Food Marketing Policy Center

Share, Price and Category Expenditure—
Geographic Market Effects and Private Labels

By William P. Putsis Jr.,
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Abstract

Focusing on the interaction between national brands and private labels, this paper has two main empirical contributions: i) a simultaneous system of demand (share), price and expenditure equations is estimated, and ii) differences in the structure of the local geographic market are incorporated into the analysis. The former represents an important step in understanding the *complete* nature of private label and national brand interaction, while the latter is important for understanding the impact of the local retail environment on market behavior. IRI scanner data from 1991 and 1992 are used to estimate the three-equation system across 135 food product categories and 59 geographic markets.

The results suggest that concentration at *both* the manufacturer and retailer level can significantly affect private label and national brand price. However, while increased retailer concentration is associated with higher national brand *and* private label prices, higher manufacturer concentration is associated with higher national brand but *lower* private label prices. Increases in national brand advertising has the effect of raising national brand price and share, but lowering private label price and share. This is consistent with previous research and suggests that advertising and local market conditions play a significant role in the ability of national brands to price at a premium over private labels. Finally, marketing decision variables such as display activity and private label distribution can have an important impact on total category expenditure.

Keywords: Competition, private labels, industrial organization

1. Introduction

In the U.S. retail environment, private label or "store" brands compete vigorously with national brands. For example, private label brand unit market share in supermarkets reached an all-time high of 20.8% in the third quarter of 1997 according to Information Resources Inc. (IRI). Not satisfied, private label manufacturers have launched a frontal assault on successful national brands. For example, private label manufacturer International Trading Co. has developed a line of shelf-stable lunches for retailers based upon Kraft's successful "Lunchable" line. Cliffstar Corp. has launched resealable 16-ounce packages of fruit juice that compete directly with offering from Ocean Spray. Even in traditional national brand strongholds, such as in the aerosol cheese spread category, private label manufacturers are now competing vigorously (*Brandweek*, 11/24/97).

Although the academic literature has just recently begun to address the reasons behind increasing private label penetration, the volume of literature is growing rapidly. Early work, focusing on the characteristics of consumers who purchased private label goods (Myers 1967; Coe 1971; Bettman 1974), has given way to research primarily concerned with explaining the cross-category variation in private label market share. Hoch and Banerji (1993), for example, employ warehouse withdrawal and LNA (Leading National Advertisers) data for 180 product categories for 1987. They find that i) private labels perform better in large categories with high margins, ii) private labels do better when competing against fewer national manufacturers who spend less on national advertising and iii) high quality is more important to private label success than lower price. Sethuraman (1992) uses aggregate U.S. scanner data (IRI) for 116 categories in a similar attempt to identify the key factors influencing private label success across categories, identifying twelve marketplace factors as potential determinants of private label success. These marketplace factors include retail sales volume, average retail price, price differential between the private label and the national brand, and private label price promotion relative to that of the leading national brands. In related research, Sethuraman (1995) finds that the nature of the cross-price demand response between private label and national brands varies significantly by category, with national brand market share being an important determinant of this relationship.

One aspect that has been mentioned briefly by various authors (*e.g.*, Sethuraman 1995, Narasimhan and Wilcox 1998), yet not addressed in any depth, pertains to the importance of the structural characteristics of individual markets and the effects of *retailer* concentration. While work in the industrial organization literature has suggested an important link between market concentration and price (*e.g.*, Weiss 1989), this research has almost exclusively been conducted at the manufacturer level (see Marion 1979 and Cotterill 1986 for two notable exceptions). In addition, regional differences, differences in market size, and retail store structure can have a profound impact on demand response (Hoch, *et al.* 1995). We suggest here that the impact of local market structure extends well beyond demand response and is also likely to influence competitive pricing behavior. Further, we expand on the limited research that has addressed demand and price interaction for private labels (see Cotterill, Putsis and Dhar 2000) by specifying a simultaneous system of share, price and expenditure, taking into account structural differences across local markets (*e.g.*, differences in local retailer concentration). Thus, there are two main empirical contributions of this research: i) previous cross-category research on private labels is expanded to include a simultaneous system of demand, price and expenditure equations, and ii) differences in the structural characteristics of the local market are incorporated into the analysis. The former represents an important step in understanding the *complete* nature of private label and national brand interaction, while the latter is important for understanding the impact of the local retail environment on market behavior.

Conceptually, the nature of manufacturer-retailer competition in any given market will change both the within channel power and the incentives for stocking and promoting store brands. For example, in markets where a large chain retailer dominates (versus a more fragmented competitive retail environment), we would expect that private labels will have a higher share. We specify an empirical model below that allows us to address these issues empirically. Before we turn to the model, however, we provide an overview of the data used in the study.

2. The Data.

The data used in this study are annual IRI scanner data on food products across 59 geographic markets and 135 categories from 1991 and 1992. Geographic markets include the 59 major markets in the U.S. (Albany to Wichita), while categories are defined at the sub-category level (examples include grated cheese, frankfurters, cake mixes, distilled water, flour, etc.). Consistent with previous work in the private label area (*e.g.*, Slade 1995, Putsis and Dhar 1998, Cotterill, Putsis and Dhar 2000), composite national brand and private label variables were created for the 135 product

categories and 59 markets.[1]

For each market and category, standard IRI measures are available (an exact variable listing will be presented in the empirical section). For example, we have detailed measures of feature and display activity, price promotions, as well as unit and volume sales for each of the 59 geographic markets and 135 food categories. We have also developed measures for the structural characteristics of the market - the manufacturer four-firm concentration ratio, and the number of brands present in the market. These data have been combined with independent data from *Progressive Grocer* on each market's population, income distribution, and local retail composition such as the four-firm local retailer concentration ratio and the supermarket to convenience store sales ratio. Finally, we have collected LNA (Leading National Advertisers) data for all the categories used in the study, providing us with detailed information on national brand advertising spending by category.[2] These combined sources provide us with a comprehensive set of variables for each category and each geographic market.

3. Theoretical Foundations, Empirical Model and Estimation.

In this section, we build on previous research to develop an empirical model that simultaneously addresses share, price and total category expenditure across multiple categories, incorporating differences in the structure of the local geographic market. To begin, we note that the ability of any firm to raise price above marginal cost depends in part upon own and cross-price demand elasticities and the competitive response of rival firms. In addition, changes in price and other marketing instruments (*e.g.*, promotion) may affect the level of expenditure for *all* brands in the category (Ailawadi and Neslin 1998, Putsis and Dhar 1998). This suggests that demand, competitive price reactions and total category expenditure are all likely to be jointly endogenous in any econometric specification.

We begin by concentrating on the demand-side specification. We employ a Linear Approximate Almost Ideal Demand (LA/AIDS) model (Deaton and Muellbauer 1980), which can be stated as follows:[3]

$$
\begin{aligned}
MS^{k}_{ij} &= \alpha_{10} + \alpha_{11}\, lnP_{ij}^{\,k} + \alpha_{12}\, lnP_{ij}^{\,l} + \alpha_{13}\, ln\,(EXPEND_{ij}/P) \\
&\quad + \alpha_{14}\,\delta_{ij}, \qquad (1)\\
MS^{l}_{ij} &= \alpha_{20} + \alpha_{21}\, lnP_{ij}^{\,k} + \alpha_{22}\, lnP_{ij}^{\,l} + \alpha_{23}\, ln\,(EXPEND_{ij}/P) \\
&\quad + \alpha_{24}\,\delta_{ij},
\end{aligned}
$$

where:

ln P = Stone's linear approximation price index,

$$(MS^{k}_{ij}\, ln\, P_{ij}^{\,k}) + (MS^{l}_{ij}\, ln\, P_{ij}^{\,l}).$$

In equation (1), $P_{ij}^{\,k}$ ($P_{ij}^{\,l}$) denotes the price charged by the national brand (private label) in the ith category (i=1,…, 135) and the jth geographic market (j =1, … , 59). Similarly, MS^{k}_{ij} (MS^{l}_{ij}) denotes the dollar market share of the national brand (private label) in category i and market j. In addition, the set of market-level demand shift variables is denoted by δ_{ij}. Note that in the LA/AIDS framework, total category expenditure, denoted by $EXPEND_{ij}$, is deflated by Stone's price index *P*. Thus ($EXPEND_{ij}/P$) denotes a deflated (real) measure of per capita expenditures with its coefficients (α_{13} and α_{23}, respectively) providing an estimate of the impact of changes in total category expenditure on demand. Contrasting with standard market share definitions used in the IO literature (see, *e.g.*, Weiss 1989), the LA/AIDS functional form is derived from the consumer's cost function and, consequently, MS^{k}_{ij} and MS^{l}_{ij} are expressed as share of total dollar expenditure. From the basic formulation in (1), the usual demand restrictions of symmetry, homogeneity, and adding up can be imposed. Further, all (quantity) demand elasticities can be recovered from the demand specification

1. For example, aggregate private label and national brand variables were created for share, regular price and temporary price reduction. Private label (national brand) share is sum of all private label (national brand) dollar shares in the ith market, jth category. Private label (national brand) price is the volume-weighted average price of all private labels (national brands) in the ith market, jth category. The two price reduction variables are volume-weighted average percent price reduction for all private label and branded products, respectively. Note that we include variables representing *both* regular price and percent price reduction during temporary price promotions since there is a great deal of evidence to suggest that the demand response to temporary price reductions is different than the response to permanent price reductions of equal magnitude (Blattberg and Neslin 1990). Finally, note that the choice of variables was influenced by data availability. For example, no coupon information was available, while average age, income and percent Hispanic were the only demographic variables available.

2. We note that essentially *all* private label advertising over this time period was through the use of feature advertising. Thus, the advertising data used in this study, which includes leading national brand advertising (through the LNA data) and feature advertising (capturing private label advertising), provides for comprehensive coverage of advertising for both private labels and national brands.

3. The LA/AIDS framework is well established and, consequently, we will not present it in great detail here. For a discussions of the model as applied to scanner data, see Cotterill, Putsis and Dhar (1999), and Green and Alston (1990) and Chalfont (1987) for discussions of elasticity estimation.

(see Green and Alston, 1990 for additional detail).

In the present setting, the use of the LA/AIDS framework is particularly attractive for a number of reasons. First, the limited work addressing the interaction between private labels and national brands to date has universally employed a linear functional form (*e.g.*, Raju, Sethuraman and Dhar 1995, Kadiyali, Chintagunta, and Vilcassim 1998, Putsis and Dhar 1998). However, the linear form is quite restrictive. For example, while Lee and Staelin (1997) demonstrate that the type of vertical strategic interaction present depends, in part, upon the convexity of the demand curve, Genesove and Mullin (1998) note that New Empirical IO studies "typically impose strong functional form [linearity] assumptions on demand, which … imply even stronger restrictions on the relationship between price and marginal cost." Second, previous research has demonstrated that LA/AIDS demands, combined with the associated (log-log) price reactions, fit well in cross-sectional applications (Cotterill, Putsis and Dhar 2000). Third, since the LA/AIDS model is PIGLOG (*P*rice *I*ndependent *G*eneralized *LOG*arithmic) in form, it does not suffer from linear aggregation bias when applied to first-differenced market-level scanner data of the type used here (Cotterill, Putsis and Dhar 2000). Finally, the assumptions necessary to derive price reaction equations consistent with the LA/AIDS functional form are supported by previous research (Kadiyali, Vilcassim and Chintagunta 1998, Cotterill and Putsis 1998).[4]

We combine this demand-side model with the associated price reaction functions. The price reaction equations consistent with LA/AIDS demands are log-log in form (see Cotterill, Putsis and Dhar 2000 and Cotterill and Putsis 1999 for additional detail on the specification of the price reaction equations). Following Cotterill, Putsis and Dhar (2000), we note that a firm's ability to raise price vis-à-vis its rivals will depend upon both the demand and competitive environment. Thus, in addition to price and own cost, we specify each price reaction equation to be a function of i) the competitive environment, captured here by structural measures such concentration and denoted by ϕ_{ij}, ii) factors (denoted by η_{ij}) such as national brand advertising and the availability of private label products that impact the ability to raise price over marginal cost via brand development (*i.e.*, via building brand loyalty), and iii) demand shift variables δ_{ij}. Defining C^{k}_{ij} and C^{l}_{ij} to represent supply-side cost shift variables for national brands and private labels, respectively, this implies the following specification:

$$ln\ P_{ij}^{k} = \beta_{10} + \beta_{11}\ ln\ P_{ij}^{k} + \beta_{12}\ ln\ C_{ij}^{k} + \beta_{12}\ ln\phi_{ij} + \beta_{14}\ ln\ \eta_{ij} + \beta_{15}\ \delta_{ij} \quad (2)$$

$$ln\ P_{ij}^{l} = \beta_{20} + \beta_{21}\ ln\ P_{ij}^{l} + \beta_{22}\ ln\ C^{l}_{ij} + \beta_{22}\ ln\ \phi_{ij} + \beta_{24}\ ln\ \eta_{ij} + \beta_{25}\ \delta_{ij}.$$

Next, we note that the demand specification in equation (1) assumes that the demand for the food items considered here are weakly separable from all other goods. However, relative price changes across separable groups may lead to a reallocation of expenditures among the groups. Thus, a price change for a national brand in the ready to eat (RTE) cereal category, for example, may not only elicit an own-price demand response and a competitive price reaction, but may also change the expenditure level for the entire RTE category. Further, the net effect of any marketing instrument (price, promotion, etc.) on expenditure may be very different for private labels versus national brands. Neither previous research addressing the interaction between private labels and national brands (*e.g.*, Putsis and Dhar 1998, Kadiyali, Vilcassim and Chintagunta 1998) nor research incorporating price reactions in a LA/AIDS framework (Cotterill, Putsis and Dhar 2000) has addressed the potential expenditure effects associated with changes in price and promotion. We do so here by estimating demand (share), price and expenditure simultaneously in the empirical analysis below. Choosing a log form to be consistent with the price reaction specification, we specify the expenditure equation as follows:[5]

$$(3)\quad ln\ EXPEND_{ij} = \gamma_0 + \gamma_1\ ln\ P_{ij}^{k} + \gamma_2\ ln\ P_{ij}^{l} + \gamma_3\ ln\ \eta_{ij} + \gamma_4\ ln\ \delta_{ij}\ .$$

4. Specifying LA/AIDS demands and deriving a log-log price reaction equation that can be estimated using retail price data uses the assumption that manufacturers act as Stackelberg leaders within the channel and that retailers follow a proportional markup rule when deciding upon retail prices. Cotterill and Putsis (1998), in a detailed analysis of vertical conduct for national brands and private labels across multiple categories, test these assumptions and find strong empirical support. Further, our treatment of vertical conduct in this regard is consistent with other studies addressing retail price conduct for private label products (Slade 1995, Kadiyali, Vilcassim and Chintagunta 1997, Cotterill, Putsis and Dhar 1999).

5. In the empirical analysis that follows, we will use deflated (real) expenditures (*i.e.*, actual expenditures deflated by Stone's price index) as the dependent measure in specifying equation 3 for estimation. This presents some econometric concerns, which are discussed in the Discussion, Conclusions and Future Research section.

The set of equations represented by (1), (2) and (3) constitute the five equation simultaneous system to be estimated. In this system, share, price and total category expenditure ($EXPEND_{ij}$) will be specified as jointly endogenous. Although the model has five equations, one of the demand equations is redundant for estimation purposes. Since the market shares of national brands and private labels sum to one, any loss of branded share due to changes in any variable, *e.g.* private label price, must go to private label share. This general adding up property of a demand system means that we can recover the estimated coefficients and standard errors (t-ratios) for the dropped equation. We drop the private label demand equation and estimate the remaining four equations using iterated three stage least squares (3SLS).

Finally, we note that we include variables capturing advertising by national brands (Leading National Advertising data) and a series of trade promotion variables as demand shift variables. The promotion variables are: short term percent price reduction, percent of volume sold on display, and percent of volume sold with a local newspaper feature ad. While one could model these as additional strategic variables to create a multi-dimensional game, this would generate six more reaction equations and prevent estimation of the system due to insufficient exogenous cost shift variables in those equations to identify them. Consequently, we specify these as endogenous strategic factors that firms use to determine price levels and/or shift demand.[6]

4. Empirical Analysis.

In estimating cross-category price equations, it is important to note that cross-category analysis precludes the use of price levels since price in each category is measured in a variety of different and non-comparable units. Following Kelton and Weiss (1989), we estimated the first difference form of our model. In the following sections, all reported estimates use the annual difference rather than the level of the variable for 1991 to 1992. For example ΔBRSHARE (national brand share) is 1992 BRSHARE minus 1991 BRSHARE and ΔBRPRICE (national brand price) is the 1992 ln BRPRICE minus 1991 ln BRPRICE (the Δ symbol will be used throughout to denote the change from 1991 to 1992). Changes in the natural logarithm of price from 1991 to 1992 are percent changes, which can be analyzed across categories. Estimating a first difference model is also attractive because it controls for first order fixed effects due to excluded local market and category variables in level regressions.[7] Further, to the extent that private label quality is constant from 1991 to 1992, estimating a first difference model eliminates the need for the inclusion of a category private label quality measure - an assumed constant level of quality drops out of the analysis when we difference. This is particularly important since quality measurement is such a difficult task (Hoch and Banerji 1993 and Narasimhan and Wilcox 1998).

We restricted our analysis to include only those markets and categories for which private label products have been introduced in the market by 1991. This left a final sample of a balanced panel of 7823 observations varying both at the category and at the local market level. Based upon the discussion above, the following system of equations were estimated via iterated three stage least squares in Limdep v. 6.0:

$$\Delta BRSHARE = \alpha_0 + \alpha_1\,\Delta BRPRICE + \alpha_2\,\Delta PLPRICE + \alpha_3\,\Delta EXPEND + \alpha_4\,\Delta BRFEATURE + \alpha_5\,\Delta BRDISPLAY + \alpha_6\,\Delta BRPRICEREDN + \alpha_7\,\Delta ADVERT + \alpha_8\,\Delta PLDISTN + \alpha_9\,\Delta AGE + \alpha_{110}\,\Delta HISPANIC + \omega_1$$

$$\Delta BRPRICE = \beta_{10} + \beta_{11}\,\Delta PLPRICE + \beta_{12}\,\Delta BRVPERU + \beta_{13}\,\Delta BRSHARE + \beta_{14}\Delta MCR4 + \beta_{15}\,\Delta NBRANDS + \beta_{16}\,\Delta SRATIO + \beta_{17}\,\Delta GROCCR4 + \beta_{18}\,\Delta PLDISTN + \beta_{19}\,\Delta ADVERT + \beta_{210}\,\Delta PLPRICEREDN + \omega_2 \quad (4)$$

$$\Delta PLPRICE = \beta_{20} + \beta_{21}\,\Delta BRPRICE + \beta_{22}\,\Delta PLVPERU + \beta_{23}\Delta BRSHARE + \beta_{24}\Delta MCR4 + \beta_{25}\,\Delta NBRANDS + \beta_{26}\,\Delta SRATIO + \beta_{27}\,\Delta GROCCR4 + \beta_{28}\Delta PLDISTN + \beta_{29}\,\Delta ADVERT + \beta_{210}\Delta BRPRICEREDN + \omega_3$$

$$\Delta EXPEND = \gamma_0 + \gamma_1\,\Delta BRPRICE + \gamma_2\,\Delta PLPRICE + \gamma_3\,\Delta PLDISTN + \gamma_4\,\Delta ADVERT + \gamma_5\,\Delta BRPRICEREDN + \gamma_6\,\Delta PLPRICEREDN + \gamma_7\,\Delta BRFEATURE + \gamma_8\,\Delta BRDISPLAY + \gamma_9\,\Delta PLFEATURE + \gamma_{110}\,\Delta PLDISPLAY + \gamma_{111}\,\Delta POP + \gamma_{112}\,\Delta INCOME + \omega_4.$$

6. We address the endogeneity of the trade promotion variables through the use of instrumental variables. The principle is similar to the approach taken by Berry, Levinsohn and Pakes (1995). Specifically, each promotional vehicle for market i, category j, is expressed as a function of the promotional activity in each of the other j ($j \neq i$) markets, using the fitted value as the instrument. Note that in order for this approach to eliminate the endogeneity bias, the equation errors for each promotion instrument have to be independent. This implies that display and feature decisions, for example, are made on a market by market (or chain by chain) basis.

7. Hausman and Taylor (1981) argue that excluded local market variables in panel data of this type can bias estimation results for level regressions. They show that this can be avoided by specifying a set of city binary variables. These drop out of the model when one takes the first difference. This is also true for specifying a set of category binary variables in level regressions to control for excluded variables in individual categories.

Variable definitions, based upon standard IRI measures, are provided in detail below:[8]

Variable Definitions:

BRSHARE Dollar share of total category expenditure for national brands in the ith market, jth category.

PLSHARE Dollar share of total category expenditure for private labels in the ith market, jth category.

BRPRICE Natural log of the volume-weighted average (non-deal or "regular") price of national brands in the ith market, jth category.

PLPRICE Natural log of the volume-weighted average (non-dealor "regular) price of private label products in the ith market, jth category

EXPEND Natural log of $(EXPEND_{ij}/P)$, where $ln\ P = (MS^k_{ij}\ ln\ P_{ij}^{\ k}) + (MS^l_{ij}\ ln\ P_{ij}^{\ l})$

Demand Shift Variables (δ_{ij})

BRFEATURE Percent of branded products sold with feature advertising in the ith market, jth category. Feature advertising is defined to be any newspaper advertising feature or store flyer regardless of whether or not the item was accompanied with a shelf price reduction, store coupon or display.

BRDISPLAY Percent of branded products sold with in store display and/or point-of-sale promotion in the ith market, jth category. Display is defined as any off-shelf display, including within and end-of-aisle displays.

BRPRICEREDN Volume-weighted percent average price reduction, national brands, ith market, jth category. This is defined as promotional "temporary" price reductions of at least 5%.

PLFEATURE Percent of private label products sold with feature advertising in the ith market, jth category. Feature advertising is defined to be any newspaper advertising feature or store flyer regardless of whether or not the item was accompanied with a shelf price reduction, store coupon or display.

PLDISPLAY Percent of private label products sold with in store display and/or point-of-sale promotion in the ith market, jth category. Display is defined as any off-shelf display, including within and end-of-aisle displays.

PLPRICEREDN Volume-weighted percent average price reduction, private label products, ith market, jth category. This is defined as promotional "temporary" price reductions of at least 5%.

POP Natural log of the total population in the ith local market.

INCOME Natural log of the average household income in the local market

AGE Natural log of the average age in the local market

HISPANIC Percent of population in the local market of Hispanic decent.

Structural Competitive Measures (ϕ_{ij})

MCR4 Four-firm manufacturer concentration (as a percent of total national brand share) ratio in the ith market, jth category

NBRANDS Natural log of the total number of brands sold in the ith market, jth category

SRATIO Percentage of grocery sales in the ith market, jth category made by supermarkets.

GROCCR4 Percentage of all grocery sales by the top four grocery chains in the ith market, jth category

"Brand Development" Influences (η_{ij})

ADVERT Natural log of the leading national advertising (LNA) for manufacturers in the jth category. This represents total advertising expenditures for all national brands.

PLDISTN Private label average distribution (percent of the market's All Commodity Volume (ACV) represented by stores offering a private label in this category).

Cost Shift Variables (C^k_{ij} and C^l_{ij})

BRVPERU Natural log of average volume (weighted) per package sold for national brands.

PLVPERU Natural log of average volume (weighted) per package sold for private label products.

Before proceeding, three additional points regarding specification and estimation are in order. First, Connor and Peterson (1992) suggest that the degree of product differentiation (and, accordingly, preference segmentation) is achieved in part through advertising. Accordingly, we incorporate national brand advertising in the demand equation to capture national brand differentiation generated by advertising spend. In addition, advertising can impact price-cost margins directly. Reasons include competitive effects such as the creation of entry barriers (hence ϕ in equation 2), and the building of brand loyalty through product differentiation (hence η in equation 2). Thus, we include advertising expenditure in the price equations as well.

Second, we specify the retail grocery four firm concentration ratio in the price reaction curves (ϕ in equation 2) to capture the increased oligopolistic interdependence in cities where a few supermarket chains account for a high percentage of total sales. Prior empirical work on the concentration-price relationship in grocery

8. In order to be consistent with previous research employing scanner data, standard IRI measures were used wherever appropriate. IRI relies on consumer panel surveys, in-store visits and individual store-level scanner data to compile the measures used here. For additional detail, see the *IRI Marketing Factbook*, which is published annually. All volume measures/weights used are ACV (All Commodity Volume) measures as defined by IRI.

retailing suggests that the general level of the markup in a local area is related to local retailer concentration (Marion 1979). Since markets characterized by higher retailer concentration are expected to provide retailers with a greater ability to price above marginal cost (*i.e*., they are likely to have higher retail margins), both branded and private label prices are hypothesized to be higher in these markets. We also specify manufacturer concentration (MCR4) expressed as a percentage of total branded share in the price reaction equations to differentiate between manufacturer versus retailer structural effects. In addition, we proxy for manufacturer costs in the two price equations by including a measure of package size to capture the hypothesis that smaller package sizes have higher costs per unit. Such a cost proxy has been used effectively in other studies (*e.g*., Cotterill, Putsis and Dhar 2000).

Finally, the theory supporting the demand-shift variables included has been examined carefully. For example, market population and income are likely to influence the total expenditure for the category, but not necessarily the distribution of private labels and national brand share within the category (note that in the LA/AIDS formulation, EXPEND captures the impact of increases in category expenditure). Alternatively, the age distribution and ethnic makeup of the local market is likely to influence the relative shares of private labels versus national brands, but not necessarily the total expenditure on the category (Hoch, *et al.* 1995). Further, since there is a great deal of evidence to suggest that promotions by weaker brands (*e.g*., private labels) are ineffective in stealing share from stronger (*e.g*., national) brands, the three private label promotion variables are not included in the national brand share equation. Lastly, since essentially all of the dynamic interaction between private labels and national brands depends upon the percentage of stores carrying private labels (PLDISTN) in the first place, the variable PLDISTN is also included as a demand-shift variable in the demand specification.

5. Results.

The results are reported in tables 1A through 1D (as before, the Δ prefix on the variables in Table 1 denote the 1992 value of the variable minus its 1991 value). Since traditional R^2 measures are not bounded between zero and one in three stage least squares, Carter and Nagar's (1977) multiple squared coefficient of correlation for simultaneous systems, R_w^2, was used.[9] The system R_w^2 was 0.855, which implies that 85.5% of the system-wide variation in the dependent variables is explained by the exogenous variables in the system. For a cross-category analysis in first difference form, this suggests that, as a whole, the model fit quite well.

In discussing the substantive implications to be drawn from the empirical analysis, we divide the results into four categories: i) *Demand Reaction Variables* (Equation 1), ii) *IO and Supply-Side Competitive Effects* (Equation 2), and iii) *Expenditure Effects* (Equation 3). We discuss each in turn.

5.1 Demand Reaction Variables

A lowering of national brand price or an increase in the temporary price reductions offered by national brands increases national brand share and lowers private label share. Similarly, national brand share falls as private label price decreases, as expected. Promotion variables in the share equation were all of the expected sign and statistically significant at α=.01or better. Advertising by national brands (as measured by the LNA data) increases national brand share, as does local feature advertising for national brands. Conversely, national brand advertising lowers private label share, consistent with previous findings of Hoch and Banerji (1993) that private labels have a harder time competing when national brand advertising is higher. The direction and significance levels of the expenditure effects indicate that national brands are viewed as luxuries and private labels as necessities – as expenditures on a category increase, more goes to national brands than to private labels. As predicted, higher private label distribution was associated with a lower national brand share (and a higher private label share) and a lower private label price. This is consistent with both a demand-side (price must be lowered to sell more) and a supply-side explanation (scale economies in production and distribution). Finally, neither age nor levels of percent Hispanic in the local market had a discernable effect on brand share.

5.2 IO and Supply-Side Competitive Effects

The results for the share and concentration variables were perhaps the most interesting. A higher manufacturer concentration increases national brand prices, but *lowers* private label prices. One explanation for this is that while more concentrated markets facilitate manufacturer coordination (Weiss 1989) for national brands, a lower price may be the only way private labels can compete in highly concentrated markets. This is consistent with the finding that private label prices are lower in categories where there are a

9. R_w^2 has a usual R^2 interpretation. Specifically, it measures the percent of system-wide variation in the endogenous variables explained by all independent variables in the system. It is bounded by zero and one. However, collinearity may inflate the estimates of R_w^2 and, accordingly, this statistic should be interpreted with caution (see Berndt 1991, p.468).

large number of national brands. On the other hand, in the price reaction equations, we find that the four-firm *retailer* concentration has a significant and positive impact on *both* branded and private labels prices – higher local *retailer* concentration clearly affords retailers the ability to raise market price for private labels, perhaps through building brand loyalty for individual store brands. This is consistent with prior work on the relationship between concentration and price in grocery retailing (Marion 1979, Cotterill 1986), but these results cover a much larger number of categories and markets. It appears as though retailers are able to obtain – and use – local monopoly power when it is available. Thus, not only does higher manufacturer concentration enable manufacturers and retailers to raise price for national brands (Weiss 1989), but under the "right" retail environment, local retailers may be able to raise prices for *all* products in the category. Finally, a higher private label (national brand) share results in a higher private label (national brand) price. This once again suggests that retailers have the potential to build brand loyalty for individual store brands – the building of brand loyalty appears not to be unique to national brands.

When viewed in light of these results, the estimated price reactions and results for the advertising variables in the price reaction equations paint an interesting picture of the competitive interaction between private labels and national brands. Both price reactions are positive, but private labels react more strongly to national brand price changes (estimated reaction coefficient of .133) than do national brands react to private labels (estimated reaction coefficient of .039). National brand advertising increases the ability of national brands to raise price, while a higher level of national brand advertising results in lower private label prices. These results are consistent with the findings of Hoch and Banerji (1993), who found that private labels have a difficult time competing in environment characterized by high national brand advertising. Here, it appears that when national brand advertising is high, retailers lower the price of private label products in order to compete. Given the demand side results, it is not clear how effective such a strategy is likely to be. This implies that national brand advertising can be an effective way of differentiating national brands, enabling them to attain a higher price premium over private labels.

A higher degree of brand proliferation, as measured by the number of products available (NBRANDS), had the effect of increasing the price of national brands, but it had the effect of decreasing the price of private labels. For national brands, there are at least two available explanations for the observed positive relationship between NBRANDS and BRPRICE. First, the entry deterrence argument set forth by Schmalensee (1978) suggests that a higher number of national brands makes it more difficult for private labels to compete effectively. Conversely, Putsis (1997) argues that a larger number of brands can also suggest the loss of scale economies in production, thereby increasing costs. For private label products, in markets characterized by higher national brand advertising, higher manufacturer concentration, a higher degree of proliferation, and lower retailer concentration, private labels appear to compete primarily on price.

5.3 Expenditure Effects

Since the literature on asymmetric competition (*e.g.*, Blattberg and Wisniewski 1989 and Allenby and Rossi 1991) suggests that private labels have a difficult time stealing share from national brands, it has often been asserted that private label promotion is futile. The results for the expenditure equation, however, suggest that most forms of promotion can indeed expand the category (the exception is private label feature advertising). Thus, since category expansion can result from promotion by *both* weaker and stronger firms, private label promotion does not need to steal share from national brands in order to be profitable. Recent research, conducted on a limited number of categories and using micro-level data, has reported similar findings (Ailawadi and Neslin 1998, Chandon and Wansink 1999). However, our analysis is conducted across 135 categories and 59 geographic geographic markets, suggesting that the ability of promotions to expand the size of the category may be widespread and not just limited to certain categories. Finally, it is important to note that increased private label distribution and advertising were both estimated to exert a positive and significant impact on category expenditure. Thus, private label distribution, in-store display and national brand advertising all seem to play important roles in determining category size.

6. Discussion, Conclusions and Future Research.

Any theory that attempts to explain the growth of private labels in the U.S. in recent years must be multi-faceted. The growing body of work addressing cross-section variations in private label growth (*e.g.*, Hoch and Banerji 1993, Raju, Sethuraman and Dhar 1995, Narasimhan and Wilcox 1998) has enriched our understanding of why private labels flourish in some categories and wither in others. Indeed, much of our analysis has been based upon what has been learned from this research. We have attempted to address at least three additional factors not previously studied. First, we have attempted to assess the impact of local market factors on private label share and pricing. Second, we have attempted to understand the role that market structure variables affect the interaction between private labels and national brands at

both the level of the manufacturer and the retailer. Third, we have attempted to explore the role that private labels and promotion plays in expanding total category sales.

There are a number of interesting findings. For example, previous work on the effects of manufacturer concentration has been expanded to include the impact of local retailer concentration. We find that industry concentration at *both* the manufacturer and retailer level can significantly affect private label and national brand price. However, while increased retailer concentration is associated with higher national brand *and* private label prices, higher manufacturer concentration is associated with higher national brand, but *lower* private label price. Further, we estimate that increases in national brand advertising has the effect of raising national brand price and share, but results in lower private label price and share. This is consistent with previous research (*e.g*., Hoch and Banerji 1993) which suggests that advertising and local market conditions play a significant role in the ability of national brands to price at a premium over private labels. In markets where private labels have a difficult time competing, perhaps due to high national brand manufacturer concentration, low local retailer concentration and/or high national brand advertising spend, they lower price in order to compete. Further, certain forms of promotion and other marketing mix decision variables play a role in determining overall category expenditure, something relevant to mangers operating in a category management environment. For example, private label distribution plays a significant role in expanding category sales.

This paper began by noting that private label share hit an all-time high of 20.8% in the third quarter of 1997 and suggested that private label shares had grown in a number of product categories over time. In light of the empirical results, it is interesting to speculate as to the cause of this growth. For example, the categories that showed the smallest gain (indeed a loss of share in certain categories) in private label share over the 1988-1992 period are the categories with the largest growth in national brand advertising expenditure over the same period. National brand advertising has a two-fold impact on private label growth (at least according to our empirical results). First, increased national brand advertising increases national brand share directly (Table 1A), but it also increases total category expenditure (Table 1D), which in turn increases national brand share relative to private labels. Thus, it appears as though national brand advertising may be able to create significant barriers to private label share growth over time. On the other hand, the single largest determinant of private label share appears to be private label penetration. Over the 1988-1992 period, average private label distribution grew by approximately 1.5%, with categories exhibiting the greatest penetration growth seeing the greatest share growth over this five-year period. According to the empirical results presented earlier (Table 1A), such an increase in private label distribution should have had a significant and positive impact on private label share. Thus, a casual observation of the changes that have taken place across time suggests that national brands may be able to increase share through extensive advertising whereas private labels grow share by increasing distribution. Future research should address these dynamics over time more carefully, with particular care given to the impact of changes in private label quality over time.

Previous research has taught us a great deal about the nature of private label competition, yet there is much more to be done. There are essentially three relevant levels of variation in private label penetration that need to be understood. First, research on cross-category variation is well under way. Second, the present research is meant to be a first step in understanding the effects of local market structural influences. Third, as just discussed, research investigating the influences on private label growth *over time* remains. This is one of the most important issues facing researchers interested in understanding the growth of private labels in the United States in recent years.

Our research, while advancing related work, is not without its limitations. For example, we note that the use of deflated (real) expenditure as the dependent measure in the expenditure equation (see system 4) is composite in form (*i.e*., it contains elements found on the right-hand side of the equation). To see this, note that deflated expenditure contains private label and national brand price in the denominator (since they are definitional components of P), while private label and national brand price are also right-hand side endogenous variables in the expenditure equation. While this is not uncommon in a variety of settings in the marketing literature (*e.g*., market share and ROI analysis), and while expenditure functions have been analyzed frequently in economics (see Deaton and Muellbauer 1980), it does present some difficult econometric issues. Although these concerns are alleviated somewhat by the exact functional form specification employed here, in order to assess the impact of the use of a composite dependent variable, we performed some simple diagnostics (see Farris, Parry and Ailawadi 1992 for a detailed discussion). These diagnostics suggested that the impact of the use of a composite form dependent variable on the empirical results may not be particularly problematic in our analysis. Nonetheless, it would be useful for future research to build the expenditure equation from underlying utility theory, hopefully deriving a functional form that does not suffer from such a limitation. Finally, we should note that given our empirical focus, we did not consider several strategic reasons

that may also determine interaction in the marketplace between national brand manufacturers and retailers. For instance, retailers may choose to introduce a private label product in a category to use as a competitive weapon with the other national brand manufacturers in that category (Narasimhan and Wilcox 1998). In a similar vein, the criteria for promoting brands may have little to do with increasing the category revenue but instead to use the entire category as a traffic builder (i.e., a loss leader) to increase total retail volume. We encourage future research in these, and other related directions.

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Table 1. Three-Stage Least Square Results, 1992-1991

A. Dependent variable is ΔBRSHARE Mean = -0.201 S.D. = 5.237
Model size: Observations = 7783 Residual Sum of Squares = 232870

Variable	Coefficient	Standard Error	P[Z≥z]
ΔBRPRICE	-0.2755	0.0245	0.0000
ΔPLPRICE	0.4183	0.0336	0.0000
ΔEXPENDI	0.3724	0.0191	0.0000
ΔBRFEATURE	0.3826	0.0374	0.0000
ΔBRDISPLAY	0.3079	0.0243	0.0000
ΔBRPRCERED	0.0699	0.0188	0.0002
ΔADVERT	0.2778	0.0592	0.0000
ΔPLDISTN	-0.2623	0.0126	0.0000
ΔAGE	0.0448	0.0627	0.4748
ΔHISPANIC	-0.0190	0.0833	0.8197

B. Dependent variable is ΔBRPRICE Mean = -0.021 S.D. = 0.198
Model size: Observations = 7783 Residual Sum of Squares = 48.64

Variable	Coefficient	Standard Error	P[Z≥z]
ΔPLPRICE	0.0389	0.0129	0.0025
ΔBRSHARE	0.7811E-02	0.1903E-02	0.0000
ΔPLPRICEREDN	-0.2070E-03	0.1263E-03	0.1013
ΔPLDISTN	0.2263E-03	0.1121E-03	0.0436
ΔADVERT	0.0186	0.0025	0.0000
ΔMCR4	0.2297E-02	0.1103E-02	0.0372
ΔNBRANDS	0.2516E-02	0.2965E-03	0.0000
ΔSRATIO	0.1880E-03	0.3024E-03	0.5342
ΔGROCCR4	0.2700E-02	0.1612E-03	0.0000
ΔBRVPERU	-0.9131	0.0161	0.0000

(continues)

Table 1. (continued).

C. Dependent variable is ΔPLPRICE Mean = -0.015 S.D. = 0.252
Model size: Observations = 7783 Residual Sum of Squares = 93.38

Variable	Coefficient	Standard Error	P[Z≥z]
ΔBRPRICE	0.1331	0.0214	0.0000
ΔBRSHARE	- 0.1095E-02	0.2393E-03	0.0000
ΔBRPRICEREDN	-0.2884E-03	0.2175E-03	0.1848
ΔPLDISTN	-0.3107E-03	0.1508E-03	0.0394
ΔADVERT	-0.5840E-02	0.3353E-03	0.0000
ΔMCR4	-0.3584E-02	0.1383E-02	0.0096
ΔNBRANDS	-0.1123E-02	0.3742E-03	0.0027
ΔSRATIO	-0.6142E-03	0.4209E-03	0.1445
ΔGROCCR4	0.3493E-03	0.2273E-04	0.0000
ΔPLVPERU	-0.8316	0.0153	0.0000

D. Dependent variable is ΔEXPEND Mean = 0.004 S.D. = 0.181
Model size: Observations = 7783 Residual Sum of Squares = 185.21

Variable	Coefficient	Standard Error	P[Z≥z]
ΔBRPRICE	-0.7310	0.0373	0.0000
ΔPLPRICE	-0.1853	0.0296	0.0000
ΔBRPRICEREDN	0.0117	0.9527E-03	0.0000
ΔPLPRICEREDN	0.0105	0.3840E-02	0.0063
ΔBRFEATURE	0.1509	0.0188	0.0000
ΔBRDISPLAY	0.1470	0.0120	0.0000
ΔPLFEATURE	0.4645E-03	0.5444E-03	0.9320
ΔPLDISPLAY	0.3963E-02	0.6451E-03	0.0000
ΔPLDISTN	0.0971	0.6093E-02	0.0000
ΔADVERT	0.0885	0.0147	0.0000
ΔPOP	0.3392E-06	0.2973E-06	0.2540
ΔINCOME	0.5737E-04	0.1136E-04	0.0000

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