Lecture Notes in Economics, Management and Social Sciences, ISSN 2617-1031
2021 6th International Conference on Economics, Business and Management
Vol. 37, 2021, pp. 45-49

Establishment and Analysis of Comprehensive Price Financial Evaluation Model for Supermarket Products

Ruixuan Liu[1], Ruifeng Song[2]

[1]Da Lian Ealing International School, Dalian, Liaoning Province, China
[2] South China Agricultural University, Guangzhou, Guangdong Province, China

ABSTRACT. Economic Mathematics mainly takes the real life as the background to examine the identification of statistical charts, which is the mathematical way and method to explain the economic phenomenon; Economic statistics is the study of economic laws by using statistical methods. Radar chart comprehensive analysis method is one of the exploratory analysis methods of economic mathematics, which is mostly used for qualitative analysis research. In this paper, the radar chart conventional qualitative analysis method is used to compare the prices of 12 different commodities in six supermarkets in Dalian, and the intuitive conclusion of the price level is obtained; Then, the radar chart multivariate quantitative analysis method is calculated to determine the comprehensive comparison function, and finally analyzes the comprehensive preferential degree of different good prices of these supermarkets, and puts forward reasonable reference suggestions for consumers to.

KEYWORDS: Mathematical statistical methods, Economic mathematics, Radar chart comprehensive analysis method, Supermarket commodities, Price comparison

1. Introduction

With the rapid development of China's economy, supermarket, as the third revolution of retail industry, plays an important role in the rapid development of retail industry. Supermarkets have won the unanimous recognition of consumers with the self-service model of large scale, low cost, low gross profit, large sales volume and a complete range of products. Supermarkets of different scales cover every corner of the country rapidly in the development course of more than ten years. However, consumers are often confused about the prices of various commodities in different supermarkets, which supermarket has the most competitive price. In this paper, the radar chart comprehensive analysis method is used to compare the prices of 12 representative commodities in 6 supermarkets in Dalian, so as to provide a reference for the consumers' consumption guide. Radar chart, also known as the comprehensive financial ratio analysis chart method, is an important tool for the analysis of customers' financial ability, and also a comprehensive analysis tool for enterprise economic benefits. The radar chart analysis method has been extended to other applications, such as the comparative analysis of multiple software indicators, personal financial spider diagram, product index comparison, etc.

2. Method

(1) Using the radar chart comprehensive analysis method to compare the prices of 12 representative commodities in 6 supermarkets in Dalian.

(2) Investigation and Analysis of Good Prices in Supermarkets

According to the good categories closely related to daily life, they are classified into six categories: grain, edible oil, meat, vegetables, fruits, and prepackaged foods, 2 of each category are selected as representatives for price investigation and comparative analysis.

The prices of the 12 commodities vary in different supermarkets, but it is unrealistic to buy only the cheapest one in each supermarket. It is very important to find a comprehensive comparison method for the prices of various commodities. The easy and intuitive way for multivariate comprehensive comparison is generally called exploratory statistical analysis. The commonly used representation methods of multivariate statistical graphs are facial, radar and constellation. The radar chart analysis method used in this paper refers to a multivariable comparative analysis technology based on a graph that looks like a navigation radar screen. The traditional radar chart method is a typical

  DOI: 10.23977/ICEBM2021010

graphical analysis method, which is used for comprehensive evaluation, mainly by drawing the radar char of each evaluation object, and then comparing various typical radar charts by the evaluator to give qualitative evaluation results through observation. Its advantages are intuitionistic, visual and easy to operate, but the disadvantage is that it is difficult to give the ranking results of comprehensive evaluation when there are many objects participating in the evaluation, This paper quantifies the intuitionistic comprehensive evaluation method of radar chart. This paper constructs an evaluation method combining graph and quantity on the basis of traditional radar chart analysis method, which is suitable for supermarket price analysis and comparison.

3. Results

3.1 Data Processing

For the convenience of calculation, first unify the data weight unit in Table 1 to 500g, remove the brand name item, and replace the 6 supermarket names with A-F, as shown in Table 1:

Table 1 the Price Standardization Table of 12 Main Commodities in the 6 major supermarkets (unit: yuan / 500g)

No.	Good name	A	B	C	D	E	F
1	rice	3.80	2.85	3.50	3.20	2.98	3.19
2	Black rice	6.00	9.90	8.58	7.90	5.98	7.00
3	Edible oil	12.44	9.85	9.35	11.22	9.38	9.66
4	Pork	32.90	42.90	39.90	21.90	42.80	33.80
5	Beef	49.90	45.80	35.70	49.80	49.90	40.80
6	Juice	5.10	6.95	4.95	6.90	7.45	8.25
7	Potato chips	39.34	36.67	53.55	45.33	39.99	45.33
8	Papaya	4.95	5.98	4.98	3.98	3.99	4.50
9	Red Fuji Apple	5.99	4.98	5.99	4.98	4.99	6.50
10	Chinese Cabbage	1.18	0.86	1.38	2.25	1.99	1.28
11	Tomato	3.59	2.97	1.99	2.58	2.99	2.98

3.2 Results of Qualitative Analysis of Radar Chart

3.2.1 The Specific Steps for Drawing a Radar Chart Are as Follows:

Suppose that there are n variables in the data to be analyzed. First draw a circle and divide the circle into n parts by n points;

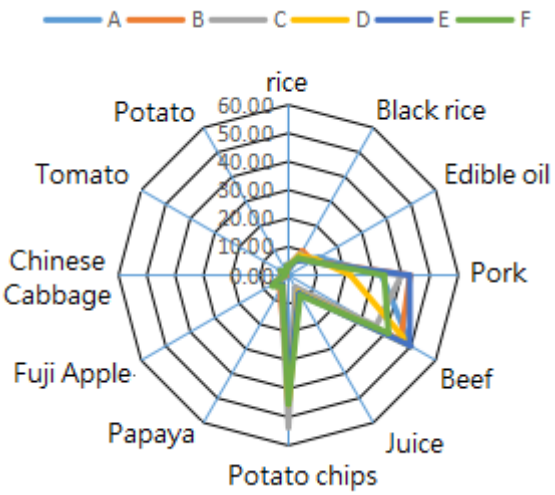
Connect the center of the circle with N points to obtain n radiative radii, which is used as the coordinate axes of n variables;

In order to divide the scale conveniently, the original data needs to be linearly transformed before marking the coordinate axis, so that the data falls within the given interval [0,r]. According to formula (1), the JTH component in the i-th multidimensional data is linearly transformed:

$$y_{ij} = \frac{x_{ij} - \min\limits_{1 \le i \le n} x_{ij}}{\max\limits_{1 \le i \le n} x_{ij} - \min\limits_{1 \le i \le n}} \quad (1)$$

Engrave the normalized values of each dimension of the n-dimensional data on the corresponding coordinate axes, and then connect them in turn to obtain an N-resular polygon, that is, a radar chart of the n-dimensional data represented by a plane, as shown in Figure 1.

Fig.1 Radar Chart of Price Comparison of Various Commodities in Different Supermarkets



From Figure 1,it is obvious that the price of pork in Supermarket B is higher than that of other supermarkets, but the prices of potato chips, Chinese cabbage and apples are lower than other supermarkets; For pre-packaged food, the price of juice in supermarket C is the lowest, but the price of potato chips is the highest; the prices of potatoes in the 12 supermarkets are basically the same; Qualitative analysis of the radar chart can intuitively and clearly obtain the price levels of various commodities in different supermarkets, but it is impossible to get the comprehensive discount level of 12 kinds of commodities. This is also the disadvantage of qualitative analysis, which mainly depends on subjective judgment, and the conclusion is relatively abstract and not specific.

3.3 Comprehensive Quantitative Analysis Results of Radar Chart

3.3.1 Algorithm Design

From the radar chart of Figure 1, the shapes of 12 good prices are similar, but the areas are different. This feature can be used for comprehensive quantitative analysis of radar charts. The specific algorithm is as follows:

Step 1: Calculate the characteristic vector according to the radar chart: Calculate the area S of the radar chart according to formula (2):

$$s = \frac{\sin\theta}{2} \cdot a \cdot b \quad (2)$$

In the formula, θ is the angle between the two sides, a and b are the prices of two adjacent commodities respectively.

Step 2: There are n supermarkets, the area and maximum radius of the radar chart of the i-th (i=1,2,l,n) supermarket are si and ri respectively, command S=max{si}, R=max {ri}, the evaluation vector Wi=(Wi1,Wi2) of the i-th supermarket is defined as follows

$$W_{i1} = \frac{S_i}{S} \quad (3)$$

$$W_{i2} = \frac{s_i}{\pi R^2} \quad (4)$$

From the above definition, it can be seen that the evaluation quantity Wi1 is the normalized value of the radar chart area of the i-th supermarket, which reflects the relative size of the radar chart area of the good price of each supermarket; The evaluation quantity Wi2 is the ratio of the area of the radar chart of the good price of the i-th supermarket to the circle with the highest good price of all supermarkets as the radius, which reflects the degree of influence of the highest price of the supermarket good on the overall situation. Since the area of the circle with the largest radius is larger than the area of the polygon, the value ranges of the evaluation variables Wi1 and Wi2 are both between [0, 1]. From the feature vector, the comprehensive vector Wi=(Wi1,Wi2) of each supermarket good price can be obtained.

Step3: the determination of the comprehensive comparison function:

$$f(W_{i1},W_{i2})=\frac{1}{\sqrt{W_{i1}\cdot W_{i2}}} \quad (5)$$

It can be determined that the larger the comprehensive comparison function value is, the higher the comprehensive discount degree of the supermarket good price is.

3.3.2 Algorithm Implementation

According to formulas (3)-(5), the comprehensive discount rate of 6 supermarket good prices is obtained, as shown in Table 2.

Table 2 Comprehensive Discount Rate of Good Prices in 6 Supermarkets

Supermarket No.	Area S	W1	W2	F
A	976.87	0.82	0.11	3.36
B	1150.12	0.96	0.18	2.41
C	913.78	0.76	0.18	2.68
D	800.03	0.67	0.12	3.47
E	1194.95	1.00	0.13	2.75
F	946.45	0.79	0.11	3.47

Analyzing the data in Table 2, we can quantify the comprehensive discount rate of each supermarket for a variety of commodities. It can be seen from Table 2 that supermarket F and D have the highest discount rate, reaching 3.47, followed by supermarket A; the discount rate of other supermarkets is far lower than these three supermarkets. This shows that if you buy the above 12 kinds of commodities at the same time, it is the most cost-effective in supermarkets F, D, and A, and the most expensive in supermarket B.

4. Conclusion

Radar chart comprehensive analysis method is one of exploratory data analysis methods, and it is a visual and intuitive graphical representation method that can comprehensively analyze multiple variables.

This method has the following characteristics: it is not affected by extreme values, the display data is highly concentrated and informative, simple and intuitive, does not require excessive mathematical calculations, easy to understand and accept by basic statisticians.

Radar chart is usually used for qualitative analysis and is currently the most widely used method for mapping multivariate data.

It can be very convenient to study the relationship between the sample points by using this method.

This paper uses radar chart to do a comprehensive quantitative analysis of various commodities in different supermarkets. Through a series of data processing, standardization, multi-directional comparison, we can intuitively and significantly compare the price of different supermarkets in the same city, the difference of the same good in different supermarkets, the price of different brand commodities at the same price, and the comprehensive quantitative analysis of supermarket commodities. The application of radar chart created in this paper in the analysis of the price discounts of various commodities in different supermarkets can provide reasonable reference suggestions for consumers to shop, and select the cheapest supermarket in the local city; at the same time, it can also provide reference for good manufacturers to select reasonable distribution methods, and it can even provide statistical help for the department store merchandise sales department to make reasonable decisions, and formulate a reasonable merchandise sales area plan, which has far-reaching economic significance.

References

[1] Cao Jianxin, Wang Chunli. Analysis on the price of small and medium-sized supermarkets, No. 12, PP. 42-45, 2007.

[2] Su Caiping, Monoj Gupta, White P. Multivariate sensory characteristics of low and ultra- low linoleic soybean oils displayed as faces. Journal of the American Oil Chemists' Society, Vol. 80, No. 12, PP. 1231-1235, 2003.

[3] Astel K.Classification of drinking water samples using the Cher- noff's faces visualization approach. Polish Journal

of Environmental Studies, Vol. 15, No. 5, PP, 691- 697, 2006.

[4] Fan Pingzhi, Darnell Michael. Sequence design for communications ap plications. Taunton, Somerset, Eng land: R esearch Studies Press LTD, 1996.

[5] Wang Yongyu. The existing problems and improvement measures in the quantitative comprehensive evaluation method of radar Chart. Statistical Education, No. 01, PP. 18-20, 2007.

[6] Wang Jinjia, Li jing, Li Xin et al. Feature sequencing in radar graph feature extraction. Journal of Yanshan University, Vol. 32, No. 5, PP. 421-428, 2008.