An Empirical Analysis of Tangshan Residents' Consumption Level

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Abstract: The consumer price index is an important index for macroeconomic analysis and national economic accounting. The paper uses the statistical data of Tangshan city in the last 10 years to analyze its residents' consumption level through principal component analysis method, demonstrating the basic situation of the residents' consumption level, which can not only provide a valuable guidance for industrial structure adjustment and transformation in Tangshan, but also promote the residents' consumption level.

Keywords: principal component analysis; consumer price; index; Tangshan

I Introduction

Tangshan has a long industrial history of one hundred year as it is rich in resources, minerals in particular, where residents' living standards are relatively higher. Especially since the 1990's, with the establishment and development of market economy system, the economic aggregate and comprehensive strength are increasing rapidly, and the consumption level of urban and rural residents improves gradually as well. Among the total consumptions, the residents' consumption plays a leading role, which can not only reflect their purchasing power, but also reflect economic development trend. It is the consumer price index that mainly reflects the residents' consumption level. The consumer price index is a relative number to reflect the price trends of personal consumption and services that urban and rural residents buy in a certain period of time. As an important index to reflect the inflation degree and national economic accounting, the consumer price index influences living standards of residents directly[3]. Analyzing changes in the consumption level in Tangshan is of great help to guide a reasonable consumer price and promote the residents' effective demands. In addition, it paves the way for industry structure adjustment and transformation in Tangshan, a resource-based city, but also promotes the residents' consumption level. Therefore, the analysis of the consumer price index is significant.

2 The Principles of Principal Component Analysis[3]

There are many indexes to affect residents' consumption level. And they are interrelated each other, which makes the problem more complicated. In order to reduce man-made factors, the paper uses the principal component analysis to evaluate the composite consumption level of the residents in Tangshan. The principal component analysis is a method, in which many initial indexes are replaced by a few indexes that can reflect most information of the initial indexes. The advantages lie in that the original weights are determined without subjective awareness, which shows that the method is more objective and scientific. Thus, it can enhance the accuracy and reliability of the evaluation. According to consumption types of Tangshan residents, we select eight consumer price indexes. They are respectively food (x_1), clothing (x_2), alcohol and tobacco products (x_3), household appliances and services (x_4), health care and personal products (x_5), transport and communications (x_6), culture, education and entertainment (x_7) and housing (x_8).

The principal component analysis uses n-time measures data of k variables to replace n-time measures data of $p(k < p)$ variables, with the amount of basic information unchanged. If the initial data matrix $X = (x_{ij})_{n\times p}$, standardize the initial data in order to eliminate effects caused by different index dimensions :

$z_{ij} = \dfrac{x_{ij} - \overline{x_j}}{s_j}$; $\overline{x_j} = \dfrac{1}{n}\sum_{i=1}^{n} x_{ij}$, $s_j = \dfrac{1}{n-1}\sum_{i=1}^{n}(x_{ij} - \overline{x_j})^2$, $(j = 1,2,\cdots p)$

$\overline{x_j}$ ----- Mean value in the selected period

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s_j -----The standard deviation of indexes

After analyzing principal components of standardized data through SPSS, we get a correlation coefficient matrix R, characteristic root, contribution rate of variance, the contribution rate of cumulative variance of p indexes. The contribution rate of variance means that the k principal component extracts the amount of information from p original indexes. The cumulative contribution rate of variance is the amount of information from initial indexes that the first k principal components retain[2]. The first k principal components, whose cumulative contribution rates are more than 85%, basically reflect the main information of the original variables. Therefore, by selecting the first k indexes as principal components and substituting original standardized data into the formula (1), we get the principal component scores.

$$F_k = \alpha_{1i}x_1 + \alpha_{2i}x_2 + \cdots \alpha_{p1i}x_p \ (i = 1,2,\cdots k) \qquad (1)$$

In the formula, $x_1, x_2, \cdots, x_p$ stand for the index values of standardized initial data, while $\alpha_{1i}, \alpha_{2i}, \cdots, \alpha_{ki}$ are the load values of the k principal component. And then, according to the principal components, we undertake comprehensive evaluation, usually using weighted arithmetic due to irrelevance of each principal component. Moreover, we take the contribution rate of variances of each principal component as weight, i.e.,

$$F = \alpha_1 x_1 + \alpha_2 x_2 + \cdots \alpha_k x_k \qquad (2)$$

In the formula, $\alpha_i \ (i = 1,2,\cdots k)$ stands for the contribution rate of variances of the i principal component. Substitute the values of the principal components of the sample (1) into (2) and we can get a comprehensive evaluation value of the principal components. Thereafter, a comprehensive comparative analy- sis and sorting can be carried out.

3 Empirical Analysis

The Data are from the *Statistical Yearbook of Tangshan* from1997 to 2006 and *Tangshan National Economic and Social Development Statistical Bulletin*. SPSS is used in the research.

After analyzing principal components of initial data[3] of the consumer price index (previous year = 100) through SPSS, we get characteristic root, contribution rate of variance, contribution rate of cumulative variance of each index. See Table 1.

From Table 1, we can see that the accumulative contribution rate of the first three characteristic roots reach up to 84.147%, nearing 85%. As a result, the first three components are affirmed as principal components.

Table 2. Component matrix(a), component score coefficient

	Component			Component		
	1	2	3	1	2	3
x_1	-0.081	0.914	0.202	-0.151	0.383	0.094
x_2	0. 675	0. 550	0 .361	0.186	0. 138	0 .153
x_3	0.981	-0.120	-0.062	0.431	-0.148	-0.147
x_4	0.870	0.315	-0.030	0.336	0.046	-0.141
x_5	-0.052	0.066	0.928	-0.132	-0.032	0.069
x_6	0.250	0.861	-0.145	0.032	0.351	-0.196
x_7	0.083	0.770	0.045	-0.050	0.316	-0.030
x_8	0.661	0.008	0.626	0.207	-0.109	-0.391

Each year the principal component scores can be calculated by principal component score coefficient and standardized values of the original variables, then

Table 1. Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.542	44.278	44.278	3.542	44.278	44.278
2	1.909	23.866	68.144	1.909	23.866	68.144
3	1.280	16.003	84.147	1.280	16.003	84.147
4	0.794	9.926	94.073			
5	0.241	3.013	99.181			
6	0.172	0.549	97.086			
7	0.055	0.692	99.239			
8	0.006	0.069	100.000			

$$F_1 = -0.151x_1 + 0.186x_2 + 0.431x_3 + 0.336x_4 - 0.132x_5 + 0.032x_6 - 0.050x_7 + 0.207x_8$$

$$F_2 = 0.382x_1 + 0.138x_2 - 0.148x_3 + 0.046x_4 - 0.032x_5 + 0.351x_6 + 0.316x_7 - 0.109x_8$$

$$F_3 = 0.094x_1 + 0.153x_2 - 0.147x_3 - 0.141x_4 + 0.069x_5 - 0.196x_6 - 0.030x_7 - 0.391x_8$$

4 Result Analysis

The first principal component bears more loads in clothing, alcohol and tobacco products, household appliances and their maintenance. Clothing consumption takes up a larger proportion in this type, showing that the pursuit of external image is the focus of the residents' consumption. Therefore, clothing industry, as the traditional industry still plays an important role. With their income rising, urban and rural residents' durable household consumption is increasing obviously. Because the system of buying houses, together with policies has been reformed to promote consumption, housing has become main consumption of the residents here, as well as their major economic burden.

The second principal component mainly reflects changes in such aspects as the food, culture, education and entertainment, transport and communication. It shows that proportion of food consumption, as the most basic consumption has been decreased gradually in their total consumption with economy growing and income increasing. The residents' consumption type starts to shift from spiritual consumption to material consumption. Furthermore, their spiritual and cultural consumption demands and investment in education are expanding rapidly. With the development of institutional reform of tuition charge and increasing employment competition, personal quality in terms of education, science and technology have been improved as the decisive factor for employment competitiveness. All these are the important reasons for the residents' expanding their cultural and educational expenditures. As modernization of the means of transport and communication increases, the residents have more mobile phones, motorcycles and automobiles rapidly, which promotes the consumer price index in transportation and communications.

The third principal component is the health care, showing that the residents increase health care consumption with the improvement of their life quality, as well as in-depth reform of the medical system. As a result, the proportion of health care expenditures will gradually increase in total consumptions. Through the empirical analysis of Tangshan residents' consumption index, we can see that their consumption level and life quality are raised constantly with development of economy and society. And their expenditures on durable high quality goods, such as automobiles, housing, education, culture and entertainment, services and health care, are growing faster. Therefore, the consumption structure of Tangshan residents has come out of the traditional poor phase with its emphasis on the survival consumption. Instead, the new type of consumption is taking shape, focusing on the enjoyment of the life quality and its development.

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