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事例研究

Evaluation of the Part Worth in Conjoint Analysis

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Abstract : When a new product is being designed, the evaluation of the consumers' understanding and acceptance of the present products are extremely important. For the product experimental design it is very important to clarify the level of consumers' preference of the product's attributes. The conjoint analysis, which is one of the marketing research techniques, is mainly used in such a situation. In the conjoint analysis, several plans including different levels of attributes are proposed. However, the error is included in the analytical result to the part worth. In this study, the error to the part worth of conjoint analysis is considered to be applied badness, and evaluation its influence is proposed.
Keywords : conjoint analysis, part worth, least squares, error, F value

1. INTRODUCTION

The time when any marketed product sells is over. Now only products which fulfill the needs of consumers can sell. In order to respond to consumers' needs, makers have to research consumers' preferences of products, services and their selection criteria of products.

The conjoint analysis measures the degree of importance which is given to particular aspects of a product or service. It's a technique which gives the concept for the development of a new product. It's very difficult and rare that the consumers are totally satisfied with the goods they obtain. For example, good items seem to be expensive, or inexpensive items seem to be of poor quality. Then, the consumer's behavior while making the purchase was observed and through that the priority of choice-value or quality was understood. While changing the levels of attributes the consumers were asked to set the order of their preferences. This kind of optimization is called "conjoint analysis" method. [1][2][3]

In conjoint analysis, it was not discussed about the error that should have been included in part worth conventionally. In this study, the influence of the error on the part worth of the conjoint analysis is evaluated by using the F value.

2. FEATURES OF CONJOINT ANALYSIS

The conjoint analysis is a technique based on not asking consumer opinion directly. Even the consumers themselves are not sure what they exactly want, and so, a new method of analysis of consumer's preferences has surfaced, in which rather than asking direct questions, the selection process is observed. This is called "behavior analysis". When the reason for the product selection is asked to the consumer, it answers only in the principle "The quality is excellent" or "The maker is well known". The maker cannot believe such an answer. Even when buying something at a special sale or at a great discount, many people would still give the same routine answers. The conjoint analysis has thought different from the method that analyzes other consumers' preferences. The approach of the conventional methods attaches importance to reason, and the principle. On the other hand, the approach of the conjoint analysis is an approach for attaching importance to the sensibility, and

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canvassing the real intention. The conventional methods analyze the general answers coming out of objective comparison, while conjoint analysis bases its results on analyzing the subjective direct comparison of one profile against another. The conjoint analysis is shown by the following flow chart. [4]

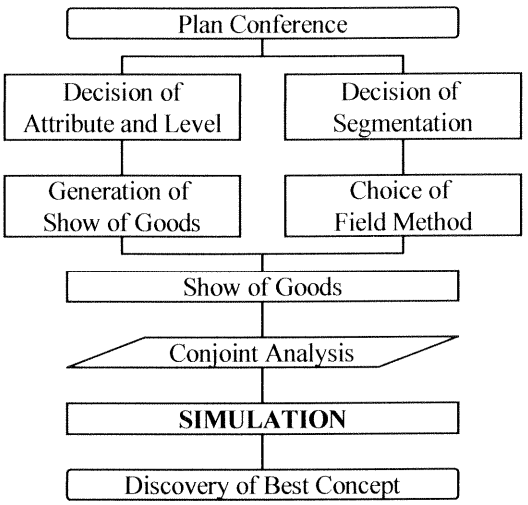

Figure 1 Flow chart of conjoint analysis

3. ATTRIBUTE AND LEVEL

In this study, conjoint analysis about the overseas travel plan to an student is made into the example.

When conjoint analysis is done, the attribute and the level of the product should be decided. Because both attribute and level have the influence on the plan of the product, both of them should be clear and precise. Then, in order to set up concrete standards, research is done on the market. The attribute and the level are determined in Table 1. In this research, 3 attributes have 2 levels, one has 5 levels, and one has 3 levels. If all of possible types were presented, there would be the total of 2x2x2x5x3=120 kinds. Time wise and physically it would be difficult to directly compare all 120 profiles. Using the orthogonal array of an experimental design, the number of profiles is reduced to 24.

Table 1 Attribute and level of the overseas travel plan

Attribute	Level
A. Country	1 = Korea (Seoul)
	2 = Singapore
	3 = Hong Kong
	4 = Taiwan (Taipei)
	5 = Thailand
B. Number of visited Countries or (visited) cities	1 = One place
	2 = Two places
C. City sightseeing	1 = Included
	2 = Not included
D. Day of departure	1 = Weekend
	2 = During the week
E. Length	1 = Three days
	2 = Five days
	3 = Seven days

4. APPLICATION OF CONJOINT ANALYSIS

4.1 CONJOINT ANALYSIS

When the research participants rank the presented profiles, the part worth is calculated according to the following procedures:

1. Conversion of preference order into continuous data.
2. Setting of design matrix.
3. Calculation of part worth by method of least squares.

If this procedure is applied to a general multiple regression analysis, then only by assuming the design matrix which consists of the combination of "0" and "1" to be an explanatory variable, the dependent variable is the preference order.

For example, from three attributes with 2 levels each, 4 profiles are made. It is assumed that the subject do ranking from the 1st to the 4th according to the preference order. If the value of inverse order of this ranking is assumed to be a dependent variable, the obtained regression coefficient w_1, w_2, and w_3 are the part worth of each level in conjoint analysis in Figure 2. [5]

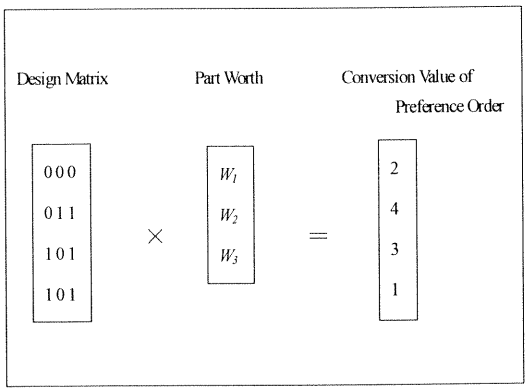

Figure 2 Calculation method of part worth

4.2 MAKING OF QUESTIONNAIRE SURVEY FORM

The questionnaire survey is done for the undergraduate student, and obtains the answer of 75. The method of answering the questionnaire survey in this research puts the order on 24 profiles in order that wants to be purchased. Moreover, when the questionnaire survey form was made, the following two disposals were done.

Attribute A: Country was made a concrete description as subjects imaged it easily when level was done with "Two places" about attribute B: Number of visited countries or cities. (Refer to Table 2.)

Table 2 Concrete description

	One place	Two places
Attribute A	Korea (Seoul)	Korea (Seoul, Pusan)
	Singapore	Singapore, Malaysia
	Hong Kong	Hong Kong, Macau
	Taiwan (Taipei)	Taiwan (Taipei, Gaoxiong)
	Thailand	Thailand, Vietnam

4.3 CALCULATION OF F VALUE

The F value is calculated as follows:

$F(A, L) = u^2 / \varepsilon^2$

A: Attribute

L: Level

u: Part worth

ε: Error term

The part worth of the overseas travel plan is shown in Table 3.

Table 3 Part worth of overseas travel plan

Attribute	Level	Part worth	Error	F value
A	1	0.528	0.351	2.265
	2	2.024	0.397	26.007
	3	0.751	0.397	3.580
	4	-1.288	0.279	9.162
	5	-1.956	0.397	24.312
B	1	0.991	0.177	31.550
	2	-0.991	0.177	31.550
C	1	2.214	0.177	157.377
	2	-2.214	0.177	157.377
D	1	0.325	0.177	3.385
	2	-0.325	0.177	3.385
E	1	-0.490	0.253	3.764
	2	0.137	0.256	0.288
	3	0.353	0.254	1.927

4.4 CALCULATION OF CONTRIBUTION RATE

The contribution rate is calculated as follows: The variance of the k-th attribute is calculated as

$$V_k = \frac{1}{m}\sum (u_j - \bar{u})^2 \qquad (k = 1,2,\cdots,n)$$

where m is the number of levels of the k - th attribute,
u_j is partial effect value of the j-th level,
$\bar{u}$ is the average of u_j (j=1,2,$\cdots$,m).

Next, we estimate the contribution rate C_k of the k-th attribute as follows:

$$C_k = \frac{V_k}{\sum_{l=1}^{n} V_l} \times 100 \qquad (k = 1,2,\cdots,n)$$

That is, with the contribution rate of an attribute, the variance ratio of the part worth of each attribute is calculated. [6]

Table 4 shows the contribution rate in this study.

Table 4 Contribution rate

Attribute	Contribution Rate
A	23.557%
B	12.280%
C	61.247%
D	1.318%
E	1.598%
Total	100.000%

5 CONSIDERATIONS

5.1 RESULTS OF THE ANALYSIS

If the combination of the optimal level is made as well as a conjoint analysis conventionally, it becomes Table 5.

Table 5 Combination of optimal level

Attribute	Level	Part worth
A	Singapore	2.024
B	One place	0.991
C	Included	2.214
D	Weekend	0.325
E	Seven days	0.353

If an optimal level to each attribute is simply obtained, it becomes for the attribute "Country" the highest part worth is "Level: Singapore", for the attribute "Number of visited countries or

visited cities" the highest part worth is "Level: One place", for the attribute "City sightseeing" the highest value is "Level: Included", for the attribute "Day of departure" the highest value is "Level: Weekend", and for the attribute "Length" the highest value is "Level: Seven days".

However, the error is included in the part worth of each level. It cannot be said that Table 5 is a combination of the optimal level when this error is disregarded.

5.2 INFLUENCE OF ERROR

The applied badness in conjoint analysis was considered to be an error, and the influence of the error on each attribute (level) is evaluated. In the case of Attribute A: Country (Level: Singapore) Attribute B: Number of visited countries or cities (Level: One place), and Attribute C: City sightseeing (Level: Included), judging from the F value, error is significant enough. It can be thought that the high part worth is preferred regarding Attribute D: Day of departure (Level: Weekend) and Attribute E: Length (Level: Seven days) because they have almost the same error.

Therefore, it can be judged that the error is not influencing the combination of an optimal level (Table 6).

Table 6 Combination of optimal level and error

Attribute	Level	Part worth	Error	F value
A	Singapore	2.024	0.397	25.992
B	One place	0.991	0.177	31.437
C	Included	2.214	0.177	156.462
D	Weekend	0.325	0.177	3.371
E	Sevendays	0.353	0.254	1.931

However, when overseas travel plans are actually made, the following attributes show a significant level, therefore should be included in the plans: attribute A: Country (Level: Singapore), attribute B: Number of visited countries (Level: One place), and attribute C: City sightseeing (Level: Included). The preferences of students are quite divided on the remaining two attributes, attribute D: Day of departure (Level: Weekend) and attribute E: Length (Level: Seven days) thus those attributes statistically are not significant.

6. CONCLUSIONS

As a result of the analysis, the following optimal plan is made: It is significant that in the attribute "Country" the highest part worth is "Level: Singapore", in the attribute "Number of visited countries or visited cities" the highest part worth is "Level: One place", and in the attribute "City sightseeing" the highest value is "Level: Included", judging from the F value. The main points obtained through conjoint analysis for students are:

1. It should include city sightseeing.
2. It should be to only one country.
3. The countries most often chosen are Singapore, Hong Kong, and Korea, in that order.

The contribution rate (Table 4) reached about 97.1% with those three attributes. It should be noted that, judging from the F value (error), statistically significant are only the first three attributes. However, even though the Table 5 gives the optimal plan, it does not necessarily mean that it is ideal for everybody. The main reason is that part worth for attribute B is relatively low. Thus, in conjoint analysis it is very

benefical to evaluate the F value (error) of the part worth.

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