National brand-store brand price differential and store brand market share

Jagmohan S. Raju
Raj Sethuraman and
Sanjay K. Dhar

The authors

Jagmohan S. Raju is Associate Professor of Marketing, The Wharton School, University of Pennsylvania, USA.
Raj Sethuraman is Assistant Professor of Marketing, College of Business Adminstration, University of Iowa, USA.
Sanjay K. Dhar is Assistant Professor of Marketing, and Beatrice Companies Scholar at the Graduate School of Business, University of Chicago, USA.

Abstract

Prior empirical research on store brands using cross-category data suggests a counterintuitive result that the lower the price of the store brand relative to the prices of the national brands, the smaller is the market share of the store brand. This result has been interpreted to imply that the national brand-store brand price differential is not an important determinant of private label share – if anything it works in the opposite direction. Using economic analysis, we show that the relationship between price differential and private label share estimated using cross-category data can be just the opposite of the relationship that actually exists within a category. Explains why this reversal occurs and discusses the implications for managers.

Pricing Strategy & Practice
Volume 3 · Number 2 · 1995 · pp. 17–24

Introduction

Private labels or store brands are brands owned, controlled, and sold exclusively by the retailers. Private labels have performed quite well in Europe (Fitzell, 1992). Recently, in the USA, they have gained a substantial market share in grocery products (Deveny, 1992; Hoch and Banerji, 1993). According to the Food Marketing Institute, the percentage of grocery shoppers buying private labels increased from 37 percent in 1990 to 44 percent in 1991 (Holton, 1992). Private labels now account for over 50 percent market share in milk, frozen vegetables, and some first-aid products, and are gaining shares even in categories such as cereals, cigarettes, and diapers, which were considered bastions of national brands (Strauss, 1993)

One important basis for selling private labels is the price differential between store brands and national brands. It is believed that private labels gain sales by offering the brand at a price lower than that of the national brands. As a result, national brand manufacturers are cutting prices and reducing the price gap in order to gain market share from private labels, as well as protect themselves from private label encroachment. For instance, in response to the threat from private labels and discount brands, Philip Morris reduced its price of Marlboro cigarettes, and Procter & Gamble reduced its price of Pampers diapers and Tide detergents (Ortega and Stern, 1993).

However, a number of recent cross-category studies (Hoch and Banerji, 1992; McMaster, 1987; Raju and Dhar, 1991; Sethuraman, 1992) have found a negative relationship between price differential and private label share across categories; that is, the higher the price differential between national brand and store brand in a category, the lower is the market share of the store brand. This particular result has been picked up by the popular press (e.g., Gibson, 1992; Holton, 1992) and interpreted to imply that price differential is not an important determinant of private label share – if anything, it is in the opposite direction. Based on this finding, and other considerations, some researchers (Hoch and Banerji, 1993; Sethuraman, 1992) have advocated that national brand manufacturers should perhaps focus less on

price reduction and more on other aspects such as product quality and advertising.

Our objective in this article is to demonstrate that the relationship between national brand-store brand price differential and private label share, estimated using cross-category data, can be just the opposite of the relationship that actually exists within a category. In particular, we show that even though a decrease in price differential (price of national brand decreases relative to the price of private label) decreases the sales and market share of private labels *within* a category (positive relation between price differential and private label share), one may observe a negative relationship between price differential and private label share *across* categories. The underlying broad implication is that one must be cautious in using cross-category relationships to infer the effect of price changes on sales. We also provide an intuitive justification for this reversal of relationships.

Model, analysis, and key results

This section provides an intuitive overview of our model, the analytical approach and the key results. The technical details are provided in the Appendix. We start with a category-level demand model consistent with the conventional notion that a decrease in the price of the national brand relative to the price of the store brand (lower price differential) decreases store brand sales (the terms *private label* and *store brand* are used interchangeably throughout the article).

'...there is a negative relationship between price differential and private label share across product categories even though there is a positive relationship within any given category...'

The retailer and national brand manufacturer(s) are assumed to engage in a set of strategic moves that results in the setting of retail and wholesale prices for the national brands and the retail price for the store brand. We compute the equilibrium price (the profit maximizing price for the brand given the prices of all other brands) for the store brand and the national brand, the equilibrium price differential and private label share. We repeat the exercise by changing parameter values of the demand function to mimic different product categories. We show that there is a negative relationship between price differential and private label share across product categories (lower price differential goes with higher share), even though there is a positive relationship within any given category (lower price differential goes with lower share). We explain why we see this reversal. Each step of the process is described below.

Model

We analyze a product category where a retailer carries multiple national brands as well as a store brand. Competition among the national brands, as well as the competitive interaction between the store brand and the various national brands, is captured through a carefully specified demand model. The model is simple enough to be analytically tractable, and yet rich enough to capture many essential aspects of the competitive situation. The demand functions are consistent with conventional economic theory such that an increase in price of the store brand relative to the price of the national brands leads to a lower demand for the store brand and a higher demand for the national brands.

More specifically, our demand model has the following structure. Each national brand has a base level of demand. The demand declines as its price increases. Demand also depends on price differentials. More specifically, national brand demand depends also on how high or low its price is relative to the average price of all national brands, and on how high or low its price is relative to the price of the store brand. The effects of price differentials are moderated by cross-price sensitivity. In other words, the same difference in price between the store brand and the national brand may have different effects on national brand demand across categories. If cross-price sensitivity is higher, the same difference in price leads to a higher effect on demand.

Similarly, the store brand also has a base level of demand. The base level of demand for the store brand is allowed to vary across categories, but is assumed to be smaller than the base level of demand for the national brands. As the price of the store brand increases, the demand for it declines. Store brand demand is also affected by

how high or low its price is relative to the average price of all national brands. As in the case of national brand demand, the same difference in price between the store brand and the national brand may have different effects on store brand demand across categories. If cross-price sensitivity is higher, the same difference in price leads to a higher effect on store brand demand.

The precise mathematical formulation of the demand model is given in equations (A1) and (A2) in the Appendix. As stated earlier, in order to keep the model analytically tractable, we make a number of simplifying assumptions. However, relaxing many of these assumptions does not in any way alter the qualitative nature of our conclusions.

The demand functions used are consistent with individual utility maximization behavior (Shubik and Levitan, 1980, p. 129). The same demand functions have also been used earlier in Raju *et al.* (1994) to explain store brand introduction decisions.

Price-setting process

The retailer decides on the retail prices of the national brands and the store brand in order to maximize the category profits. National brand manufacturers competitively decide on wholesale prices for their respective brands in order to maximize their profits. The national brand manufacturers are aware of the retailers' decision rule and take this into account when setting their wholesale prices. In line with the existing industry practice, we assume that the retailer has a long-term contract for procuring the store brand on a cost-plus basis (Cook and Schutte, 1967; McMaster, 1987).

Analysis

We use game theory to solve for optimal (equilibrium) retail prices, wholesale prices and sales quantities. A technical sketch and the key results at each of the stages of the equilibrium solution are provided in the Appendix. The equilibrium national brand retail prices, wholesale prices and demand; equilibrium store brand price and demand that result from this analysis are given in the Appendix.

Our model allows product categories to differ on a number of factors, namely:

- the number of national brands;
- the relative strength of the store brand, and the national brands;
- the cross-price sensitivity among the national brands; and
- cross-price sensitivity between the national brands and the store brand.

In order to understand the relationship between store brand market share and the price differential between the national brand and the store brand across categories, we mimic different product categories by appropriately varying these model parameters. For each set of parameters, we compute the equilibrium store brand market share and equilibrium national brand-store brand price differential using the expressions derived in the Appendix. We then relate store brand share to price differential across this wide set of parametric scenarios. Overall, we studied a total of 30,250 combinations.

Results

The key results are summarized in the correlation matrix in Table I which outlines the relationship among the key variables that one might observe across categories. With reference to Table I, note that the correlation between the national brand-store brand price differential and the store brand market share is negative (–0.37), indicating that categories where the equilibrium store brand share is high are also the categories where the equilibrium price differential is small. This is exactly what has been found in the cross-category studies cited earlier. Note that the cross-category relationship exists even though the underlying within-category demand model assumes that when the store brand price is lower relative to national brand price, its market share is *high*. We next explain why this occurs.

Table I Correlation matrix

	SB share	Price differential (%)	NB-SB price sensitivity
SB share	1.00		
Price differential (%)	–0.37	1.00	
NB-SB price sensitivity	0.14	–0.38	1.00

An intuitive justification

Recall that store brand demand as well as the demand for a national brand depends on how sensitive consumers are to the difference in price between the store brand and the national brands (cross-price sensitivity). If consumers are more price-sensitive when comparing the store brand with the national brands, they may switch brands in substantial numbers even for a low price differential between the national brands and the store brand. Hence, the store brand has the potential to obtain higher market share in such categories. But in these very product categories, the retailer can maintain a low price differential and still get large shares because consumers' reponse to price difference is higher. Thus, as the cross-price sensitivity between the national brands and the store brand increases, we expect equilibrium price differential between the national brand and the store brand to decrease and store brand market share to increase. These expectations are borne out in the results from our numerical experiment. Cross-price sensitivity is negatively correlated with equilibrium national brand-store brand price differential and positively correlated with equilibrium store brand market share. Hence, in categories with high cross-price sensitivity between the national brands and the store brand, the national brand-store brand price differential is low and the store brand share is high, leading to a negative correlation across categories.

Managerial implications

A number of cross-category studies have shown a negative relationship between national brand-store brand price differential and store brand market share. This result has been interpreted to imply that price differential is not an important determinant of store brand share – if anything, it is in the opposite direction. Our equilibrium analysis shows why the relationship between national brand-store brand price differential and store brand market share across categories can be just the opposite of what may actually exist within a category.

Our research suggests that inferences about the effect of price differential on store brand share from cross-category studies may be misleading. Consequently, we would suggest the use of within-category data for estimating the effect of price differential on store brand sales. For grocery products, within-category data are available from scanner data suppliers (e.g., Information Resources, Inc. and A.C. Nielsen Co.) both at the store level and at the household level.

Store level data typically provide the following weekly information for all brands in the category sold in that store:

- unit sales;
- average purchase price;
- whether the brand was on deal; and
- whether the brand was given a display space in the store or featured in local newspapers during that week.

These data can be used for estimating the short-term effect of price differential on aggregate private label sales in that store or chain (see e.g., Blattberg and Wisniewski, 1989).

Household data (or panel data) provide information about the purchase history of a large number of panelists in a market area. The dataset typically contains information on brands in a category that panelists purchased on different purchase occasions, the price at which they purchased, the store they purchased from, whether they used a coupon, etc. Current panel databases also provide information on the environment (e.g. prices of other brands) faced by the consumer at the time of purchase. This database can be used for estimating the effect of prices and other variables on consumer purchases of national brands and store brands (e.g., Kamakura and Russell, 1989). Because the data are at the household level, one can investigate heterogeneity among consumers in their preferences for national brands and store brands.

Our results suggest that a store brand can obtain a high market share even with a low price differential when cross-price sensitivity is high. However, one needs to recognize the limits within which this result holds in a meaningful manner. For example, it will be inappropriate to conclude that if cross-price sensitivity is very high, retailers can set the same price for both brands and still get a large store brand market share. Managers need to keep in mind that our parsimonious economic model does not take into account the concept of threshold price differential. Research (e.g., by Gurumurthy and

Pricing Strategy & Practice
Volume 3 · Number 2 · 1995 · 17–24

Little, 1989; Monroe, 1971) has shown that consumers have an acceptable range of prices within which they will continue to buy their preferred brand. The existence of a threshold price differential has important implications for managing price differences.

'...Research has shown that consumers have an acceptable range of prices within which they will continue to buy their preferred brand...'

The implication for national brand managers is as follows. National brands are typically advertised heavily and distributed widely; hence, they are considered the "strong" brands. The store brands are considered the "weak" brands. Consequently, national brands are priced higher than the store brands. The optimum price difference would depend on the relative brand strength as well as consumers' sensitivity to brand price differences, as our analysis has indicated. If the national brand attempts to maintain a larger price differential, then consumers would shift to store brand, and the national brand would lose sales and profits. However, if the national brand attempts to bring its price too close to the store brand, then consumers would believe both brands are of the same quality (i.e. price differences signal no brand differences) and buy the lower-priced brand. A national brand manager should attempt to manage price differences within this "acceptable" range.

The implication for store brand managers who wish to switch national brand consumers is as follows. In general, national brand consumers are willing to pay some premium for their brands. Hence, consumers would continue to purchase a national brand if the price differential is small, and would switch to the store brand only if the price differential is above some threshold level. Along these lines, some studies report that in typical grocery products, a minimum price differential of 10 percent should be provided as a monetary incentive for consumers to buy the store brands instead of the national brands (Donegan, 1989). There may also be an upper limit on the price differential that consumers are willing to accept – if the price differential is too large, consumers may impute low quality to private labels. This aspect of an acceptable price range is important as retailers attempt to gain private label shares in high-volume, high-growth markets such as cereals, frozen dinners and cosmetics. The shares of private labels in these categories are fairly low (about 5 percent), even though the prices of store brands are about half those of the leading national brands. While low prices can be a good incentive for inducing trial of private labels, consumers may:

- impute inferior quality to private labels; and
- expect to be able to buy private labels at a very low price.

Retailers should guard themselves against these possibilities.

Our economic model is applicable only within these ranges of acceptable price differential. The range of acceptable price differential would depend on product/consumer characteristics (e.g., brand familiarity (Monroe, 1976)), and on the nature of external price, brand and store information provided to them (Dodds *et al.*, 1991). For a good understanding of the acceptable price range, one needs to gain better insights into consumers' perceptions of price and value. Consumer surveys and experiments (Yadav and Monroe, 1993) can also be helpful in this regard.

In summary, our analysis explains why the relationship between price differential and private label share estimated using cross-category data can be just the opposite of the relationship that actually exists within a category. Hence, one must use caution in inferring price effects estimated from cross-sectional analysis. Our results also explain how store brand strength and price-sensitivity influence private label share and price differential. These relationships may be a useful starting point for future empirical research.

Our research provides a model based justification for why one might observe a negative relationship between store brand share and price differential. However, we do acknowledge that our research does not provide a solution for how one might accurately estimate the effect of national brand-store brand price differential on store brand share using cross-sectional data. This is a potentially useful area for future research.

References and further reading

Blattberg, R.C. and Wisniewski, K. J. (1989), "Price induced patterns of competition", *Marketing Science*, Fall, Vol. 8, pp. 291-309.

Cook, V.J. and Schutte, T.F. (1967), *Brand Policy Determination*, Allyn & Bacon, Boston, MA.

Deveny, K. (1992), "More shoppers by-pass bigname brands and steer carts to private-label products", *The Wall Street Journal*, October 20, p. B1.

Dodds, W.B., Monroe, K.B. and Grewal D. (1991), "Effects of price, brand, store information on buyers' product evaluations", *Journal of Marketing Research*, August 28, pp. 307-19.

Donegan, P. (1989), "Private label is alive and well", *Progressive Grocer*, February, pp. 61-7.

Fitzell, P. (1992), *Private Label Marketing in the 1990s*, Global Book Productions, New York, NY.

Gibson, R. (1992), "Store brand pricing has to be just right", *The Wall Street Journal*, February 1, p. B1.

Gurumurthy, K. and Little, J.D.C. (1989), "A price response model developed from perceptual theories", MIT, Cambridge, MA.

Hoch, S.J. and Banerji, S. (1992), "When do private labels succeed", Working Paper, Graduate School of Business, University of Chicago, Chicago, IL, p. 36.

Hoch, S.J. and Banerji, S. (1993), "When do private labels succeed", *Sloan Management Review*, Summer, Vol. 37, pp. 57-67.

Holton, L. (1992), "You'll love private labels", *Chicago Sun-Times*, March 1, p. 45.

Kamakura, W. and Russell, G. (1989), "A probabilistic choice model for market segmentation and elasticity structure", *Journal of Marketing Research*, November, Vol. 26, pp. 379-90.

McMaster, D. (1987), "Own brands and the cookware market", *European Journal of Marketing*, Vol. 1. No. 21, pp. 83-94.

Monroe, K.B. (1971), "Measuring price thresholds by psychophysics and latitudes of acceptance", *Journal of Marketing Research*, November, Vol. 8, pp. 460-4.

Monroe, K.B. (1976), "The influence of price differences and brand familiarity on brand preferences", *Journal of Consumer Research*, Vol. 1 No. 3, pp. 42-9.

Ortega, B. and Stern, G. (1993), "Retailers' private labels strain old ties", *The Wall Street Journal*, September 9, p. B1.

Raju, J.S., and Dhar, S.K. (1991), "Cross-category differences in store brand market share", working paper, John E. Anderson Graduate School of Management at UCLA, Los Angeles, CA.

Raju, J.S., Sethuraman, R. and Dhar, S.K. (1995), "The introduction and performance of store brands", *Management Science* (forthcoming).

Sethuraman, R. (1992), "The effect of marketplace factors on private label penetration in grocery products", Working paper 92-128, Marketing Science Institute, Cambridge, MA.

Strauss, G. (1993), "Shoppers find value beyond bignames", *USA Today*, January 7, p. 1B.

Shubik, M. and Levitan, R. (1980), *Market Structure and Behavior*, Harvard University Press, Cambridge, MA.

Yadav, M.S. and Monroe, K.B. (1993), "How buyers perceive savings in bundle price: an examination of a bundle's transaction", *Journal of Marketing Research*, August, Vol. 30, pp. 350-8.

Appendix

Demand functions

We model a product category with k national brands labeled with subscripts $i = 1, 2, 3, \ldots k$ and one store brand with subscript s. In the absence of price competition, the store brand's ability to attract core buyers is assumed to be lower than that for a national brand. This is represented by the store brand's relative strength, α, a number between 0 and 1. The demand for each of the k national brands (q_i), and the store brand (q_s), are assumed to be as follows:

$$q_i = \frac{1}{k+\alpha}\left[1 - p_i + \frac{1}{k}\right]\left[\sum_{j \neq i}\theta(p_j - p_i) + \delta(p_s - p_i)\right] \quad \text{(A1)}$$

$$q_s = \frac{1}{k+\alpha}\left[\alpha - p_s + \frac{1}{k}\left[\sum_i \delta(p_i - p_s)\right]\right], \quad \text{(A2)}$$

where p_is the price of the k national brand, and p_s is the price of the store brand. θ and δ represent the cross-price sensitivity among the national brands and between each national brand and the store brand, respectively, each between 0 and 1.

Equilibrium analysis

We begin with the retailer's decisions to maximize the profits they make from the category.

Retailer's profit maximization problem

Define w_i to be the wholesale price charged by national brand manufacturer i. The analytical representation of the profit maximization problem of the retailer is as follows:

$$\max_{p_1, p_2, \ldots p_k, p_s} \sum_{i=1}^{k}\left[(p_i - w_i)q_i\right] + p_s q_s.$$

The first order conditions for the retailer's profit maximization problem are given by

$$1 - 2\hat{p}_i\left(1 + \left(\frac{k-1}{k}\right)\theta + \frac{\delta}{k}\right) + 2\frac{\theta}{k}\sum_{j\neq i}\hat{p}_j + 2\frac{\delta}{k}\hat{p}_s + w_i\left(1 + \left(\frac{k-1}{k}\right)\theta + \frac{\delta}{k}\right) - \frac{\theta}{k}\sum_{j\neq i} w_j = 0$$

$$2\frac{\delta}{k}\sum_{j}\hat{p}_j - \frac{\delta}{k}\sum_{j} w_j - 2\hat{p}_s(1+\delta) + \alpha = 0$$

where $\hat{p}_i$, $i = 1, 2, \ldots, k$ and $\hat{p}_s$, represent the solutions to the above first order conditions. Simplifying, we get

$$\hat{p}_i - \left(\frac{\delta}{k+\delta}\right)\hat{p}_s = \frac{w_i}{2} + \frac{k}{2(k+\delta)} \qquad \text{(A3)}$$

$$\hat{p}_i - \left(\frac{1+\delta}{\delta}\right)\hat{p}_s = \frac{w_i}{2}. \qquad \text{(A4)}$$

Solving (A3) and (A4) gives us the retail prices as a function of the wholesale prices,

$$\hat{p}_i = \frac{w_i}{2} + \frac{k(1+\delta) + \alpha\delta}{2(k+\delta+k\delta)}$$

$$\hat{p}_s = \frac{k\delta + \alpha(k+\delta)}{2(k+\delta+k\delta)}.$$

Substituting these retail price expressions in (A1), we obtain national brand demands ($\hat{q}_i$) as functions of wholesale prices.

$$\hat{q}_i = \frac{1}{k+\alpha}\left[\frac{1}{2} - \frac{w_i}{2}\left(1 + \left(\frac{k-1}{k}\right)\theta + \frac{\delta}{k}\right) + \frac{\theta}{k}\sum_{j\neq i}\frac{w_j}{2}\right].$$

Manufacturers' profit maximization problem

Given the retailers' pricing decision rule above, each manufacturer is independently assumed to select the wholesale price that maximizes their firm's profits. For manufacturer i, the problem can then be expressed as follows:

$$\max_{w_i}[w_i\hat{q}_i(w_1, w_2 \ldots w_k)].$$

Table AI Equilibrium expressions

National brand retail price	p_i^*	$\frac{k(1+\delta)+\alpha\delta}{2(k+\delta+k\delta)} + \frac{k}{2[k(2+\theta)+2\delta-\theta]}$
Store brand retail price	p_s^*	$\frac{\delta k + \alpha(k+\delta)}{2(k+\delta+k\delta)}$
National brand wholesale price	w_i^*	$\frac{k}{[k(2+\theta)+2\delta-\theta]}$
National brand demand	q_i^*	$\frac{k(1+\theta)+\delta-\theta}{2(k+\alpha)[k(2+\theta)+2\delta-\theta]}$
Store brand demand	q_s^*	$\frac{\delta k + \alpha[k(2+\theta)+2\delta-\theta]}{2(k+\alpha)[k(2+\theta)+2\delta-\theta]}$
Store brand market share	ms_s^*	$\frac{\delta k + \alpha(k(2+\theta)+2\delta-\theta)}{k(k(1+\theta)+2\delta-\theta)+\delta k+\alpha(k)(2+\theta)+2\delta-\theta)}$
Price differential	$\frac{p_i^* - p_s^*}{p_i^*}$	$\frac{(3\delta-2\alpha\delta-\theta+\alpha\theta)k+(3-2\alpha+\delta+\theta-\alpha\theta)k^2}{[\alpha\delta(2\delta-\theta)+k(3\delta+2\alpha\delta+2\delta^2-\theta-\delta\theta+\alpha\delta\theta)+k^2(3+\theta)(1+\delta)]}$

Pricing Strategy & Practice
Volume 3 · Number 2 · 1995 · 17–24

The first order conditions for each of the $i = 1, 2, 3, \ldots, k$ manufacturers is given by

$$\frac{1}{2} - w_i^* \left(1 + \left(\frac{k-1}{k}\right)\theta + \frac{\delta}{k}\right) + \frac{\theta}{k} \sum_{j \neq i} \frac{w_j^*}{2} = 0$$

where w_i^* represent equilibrium national brand wholesale prices. Solving the above conditions, we obtain a unique symmetric equilibrium. The resulting equilibrium wholesale prices of national brands are given by

$$w_i^* = \frac{k}{k(2+\theta) + 2\delta - \theta}.$$

Substituting these in $\hat{q}_i$, $\hat{p}_i$, $\hat{q}_s$, and $\hat{p}_s$, we obtain equilibrium retail prices (p_s^*, and p_s^*) and demand (q_i^* and q_s^*). These equilibrium expressions are listed in Table AI:

Relationship between national brand-store brand price differential and store brand share

In order to mimic different product categories, we varied the number of national brands to be between two and 50 in steps of two. Also, the cross-price sensitivities among the national brands and the cross-price sensitivity between the national brands and the store brands each vary between 0.01 and 0.99 in steps of 0.1; and the relative strength of the store brand varies between 0 and 0.9 in steps of 0.1. This led to a total of 30,250 combinations. The equilibrium store brand market share and price differential are then computed using the expressions from Table AI for each of the 30,250 combinations. The correlation between store-brand share and price differential is reported in Table I.