

## Price Response Function With and Without Choice Set Information in Denim Jeans Market

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### 고려상품군의 유·무에 따른 가격반응함수의 비교연구

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#### Abstract

The primary purpose of this study is to suggest a new methodology for calibration of a continuous price response function and to compare the differences in the price response function with and without choice set information. Through the new methodology, the two-staged conjoint analysis, the continuous price response function for jeans market was calibrated. Three steps were required to complete the two-staged conjoint analysis. Step one provided respondents with both a written and a visual description of two different randomly selected styles and colors of denim jeans. In step two respondents were asked to choose the combination of attributes they intended to purchase. Based upon the literature review, these four attributes included: brand, style, price, and color. Respondents were required to assess their purchase intentions for 32 combinations by marking Yes if she/he would purchase a given combination and No if she/he would not purchase a given combination. This allowed for identification of each respondents choice set. Instructions in step three required respondents to rate each combination marked Yes on a scale of 1-100, with one as least likely to be purchased and 100 as most likely to be purchased. This value served as the dependent variable for estimating the parameters in the model. Furthermore, the empirical study shows that there is a difference in price response function with and without choice set information. Therefore, when one calibrates a price response function for a given brand, we can recommend to include choice set information in his/her research.

**Key words:** Price response function, Conjoint analysis, Choice set information, Denim Jeans market

### I. Introduction

Today's retail environment is in a state of flux. Caught in a profit squeeze, retail organizations are in a constant battle for market share. To succeed in a highly competitive market dominated by strategic shoppers, marketers in the 2000s must focus on the range of factors or attributes consumers use to make judgments or trade-offs in determining their final

purchase choice. In this context, it is important for manufacturers and retailers to understand how price, promotion, and other marketing variables affect product sales. Such information is the basic material for marketing mix decisions.

The relationship between alternative prices and the resulting sales quantity is called the price response function (PRF) (Simon, 1989). The price response function of a product is a tool to understand

the effect of price on sales. Researchers have recommended calibrating the price response function for a product or a brand to find the optimal price for the product or the brand based on conjoint analysis (Kucher and Hilleke, 1993; Geurts & Whitlark, 1993; Simon, 1989, Weiner, 1994; Yoo, 1991). This conjoint measurement uses individual customer's preference, which also satisfies the condition of setting the prices from the customers viewpoint.

However, the traditional conjoint analysis and several variant conjoint analysis have only one stage in which respondents are required to express their purchase intentions among the prespecified combinations, although respondents may not consider one of the prespecified combinations as they want to buy. In the previous studies investigating individual consumer choice decision-making, researchers have concluded that individuals have their own choice set in selecting a certain product category (Engel et al., 1995; Han and Vanhonacker, 1995; Shocker et al., 1991; Siddarth et al., 1995). A choice set for a specific product category is basically built in the information search process, which is one of the steps in the consumer decision-process model. Therefore, it is suggested that the one-stage conjoint analysis need to consider a consumer's choice set within the information search process (Shocker et al., 1991). However, there hasn't been a research investigating the price response function considering consumer's choice set information based on the conjoint analysis.

The primary purposes of this study were to develop a new alternative research methodology for calibration of the price response function utilizing a two-staged conjoint analysis, which includes choice

set information. The usefulness of an by comparing the price response functions with choice set information to the price response function without choice set information.

This study hired multiple attributes of denim jeans in order to measure choice set information and distinguished choice set information from product selection behavior. The price response function including the consumer's choice set information will be able to reflect a part of information search process of consumer decision-process model and will be more precise and sophisticated than the price response function without choice set information. Marketers can lead to a better pricing decision by incorporating choice set information into price response function.

## II. Literature Review

### 1. Price Response Function

In the quantitative/methodology-based approach pricing is dependent on external and internal determinants. External determinants are factors beyond the firm's control (e.g., consumer characteristics, market structure, legal conditions), while internal determinants are factors under the firms control (e.g., advertising, price, product, distribution). These factors determine the number of product units that can be sold at alternative prices (Yoo, 1991).

The dependent variable of the price response function is sales volume or market share. Market share is an aggregation of individual customer choice or preference. This individual customer choice or pref-

**Table 1. Comparison of Methods for Collecting Price Response Data.**

Criteria	Expert Judgment	Customer Survey		Price Experiments	Actual Market Data
		Direct Survey	Conjoint Analysis		
Validity	Medium	Very Low	Medium-high	Medium-low	High
Reliability	Medium-high	Uncertain	Uncertain	High	Low
Costs	Very Low	Low-medium	Medium	Medium-high	Depends on Availability & Accessibility
Overall Evaluation	Useful for New Situations	Questionable	Very Useful	Useful	Useful for Established Products

Note. From Price management (p. 36). by H. Simon, 1989, New York; North-Holland. Copyright 1989 by North-Holland. Adapted.

erence can be explored by conjoint measurement. Calibration of the price response function requires price data and sale/market share data. Simon (1989) classified the method for calibrating the price response function into four categories; expert judgment, customer survey, price experiment, and collection of actual market data. The customer survey method can be divided into two different types. Researchers can either directly ask customers how they would react to certain price levels, price changes, or price differentials (Direct price response surveys), or one can ask customers about their preferences and infer the information on price response from these preference data; (Conjoint measurement). Table 1 provides an evaluation of these methods on various criteria. Although Simon (1989) identifies the reliability of conjoint analysis as uncertain, Reibstein et al. (1987) reported that conjoint analysis was generally reliable with respect to reliability over the stimulus set, the attributes set, and the data collection procedure. From Table 1, one can infer that conjoint analysis is a useful method for estimating price response functions.

## 2. Conjoint Analysis

Since the mid-1970s conjoint analysis has attracted considerable attention as a method to realistically portray consumers decisions as a trade-off among multi-attribute products or services (Wittink and Cattin, 1989). A recent survey reported applications in the areas of new product, concept identification, competitive analysis, pricing, market segmentation, advertising, and distribution (Wittink et al., 1994).

Especially, Simon (1989) recommended a conjoint analysis as a calibrating tool for the price response function. Kucher and Hilleke (1993) further indicated that conjoint analysis is a more sophisticated and valid pricing method than using the cost-plus approach, which uses the perceived relative value of products. Finally, Wittink et al. (1994) reported that pricing is the single most frequently identified purpose served by conjoint analyses in Europe, whereas it was third in frequency in the United States.

Although conjoint analysis has gained widespread acceptance and use in many industry settings, few researchers have applied it to the field of clothing and textiles. Oh and Huh (1995) used conjoint analysis to determine optimal jeans product development in South Korea. However, they failed to satisfy the conditions of mutual exclusiveness between the levels of the various attributes; a condition recommended by Green and Srinivasan (1990).

Virtually little research has been completed in the textiles and clothing field which utilizes calibration of the price response function by conjoint analysis. In this regard, application of this methodology will contribute significantly the breadth of knowledge in the textiles and clothing discipline.

As of today, there are two types of conjoint analysis which include choice set information in its analysis procedure: ACA (Adaptive Conjoint Analysis) and CBC (Choice Based Conjoint Analysis). ACA method is dependent on single attribute of brand to measure choice set information while CBC adapted multiple attributes of a product in measurement of choice set information based on Louvier and Woodworths study (1983) which suggested that it is more reasonable to include multiple attributes of a product in measuring choice set information. However, CBC analysis failed to distinguish choice set information from product selection behavior (Green et al., 1991).

## 3. Choice Set

The concept of choice set was introduced by Howard and Sheth in 1969, and defined as the brands that consumers consider seriously during the decision process for buying. It has been an important concept in the area of research related to information search behavior and consumer's response model (Engel et al., 1995). Campbell (1969) demonstrated the existence of choice set in brand choice behavior. Wright (1975) interpreted the reasons for building a choice set as consumers' tendency to make buying decision process simpler.

The concept of choice set has been widely utilized

in developing marketing strategies. Hauser & Wernerfelt (1990) measured the size of choice set for various product categories, also showing that the size of choice set varies significantly depending on product categories. Based on Hauser & Wernerfelt (1990), recent studies focused on the consumer responses and marketing strategies by the size of a choice set. In the area of pricing, Kalyanaram & Little (1994) showed that acceptable price range gets smaller as the size of choice set increases.

In the field of clothing & textiles, Kwak & Lee (2002) identified the consumers who use the level of the price as the indicator of the product quality using the quadratic price response function and CBC conjoint analysis. Kwak et al. (2002) used traditional conjoint analysis method on the purpose of searching the optimal timing of mark-down in denim jeans market. In addition, Beck et al. (2003) hired the CBC conjoint analysis and price response function in order to find the price range in which total sales amount is not decreased as the price is increased.

### III. Method and Procedure

The primary purposes of this study were to develop a new methodology for calibration of the price response function and to compare differences in the price response functions with and without choice set information. A new methodology for calibration of a continuous price response function including choice set information was developed to meet the purposes of the study. The new methodology, identified as the two-staged conjoint analysis, incorporated the logit transformation into the conjoint analysis and added the choice set formation step in the conjoint questionnaire.

Data were collected using a two part questionnaire developed by the researcher. Section one was designed to collect preference data from each respondent using the full profile method (Park, 1994). However, due to the large number of potential combinations to be evaluated by respondents, a fractional factorial design was used.

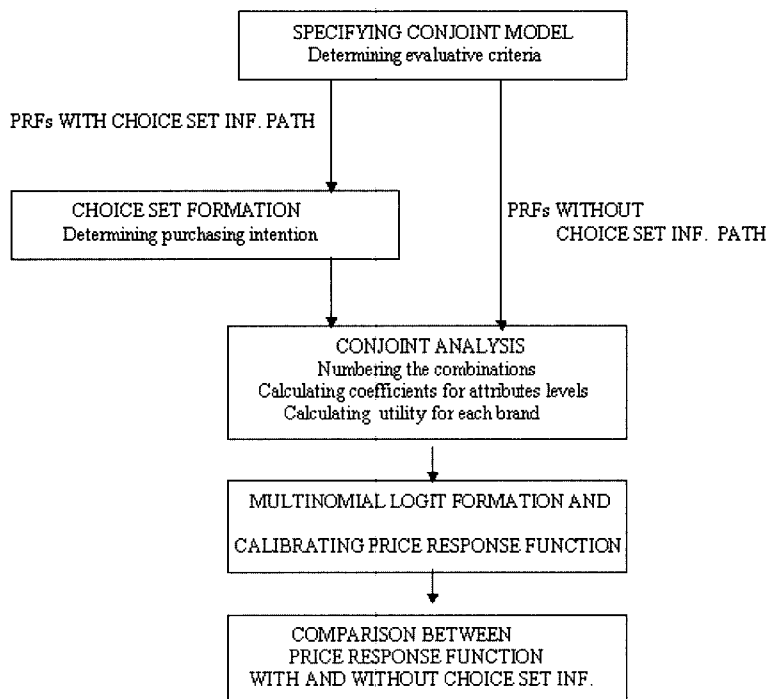


Fig. 1. Flow of calibration of price response function and optimal price.

Three steps were required to complete the first section. Step one provided respondents with both a written and a visual description of two different randomly selected styles and colors of denim jeans. Because denim jeans are a frequently purchased product actively marketed by manufacturers and retailers alike, this product category was selected for the current study.

Based upon the literature review, four attributes were selected for the study: brand, style, price, and color. These four criteria have used as the product evaluation criteria most frequently from the Clothing and Textiles Research Journal and Journal of the Korean Society of Clothing and Textiles since 1970s. (Dardis et al., 1985; Davis, 1987; Eckman et al., 1990). Brand and price levels for the study were determined based upon product availability and brand characteristics at one shopping mall complex with several department stores in Lubbock, Texas in 2002. A total of 11 brands were available for consumer purchase. From these 11 brands, eight national brands were selected for inclusion in the study; Levi, Guess, Lee, Rocky Mountain, Pepe, Wrangler, Girbaud, and Dockers. Prices ranged from \$23 to \$72. Based upon this information, price levels for the study were set at \$20, \$40, \$60, and \$80. Two basic styles were randomly selected by the researcher. The "Baggy Fit" featured a straight leg and pleated front, while the "Easy Fit" was designed with a flat front and narrow leg. Examples of both styles were presented to the respondents prior to completion of the questionnaire. Each manufacturer typically uses different terminology for various shades of blue denim. Therefore, the researcher arbitrarily selected two distinctly different shades of blue denim which were available to consumers simultaneously; a deep, unwashed denim referred to as 'Dark Color' and a pre-washed denim referred to as 'Light Color'. Accordingly, the conjoint analysis consisted of eight brands, four prices, two designs, and two colors. Therefore, 128 combinations could be obtained from these levels of attributes. By the fractional factorial design, 32 combinations were identified.

In step two, respondents were asked to choose the

combination of attributes they intended to purchase. Respondents were required to assess their purchase intentions for 32 combinations by marking "Yes" if she/he would purchase a given combination and "No" if she/he would not purchase a given combination. This allowed for identification of each respondents choice set. A score of zero was assigned to all purchase intention scores marked "No". The dependent variable of the conjoint analysis model without choice set information equaled each respondents purchase intention data numbered 0 to 100, while the dependent variable of the conjoint analysis model with choice set information equaled each respondents purchase intention data numbered 1 to 100. The Least Squares method was employed to estimate beta coefficients for the model with dependent variables equal to each respondents purchase intention data numbered 0 to 100, and independent variables of brand name, price, style, and color.

$$V_{ik} = u_{ik} + \beta_1 \text{price}_k + \beta_2 \text{style}_k + \beta_3 \text{color}_k \quad (1)$$

where  $V_{ik}$  = utility assigned to brand  $k$  by consumer  $i$

$u_{ik}$  = the intrinsic utility/value of brand  $k$  for consumer  $i$  (brand-specific intercept)

$\text{price}_k$  = the net available price of brand  $k$  for consumer  $i$

$\text{style}_k$  = the available style of brand  $k$  for consumer  $i$ , easy fit is 1; otherwise 0

$\text{color}_k$  = the available color of brand  $k$  for consumer  $i$ , dark color is 1; otherwise 0

$\beta_1, \beta_2, \beta_3$  = the parameters to be estimated for consumer  $i$

Section two of the questionnaire was designed to elicit demographic information from respondents. Age, gender, marital status, student classification, jean consumption, jean ownership, and ethnic background served as demographic variables.

A pretest was conducted to test interpretability of the instrument. Participants consisted of four students at a major state supported southern university. Students were randomly selected and represented both males and females of various ages. Changes in section two of the questionnaire were made as

necessitated by the respondents including additional refinements in terms of rewording and reordering of questions. No revisions were required in section one.

Park (1994) and Urban and Hauser (1993) recommend using at least 100 respondents for a conjoint analysis. Accordingly, in this study no criteria were employed to either admit or exclude subjects, and the convenience sample consisted of 103 voluntary respondents enrolled at a major state supported southern university in US.

#### IV. Results

The sample consisted of both male (72.8%) and female (27.2%) participants, ranging in age from 21 to 40 years with a mean age of 23.1 years (standard deviation (SD) of 3.83). The majority of the sample was single (82.5%). Over half of the respondents were seniors (51.4%), 37.9% juniors and 10.7% sophomores. The majority of participants were White/Non-Hispanic (78.6%), 10.7% Hispanic, 4.9% Asian/Pacific Islander, 3.9% Black/Non-Hispanic, and 1.9% American Indian/Native American.

Jean consumption per week ranged from 0 to 7 wearings, with a mean frequency of 4.7 ( $SD=1.74$ ). Nearly a quarter of the sample (24.3%) wore denim jeans five times per week, 21.4% 7 times per week, and 19.4% four times per week. The mean number of denim jeans pants owned by respondents was 6.5 ( $SD=4.2$ ), while the mean number of denim jeans shorts was 3.1 ( $SD=2.7$ ).

Data addressing this question were analyzed using

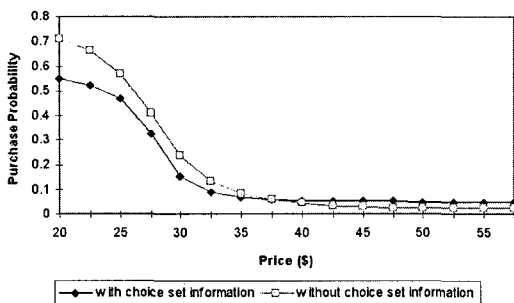


Fig. 2. Levi's Price response functions with and without choice set information.

Table 2. The Results of t-test at Various Price Points.

price brand	\$20	\$30	\$40	\$50	\$60
Levis	-3.12*	-4.03*	3.18*	4.34*	3.83*
Guess	-3.02*	-3.84*	3.28*	4.63*	4.03*
Lee	-3.65*	-1.69	1.85	3.72*	3.64*
Pepe	-2.57*	-1.25	3.50*	4.27*	3.90*
R. M.	-2.54*	-1.50	4.07*	4.85*	3.85*
Girbaud	-3.28*	-5.35*	2.66*	3.55*	1.86*
Wrangler	-3.98*	-6.69*	0.91*	3.33*	3.18*
Dockers	-3.06*	-3.19*	2.72*	4.00*	3.75*

\*denotes that there is a significantly difference in mean choice probability at a given price with 95% confidence.

the following steps: (1) calculation of the utility function of each brand through conjoint analysis; (2) application of various prices to each brands utility function to determine respondents choice probabilities, under the assumption that prices of other brands be fixed; (3) determination of a price response function for each brand from the mean choice probabilities; and (4) application of the *t*-test to determine differences in mean choice probabilities for the price response functions with and without choice set information for each brand.

<Fig. 2> illustrates the price response functions with and without choice set information for one brand among eight brands. In each case, as prices increased, choice probability was decreased. For seven of the brands, this phenomenon was evidenced between the price range of \$20-\$60.

Utilizing the *t*-test, differences between the price response functions with and without choice set information were examined for each brand (Table 2). Significant differences in mean choice probabilities were found at the 0.05 level of significance at several price points on the price response functions with and without choice set information.

To further examine the differences in the price response functions with and without choice set information, a comparison was made on price elasticities. <Table 3> illustrates the differences in price elasticity on the price response function. All brands appear to have lower price elasticities with choice set information than without choice set information at the \$20

**Table 3. The Differences in Price Elasticity on Price Response Function.**

Brand	Choice Set Information	Price					
		\$20	\$25	\$30	\$35	\$40	\$45
Levi's	With	-0.040	-0.063	0.000	-0.017	-0.010	-0.007
	Without	-0.053	-0.055	0.000	-0.015	-0.010	-0.007
Guess	With	-0.040	-0.064	0.000	-0.016	-0.009	-0.006
	Without	-0.052	-0.051	0.000	-0.013	-0.008	-0.006
Lee	With	-0.025	-0.044	0.000	-0.043	-0.025	-0.017
	Without	-0.049	-0.066	0.000	-0.027	-0.017	-0.012
Pepe	With	-0.039	-0.063	0.000	-0.018	-0.011	-0.007
	Without	-0.051	-0.048	0.000	-0.012	-0.008	-0.006
Girbaud	With	-0.039	-0.062	0.000	-0.018	-0.010	-0.007
	Without	-0.051	-0.048	0.000	-0.012	-0.008	-0.006
Wrangler	With	-0.040	-0.064	0.000	-0.016	-0.009	-0.006
	Without	-0.052	-0.050	0.000	-0.012	-0.008	-0.006
Rocky	With	-0.039	-0.063	0.000	-0.019	-0.011	-0.008
Mountain	Without	-0.053	-0.057	0.000	-0.017	-0.011	-0.008
Dockers	With	-0.040	-0.063	0.000	-0.017	-0.010	-0.007
	Without	-0.052	-0.051	0.000	-0.013	-0.009	-0.006

price point, while higher price elasticity is evidenced with choice set information from \$25 to \$45 than without choice set information. Based upon the results and these of the *t*-tests and price elasticities, it can be considered that the price response function with choice set information has a different structure than the price response function without choice set information.

The different shapes and price elasticities of the price response functions with and without choice set information resulted from the different coefficients of the attributes between the two conjoint models. Each respondents choice set information affected the variance of the levels in the attributes, which resulted in the different coefficients of the attributes between the two conjoint models. Furthermore, in this study, the brand specific constant was used as the attribute unique to brand *j*. The different brand specific coefficients are resulted in the different price response function for each brand.

## V. Conclusions and Implications

Consumer's choice set information has not been

considered in the previous pricing studies with conjoint analysis which focus on the range of factors or attributes that consumers use to make final purchase decisions. In addition to the merit of conjoint analysis, which has good reflection for the consumers price responses, it is expected that choice set information provides further understanding of consumers price response.

The purposes of the study were to suggest a new methodology for calibration of the price response function and compare differences in the price response functions with and without choice set information. Results of the *t*-test and price elasticity showed that the price response functions with and without choice set information had different price response structures; as the price increased, the purchase probability of price response function with choice set information was decreased less than PRF without choice set information. In conclusion, this study proved the usefulness of price response function with choice set information and provided an alternative research methodology for the studies including normative pricing (Beck et al., 2003) and dynamic pricing (Kwak et al., 2002).

Although the primary purposes were successfully achieved, the following are suggestions for further research:

1. Develop a new model for calibration of the price response function to include only the deterministic component with attributes unique to subject brand in the utility function.

2. Replicate the study using evaluative cues other than color and style. For parsimony this study used only four attributes in the utility function. However, in the case of the price response function with choice set information, color and style did not play a major role in affecting the utility for each brand. Therefore, other evaluative cues may elicit significantly different results.

3. Conduct future research which consider competitive situations. This study assumed that when the price of a brand changes in utility function, other brands do not take any action in price and other marketing variables. Game theory can provide a framework for analyzing the competitive market situation.

4. Replicate the current study utilizing product categories where validity tests are available. This study did not include a procedure to test the validity of the new methodology with market share data. However, the real market data in the U.S. apparel market was available based on the company level, not on the brand level.

5. Further research may include different types of product attributes, which can be used in conjoint analysis, by contemplating the building process of choice set.

However, the result from this study needs to be carefully interpreted due to the limitation of convenient sampling from only one city in United States. By the way, the difference in price response functions between with and without choice set information provides the empirical evidence that conjoint analysis with a choice set is a useful tool to find more sophisticated price response function.

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## 요 약

가격반응함수는 각 가격대별로 판매량의 변화를 추적한 함수이다. 가격에 판매량을 곱하면 판매량이 되고, 여기에 비용을 차감하면 이익이 된다. 따라서 가격반응함수는 상표나 제품의 이익을 최대로 하는 가격을 찾는 바탕이다. 컨조인트분석은 고객시각에서 가격반응함수를 도출하는데 신뢰성 높은 방법으로 적극적으로 권해지고 있으나, 고려상표군을 고려하지 못한다는 단점이 지적되어 왔다. 이 연구는 고려상표군을 측정할 수 있는 컨조인트분석의 한 변종으로 2단계 컨조인트분석을 개발하여 미국의 한 도시의 청바지 시장에 적용하였다. 그 결과, 고려상표군 정보를 가진 가격반응함수와 그렇지 않은 가격반응함수 간의 특정가격대별 선택확률과 가격탄력성에 차이가 발생함이 발견되었다. 고려상표군 형성이 소비자의 구매의사결정과정의 한 단계임을 고려할 때, 고려상표군 정보를 가진 가격반응함수로 소비자의 가격반응을 추적하는 것이 필요함이 이 연구를 통해 실증되었다.

**주제어:** 가격반응함수, 컨조인트 분석, 고려상표군, 청바지 시장