Determinants of Price Elasticities for Store Brands and National Brands of Cheese

Min-Hsin Huang, David E. Hahn, and Eugene Jones

The Authors are, respectively, Ph.D. Candidate, Professor, and Associate Professor,
Department of Agricultural, Environmental, and Development Economics,
The Ohio State University
2120 Fyffe Road
Columbus, Ohio 43210-1067
huang.354@osu.edu, (614) 292-6233
hahn.1@osu.edu, (614) 292-2642
jones.73@osu.edu, (614) 292-3543

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Abstract

A two-stage modeling process is developed to estimate factors that determine price sensitivities for store and national brands of cheese. Results show that several factors affect price sensitivities. AIDS and LA/AIDS models are used in the analyses and meta-regression results show no difference in own-price elasticities for these two models.

I. INTRODUCTION

Cheese is the most important manufactured dairy product in the United States. By raw milk-equivalent, cheese utilized 38 percent of raw milk and overtook fluid milk products as the largest user of raw milk. Turning from production to consumption, per capita consumption of cheese has increased by 70 percent in the past two decades. Many applied economists have examined the important issues on cheese products demand. For example, Maynard and colleagues (Maynard, 2000, Maynard and Liu, 1999) used various demand models to estimate demand elasticities for different cheese product categories. Gould and Dong (2000) used a simulated maximum-likelihood procedure to investigate the relationship between the discrete purchase decision and a set of household and purchase characteristics for cheese products. Gould (1997) estimated a series of econometric models of different time durations, based on a 170-week household panel that included purchase quantity, price, coupon use, and household demographics. However, these studies concentrated on cheese products demand at the commodity level and little research focused on brand level, particularly the competitive interaction between store brands and national brands of cheese products.

Store brands play an important role in cheese products marketing. In the retail cheese market, store brands account for 35 percent of market share whereas a single national brand (Kraft) accounts for 45 percent of market share (Cropp, 2001). Together, store brands and Kraft account for 80 percent of the retail cheese market. It is therefore important to examine price competition issues, such as determinants of price sensitivity, for store brands and national brands (Kraft) of cheese products. Knowledge of factors that determine price sensitivity for store and national brands of cheese can help retailers and manufacturers make relevant production and marketing decisions. Marketing practitioners of retail cheeses make decisions on price level for both regular and promotion prices on an ongoing basis. Knowledge of price elasticities for brands can assist many pricing decisions. Included among these are: identifying which items can withstand regular price increase; selecting items that should have price discounts; and setting price discount levels. More importantly, an understanding of the determinants of price sensitivity can facilitate marketing managers' ability to implement micro-marketing strategies with different prices in different stores or retail market areas (e.g., lower- and higher-income stores).

Studies on determinants of price elasticities can be found in the marketing literature with the focus on alternative functional forms and broad product category. For example, Hoch et al. (1995) used a log-linear function, while Mulhern, Williams, and Leone (1998) used a negative exponential function to estimate price elasticities. However, these functional forms have not so far been considered in a formal economics framework (Baltas, 2002). In addition, broad product categories, such as soft drinks, paper towels, and toothpaste increases the possibility of aggregation bias in the estimation procedures. This paper focuses on a single product, hard cheese, and this product is disaggregated into product classes by brands and package sizes to estimate price elasticities at a more refined and narrow level.

The purpose of this paper is to estimate brand demand elasticities by using plausible economic theory within a consumer demand framework. The framework developed incorporates factors that determine price elasticities for store and national brands of cheeses products. An important objective of the study is to provide managerial information to marketing practitioners, while suggesting ways for implementing price promotion strategies and effective pricing policies.

II. THEORETICAL FRAMEWORK

Based on the neoclassic consumer economics theory, applied demand analysis discusses the optimal allocation of consumer expenditure among different products and services. The associated demand system is derived from the utility maximization problem and its parameters are estimated on the basis of observations on price and expenditure. Assuming weak separability of preferences, a brand demand system is defined as a set of demand equations that determine the utility-maximizing allocation of category expenditure among the competing brands (Baltas, 2002). Within the same brand, small and large package sizes provide different levels of utility to consumers. Folkes, Martin, and Gupta (1993) suggested that compared to small packages, one reason large packages might be expected to encourage greater use is because consumers would be less concerned about running out of the product. The greater the supply of a product (e.g., large package), the lower the transaction (replacement) costs for using the product and greater the volume people are willing to use (Lynn, 1992). Wansink (1996) provides further support for the argument that packaging influences purchase behavior and usage behavior. Therefore, in this paper, small and large package sizes are incorporated into the brand demand system.

Applied economists have utilized several econometric models or functional forms for estimating consumer demand. A major goal of this study is to derive demand elasticities for store and national brands by estimating theoretically plausible demand systems. Furthermore, demographic and marketing effects are known to impact brand level demand, and thus a flexible functional form that incorporates demographic and marketing variables is utilized. From this viewpoint, the Almost Ideal Demand System (AIDS) (Deaton and Muellbauer, 1980) is superior to other common demand systems, such as Linear Expenditure System (LES) (Stone, 1954), Rotterdam model (Barten, 1964, Theil, 1965) and Translog model (Christensen, et al., 1975).

Another factor suggesting the AIDS model is that it satisfies the axioms of choice exactly, thereby allowing for testing and imposition of homogeneity and symmetry conditions. Further, this model permits some forms of aggregation and it is mathematically integrable. Such desirable theoretical properties and flexibility of the AIDS model facilitate the incorporation of marketing and demographic variables into the model. In particular, the "price independent generalized log" (PIGLOG) class of expenditure functions in the AIDS model fulfills the conditions required for exact non-linear aggregation. That is, the share equations and the expenditure function derived from the AIDS model can be seen as coming from a single representative household. Thus the parameters of a household's expenditure function can be (approximately) recovered even though the share equations are estimated using aggregate data. This advantage of the AIDS model is extremely important when using store-level, supermarket scanner data, because demand equations in this study represent the retail-level market demand.

Utilizing these principles, the economic form of the AIDS budget share demand function for a cheese product category can be written as:

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log\left(\frac{x}{P}\right) \tag{1}$$

where w_i is average expenditure share for a specific product class i (e.g., store brands of small package size); α_i, β_i, γ_{ij}, are parameters of the system;

$$x = \sum_{i=1}^{n} p_i q_i$$

is total expenditure in the cheese product category; p_j represent the price of the j^{th} product class; p_i and q_i represent the price and quantity, respectively, of the i^{th} product class; and P is a price index defined as

$$\log P = \alpha_0 + \sum_k \alpha_k \log p_k + \frac{1}{2}\sum_k \sum_j \gamma_{kj} \log p_k \log p_j \quad (2)$$

The parameter restrictions derived from utility theory require that the following conditions be satisfied:

$$\sum_{i=1}^{n} \alpha_i = 1;\ \sum_{i=1}^{n} \gamma_{ij} = 0;\ \sum_{i=1}^{n} \beta_i = 0 \quad \text{(adding-up);} \quad (3)$$

$$\sum_j \gamma_{ij} = 0 \quad \text{(homogeneity);} \quad (4)$$

$$\gamma_{ij} = \gamma_{ji} \quad \text{(symmetry).} \quad (5)$$

III. ESTIMATION PROCEDURE

The estimation procedure involves a two-stage modeling process. First, the empirical AIDS model is derived and used to estimate price elasticities. Second, a meta-analysis procedure that uses price elasticities as starting data points is used to estimate the impact of independent factors on these elasticities. That is, estimated price elasticities from the AIDS model for both store and national brands of cheese were regressed on a set of independent factors.

The Empirical AIDS Model

As currently expressed, equation (1) is void of marketing variables. Given the influence of marketing activity on consumer shopping behavior, it is natural to extend the AIDS model to incorporate these marketing variables. This study employs the linear demographic translating method to incorporate marketing variables as discussed in Pollak and Wales (1980, 1978). That is, the intercept term, α_i in equation (1), is assumed to be a linear function of marketing attributes such as price promotion, customer counts, holidays and seasonal effects. More specifically,

$$\alpha_i = \alpha_i^* + \sum_j \delta_{ij} PR + \zeta_i CC + \eta_i HD + \sum_k^3 \theta_{ik} SE \quad (6)$$

where α^*_i is the intercept net of marketing effect; PR is price promotion, representing the number of items on price discount within a product class during a given week; CC is customer count that is simply the number of customers shopping each week and this variable is specified to capture the effect of store traffic on particular product sales; HD is a zero-one dummy variable that captures the effect of calendar holidays; and *SE* is seasonal effect that is quarterly dummy variable to capture seasonal effects on cheese purchase. Substituting equation (6) into the AIDS model presented in equation (1), the empirical AIDS model incorporating marketing variables used in this study can be derived as

$$w_i = \alpha_i^* + \sum_j \delta_{ij} PR + \zeta_i CC + \eta_i HD + \sum_k^3 \theta_{ik} SE + \sum_j \gamma_{ij} \log p_j + \beta_i (\log x - \alpha_0 - \sum (\alpha_i^* + \sum_j \delta_{ij} PR + \zeta_i CC + \eta_i HD + \sum_k^3 \theta_{ik} SE) \log p_k - \frac{1}{2} \sum_k \sum_j \gamma_{kj} \log p_k \log p_j) \quad (7)$$

where *w* denotes expenditure share, *p* represents price, *x* is total expenditure in the cheese product category, $\alpha, \ \beta, \ \gamma, \ \delta, \ \zeta, \ \eta, \ \theta$, are model parameters to be estimated.

Theoretical restrictions placed on the parameters can be summarized as

$$\sum_{i=1}^n \alpha_i^* = 1; \sum_{i=1}^n \gamma_{ij} = 0; \sum_{i=1}^n \beta_i = 0; \sum_{i=1}^n \delta_{ij} = 0; \sum_{i=1}^n \zeta_i = 0; \sum_{i=1}^n \eta_i = 0; \sum_{i=1}^n \theta_{ik} = 0 \quad (8)$$

(adding-up)

$$\sum_j \gamma_{ij} = 0 \quad \text{(homogeneity)} \quad (9)$$

$$\gamma_{ij} = \gamma_{ji} \quad \text{(symmetry)} \quad (10)$$

Once the parameters have been estimated, the own-price elasticities can be calculated as follows (Green and Alston, 1990):

$$e_{ii} = -1 + \frac{\gamma_{ij} - \beta_i(\alpha_i + \sum_j \gamma_{ij} \log p_j)}{w_i} \tag{11}$$

In this study, the linear approximation AIDS (LA/AIDS) model is also estimated to compare with the results of original nonlinear AIDS model. The linear approximation AIDS model involves the replacement of *logP* with a simpler index as suggested by Moschini (1995). That is, the simpler price index can be represented as

$$\ln P^* = \sum_{i=1}^{n} w_i^0 \ln(p_{it}) \tag{12}$$

where w_i^0 is the expenditure share of good i in the base period. Consequently, the empirical LA/AIDS model used in this study can be represented as

$$w_i = \alpha_i^* + \sum_j \delta_{ij} PR + \zeta_i CC + \eta_i HD + \sum_k^3 \theta_{ik} SE + \sum_j \gamma_{ij} \log p_j + \beta_i \log(\frac{x}{P^*}) \tag{13}$$

and the own-price elasticities can be calculated as follows

$$e_{ii} = -1 + (\frac{\gamma_{ii}}{w_i}) - \beta_i \tag{14}$$

The literature supports the hypothesis that higher- and lower-income consumers exhibit different shopping behavior and sensitivity to price change (e.g., Jones and Mustiful, 1996, Mulhern, et al., 1998). In addition, cheese is classified into five product categories based on product forms: shredded, sliced, chunk, snack, and miscellaneous. Given five product categories and two income groups, a total of 20 demand systems are estimated for the two AIDS models (equation 7 and equation 13).

IV. DATA DISCUSSION AND ISSUES

The data used in this study are store-level scanner data provided by a national supermarket chain in the Columbus, Ohio metropolitan area (CMA). The data represent weekly observations and they include UPCs (Universal Product Codes), prices, package sizes, and sales quantities. The data used in the empirical model covers 69 weeks, for the period 12/31/2000 to 4/21/2002.

Six stores are included in the data set and these stores represent two distinct store groups, higher and lower-income. These groups are identified from socioeconomic information provided by the chain for all residents within a 3-mile radius of each store. The lower-income stores (1, 2 and 3) are located in areas that have large proportions of lower-income shoppers, while the higher-income stores (4, 5 and 6) are located in areas that have a large proportion of higher-income shoppers. The three lower-income stores are within the inner city of Columbus, located on: Cleveland Avenue, Eakin Road and S. High Street. The three higher-income stores are located in the suburbs of Hilliard, Upper Arlington and Westerville. As shown in Table 1, an average of 4.2 percent of the residents in higher-income areas have household income less than $10,000 annually. At the opposite end of the income spectrum, an average of 34.1 percent of residents in higher income areas have annual household incomes exceeding $75,000. Comparative percentages for the lower-income areas are 12.0 percent and 11.8 percent, respectively.

These two store groups reflect significantly different socioeconomic conditions not only in income, but also in education and race. As shown in Table 1, for example, only 10 percent of the prospective shoppers in areas identified as lower-income stores (stores 1, 2 and 3) are college graduates, as compared to 38 percent of prospective shoppers in higher-income areas (stores 4, 5 and 6). The lower-income areas are also characterized by populations that are more heterogeneous than the homogeneous populations of the higher-income areas.

Stationarity is an important issue when using time series data in econometric analysis. The traditional test for stationarity of time-series data is called the unit-root test. In the current study, the Augmented Dickey Fuller (ADF) tests are executed to identify whether each individual time-series variable in the AIDS model is stationary or non-stationary. The results of ADF test indicate that absolute values of the estimated t-statistics are larger than corresponding asymptotic critical values for most of variables in the AIDS model, with some exceptions. In other words, the time-series variables used in the present study are stationary and one can reject the null hypothesis that data contain a unit root.

V. A META-ANALYSIS

The essence of meta-analysis is the comparison of similar, but not necessarily identical, estimates of quantities measured in different settings. Meta-analysis is broadly applicable in terms of interpreting empirical research results (Farely and Lehmann, 1986). Meta-analysis has been developed and widely used in the context of the social sciences such as marketing, economics, and psychology, and refers to the statistical analysis of empirical research results (Stanley, 2001). Meta-analysis has also been established to synthesize empirical research results by means of an analysis of the variation in estimated demand elasticities. For example, Tellis (1988) described a meta-analysis of econometric studies that estimated the elasticity of selective sales or market share to price. Dalhuisen et al. (2003) presented a meta-analysis of variations in price and income elasticities of residential water demand.

In the current study, meta-analysis is used to synthesize the factors that determine the estimated store-level price elasticities for national brands and store brands of cheese. More specifically, the meta-regression of price elasticity for store brands and national brands respectively can be written as:

$$Elasticity = \lambda_0 + \lambda_1\, Share + \lambda_2\, LowIncome + \lambda_3\, ShredCheese + \lambda_4\, SlicedCheese + \lambda_5\, SnackCheese + \lambda_6\, MiscelCheese + \lambda_7\, SmallSize + \lambda_8\, AIDS + \varepsilon \qquad (15)$$

where:

Elasticity	is the absolute value of own-price elasticity for a specific product brand;
Share	is the market share of the specific product brand;
LowIncome	is 1 for lower-income stores; 0 otherwise;
ShredCheese	is 1 if shredded cheese; 0 otherwise;
SlicedCheese	is 1 if sliced cheese; 0 otherwise;
SnackCheese	is 1 if snack cheese; 0 otherwise;
MiscelCheese	is 1 if miscellaneous cheese; 0 otherwise;
SmallSize	is 1 if small package size; 0 otherwise;
AIDS	is 1 if elasticity i is estimated by nonlinear AIDS model; 0 otherwise; and

λ's are parameters to be estimated.

This study estimates two meta-regressions. One set of regression involves the own-price elasticities for store-brands of cheese; the other involves own-price elasticities for national-brands of cheese. The two-stage modeling process is utilized in the current research. More specifically, in the first stage, the own-price elasticities for store brands and national brands are estimated by AIDS models (original nonlinear AIDS and linear approximation AIDS). In the second stage, the estimated own-price elasticities are regressed on the determinant factors.

This meta-analysis is used to reveal the factors that affect store-level price elasticities of store brands and national brands of cheese. For instance, λ_2 represents the difference in price elasticity of store brands (national brands) cheese associated with a change from the higher-income group to the lower-income group. A test of the null hypothesis that $\lambda_2=0$ provides a test of the hypothesis that there is no difference between the price elasticity of store brands (national brands) of cheese associated with the higher-income group and that associated with the lower-income group.

VI. RESULTS AND DISCUSSION

As has been mentioned, a total of 20 demand systems are estimated for the nonlinear original AIDS and linear approximation AIDS models. The estimated results of parameters are not illustrated due to space limit. Table 2 summarizes the own-price elasticities estimated from both the linear and non-linear AIDS models for store and national brands of cheese. These elasticities are shown for store locations (lower- and higher-income stores), cheese categories, and package sizes. Scanning the 32 pairs of Marshallian (uncompensated) own-price elasticities shown in Table 2, it is clearly seen that shoppers in lower-income stores are more price sensitive than those in higher-income stores. Lower-income stores have larger price sensitivity for all products, except store brands of sliced cheeses, national brands of sliced cheeses (large package size), and national brands of chunk cheeses (small package size). In addition, compared with store brands, consumers are more sensitive to price changes for national brands. National brands are more price-elastic than store brands for most cheese categories among lower- and higher-income stores, except the category of snack cheese, shredded cheeses (large package size), and chunk cheeses (small package size).

Table 3 reports the descriptive statistics of estimated own-price elasticities for store brands and national brands of cheese. The results of the AIDS and LA/AIDS models show own-price elasticities for national brands that range from –0.36 to –3.47, while those for store brands range from –0.53 to –2.94. Again, consumers are more sensitive to price changes for national brands, as shown by an own-price elasticity for national brands of –2.18 versus –1.91 for store brands (pooled measure of means).

These findings shed some insight on the issue of why a national brand manufacturer like Kraft may struggle with price competition from private label products, an issue addressed by a series of reports in the *Wall Street Journal*. Included among these were: "Kraft Profit Misses Expectations, Hurt by Private-Label Brands" (July 17, 2003); "Kraft Loses 2 Top Executives Amid Private-Label Struggle" (July 10, 2003); and "Food for Thought: Why Kraft Is Still Frowning" (April 16, 2003). Although much of the literature (e.g., Bushman, 1993, Richardson, et al., 1994) support the premise that store brands are inferior in quality to national brands, the price responses of consumers shown in Table 3 call this premise into question. This question is especially relevant when considered against the evident that national brands invest considerable budget on marketing activity to build brand loyalty. Strong brand loyalty means that consumers are willing to pay premium prices for national brands and therefore should be relative insensitive to price changes for national brands. Store brands are generally hypothesized to have fairly elastic price responses and therefore the results of Table 3 do not support the theoretical arguments of consumer demand.

The relatively high price elasticities coupled with substantial variation among them for both store and national brands of cheese provide an excellent opportunity for an assessment of the factors most influential in their determination. The meta-regression results for store brands are provided in Table 4. The R^2 and adjusted R^2 are 62.3% and 49.2%, respectively. The goodness of fit measures show reasonably good performance for the model. It should be noted here that the dependent variable, own-price elasticity, is expressed as an absolute value, as the interest lies in determining the impact of independent factors on the magnitude of change for cheese price elasticities. Based on the estimated parameters, market share has a negative impact on own-price elasticity for store brands, but this coefficient is statistically insignificant. This suggests that higher market shares have not reduced the price elasticity for store brands. In addition, lower-income stores as compared to higher-income ones, have larger own-price elasticities, although statistically this difference is not significant. Two parameter estimates that are statistically significant are: shredded cheese and miscellaneous cheese. Relative to the base of chunk cheeses, these two classes of cheese decrease the price elasticity of store brand cheese.

The results of meta-regression for national brands are reported in Table 5. The R^2 and adjusted R^2 are 69.2% and 58.5%, respectively, which indicates that the model explains a great deal of the variation in the price elasticities. Market share has a negative and statistically significant impact on the magnitude of price elasticities for national brands. In other words, large market shares convey market power and serve to diminish consumers' price sensitivity. With respect to store location, lower-income stores have a higher price elasticity for national brands and this difference is statistically significant with chunk cheese as the base category. The results show that snack cheese serve to decrease price elasticity for national brands. By contrast, sliced and miscellaneous cheese serve to increase price elasticity for national brands. Relative to package size, small package sizes have a positive impact on the price elasticity for national brands. Results in both Table 4 and 5 show no statistically significantly difference between the LA/AIDS and AIDS model for store or national brands of cheese.

Results from the meta-regressions for both store and national brands provide informative information for marketing managers in the cheese industry. First, as discussed in the empirical results section, lower-income shoppers are more price-sensitive than higher-income shoppers and these meta-analysis results provide additional information for examining differences in their shopping behavior. For national brands of cheese, lower-income shoppers are shown to be considerably more price sensitive, as measured by a statistically significant coefficient of 0.352. That is, relative to the base of higher-income stores, the lower-income stores significantly increase the magnitude of the own–price elasticity for national brands. Similar results are also revealed for store brands. That is, relative to the base of higher-income stores, lower-income stores are shown to increase the magnitude of own–price elasticity, although the coefficient is not statistically significant. Differences in consumers' price sensitivity for store locations (e.g., lower- and higher-income) suggest that retail managers could utilize micro-marketing strategies with different prices across stores or retail market areas. That is, these findings suggest that there are possible advantages to having store specific or area specific pricing. A retailer might be able to set prices in a more profit-maximizing manner by matching prices to customers' price sensitivity with a given store or location.

A second piece of information for marketing managers is derived from the observation that brands with higher market shares have lower levels of price sensitivity. Meta-regression results show market share coefficients to be negative for both national and store brands, although estimates for store brands are not statistically significant. Yet, the negative signs lend support to the economic principle that market share leads to market power and therefore inelastic price responses. For national brand manufacturers, these findings suggest that consumer price sensitivity might be reduced by adopting an explicit strategy of increasing market share. For manufacturers of store brands, this research suggests that store brands can be competitive products, particularly after they build up store loyalty. In the long run, store brands are likely to experience growth and narrow the price gap between store and national brands and capture a larger percentage of store profits.

A third piece of informative information relates to the fact that price elasticities for both store and national brands of cheese vary by product types. Meta-regression results of national brands indicate that, relative to the base of chunk cheeses, snack cheese has a coefficient of –0.897 and this measure is statistically significant. That is, holding the sales of chunk cheese constant, an increase in the sales of snack cheese will reduce the price-sensitivity of national brands of cheese. Stated differently, consumers are less sensitive to price changes for national brands and the coefficient estimate for snack cheese suggests a willingness to pay premium prices for value-added products, such as snack cheeses. A plausible explanation for this observation is that consumers may associate higher-levels of product quality with some value-added products such as snack cheese, but may associate lower-levels of product quality with other value-added products. These research findings suggest that manufacturers of national brands can implement premium price policies for some product categories, but utilize competitive price policies for other product categories. For store brands, the meta-regression results show that, relative to the base of chunk cheeses, shredded and miscellaneous cheese significantly decrease the magnitude of own-price elasticities. This suggests that store managers may wish to focus much of their advertising, merchandising and promotion efforts on increasing the sales of shredded and miscellaneous cheese.

VII. CONCLUSIONS

Marketing managers are very interested in gaining an understanding of consumers' sensitivity to price changes. The most prevalent measure of consumer price sensitivity is the price elasticity of demand, which represents the percentage change in quantity sold for a given percentage change in price. By utilizing retailer-supplied scanner data, the present research developed and estimated a theoretically plausible model to estimate price elasticities for specific cheese products and revealed factors that determine price elasticities for store and national brands of cheese. More importantly, this study provides a rich knowledge base for retail store managers and manufacturers to use for maximizing sales and profits.

Unlike previous studies that have used general market response models and have been subjected to criticism for lacking a theoretical foundation, the current research utilized a theoretically plausible demand model in the first stage to estimate brand demand elasticities. By utilizing supermarket scanner data, this study demonstrated the application of an AIDS model in the study of a marketing strategy. This paper focused on hard cheeses products and it provided demand elasticities results for store brands and national brands. Results were disaggregated to include different product forms, package sizes and store locations, all estimated with two versions of the AIDS model. This level of disaggregation makes this the first empirical study to investigate store brands and national brands of cheese within a comprehensive framework.

Table 1: Household Demographic Data for Six Stores (By Percentage)

	Lower-Income Stores				Higher-income Stores			
Demographic Information[a]	Store 1	Store 2	Store 3	**Average**	Store 4	Store 5	Store 6	**Average**
Household Income								
Under $10,000	13.8	12.9	9.3	**12.0**	3.8	5.0	3.8	**4.2**
$10,000-$49,999	57.6	58.3	54.1	**56.7**	32.8	41.8	37.7	**37.4**
$50,000-$74,999	18.5	18.2	22.4	**19.7**	27.4	20.9	24.6	**24.3**
$75,000-$99,999	6.5	6.3	8.4	**7.1**	17.5	12.1	15.3	**15.0**
$100,000 +	3.8	4.3	5.9	**4.7**	18.8	20.2	18.2	**19.1**
Race								
White	59.2	83.6	85.7	**76.2**	95.4	92.4	93.1	**93.6**
Black	38.6	14.4	12.1	**21.7**	2.3	3.2	5.0	**3.5**
Others	2.1	2.0	1.8	**2.0**	2.6	4.6	1.9	**3.0**
Education								
Grade School	7.3	10.0	11.1	**9.5**	4.1	2.0	2.5	**2.9**
Some high School	21.3	25.4	25.8	**24.2**	11.6	5.0	8.6	**8.4**
High School Gradate	33.5	36.7	37.6	**35.9**	28.2	16.2	27.0	**23.8**
Some College	24.3	19.2	17.8	**20.4**	26.2	26.6	28.2	**27.0**
College Graduate	13.8	8.8	7.5	**10.0**	29.9	50.6	33.5	**38.0**

Source: Spectra, 2001

[a] Numbers may not add to 100.0 because of rounding.

Table 2: The Estimated Own-Price Elasticities of Store Brands and National Brands.

	Lower-Income Stores		Higher-Income Stores	
	Store Brands	National Brands	Store Brands	National Brands
AIDS Model				
Shredded Cheese				
Small Sizes[a]	-1.655	**-3.453**	-1.520	**-2.704**
Large Sizes	-2.165	-1.865	-1.653	-1.573
Sliced Cheese				
Small Sizes[b]	-1.935	**-3.454**	-1.988	**-2.114**
Large Sizes	-1.778	**-3.049**	-2.943	**-3.149**
Chunk Cheese				
Small Sizes[a]	-2.568	-1.235	-2.306	-2.275
Large Sizes	-2.014	**-2.331**	-1.874	**-2.232**
Snack Cheese	-2.397	-1.530	-2.161	-0.538
Miscellaneous Cheese	-1.350	**-1.979**	-0.526	**-1.649**
LA/AIDS Model				
Shredded Cheese				
Small Sizes	-1.691	**-3.407**	-1.508	**-2.686**
Large Sizes	-2.170	-1.764	-1.601	-1.426
Sliced Cheese				
Small Sizes	-1.851	**-3.470**	-1.901	**-2.070**
Large Sizes	-1.700	**-3.011**	-2.936	**-3.137**
Chunk Cheese				
Small Sizes	-2.452	-1.187	-2.182	**-2.695**
Large Sizes	-2.121	**-2.341**	-1.837	**-2.326**
Snack Cheese	-2.256	-1.262	-1.981	-0.363
Miscellaneous Cheese	-1.477	**-1.956**	-0.553	**-1.704**

[a] package size at 8-oz or below; [b] package size at 12-oz or below

Table 3: The Descriptive Statistics of Estimated Own-Price Elasticities for Store Brands and National Brands.

Brands	Number of Observations	Mean	Std Dev	Minimum of Magnitude	Maximum of Magnitude
AIDS					
Store Brands	16	-1.927	0.552	-0.526	-2.943
National Brands	16	-2.196	0.818	-0.538	-3.454
LA/AIDS					
Store Brands	16	-1.889	0.519	-0.553	-2.936
National Brands	16	-2.175	0.876	-0.363	-3.470
POOLED					
Store Brands	32	-1.908	0.527	-0.526	-2.943
National Brands	32	-2.185	0.834	-0.363	-3.470

Table 4: Meta-Analysis Parameter Estimates for Determinants of Store Brands Price Elasticities.

Variable	Regression Coefficient	Standard Error	Prob>|t|
Intercept	2.447	0.321	0.000
Share	-1.190	1.014	0.253
LowIncome	0.193	0.143	0.190
HighIncome(base)			
ShredCheese	-0.424	0.188	0.034
SlicedCheese	-0.132	0.204	0.523
SnackCheese	0.295	0.303	0.341
MiscelCheese	-1.323	0.252	0.000
ChunkCheese(base)			
SmallSize	0.005	0.179	0.977
LrgeSize(base)			
AIDS	0.038	0.133	0.775
LA/AIDS(base)			
N	32		
Model F statistic	4.75		0.002
R-square	0.623		
Adjusted R-square	0.492		

Table 5: Meta-Analysis Parameter Estimates for Determinants of National Brands Price Elasticities.

Variable	Regression Coefficient	Standard Error	Prob>|t|
Intercept	2.971	0.485	0.000
Share	-10.568	3.767	0.010
LowIncome	0.352	0.191	0.079
HighIncome(base)			
ShredCheese	-0.325	0.345	0.356
SlicedCheese	1.518	0.358	0.000
SnackCheese	-0.897	0.370	0.024
MiscelCheese	1.364	0.641	0.044
ChunkCheese(base)			
SmallSize	1.115	0.390	0.009
LargeSize(base)			
AIDS	0.020	0.190	0.916
LA/AIDS(base)			
N	32		
Model F statistic	6.46		0.000
R-square	0.692		
Adjusted R-square	0.585		

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