

Consumer Preferences and Evaluations Of a Processed Meat Product

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Introduction

A major activity in consumer research since the 1970s has been the modeling of consumers decision-making process based on their evaluations of the multiple attributes associated with the product (Green and Wind, 1973). Conjoint analysis, a recent development in mathematical psychology, has been applied extensively in marketing research as a means for quantifying consumers' preferences among multiattribute alternatives and for identification of market segments (Currim, 1981; Green and Srinivasan, 1978). It models consumers' choice behavior based on their evaluation of the underlying product attributes. Recently, many researchers have adopted conjoint measurement to analyze multiattribute choice in an agricultural context. The use of conjoint analysis in agribusiness research varies from marketing of horticultural products (Gineo, 1990; Manalo, 1990), processed food (Steenkamp, 1987) and fishery products (Anderson, 1987) to estimation of willingness-to-pay for deer hunting (Mackenzie, 1990).

Increased economic prosperity has fostered the growth of food processing industry in Taiwan. Chinese sausage, a processed pork product, is considered a specialty food and a delicacy enjoyed by the populace. The demand for Chinese sausage in Taiwan increased substantially during the 1980s due to growing household affluence. Consequently, new firms entered the market offering a variety of branded products differentiated by flavor, packaging method, quality assurance, and other attributes. The purpose of this study is to determine how consumers evaluate the different attributes of processed meat products in making purchase decisions. Such information is needed for the food processing firms in designing a successful product and in formulating an effective marketing strategy. More specifically, this study uses conjoint analysis to assess consumers' preferences for Chinese sausage, and to identify the underlying important attributes that influence consumers' decision-making and choice behavior.

Theoretical Framework

The basic concept of conjoint analysis is rooted on Lancaster's consumer demand theory in

which he argues that consumers derive utility not from goods directly but from the want-satisfying attributes of the goods (Lancaster, 1971). It assumes that a product can be described in terms of a set of multidimensional attribute profiles, and that consumers' choice behavior reflect their preferences and overall judgement regarding that set of profiles. In essence, the utility theory based on attribute spaces suggests that goods and services, singly or in combination, are evaluated according to utility only indirectly through values assigned to the underlying attributes that they are perceived to possess. To the extent that decision-making is a major characteristic of consumer behavior, the Lancaster approach also provides a theoretical framework for analyzing consumer preferences and choice behavior that involves multiattribute purchase decision.

Green and Wind (1973) suggest that two major approaches, namely noncompensatory and compensatory models, can be used to model how information is processed to arrive at a choice among alternatives. Noncompensatory information processing models assume that alternatives are evaluated on an attribute-by-attribute basis, and that substitutions or trade-offs between attributes do not exist. In contrast, compensatory models permit trade-offs between attributes in the sense that a low value on a specific attribute can be offset by a high value on some other attribute. In compensatory models, it is assumed that all multidimensional profiles or alternatives can be ultimately described in terms of single utility numbers that are commensurate with each other. Among the class of compensatory models, the additive utility model is the best known and has been used most frequently by applied researchers (Cattin and Wittink, 1982).

The additive utility model assumes that the utility of an alternative is formed by a linear combination of the utilities of its parts that are commensurate with each other. Specifically, it posits that the total utility for an alternative X , $U(X)$, can be expressed as:

$$U(X) = U_1(X_1) + U_2(X_2) + \dots + U_p(X_p);$$

$$\text{for } j = 1, 2, \dots, p, \quad (1)$$

where $U_j(X_j)$ is a component utility, and X_j is the level of the alternative X on the j th attribute.

Within the framework of additive utility, there exist a number of models that can be used to represent the preference function for empirical analysis. Green and Srinivasan (1978) suggest that the part-worth function provides the greatest flexibility in describing different shapes for the preference functions for various attributes. Thus, the major objectives of conjoint analysis are to estimate the importance of the various attribute levels (i.e., part-worth) that contribute to each individual's overall judgement of the product, and to provide insight into the trade-offs which individuals make among levels of the various product attributes. Mathematically, the part-worth function is given by:

$$S_i = \sum_{j=1}^p f_j(Z_{ij});$$

$$\text{for } i = 1, 2, \dots, n, \quad (2)$$

where S_i is the consumer's preference ranking of the i th stimulus or product alternative; f_j is a function denoting the part-worths of different levels of Z_{ij} for the j th attribute; and Z_{ij} is the level of the j th attribute for the i th stimulus.

Equation (2) provides a means to estimate the importance and contribution of each attribute to the total utility of an alternative as expressed in equation (1). Conjoint analysis produces part-worth estimates for the levels of each attribute that make all utility scales commensurate with each other so that the part-worths can be summed to yield an overall utility. This approach enables the researcher to assess the relative importance of various attribute levels in the context of preference and to study the effects of trade-offs among different attributes on consumer evaluations. In practice, $f_j(Z_{ij})$ is estimated for only a few levels of Z_{ij} based on the research design, and part-worths for intermediate levels of Z_{ij} are obtained by linear interpolation. Thus, the part-worth function is represented by a piecewise linear curve that approximates any arbitrary shape of the preference function (Green and Srinivasan, 1978).

Study Design and Survey Procedure

Data for conjoint analysis are usually obtained through consumer interviews. In practical application, considerations underlie every experimental design should be carefully evaluated to reduce potential information overload on the respondent (Green and Srinivasan, 1978). One basic design often used to structure the interviews for data collection is the full-profile approach. This approach uses the complete set of factors that include levels of all the attributes being studied. The primary advantage of the full-profile approach is that it provides a more realistic description of stimuli and it takes the levels of all attributes into consideration simultaneously much as in the true environment (Green and Srinivasan, 1978). However, judgements may be very difficult when a large number of factors are involved and the possibility of information overload may render this approach with lower predictive validity.

For the purpose of this study, five important product attributes affecting the purchasing decision of Chinese sausage were identified. For each attribute, specific levels were chosen so that they were both relevant to consumers and representative of the market situation in Taiwan. The selected attributes (attribute-levels) were: brand name (national, regional, or no brand); packaging (vacuum packed, nitrogen flush packed, or unpacked); price (NT\$170, NT\$150, or NT\$120); store (supermarket or traditional market); and quality assurance label (yes or no). The levels for brand name and packaging represent the characteristics of product differentiations available in the market. Price levels reflect the range of prices observed at the time of the study. The Chinese Agriculture Standard (CAS) seal indicates that the processing plant and its products meet the quality standards set forth by the Council of Agriculture, Executive Yuan of the Republic of China.

The study design includes three attributes at three levels and two attributes at two levels representing a total of 108 ($3^3 \times 2^2$) profiles of possible combinations of attributes and levels. It would be extremely difficult for a respondent to rank all 108 combinations. To reduce the information overload potential and accompanying respondent fatigue, Green (1974) suggests that a fractional

factorial design based on orthogonal arrays may be used to limit all possible profiles to a specific subset of stimuli that can be dealt with cognitively by the respondents. The fractional factorial approach is known as a main effects only design, assuming that all interaction effects are negligible and can be neglected. Orthogonal arrays require the smallest number of judgments or evaluations on the part of the respondent, and represent the most parsimonious set of designs available for main-effect parameter estimation (Green, 1974).

The advantage of fractional factorial design is that it simplifies the task for the respondents and hence, increases the reliability of the results. Further, it also allows the determination of a respondent's overall judgment regarding other attribute combinations not included in the selected set of stimulus presentations. However, the use of fractional factorial designs may reduce the accuracy of parameter estimates because it does not allow for estimation of interactions should they exist. This study uses the method of orthogonal arrays, developed by Bose and Bush (1952) to identify a subset of 18 stimuli to structure the interviews.

The data used for this study were collected from personal interviews of 200 housewives who resided in the city of Taipei, Taiwan. Households were selected from stratified random probability samples. The city of Taipei is classified into 12 administrative districts. From each district, a random sample was drawn proportional to the population distribution. The survey was conducted in the summer of 1991 by trained interviewers. The enumerators were instructed to interview the housewives of the selected households. In case of refusal, replacement households were drawn and interviewed. Respondents who provided incomplete or inconsistent information were contacted and re-interviewed.

To facilitate the interview, 18 stimulus cards were prepared. Each card represents a different combination of attribute-level selected from the orthogonal arrays. A sample stimulus card representing one of the profile combinations is shown below in Figure 1. At the beginning of each interview, these stimulus cards were shuffled and divided equally into three groups. Each

interview was conducted in three steps to help ease the respondents' task of ranking their preferences. At first, one set of six cards was selected randomly for evaluation. Once ranked, a second set was presented and the subject was asked to compare and insert each card into the first set according to its preference ranking. This experiment was repeated for the last set of cards with the final ranking for all profiles recorded on the questionnaire. In addition, questions concerning preferences for product attributes were solicited from the respondents prior to presentations of stimuli. The interview was concluded by asking the respondent to provide specific information about herself, as well as demographic characteristics of the household.

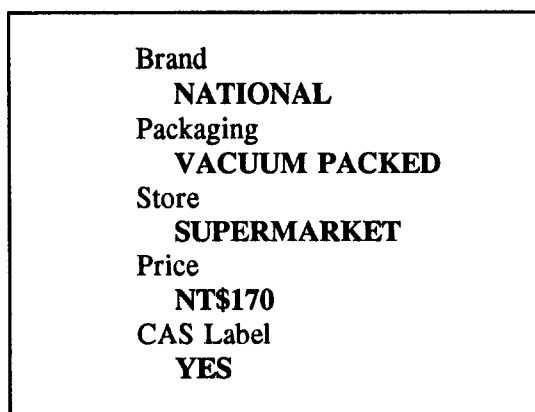


Figure 1. Sample Stimulus Card

Empirical Model and Estimation Procedure

Given the ranked preferences information provided by the respondents, the part-worth function of equation (2) representing the additive utility model can be rewritten as:

$$\begin{aligned}
 RANK_i = & \alpha_{11}NATB_i + \alpha_{12}REGB_i + \alpha_{13}NOB_i \\
 & + \alpha_{21}VACPK_i + \alpha_{22}NITPK_i + \alpha_{23}UNPK_i \\
 & + \alpha_{31}P1_i + \alpha_{32}P2_i + \alpha_{33}P3_i \\
 & + \alpha_{41}SUPMKT_i + \alpha_{42}TRADMKT_i \\
 & + \alpha_{51}CASLAB_i + \alpha_{52}NOLAB_i, \quad (3)
 \end{aligned}$$

where $RANK_i$ denotes an individual's ranking for the i th stimulus; α_{jk} s are the part-worths associated with the k th level of attribute j in the i th alterna-

tive. The set of product attributes are represented by: *NATB* (national brand), *REGB* (regional brand), *NOB* (no brand), *VACPK* (vacuum packed), *NITPK* (nitrogen flush packed), *UNPK* (unpacked), *P1* (NT\$170), *P2* (NT\$150), *P3* (NT\$120), *SUPMKT* (supermarket), *TRADMKT* (traditional market), *CASLAB* (CAS label), and *NOLAB* (no label). Note that each factor in equation (3) is a binary variable, indicating the presence or absence of an attribute-level in the i th stimulus being evaluated.

The specification of equation (3) is equivalent to the familiar linear regression model in which the parameters, α_{jk} s, may be estimated by least squares procedure. As with the multiple regression model, the value of part-worth function for a particular profile linearly increase or decrease, depending on the signs of α_{jk} s, with changes in the levels of attributes. Several estimation procedures can be used to estimate the part-worth utilities, which relate the attribute levels of a product to an individual's overall preference or evaluation. The use of ordinary least squares (OLS) procedure has shown to yield very good results (Jain et al., 1979). In their survey, Cattin and Wittink (1982) found that OLS was by far the most commonly used estimation method in conjoint analysis. However, prior to the OLS estimation of equation (3) with the ranked dependent variable, the independent variables need to be transformed through effects coding. The effects coding method is a variant of binary variables approach used to represent the different levels of the attributes included in the set of stimuli. Cohen and Cohen (1975) suggest that the three-level variables can be coded as (1, 0) for the first level, (0, 1) for the second level, and (-1, -1) for the third level. For the two-level variables, they are coded as 1 and -1 for the first and second level, respectively.

Equation (3) can be estimated separately for each respondent to obtain individual level part-worth utilities. The individual-level approach has demonstrated good predictive power (Cattin and Wittink, 1982). The results, however, may be difficult to analyze and understand when sample observations are large. Alternatively, an aggregate model, or a pooled regression, may be estimated across all respondents. It requires only a

single regression analysis to obtain the estimates of average part-worth utilities. This approach is equivalent to taking the average of individual estimates across all respondents. Although the predictive power may be reduced due to heterogeneity of individual preferences, the pooled approach represents the most efficient estimation method and provides a straightforward interpretation of the conjoint analysis results.

Results and Discussion

Nearly a half of the respondents interviewed were employed housewives, and they averaged about 41 years of age. The majority of the housewives (67%) had at least a high school education. The average household size was 4.6 persons. On the average, the households had a monthly income about NT\$47,225 and spent about NT\$140 per month on Chinese sausage. In general, the survey shows that the majority of the housewives consider CAS quality seal (65%), brand name (62%), and packaging (59%) as important or very important attributes. Most of the respondents, however, consider price (57%) and type of stores (54%) as somewhat important or not important. Although the results provide some insight as what the consumers consider to be important attributes of Chinese sausage, this information does not reveal the relative importance of attributes. It says nothing about which attribute is more important relative to the others and about how consumers will trade-off one attribute for the other. Yet, this type of information would be most useful to the producers for making strategic production and marketing decisions.

The estimated OLS regression based on the part-worth model of equation (3) is:

$$\begin{aligned}
 RANK_i = & 9.472 - 2.207Z_{11} - 0.118Z_{12} - 1.708Z_{21} \\
 & (124.50) \quad (-20.59) \quad (-1.06) \quad (-15.75) \\
 & - 0.268Z_{22} + 0.302Z_{31} + 0.213Z_{32} \\
 & (-2.50) \quad (2.67) \quad (1.82) \\
 & - 0.215Z_{41} - 1.118Z_{51}; \\
 & (-2.49) \quad (-14.24) \\
 R^2 = & 0.24, \quad N = 3,600. \quad (4)
 \end{aligned}$$

Where $RANK_i$ is the observed ranking for the i th combination of attributes from 1 to 18, with 1 being the most preferred combination. Z_{11} and Z_{12} represent the brand name attribute levels and are set to 1 and 0, or 0 and 1, or -1 and -1, respectively for national brand, regional brand and no brand. Similarly, Z_{21} and Z_{22} are the levels of packaging attribute; Z_{31} and Z_{32} represent the price levels; Z_{41} is the level of store attribute, and Z_{51} represents the presence or absence of the CAS label. The t -statistics are in parentheses and N is the number of observations used in the regression analysis. Overall, the results are satisfactory. The estimated regression is statistically significant and all the estimated coefficients are statistically significantly different from zero at the 0.01 significance level, except for Z_{12} which is deemed statistically insignificant and Z_{32} is significant at the 0.10 level.

The estimated part-worth utilities associated with each attribute level are derived from the regression coefficients are presented in Table 1. Since consumers were asked to evaluate and rank the various combinations of attributes from 1 to 18, with 1 representing the most preferred combination, the importance assigned to the part-worths derived from the OLS estimates is interpreted in the reverse order. That is, the lowest part-worth value within an attribute would be the most preferred attribute-level because it represents the highest utility assigned by the respondents. In this study, the part-worths within an attribute are normalized so that the utility of the least desirable level of the attribute is set to 0. This is accomplished by taking the absolute value of the difference between each part-worth and the maximum part-worth of the attribute. The results are shown in Table 1 as adjusted part-worths.

A paired comparison based on the t -statistic was used to test if the part-worths are statistically significantly different from each other for an attribute. The results suggest that the null hypothesis of no difference among attribute levels can be rejected for all attributes at the 0.01 significance level, except for the price attribute (Table 1). In other words, consumers do not perceive the sausages that were priced at NT\$170 to be significantly different from those priced at NT\$150, *ceteris paribus*. The conditional oppor-

Table 1. Estimated Attribute-Level Part-Worth Utilities, Conditional Opportunity Losses, and Relative Attribute Importance for Chinese Sausage

Attributes and Levels	Part-Worth Utilities*	Adjusted Part-Worths	Conditional Opportunity Losses	Relative Importance (%)
Brand Name				38.74
National brand	$\alpha_{11} = \beta_0 + \beta_1 = 7.265$	4.532	0	
Regional brand	$\alpha_{12} = \beta_0 + \beta_2 = 9.354$	2.443	2.089	
No brand	$\alpha_{13} = \beta_0 - \beta_1 - \beta_2 = 11.797$	0	4.532	
Packaging				31.49
Vacuum packed	$\alpha_{21} = \beta_0 + \beta_3 = 7.764$	3.684	0	
Nitrogen flush packed	$\alpha_{22} = \beta_0 + \beta_4 = 9.204$	2.244	1.440	
Unpacked	$\alpha_{23} = \beta_0 - \beta_3 - \beta_4 = 11.448$	0	3.684	
Price				6.98
NT\$170 ^b	$\alpha_{31} = \beta_0 + \beta_5 = 9.774$	0	0.817	
NT\$150	$\alpha_{32} = \beta_0 + \beta_6 = 9.685$	0.089*	0.728	
NT\$120	$\alpha_{33} = \beta_0 - \beta_5 - \beta_6 = 8.957$	0.817	0	
Store				3.68
Supermarket	$\alpha_{41} = \beta_0 + \beta_7 = 9.257$	0.430	0	
Traditional market	$\alpha_{42} = \beta_0 - \beta_7 = 9.687$	0	0.430	
CAS Label				19.11
Yes	$\alpha_{51} = \beta_0 + \beta_8 = 8.354$	2.236	0	
No	$\alpha_{52} = \beta_0 - \beta_8 = 10.590$	0	2.236	

*Computed from the estimated coefficients of the regression model: $RANK_i = \beta_0 + \beta_1 Z_{11i} + \beta_2 Z_{12i} + \beta_3 Z_{21i} + \beta_4 Z_{22i} + \beta_5 Z_{31i} + \beta_6 Z_{32i} + \beta_7 Z_{41i} + \beta_8 Z_{51i} + \epsilon_i$.

^bOne New Taiwan dollar (NT\$) equals to US\$0.04.

*Not significantly different from zero at the 0.01 significance level.

tunity losses are the differences between each adjusted part-worth and the highest adjusted part-worth utility within an attribute. The conditional opportunity losses provide a measure that indicates the losses of utility for an attribute not being perceived at its best level. Thus, the conditional opportunity loss for the most desirable attribute-level is equal to 0. The conditional opportunity losses are reported in column four of Table 1.

As shown in Table 1, the results suggest that the most preferred combination of attributes is represented by a national brand sausage that is vacuum packed with CAS seal and sold at the supermarkets for NT\$120. This combination gives consumers the highest total worth of 11.699 (i.e., sum of the highest attribute-level part-worths = $4.532 + 3.684 + 0.817 + 0.430 + 2.236$). The next preferred combination would be the same sausage that is marketed through the traditional markets instead of supermarkets. The associated opportunity loss for buying sausage from the traditional markets instead of supermarkets is 0.430. Furthermore, it can be inferred from the estimated part-worths that a trade-off of vacuum packed for nitrogen flush packed is preferred by consumers over a trade-off of national brand for regional brand. The opportunity loss for such a trade-off is 1.440 for nitrogen flush packed vs. 2.089 for regional brand. Thus, other things constant, consumers value the worth of a nitrogen flush packed national brand sausage higher than a vacuum packed regional brand. Similarly, other comparisons and trade-offs among attributes can be easily evaluated based on the estimated adjusted part-worth utilities or conditional opportunity losses.

The estimated part-worths indicate the importance of each attribute-level within an attribute. They are not directly comparable across the attributes. To provide a comparable measure, the highest adjusted part-worth utility of an attribute is divided by the sum of the highest attribute-level part-worths to obtain a relative importance index for each attribute. The relative attribute importance expressed in term of percentage is shown in the last column of Table 1. The results suggest that consumers consider brand name, followed by packaging, to be the most important attribute. The conjoint results also confirm the survey find-

ings that price and retail outlet are the least important attributes for Chinese sausages. The results suggest that consumers are generally indifferent with respect to point of purchase.

While CAS quality seal was considered to be an important or very important attribute by most of the housewives surveyed (65%), the conjoint analysis suggests that its importance may not be as prominent as the survey indicated. The CAS attribute ranked a distant third followed brand name and packaging method. A possible explanation is that respondents may view brand name or packaging method as an assurance for desirable quality. Thus, in making purchase decisions, consumers are likely to select a familiar brand with known quality instead of relying on CAS label for quality assurance. Other things being equal, consumers would prefer a regional brand or nitrogen flush sausage without CAS seal to a no brand or unpacked sausage with CAS seal. The CAS seal apparently is considered as an important and desirable attribute that enhances the quality of sausages, but not as a viable substitute for either brand name or packaging method.

Furthermore, it is possible that other attributes, such as flavor, taste and texture, were embedded in brand names because they are most likely developed as a basis for product differentiation. The results could very well be different, if the attribute levels were modified or a different set of attribute descriptions were designed and chosen for the study. Thus, it should be noted that conjoint analysis results are not invariant to changes in attribute levels and they are sensitive to study design. This also reveals the strength and potential usefulness of conjoint analysis. Because of its sensitivity, conjoint analysis would be an ideal application for investigating changes in consumers' product evaluation associated with potential modification of attributes, or introduction of new products and/or attributes.

Conclusions

This study uses conjoint analysis to collect preference data from 200 Taiwanese housewives. The OLS procedure was used to analyze consumers' preferences ranking with regard to various combinations of product attributes and to estimate

the part-worth utility of each attribute-level assigned by the consumers. The analysis also provides information concerning the relative importance of product attributes that usually are not readily available from surveys that asked respondents about their attribute preferences. It allows the producers to determine what attributes are most desirable and what potential trade-offs among attributes are acceptable to the consumers. Based on these information, a producer can focus on developing a product that entices demand and provides satisfaction to consumers.

Specifically, the analysis suggests that the most preferred combination of attributes is represented by a national brand sausage that is vacuum packed with CAS seal and sold at the supermarkets for NT\$120. Results suggest that brand name, packaging, and CAS label are the most important attributes that influence consumers' overall judgment of sausage quality. Price and retail outlet are found to be relatively unimportant attributes in consumers' product evaluation. Although consumers would prefer a lower price to a higher price, the results suggest that the opportunity loss for selling sausages at either NT\$170 or NT\$150 would be relatively small compared with forgoing either brand name, packaging, or CAS label.

To sausage producers, the most important marketing implication is to establish brand name loyalties among consumers. Although meat packaging using nitrogen flush technology has the advantages of extending shelf-life and maintaining original color and flavor, this improved method evidently has not gained widespread acceptances among Taiwanese consumers. Thus, it would be advisable for producers, who opt for nitrogen flush packaging, to educate consumers and promote their awareness of what this technology has to offer. In addition, the study suggests that CAS label was not as important as the survey indicated. Nevertheless, the CAS seal still represents an important product attribute that is desirable to the consumers. To increase their market share and consumers acceptance, it would be prudent for sausage producers to enhance their product quality with CAS assurance.

The study demonstrates that conjoint analysis is a useful methodological complement to conventional surveys to evaluate consumers' overall judgment of a product. Although the aggregate model is efficient and convenient to estimate, its major shortcoming is that the results are less predictable due to potential heterogeneity of preferences. Further research is needed to study consumers' preferences structure based on less aggregate and/or segmentation models. In particular, if the preferences are homogeneous, the predictive power of conjoint analysis would be improved substantially. More importantly, segmentation models provide a means to identify market segments based on similarity of preferences and/or consumer characteristics. The ability to identify groups of consumers having similar preferences and/or characteristics would be useful for the producers to target a market more efficiently with specific marketing strategies and mixes.

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