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Research on College Students' Consumption Structure Based on Principal Component Analysis and Questionnaire Survey Information and Computing Science

Dongchen Wu[1], Yaning Xiao[2]

[1]*School of Mathematics and Statistics, Xidian University, Xi'an, China*
[2]*Faculty of Science, North China University of Science and Technology, Tangshan, China*

Abstract: *Based on principal component analysis, this paper collects data from college students through questionnaire survey to study the consumption structure of college students, and gives reasonable suggestions according to the found problems, so as to help college students consume reasonably and establish mainstream consumption values in line with the times. In today's society, college students have become an indispensable part of the consumer. Because most college students do not have independent economic sources, there are many different economic problems in today's college students, and because the consumption structure of different college students is determined by their own characteristics, the problem research is complicated. Therefore, it is appropriate for us to classify complex factors into several principal components through questionnaire survey and principal component analysis. The solution of the model shows that the proportion of enjoyment consumption accounts for a large proportion, and the proportion of various consumption types is quite different, indicating that there are some problems in the consumption concept of college students affected by the environment.*

Keywords: *principal component analysis, The consumption structure of college students, Relation number matrix, Standardization, Consumption values.*

1. Introduction

Consumption structure refers to "the percentage relationship between various types of consumption (including services) consumed by people in the process of consumption under relatively stable socio-economic conditions"[1]. Broadly speaking, the consumption structure of college students refers to the percentage of each consumption expenditure in the total consumption expenditure of college students during their study; In a narrow sense, it refers to the composition of different consumption of different college students and their correlation. The rationality of College Students' consumption structure is related to the correct establishment of values and the formation of a sound personality. However, as the future of the motherland, college students, a special consumer group, have not yet formed their own stable consumption concept, are more likely to accept new ideas and products, and are also vulnerable to bad consumption habits, breed incorrect consumption concepts, and produce distorted consumption psychology and bad consumption behavior[2]. For most college students, before entering the society, the university is the last transition stage, and it is also a place for them to cultivate and improve their values. Therefore, the research on the consumption behavior and consumption concept of this special consumer group is particularly important.

This paper studies the consumption structure of college students through questionnaire survey and principal component analysis. In this era of intense competition in which "those who get talent win the world", the cultivation of high-quality college students has an important impact on the development of the whole society and the progress of civilization [2]. According to the data obtained, we can put forward targeted suggestions and opinions, so as to better guide and educate contemporary college students to make reasonable consumption, and then help them form the concept of rational consumption and scientific consumption in line with the development of the times, and form correct values and world outlook. So as to make some contributions to the socialist economic construction and cause construction.

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2. Establishment of model

2.1. Specific steps of principal component analysis

(1) Firstly, the index system should be confirmed. The selection and setting of indicators should follow the principles of comprehensiveness, dominance and operability.

(2) Using the formula:

$x_{ij}^{*} = \frac{x_{ij} - \bar{X}_j}{S_j}$, among $\bar{X}_j = \frac{1}{n}\sum_{i=1}^{n} x_{ij}$, $S_j = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(x_{ij} - \bar{X}_j)^2}$, $i = 1, 2, \cdots, n$ 。

Standardize the initial data, so as to ensure that it is not affected by the dimension and the difference of each index in the order of magnitude.Among, x_{ij}^{*} is the standardized data of x_{ij}, $\bar{X}_{ij}$ and S_j are the sample mean and sample standard deviation of the j-th index respectively. $j = 1, 2, \cdots, p$

(3) Correlation coefficient matrix of standardized data $R = (r_{ij})_{p \times p}$, r_{ij} is the correlation coefficient of x_i^{*} and x_j^{*}, x_i^{*} and x_j^{*} are the standardized indicators of x_i and x_j.

(4) The eigenvalues of the correlation coefficient matrix R and corresponding eigenvectors are obtained $\lambda_1 \geq \lambda_2 \geq \cdots \geq \lambda_p > 0$, $e_1, e_2, \cdots, e_p$, ,among, λ_m is the variance of M th components, the greater the variance, the greater the contribution to the total variance. Calculate the contribution rate of f_m, $\alpha_m = \frac{\lambda_m}{\sum_{j=1}^{p}\lambda_j}$.

(5) The scores of each principal component are listed in a linear table

$$\begin{cases} f_1 = l_{11}x_1 + l_{12}x_2 + \cdots + l_{1p}x_p \\ f_2 = l_{21}x_1 + l_{22}x_2 + \cdots + l_{2p}x_p \\ \cdots \quad \cdots \quad \cdots \\ f_m = l_{m1}x_1 + l_{m2}x_2 + \cdots + l_{mp}x_p \end{cases}$$

($l_{ij} = \sqrt{\lambda_i}e_{ij}$, e_{ij} is Jth component of what eigenvector, $i, j = 1, 2\cdots, p$)

3. Solution of model

System indicators can comprehensively reflect the various elements of College Students' consumption expenditure level. Can find out the leading factors reflecting college students' consumption. The selected indicators can be quantified, the data can be obtained, the indicator content is simple and clear, and has strong comparability.

The collected data were analyzed and processed by statistical software SPSS, and the test results in Table 2 were obtained.

Table 1: Kmo and Bartlett's inspection

Test of Kaiser-Meyer-Olkin	Measure	0.712
Sphericity test of Bartlett	Approximate chi square	22.065
	df	15
	Sig.	0.006

It can be seen from the results of kmo and Bartlett spherical test that the significance level is far less than 0.05. It is certain that the data are suitable for principal component analysis.

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Table 2: Total variance explained

Ingredient	Initial feature value			Extract square and load			Rotating square and load		
	Total	Variance%	Accumulate %	Total	Variance%	Accumulate %	Total	Variance %	Accumulate %
1	1.466	24.437	24.437	1.466	24.437	24.437	1.246	20.768	20.768
2	1.173	19.542	43.979	1.173	19.542	43.979	1.208	20.136	40.905
3	0.982	16.372	60.351	0.982	16.372	60.351	1.061	17.678	58.582
4	0.896	14.940	75.291	0.896	14.940	75.291	1.003	16.709	75.291
5	0.768	12.805	88.096						
6	0.714	11.904	100.000						

By analyzing the total variance results explained by the research, it can be obtained that the cumulative variance contribution rate of the first four principal components reaches 75.291%, so four principal components are selected to analyze the consumption structure.

Table 3: Rotating component matrix A

	1	2	3	4
Cultural and educational entertainment and other x_6	0.816	0.131		
Clothing x_2	0.746		0.199	
Communication x_5		0.837	-0.186	
Food x_1	0.119	0.695	0.357	
Residential x_3			0.924	
Transportation x_4				0.996

Extraction method: principal component. Rotation method: Kaiser standardized orthogonal rotation method. The rotation converges after 5 iterations.

It is obvious from the above table that Clothing x_2, Cultural and educational entertainment and other x_6 have the largest absolute load in the first principal component. Therefore, the first principal component is interpreted as enjoyment consumption.

The absolute load of Food x_1 and Communication x_5 is the largest in the second principal component. They represent essential consumption. Food has always been a necessity. With the development of network technology, the transmission of information is particularly important, because communication consumption has changed from what only the rich can use to what everyone needs. Therefore, the second principal component is interpreted as necessary consumption.

In the third and fourth principal components, the absolute values of Residential x_3 and Transportation x_4 are the largest respectively. It is interpreted as accommodation and travel consumption respectively. Therefore, the principal component division table is summarized as follows:

Table 4: Principal component Division

Primary component	Consumption name	Main ingredient name
1	Clothing x_2 Cultural and educational entertainment and other x_6	Enjoy consumption
2	Food x_1 Communication x_5	Essential consumption
3	Residential x_3	Accommodation
4	Transportation x_4	Travel consumption

The following factor score formula is obtained from the component score coefficient matrix in Table 6:

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Table 5: Component score coefficient matrix

	1	2	3	4
VAR0001	-0.003	0.557	0.290	-0.079
VAR0002	0.596	-0.119	0.071	0.032
VAR0003	-0.089	-0.041	0.894	0.021
VAR0004	0.032	-0.017	0.015	0.997
VAR0005	-0.045	0.711	-0.225	0.040
VAR0006	0.690	0.071	-0.213	0.023

$$y_1 = -0.003x_1 + 0.596x_2 - 0.089x_3 + 0.032x_4 + 0.046x_5 + 0.690x_6$$

$$y_2 = 0.557x_1 - 0.119x_2 - 0.041x_3 - 0.017x_4 + 0.711x_5 + 0.071x_6$$

$$y_3 = 0.290x_1 + 0.071x_2 + 0.894x_3 + 0.015x_4 - 0.225x_5 - 0.213x_6$$

$$y_4 = -0.079x_1 + 0.032x_2 + 0.021x_3 + 0.997x_4 + 0.040x_5 + 0.023x_6$$

Substitute the six items of consumption expenditure data of 100 students into the above expression to calculate the score of each student on the four principal components. The following table shows the principal component scores of some students:

Table 6: Principal component scores

Student	Enjoy consumption	Essential consumption	Accommodation	Travel consumption	Travel consumption	Rank
Student1	421.2	317.3	299.3	29.2	1067.0	99
Student2	243.8	479.0	380.0	53.6	1156.5	95
Student3	354.4	317.2	263.8	88.7	1024.1	100
Student4	409.3	408.3	525.0	112.0	1410.1	36
Student5	245.1	395.8	586.1	21.6	1239.6	81
Student6	360.8	504.3	447.0	21.1	1145.4	96
Student7	402.6	390.6	484.5	40.9	1092.6	98
Student8	398.3	442.6	464.4	17.2	1248.4	79
Student9	224.2	385.7	572.3	47.5	1367.8	46
Student10	621.3	486.2	436.6	39.1	1304.8	68
Student11	400.5	400.0	458.0	52.7	1448.6	30
Student12	501.3	504.1	484.0	26.8	1505.8	22
Student13	585.1	476.6	545.6	31.8	1375.6	45
Student14	532.3	420.0	522.5	46.6	1321.1	65
Student15	415.5	571.0	459.0	1.0	1538.3	14
Student16	253.9	495.7	442.1	26.9	1394.4	41
Student17	428.1	321.1	418.9	38.2	1434.4	34
Student18	592.5	322.5	505.8	60.4	1445.6	32
Student19	453.9	362.9	283.3	40.3	1159.8	93
Student20	454.1	400.8	509.8	54.1	1385.2	43
Student21	572.0	414.1	535.1	55.3	1351.5	53
Student22	509.3	464.6	556.7	30.8	1181.9	91
Student23	523.6	425.3	526.5	53.0	1211.6	87
Student24	534.6	545.7	526.9	27.3	1433.9	35
Student25	399.5	509.1	428.4	4.7	1498.3	24
Student26	395.6	445.9	427.0	28.6	1381.4	44
Student27	279.4	437.6	334.1	22.6	1362.5	48
Student28	447.7	340.7	253.2	40.5	1281.1	73
Student29	518.8	537.9	524.5	31.1	1602.4	8
Student30	373.5	486.5	506.4	29.9	1345.6	59

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4. Conclusion

4.1. Problems of College Students' consumption

According to the score of the main component of Table 7, it can be seen that there is a problem in the concept of consumption of college students. In addition to life, the entertainment and clothing consumption of college students are very high. College students who have not yet entered into the society, the concept of consumption is not mature, and the impact of the bad breath of the outside society is used to change the clothes of the clothes and entertainment and enjoyment of entertainment, but only the consumption of learning purposes. To be clear, college students are still student, and is more important to learn.

4.2. Opinions and suggestions on College Students' consumption

The youth period is an important stage of the development of college students' world outlook and values. Therefore, helping college students form the correct consumption concept, developing a good consumption habit is the weight. You can organize some good guidance for college students in theory. At the same time, we must also promote our excellent traditions of our Chinese national diligence and hard work. Society in this abortion, these education for college students are not only benefiting students, and even a family will benefit from it, which is also part of the socialist economic construction. College students are also part of a pure consumer group, I hope everyone can use life expenses properly. The students can not blindly follow the style, according to their own actual situation, insist on the principle of consumption than the consumption, can't let the consumption become the spirit of universities.

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