to consume were decreasing. Keynes' consumption theory came to be known as the absolute income hypothesis. This absolute income hypothesis studies static immediate consumption under the condition of certainty, without considering the influence of uncertainty on household consumption (demand). Keynes' consumption theory is the cornerstone of this paper. This paper analyzes the residents' current disposable income and its structure.

2.2. Extended Line Expenditure System Model (ELES Model)
The ELES model was proposed by economist Lunch in 1973, which is fully called the extended linear expenditure system model. Model assumes that the needs of residents of a commodity that is affected by the commodity price [4], will be subject to the conditions of people's income, the demand is divided into two kinds, one is the most basic requirements, the second is beyond the requirements of basic, fundamental requirements will not be affected by per capita income, and beyond the basic needs can be under the influence of income per capita consumption according to some kind of marginal propensity to consume (Figure 1). Only the influence mechanism of demand and consumption is shown here, and the specific model is shown in 3.4. This model is the theoretical foundation for the analysis of consumption structure in this paper.

Figure 1. Demand and consumption influence mechanism.

3. Results and discussion

3.1. Comparative analysis of income and expenditure
From 2014 to 2018, the per capita disposable income and per capita consumption expenditure of both urban and rural residents in China and Sichuan Province increased significantly. On the whole, the per capita disposable income and per capita consumption expenditure of Sichuan residents are lower than the national average level, but the annual average growth rate of both in the five years is higher than the national average level. In terms of the proportion of per capita consumption expenditure to per capita disposable income, Sichuan province kept at about 78% during the five years, higher than the national average level of 71%, indicating that residents in Sichuan province have a high consumption concept. Sichuan province from the point of urban and rural, urban and rural residents per capita disposable income, urban per capita consumer spending are below the national average, rural residents per capita consumption expenditure from 2015 began to catch up with the national average, rural residents per capita consumption expenditure annual average growth rate of 11.27%, 1.61 percentage points higher than the national average level, It shows that the consumption level of rural residents in Sichuan Province has been significantly improved (Table 1).
Table 1. Table of per capita disposable income and consumption expenditure of Sichuan province and China from 2014 to 2018.

| year     | 2014  | 2015  | 2016  | 2017  | 2018  | Average annual growth rate |
|----------|-------|-------|-------|-------|-------|---------------------------|
| Sichuan per capita disposable income | 15749 | 17221 | 18808 | 20580 | 22461 | 9.28%                     |
| National per capita disposable income | 20167 | 21966 | 23821 | 25974 | 28228 | 8.77%                     |
| Sichuan per capita consumption expenditure | 12368 | 13632 | 14839 | 16180 | 17664 | 9.32%                     |
| National per capita consumption expenditure | 14491 | 15712 | 17111 | 18322 | 19853 | 8.19%                     |

3.2. Engel coefficient analysis

Engel's coefficient is an internationally used index to measure residents' living standard. According to the standard of the Food and Agriculture Organization of the United Nations, an Engel's coefficient above 59% means poor, 50% ~ 59% means adequate food and clothing, 40% ~ 50% means well-off, 30% ~ 40% means rich, and less than 30% means the most affluent.

According to the collected data, the Engel coefficient of urban and rural residents in Sichuan Province and China from 2014 to 2018 was calculated (Figure 2). The Engel coefficient of Sichuan Province during 2014 to 2018 was within the range of 30% to 40%, which was considered as the rich level, and showed a trend of decline year by year, indicating that the living standard of the whole province was continuously improving. But it still falls short of the national average, with the country's Engel's coefficient falling below 30 percent since 2017 and moving into a new stage of being the most affluent. The Engel coefficient of urban residents in China has entered the most affluent stage since 2015, while the cities and towns in Sichuan are still in the rich stage. The annual difference between the Engel coefficient of rural areas in Sichuan and that of the whole country is about 5 percentage points, indicating that there is still a certain gap between the living standard of rural residents in Sichuan and the average level of rural residents in China. In addition, the Engel coefficient gap between urban and rural areas in Sichuan is about 1 percentage point higher than that between urban and rural areas in China, indicating that the living standard imbalance between urban and rural residents in Sichuan is more prominent.

Figure 2. Changes of Engel's coefficient of urban and rural residents in Sichuan Province and China during 2014-2018.
3.3. Comparative analysis of various consumer expenditures
According to the classification standard of consumption expenditure in the statistical yearbook, residents' consumption expenditure is divided into eight categories, such as food, tobacco and alcohol, clothing and housing. The proportion of eight types of consumption is shown in Table 2. From 2014 to 2018, the proportion of food, alcohol and tobacco, clothing consumption of Sichuan residents decreased year by year, indicating that people's needs in food and clothing have been met and they have begun to move forward towards a high-quality life. The proportion of housing consumption is increasing year by year. In recent years, the housing price remains high in Sichuan Province, and the excessively high housing consumption limiting people's other consumption behaviors. The government should exercise moderate regulation. The proportion of consumption expenditure in traffic communication, education, culture and entertainment, and Medical care all increased. Consumption is a form of demand, indicating that residents' consumption in Sichuan Province is upgrading.

| Consumption category | Food alcohol and tobacco | clothing | housing | Supplies and services | Traffic communication | Education, Culture and Entertainment | Medica l care | Other supplies and services |
|----------------------|-------------------------|---------|---------|----------------------|----------------------|-------------------------------------|--------------|--------------------------|
| 2014                 | 36.77%                  | 7.88%   | 17.93%  | 7.12%                | 11.62%               | 8.58%                               | 7.79%        | 2.32%                    |
| 2015                 | 36.69%                  | 7.86%   | 17.61%  | 6.73%                | 11.95%               | 8.86%                               | 7.86%        | 2.44%                    |
| 2016                 | 35.86%                  | 7.69%   | 18.43%  | 6.52%                | 12.47%               | 8.66%                               | 7.90%        | 2.47%                    |
| 2017                 | 34.81%                  | 7.13%   | 18.21%  | 6.57%                | 13.60%               | 9.07%                               | 8.16%        | 2.45%                    |
| 2018                 | 33.62%                  | 6.65%   | 19.07%  | 6.69%                | 13.58%               | 9.06%                               | 8.88%        | 2.46%                    |

3.4. ELES model introduction
ELES can reveal the characteristics of consumption structure and reflect the changing trend of consumption structure through comparative analysis of different consumption demand factors. The basic formula is as follows:

$$Z_i = p_i q_i + b_i (Y - \sum_{i=1}^{n} p_i q_i)$$  \(i=1, 2, 3 \ldots n\)  (2)

Where, \(Z_i\) represents the consumption expenditure of commodity \(i\), \(p_i\) represents the price of commodity \(i\), \(q_i\) represents the basic demand of commodity \(i\), \(Y\) represents the per capita income of residents, and \(b_i\) represents the marginal propensity to consume. Expand the above formula to get:

$$Z_i = p_i q_i + b_i Y - b_i \sum_{i=1}^{n} p_i q_i$$  \(i=1, 2, 3 \ldots n\)  (3)

If \(a_i = p_i q_i - b_i \sum_{i=1}^{n} p_i q_i\) can get:

$$Z_i = a_i + b_i Y + \varepsilon_i$$  \(i=1, 2, 3 \ldots n\)  (4)

Where, \(a_i\) and \(b_i\) are the parameters to be estimated, and \(\varepsilon_i\) is the random error term.

3.5. Establishment of ELES model
The data of per capita disposable income and expenditure of rural and urban residents in Sichuan Province from 2008 to 2018 were collected and sorted through Sichuan Statistical Yearbook. Eviews software was used to carry out linear regression based on OLS to obtain the estimated values of various parameters. As can be seen from the estimation results of ELES model of urban residents' consumption in Sichuan Province, the P values of each consumption variable are all less than 0.05 at the significance level of 5%, indicating that the per capita disposable income of urban residents in Sichuan Province has a significant impact on all kinds of consumption expenditures. According to the
R-squared determination coefficient of the model, except for medical care, other supplies and services, the determination coefficient of other consumption structure models is above 70%, indicating that more than 70% of these consumption expenditures are determined by residents' per capita disposable income (Table 3).

**Table 3.** Estimation results of ELES model of urban household consumption in Sichuan Province from 2008 to 2018.

| Dependent variable                   | ai     | bi     | R-squared | Prob.  |
|--------------------------------------|--------|--------|-----------|--------|
| Food alcohol and tobacco             | 2425.324 | 0.162139 | 0.948857 | 0.0000 |
| clothing                             | 817.6624 | 0.031786 | 0.748369 | 0.0006 |
| housing                              | -1957.746 | 0.191418 | 0.892395 | 0.0000 |
| Supplies and services                | 178.8329 | 0.041729 | 0.943843 | 0.0000 |
| Traffic communication                | -1752.039 | 0.152997 | 0.903479 | 0.0000 |
| Education, Culture and Entertainment | 829.8271 | 0.045358 | 0.725751 | 0.0009 |
| Medical care                         | 778.5956 | 0.029049 | 0.493913 | 0.0159 |
| Other supplies and services          | 292.8533 | 0.01085 | 0.632019 | 0.0034 |

It can be seen from the estimation results of ELES model of rural residents' consumption in Sichuan Province that at the significance level of 5%, the P values of all consumption variables are less than 0.05, indicating that the per capita disposable income of rural residents in Sichuan Province also has a significant impact on all kinds of consumption expenditure. According to the R-squared determination coefficient of the model, the lowest medical care determination coefficient also reaches 94.53%, indicating that the model of rural residents' consumption structure in Sichuan Province has a good matching effect, and more than 94% of all kinds of consumption expenditure are determined by residents' per capita disposable income (Table 4).

**Table 4.** Estimation results of ELES model for rural household consumption in Sichuan Province from 2008 to 2018.

| Dependent variable                   | ai     | bi     | R-squared | Prob.  |
|--------------------------------------|--------|--------|-----------|--------|
| Food alcohol and tobacco             | 260.2207 | 0.321255 | 0.99641  | 0.0000 |
| clothing                             | -87.66608 | 0.063254 | 0.988045 | 0.0000 |
| housing                              | -328.3135 | 0.198169 | 0.877002 | 0.0000 |
| Supplies and services                | -154.1331 | 0.076819 | 0.983145 | 0.0000 |
| Traffic communication                | -481.5488 | 0.148741 | 0.981473 | 0.0000 |
| Education, Culture and Entertainment | 12.48619  | 0.06731 | 0.964102 | 0.0000 |
| Medical care                         | -473.6281 | 0.129783 | 0.945321 | 0.0000 |
| Other supplies and services          | -35.90537 | 0.020208 | 0.974322 | 0.0000 |

### 3.6. Model analysis

#### 3.6.1. Analysis of marginal propensity to consume
The parameter $b_i$ in the model represents the marginal propensity to consume. That is, after the residents' disposable income has met the basic demand for a certain commodity or service, the remaining income will be distributed between the consumption of the $i$th commodity and the savings according to the proportion of $b_i$. At this point, each increase or decrease of a unit of income, the average will cause a change in the consumption of some goods or services. It can be seen from the estimation results of ELES model of urban residents' consumption in Sichuan Province that the highest marginal propensity to consume for residential...
consumption is 0.1914. That is to say, after the basic needs are met, 19.14% of the disposable income of urban residents will be spent on housing consumption for each unit of disposable income increased. It shows that housing is the main part of urban residents' consumption. This is mainly because house prices have risen too fast over the past 11 years. The marginal propensity to consume food, tobacco and alcohol is the second, indicating that food, tobacco and alcohol are still the basis of residents' consumption. The marginal propensity to consume traffic communication is 0.153, indicating that urban residents have a large demand for traffic communication. The estimation results of ELES model of rural residents' consumption show (Table 4) that the marginal propensity to consume food, tobacco and alcohol is the largest, reaching 0.3213, indicating that 32.13% of rural residents' disposable income is spent on food, tobacco and alcohol consumption, and food, tobacco and alcohol consumption is still the focus of rural residents' consumption. Secondly, the marginal propensity to consume of residential consumption is 0.1982, which is the same as that of urban residents, indicating that the change of housing price also stimulates the consumption structure of rural residents. The marginal propensity to consume of traffic communication consumption and medical care consumption both exceeded 0.1, indicating that the increasingly developed transportation and communication has driven the change of rural residents' consumption. Due to the large number of elderly people in rural areas, rural residents have a higher demand for medical care.

3.6.2. Demand income elasticity analysis. Income elasticity of demand can reflect the degree of impact of income changes on commodity consumption demand. Generally, Em is used to represent the income elasticity coefficient of demand. If Em<0, it means that the income elasticity of demand is very low, generally for low-grade products; If 0<Em< 1, indicates lack of elasticity and is generally a necessary product; If Em>1, that is full of elasticity, generally is high-grade products. Its calculation formula is as follows:

\[ Em = \frac{b_i Y}{Z_i} \]  

(5)

Where, bi represents the marginal propensity to consume, Zi represents the consumption expenditure of commodity i, and Y represents the per capita income of residents. The elasticity coefficient of demand income of urban and rural residents in Sichuan Province was calculated according to the formula (Table 5). It can be seen that the Em values of traffic communication and housing of urban residents are both greater than 1, indicating that the growth rate of demand for traffic communication and housing of urban residents is higher than the growth rate of income, and traffic communication and housing are the key points of urban residents' consumption. The Em values of the other 6 categories are all between (0, 1), which belong to the basic category of consumer goods. The Em values of food, tobacco and alcohol, education, culture and entertainment of rural residents are between (0, 1), all close to 1, indicating that the basic needs of rural residents in food, tobacco and alcohol, education, culture and entertainment have been met. The Em values of the other six categories of consumption are all greater than 1, indicating that rural residents are greatly affected by income changes in these six categories of consumption.

Table 5. Elasticity coefficient of demand income of urban and rural residents in Sichuan Province from 2008 to 2018.

| Em                | Food, alcohol and tobacco | clothing | housing | Supplies and services | Traffic communication | Education, Culture and Entertainment | Medical care | Other supplies and services |
|-------------------|---------------------------|----------|---------|-----------------------|-----------------------|--------------------------------------|--------------|---------------------------|
| urban             | 0.598                     | 0.464    | 1.848   | 0.839                 | 2.056                 | 0.549                                | 0.454        | 0.452                     |
| rural             | 0.911                     | 1.201    | 1.250   | 1.320                 | 1.642                 | 0.978                                | 1.789        | 1.274                     |
4. Conclusions
From the above analysis, it can be concluded that the level of basic living consumption of residents in Sichuan Province is gradually improved with the basic consumption demands such as food and clothing met. The overall consumption structure is being gradually optimized, but the proportion of residential consumption expenditure in the total household consumption expenditure is too large, affecting the demand for other consumption. Urban residents’ consumption focuses on traffic communication and residential consumption, while rural residents have a strong demand for traffic communication and medical care. At the same time, their consumption is also hot in housing and clothing, and the overall movement towards a high quality of life. However, as Sichuan Province is located in the western region, the overall consumption level of residents has not reached the national average level, thus the consumption structure still needs to be optimized.

References
[1] Fang Fuqian, Yu Jian. The Evolution of Household Consumption Theory and Empirical Facts [J]. Economic Trends, 2014(3):11-34.
[2] Wei Xiaoyu, Geng Xianhui. Comparative analysis of consumption structure of urban and rural residents in Jiangsu Province: Based on ELES model [J]. Rural Economy and Science and Technology, 2020, 31(13):135-139.
[3] Zhang Guangzhu. Empirical research on the relationship between household consumption structure and industrial structure [J]. Statistics and decision-making, 2020, 36(06):118-122.
[4] Fu Zhaoyang. Analysis on the consumption structure of urban and rural residents in Shanghai [J]. Shang xun, 2020(09):1-2+4.