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National Brand and Private Label Pricing and Promotional Strategy

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Selected Paper prepared for presentation at the Agricultural & Applied Economics Association 2010

AAEA,CAES, & WAEA Joint Annual Meeting, Denver, Colorado, July 25-27, 2010

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Abstract

In this paper I use a unique and rich data set on prices and promotions from major US supermarkets to examine the nature of National Brand and Private Label interaction. Private labels are priced and promoted competitively with NBs, in a manner suggesting that retails are careful not to lose private label market share during times of national brand promotions. The price margin between the two types of products continues to fall in US supermarkets, and the major determinants of the price differences between the two are promotional frequency and market concentration.

Private Labels Today

PLs have been of interest to researchers in economics and marketing for almost a century. They command attention and generate discussion primarily because of the manners in which they differ from NBs. NB products, regardless of the departments in which they are sold, travel from the farmgate to the consumer's dinner plate by way of distributors, often referred to as manufacturers or processors in the literature. An illustrative example of an NB is Heinz Ketchup, which is manufactured and distributed by the Heinz Corporation across the United States. Heinz Ketchup is a homogenous product across every chain that sells it throughout the country, in terms of taste, size, and appearance. Alternatively, supermarkets obtain PLs through a form of vertical integration or from small firms on the competitive fringe (Berges-Sennou, Bontems, and Requillart, 2004) (hereafter BBR). PLs therefore are unique to the chains at which they are sold, or at least are marketed as being so. The PL substitutes to Heinz Ketchup germane to this study are Safeway Ketchup and Albertsons Ketchup.

As a result of this dual-channel paradigm, PLs are important components of both interstore and intrastore competition. They are uniformly less expensive than their NB substitutes and they allow retailers to differentiate themselves from one another in terms of product offerings, and hence they are valuable tools in competition with rival chains. However they also typically have higher margins than NBs and the profits from the sales of PLs are not shared with NB manufacturers, and hence PLs increase the bargaining power of retailers relative to manufacturers in the food distribution channel (Narasimhan and Wilcox, 1998; Bontems, Monier-Dilhan, and Requillart, 1999). An entire stream of literature, as summarized by Steiner (2004), focuses on the competitive interaction between NBs and PLs within stores. Hence PLs

are of interest to researchers as well as all agents in the food distribution channel in two key competitive dimensions.

One of the most influential and heavily cited empirical studies on NBs and PLs is Connor and Peterson (1992), which examined the major determinants of the NB/PL price margin in supermarkets. However it is worth noting the major working assumptions of this paper. The authors assumed that the market share of PLs within product categories is very small, that there is no product differentiation among PLs, and that PLs are subject to no advertising in newspapers or any other media outlets. Each of these assumptions were likely plausible at the time of writing, but could be considered no less than heroic in today's food retailing environment.

A number of studies, including Corstjens and Lal (2000) and Cotterill and Putsis (2000) as well as several more summarized by Steiner have shown that the quality and penetration of PLs have sustained a considerable increase in quality and penetration within product categories. The food retailing publication *Progressive Grocer* has dedicated at least one dozen articles from the years 2007 through 2009 to the documentation the rise in popularity of PLs and the concerted efforts of grocers to promote them to consumers and maximize sales. Retailers are increasingly using PLs as a means by which to differentiate themselves from competitors. Safeway alone offers three brands of PLs-the flagship Safeway brand, the premium SELECT label, and the O Organics label. *Consumer Reports* has determined across a wide variety of product categories that the quality gap between leading NBs and PLs is narrow to nonexistent and also that there exists significant variation in the quality of PLs across chains. Finally, despite arguments from the literature that PLs should not be promoted or advertised due to the cannibalization of NBs or low promotional elasticities on the part of consumers, my data show that PLs are promoted more

frequently than are NBs. Furthermore PLs are featured prominently in both the weekly flyers and the television ads for both chains.

The data used for this study includes only products for which very close pairings were possible across NBs and PLs. The criteria for matching across labels imposed that potential substitutes be found within the same product category and have the same characteristics used as descriptors in the product names. Therefore each pair of products examined in this study is matched according to product size as well as defining taste and nutritional attributes such as flavor, low sodium content, etc. In total this study analyzes the pricing and promotional behavior of over 5,800 unique NB products, each paired with an appropriate PL substitute. Many PL products are paired with more than one NB, as most product categories contain multiple NBs with similar characteristics. The products span 257 product categories and cover every major department in the supermarket. Additionally, the analysis of this study does not rely upon competitive interaction between chains, and therefore the dataset includes prices and promotions from all 17 cities for which online retail data were available. A complete list of the cities is available in appendix A.

Table 6.1 provides the percentage differences between NBs and PLs across four key metrics of food retailing. The shelf price is defined as the price printed on the supermarket shelves and does not include promotional discounts. The promotional price is the price of products, taking into account promotions when applicable. That is, shelf price is equal to promotional price in the absence of promotions and the promotional price represents the price paid by consumers who use a club car when making purchases. Promotional frequency is the percentage of time a given product is on promotion and promotional depth is the percentage difference between the shelf price and promotional price, when applicable.

Table 6.1: Percentage Differences in NB and PL Pricing and Promotional Activity, by Department.

	Percentage Difference, NB-PL			
Department	Shelf Price	Promotional Price	Promotional Frequency	Promotional Depth
Beauty Aids	33.99	36.33	-40.18	4.77
Baby Care	34.92	37.10	-5.36	-14.29
Baking and Cooking	17.24	17.56	-10.61	-1.42
Boxed Dinners	28.45	26.83	-11.47	4.04
Beverages	28.95	27.30	-5.90	2.92
Breakfast Foods	26.59	26.46	-14.99	2.55
Canned Goods	23.35	24.82	-15.67	0.37
Cleaning Products	24.17	23.68	-12.05	2.46
Condiments	19.25	24.47	-24.96	-3.48
Coffee and Tea	18.83	19.45	-13.33	14.27
Dairy	20.58	25.51	-14.19	2.62
Salad Dressing	16.88	21.08	-25.21	-0.99
Frozen Food	19.13	22.77	-6.03	-3.69
General Merchandise	21.57	23.47	-11.72	-1.16
Health Aids	28.82	29.91	-24.87	4.62
Mexican	24.61	26.25	-23.05	0.88
Meat and Seafood	18.13	12.06	-3.20	1.04
Packaged Bread	33.62	34.54	-22.49	1.27
Pasta, Rice, & Beans	22.64	22.33	-17.46	3.15
Snacks	22.98	20.87	-7.00	4.66
Soup and Chili	25.06	28.39	-45.54	8.26
Spices & Seasonings	22.23	21.96	-6.32	1.29
Total	22.89	24.53	-16.35	0.28

All differences are significant at the 0.01 level.

The first two columns of table 6.1 allows for the immediate comparisons with prior work on NB/PL interaction. The margin for shelf prices and promo prices varies considerably across supermarket departments. Among shelf prices, the greatest margin is found in the beauty aids department, at 34 percent, and smallest margin occurs for the dressing and salad toppings department, at close to 17 percent. For some departments, the promo price margin is wider than that for the shelf price and for others it is slimmer. Across the entire supermarket, the NB/PL margin is 23 percent for shelf prices and 24.5 percent incorporating promotions. These figures are significantly lower than 40 percent, as found by Dhar and Hoch (1997) or 30 percent, as

found by Ailawadi, Neslin, and Gedenk (2001) (hereafter ANG). Therefore these results support the consensus building in the literature that PL prices are rising relative to NB prices, for a number of reasons.

Across the board, promotional frequency is higher for PLs than it is for their NB substitutes. On average, a PL product is on promotion 16 percent more often than its close NB substitutes. Due to the fact that the data set used in this study has over 1.6 million observations, all of the estimates in table 6.1 are very precise and each difference is highly statistically significant. However the average difference in promotional depth across labels is negligible, at about one quarter of one percent. Therefore it is plain to see that the higher promotional frequency for PLs is a likely explanation for the wider overall price margin when considering promotional activity.

Certain products in the data are observed to be on promotion nearly constantly. This phenomenon has been neither observed nor discussed in the economic or marketing literature, yet it is fairly common in conventional supermarkets. It is also partially responsible for the gap in average promotional frequency between NBs and PLs. Examining the entire data set of all products sold online at Safeway or Albertsons, nearly 7,200 unique products were on promotion at least 85 percent of the time during the data collection.[2] As the focus is limited to increasingly higher promotional frequencies, the products remaining under consideration become more like to be PLs. For example, 74 percent of all products on promotion at least half the time are NBs. Given that slightly over 80 percent of all products are NBs, PLs are only marginally overrepresented among those products on promotions more often than not. However if we

[2] A product is defined entirely by its name in this data set, which is in turn provided by the chain in which it is sold. Therefore an identical NB product sold at both Safeway and Albertsons is counted at two unique products for the purposes of this analysis. The entire data set collected from both chains includes approximately 70,000 unique products by this definition, after the requisite data cleaning.

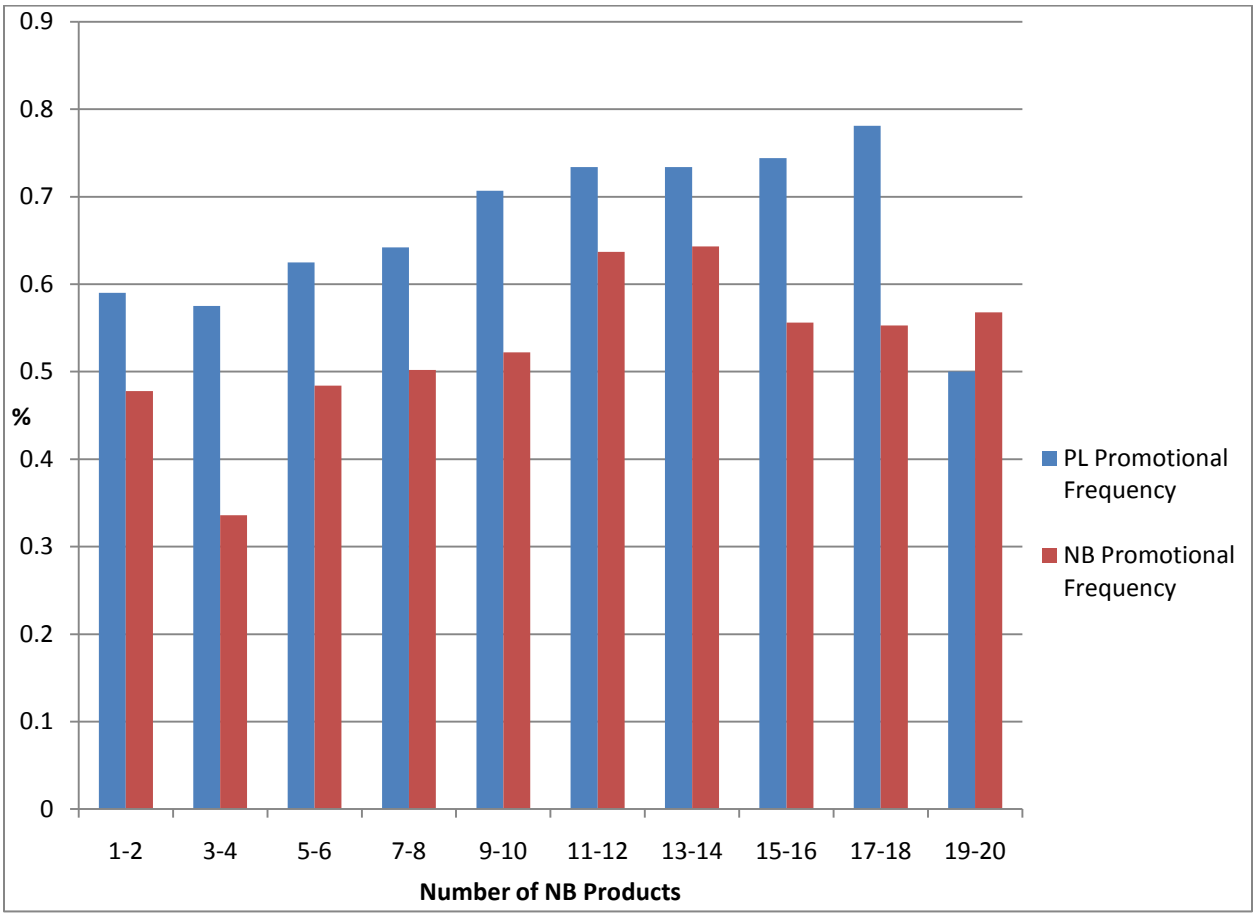
consider only those products on promotion at least 85 percent of time, only 28 percent of the remaining products are NBs. Therefore PLs are significantly more likely to be placed on constant or near constant promotion than are NBs.

The literature suggests two plausible and complementary explanations for this phenomenon. The first comes from Steiner's review of the literature on NB/PL instrastore competition, in which he noted that retailers face a difficult balancing act when setting PL promotions, relative to NBs. A price margin between substitutes that is too high signals to consumers that the PL is of low quality. However if the margin is too narrow then consumers will always purchase the NB because NBs enjoy a "reputation premium" drawn from familiarity and longevity on the shelves. The nearly perpetual PL price promotion may represent a solution that retailers have found to this pricing conundrum. Under this strategy, PLs are given a clearly visible shelf price with that is relatively close to the price of respective NB substitutes. However the promotional price provides a wider price margin, increasing the probability that the consumer who would always choose the NB at equal prices will purchase the PL. The second explanation comes from Chintagunta (2002), who noted that PLs are more likely to be priced strategically to maximize penetration within product categories, or maximize sales relative to competing NB brands. The primary objective of any promotion is to increase sales and therefore nearly constant promotions are likely to be indicative of a concerted effort to market share within product categories rather than any standard competitive considerations.

Figure 6.1 shows how the average promotional frequency for NBs and PLs varies according to the number of competing NBs within product categories. In general, the PL promotional frequency follows a clear and direct relationship with the number of NBs, i.e., supermarkets promote their PLs more heavily in product categories with more NB substitutes.

When the number of NBs is low, between one and four, average PL promotional frequency is slightly below 60 percent. However the average PL promo frequency is nearly 80 percent when considering product categories with 17 or 18 NBs. Examples of such populous categories include ice cream and shredded cheese. Raju, Setharuman, and Dhar (1995) found that the more NB products were in a category, the lower was the equilibrium PL market share, and this trend suggests that retailers make a more determined effort to promote and expand the market share of PLs when they are competing with more NBs. The overall trend for NB promo frequency is similar but less clear, as NB promotional activity appears to peak sharply for categories with 11 to 14 products from which to choose. As expected, the average promo frequency of PLs exceeds that of NBs for each category size.

Figure 6.1: Average Promotional Frequency by the Number of NB Products within Categories.



Another issue raised in the literature with respect to NB/PL interaction is the potential for NB promotions to put NBs and PLs directly in competition in the eyes of consumers within stores. For example, ANG noted that the average NB promotional discount was approximately equal to the average price margin between NBs and PLs. ANG determined that while this closing of the margin during NB promotions could potentially lead to unprofitable cannibalization within product categories, the authors determined that consumers were sufficiently segmented to obviate this possibility. Table 6.2 shows the percentage difference between NB promotional prices and PL shelf prices, by department. The margin varies widely across departments in terms of sign and magnitude. For some departments, such as salad dressing and soup and chili, the NB promotional prices undercut the PL shelf prices, on average. Looking at the entire supermarket, NB promotional prices are indeed very close to PL shelf prices on average, with a margin of just over two percent. As was the case with table 6.1, all percentage differences are significant at the 0.01 level, but this margin remains small in terms of consumer expenditure. The reputation premium enjoyed by NBs due to their longevity in the market and homogeneity across stores has not been quantified in the literature but it is almost certain to exceed two or three cents on the dollar.

Table 6.2: Statistical Comparison of NB Promotional Prices and PL Shelf Prices, by Department.

	(1)	**(2)**	
Department	NB Promotional Price ($)	PL Shelf Price ($)	Percentage Difference (1) – (2)
Beauty Aids	5.15	4.11	20.19
Baby Care	6.98	4.74	32.09
Baking and Cooking	4.52	4.68	-3.54
Boxed Dinners	1.52	1.58	-3.94
Beverages	2.97	2.86	3.70
Candy	2.23	2.93	-31.39
Breakfast Foods	3.41	3.22	5.57
Canned Goods	1.97	1.98	-0.51

Cleaning Products	6.12	5.70	6.86
Condiments	2.82	2.94	-4.26
Coffee and Tea	5.59	5.72	-2.32
Dairy	3.49	3.01	13.75
Delicatessen	3.84	3.66	4.69
Salad Dressing	2.96	3.27	-10.47
Frozen Food	3.51	3.82	-8.83
General Merchandise	5.51	5.32	3.44
Health Aids	5.78	4.95	14.36
Mexican	2.24	2.21	1.34
Meat and Seafood	2.78	3.20	15.11
Packaged Bread	2.53	2.43	3.95
Produce and Floral	3.08	3.43	-11.36
Pasta, Rice, and Beans	1.74	1.78	-2.29
Snacks	2.96	3.03	-2.36
Soup and Chili	1.78	2.03	-14.05
Spices and Seasonings	2.86	2.79	2.45
Total	3.43	3.35	2.33

All differences are significant at the 0.01 level.

Several papers have been devoted to the examination of trade promotion pass-through, or the rate at which retailers pass on the trade promotions they receive from manufacturers on to consumers. Examples of the majority of studies demonstrating significantly less than 100% pass-through include Tellis and Zufryden (1995), the literature review of Blattberg, Briesch, and Fox (1995) (hereafter BBF), and Besanko, Dube, and Gupta (2005). Therefore it is unlikely that this margin is so small on average primarily due to the magnitude of manufacturer trade promotions, though they may play a role. It is more likely that the NB promotional depths reflect factors such as consumer demand or promotional elasticities as they are understood by retailers or the prices and promotions of competitors. As mentioned above, ANG argued that this close margin should not be a profitability concern on the part of retailers, but the promotional behavior of Safeway and Albertsons suggests otherwise. Indeed, table 6.1 shows that the average margin between NB and PL prices when accounting for promotions is actually slightly higher than the margin when not accounting for promotions, 24 percent to 22 percent. Therefore it appears as if conventional

supermarkets are using their PL promotions as a means by which to maintain sufficiently wide price margins between NBs and PLs within product categories despite NB promotional activity.

In stark contrast to the food retailing environment being studied as recently as 10 or 15 years ago, today's supermarkets feature PL substitutes for almost every NB product offered in the store. Chains are aggressively promoting and advertising their PLs and attempting to market them towards traditionally higher-income segments of the population while consensus is building that PL quality is generally approaching that of NBs. The statistics presented thus far in this study suggest that PLs are priced and promoted to compete with NBs within stores for market share.

Promotional Interaction for National Brand and Private Label Substitutes

As mentioned above, one of the main reasons why PLs are interesting to researchers is because they are components of both interstore and intrastore competition. In this section I apply the a contingency analysis to examine competition within stores between NBs and PLs.

Figure 6.2 provides an illustrative example of two-way contingency table, comparing the promotions of PL and NB products for the snack category, pooling both chains. The only products under consideration in this analysis are those NBs and PLs that I have been able to match as being close substitutes within product categories. The two-way table reports the total promotional frequencies for all possible outcomes promotions can take across labels, namely both on promotion, only on promotion if NB, only on promotion if PL, or neither product on promotion. Therefore the figure reveals that the NB snack products are on promotion 47.53 percent of the time, a figure hereafter referred to as p_{NB}. The PL substitutes to these products are on promotion 55.69 percent of the time, yielding our p_{PL}. The expected percentage, p_E of the time promotions occur simultaneously across labels for substitutes, given independence, is thus

given by p_{NB}*p_{PL} = 26.46 percent. However the bottom right cell of the contingency table reveals that promotions occurred simultaneously for substitutes 28.63 percent of the time. The percentage difference between p_E and the observed coincidence of joint promotions, p_O, is given by ($p_O - p_E$) / p_E = (28.63-26.46) / 26.46 = 8.20 in this case. Therefore NB and PL substitutes are on promotion contemporaneously eight percent more often than would be expected given independence in pricing across labels.

Figure 6.2: Contingency Table for the Promotional Comparison of National Brands and Private Labels for the Snack Department.

National Brand	Private Label: No Promotion	Private Label: Promotion	Total %
No Promotion	41.67	15.31	52.47
Promotion	14.49	28.63	47.53
Total %	44.31	55.69	100.00

Positive values for the percentage difference between expected and observed promotional frequencies are interpreted as retaliation and negative values depict accommodation. When considering NBs and PLs within chains, the contemporaneous case is of significant importance because competition among brands can and does manifest itself as simultaneous promotions. This section also accounts for lags of up to four weeks in addition to the contemporaneous case. Table 6.3 provides summary statistics for the promotional interaction between NBs and PLs over the time series.

Table 6.3: Summary Statistics on Promotional Interaction between NB and PL Substitutes, by Department.

Department	Mean	St. Deviation	Minimum	Maximum
Beauty Aids	0.1017***	0.0189	0.0778	0.1411
Baby Care	-0.0993*	0.1417	-0.3471	0.0411
Baking and Cooking	0.2641***	0.0168	0.2311	0.2834
Boxed Dinners	0.2264***	0.0411	0.1571	0.2769
Beverages	0.1751***	0.0035	0.1690	0.1801
Breakfast Foods	0.0829***	0.0160	0.0583	0.1090
Canned Goods	0.2515***	0.0125	0.2245	0.2678
Cleaning Products	0.0171	0.0995	-0.2482	0.0550
Condiments	0.2220***	0.1587	0.1598	0.6448
Coffee and Tea	0.2727***	0.0119	0.2458	0.2872
Dairy	0.0750***	0.0051	0.0645	0.0797
Salad Dressing	0.0743***	0.0116	0.0513	0.0870
Frozen Food	0.1041***	0.0058	0.0947	0.1131
General Merchandise	0.1936***	0.0102	0.1813	0.2102
Health Aids	0.0812***	0.0119	0.0714	0.1053
Meat and Seafood	0.0309***	0.0264	-0.0204	0.0693
Packaged Bread	0.1346***	0.0114	0.1168	0.1482
Produce and Floral	-0.0775	0.1230	-0.2426	0.0464
Pasta, Rice, and Beans	0.2109***	0.0118	0.1871	0.2250
Snacks	0.1003***	0.0125	0.0816	0.1188
Soup and Chili	0.1644***	0.0135	0.1501	0.1869
Spices and Seasonings	0.1045***	0.0708	-0.0113	0.2080
Total	0.0827***	0.1872	-0.9349	0.6448

***: Mean is statistically different from zero at the 0.01 level. **: At the 0.05 level. *: At the 0.10 level.

Overall, the frequency of observed joint promotions on NBs and PLs is about eight percent higher than the frequency of expected joint promotions. Therefore the relationship between NBs and PLs is overall a competitive, retaliatory one. The literature on NB/PL competition, as summarized by Steiner, argues that intrastore competition between labels is beneficial to social welfare. For most departments, the nature of the promotional interaction is retaliatory and statistically significant. Competition is accommodating only for the baby care department and it is insignificant for the relatively small cleaning products department and for the produce and floral department, which is the unique in that is the only department in the

supermarket in which PLs outnumber NBs. A large number of PL products in the produce department have no NB substitutes.

In order to quantify the nature and the determinants of NB/PL promotional interaction, I run a regression model with the percentage difference between expected and observed joint promotions, as calculated by the two-way contingency tables, as the dependent variable. The explanatory variables are drawn from a review on the literature on NB/PL interaction, though it is difficult to formulate ex ante expectations on most coefficient signs as the nature of NB/PL promotional interaction has not been considered or quantified to any significant degree. The model to be estimated is given by:

$$
\begin{aligned}
(1) \qquad & PromoResponse_{i,j} = \beta_0 + \beta_1 Lag1_i + \beta_2 Lag2_i + \beta_3 Lag3_i + \beta_4 Lag4_i + \\
& \beta_5 Storable_i + \beta_6 NB_i + \beta_7 Herf_{i,j} + \beta_8 WalShare_{i,j} + \beta_9 MHI_{i,j} + \\
& \beta_{11} Online_i + \boldsymbol{\beta_S StoreLags} + u_{i,j}
\end{aligned}
$$

where *PromoResponse* is the percentage difference between frequency of joint promotions and the expected frequency of joint promotions given independence between labels, for product pairing *i* in city *j*, as calculated above. *Lag1*, *Lag2*, *Lag3*, and *Lag4* are binary variables equal to one if the response time given to the labels is equal to one, two, three, or four weeks, respectively. *Storable* is a binary equal to one for departments with products that consumers can stockpile, meeting the criteria of small size and distant-to-no expiration dates.[3] When examining NB/PL interaction, the contemporaneous case is worth considering and the motivation to compete for storable products is potentially stronger in that case. The lag lengths are interacted with storability in order to fully decompose the nature of promotional interaction for storable vs. non-storable products.

[3] At the department level beauty aids, baby care, baking & cooking, boxed dinners, beverages, breakfast foods, canned goods, cleaning products, condiments, coffee & tea, salad dressing, general merchandise, health aids, pasta rice & beans, soup & chili, snacks, and spices & seasonings are considered storable. Frozen food is not included due to the limited storage space available to consumers for products requiring freezing.

NB is also a binary, equal to one if the promotions being lagged are on NB products. In order words, it represents the cases in which PL promotions are responding to NB promotions. BBF showed that the amount of brand switching that occurs is asymmetric with respect to labeling, in that more consumers switch from PL to NB during an NB promotion than the converse. Leeflang and Wittink (1996) showed empirically that brand switching increases with total market share, a finding in line with BBF. Therefore if in fact NBs and PLs set firms like rival firms, PLs would have a stronger motivation to respond directly the NB prices than vice versa. However, again, what we might think of as promotional "response" when considering rivals can occur simultaneously in the instrastore case, which cannot be identified by this model.

Herf gives the market concentration of the city in which the promotional response is calculated, as measured by the Herfindahl Index. The relationship between price and concentration has been explored extensively in the literature and the overwhelming consensus among researchers is that prices rise and in general supermarkets set prices less competitively as concentration increases. Volpe and Lavoie (2008) showed that the direct relationship between prices and concentration applies much more strongly to NBs, as PL prices rise only marginally in concentrated markets. Given that the NB/PL margin is likely to increase with concentration, I therefore expect competition between the labels to decrease with concentration. The intuition is most clear when considering PLs: retailers have less incentive to closely manage their PL promotions with respect to NB promotions if the margin is great enough to preclude the loss of PL market share to higher-priced NB substitutes.

WalShare is the market share of Wal-Mart, as measured by Supercenters and Sam's Clubs warehouse stores. Several researchers have stressed the importance of considering the presence of Wal-Mart when examining supermarket behavior and food retail in general.

Supercenters are most popular among low-income consumers Franklin (2001), which is also the demographic most likely to purchase PLs. Therefore it stands to reason that PLs are priced more competitively in cities in which Wal-Mart is strongest, but this pricing would likely manifest itself in more retaliatory interstore pricing. The effect of Wal-Mart Supercenters on NB/PL interaction is unclear, though Jones (2004) argues that conventional supermarkets would do best to minimize promotions in general when faced with direct competition from Supercenters, which could result in weaker competition between NBs and PLs overall.

MHI is the median household income. As mentioned above, low-income consumers have historically been the target demographic for PLs. Therefore as MHI increases, I expect firms to have less incentive to promote their PLs competitively with NBs, resulting in weaker NB/PL competition overall.

Finally, *Online* is a binary equal to one for those cities in which both Safeway and Albertsons offer online retail. In this data set, those cities are Las Vegas, Los Angeles, San Diego, Portland, and Seattle. Given that the presence of two online retailers increases the ease of competitive price monitoring, I have reason to expect that interstore competition may be higher in these cities. The inclusion of this variable in this intrastore model is mainly to help round out the answer to an overarching question in this study investigating whether or not the presence of online retailers affects overall pricing strategies. All demographic and market condition variables were calculated using data from Market Scope, a publication of *Trade Dimensions*. Table 6.4 provides selected summary statistics for the continuous explanatory variables of equation 1 and shows that across the 14 cities sampled, the regressors show significant range.

Table 6.4: Summary Statistics for the Determinants of Promotional Interaction.

Variable	**Units**	**Mean**	**St. Deviation**	**Minimum**	**Maximum**
Herfindahl	None	0.177	0.039	0.104	0.265
WalShare	%	8.470	9.836	0.000	29.500

MHI	1000s USD	45.465	9.116	32.456	70.291

Table 6.5 reports the results of the GLS estimation of equation 1, corrected for heteroskedastic errors. Overall, the relationship between NB and PL promotions is significantly competitive, in that promotions are more likely to overlap across labels than we would expect given independence. None of the time period binaries are statistically significant, although the negative sign of the binary for four weeks suggests that promotional interaction trails off after time.

Table 6.5: GLS Results for the Estimation of Model 1

	Coefficient	**T-statistic**
Intercept	0.0705***	2.75
Lag1Week	0.0185	1.58
Lag2Weeks	0.0201	1.57
Lag3Weeks	0.0018	0.16
Lag4Weeks	-0.0096	-0.85
Storable	0.0578***	9.20
StoreLag1	0.0251	1.20
StoreLag2	0.0176	0.69
StoreLag3	0.0106	0.53
StoreLag4	-0.0096	-0.48
NB	0.0110	1.27
Herfindahl	-0.6199***	-4.52
WalShare	-0.0014***	-3.59
MHI	0.0026***	6.16
Online	-0.0030	-0.38
F	16.11***	
Adj. R^2	4.72	
N	3,357	

***: Coefficient is significant at the 0.01 level. **: At the 0.05 level. *: At the 0.10 level.

Promotional competition is six percent stronger, overall, for storable products. All of the interactions between lag lengths and the storable binary are insignificant. Just as with non-storable products, the contemporaneous case features promotional competition as strong as that observed when allowing for responses across brands. While supermarket chains have less

incentive to respond to competitors' promotions on storable products due to stockpiling, supermarket managers are able to intentionally promote NBs and PLs simultaneously in order to limit cannibalization and brand switching which may harm PL market share. Therefore the incentive exists to compete more, rather than less, fiercely on storable products in this setting.

In perhaps the most counterintuitive result in table 6.5, the coefficient on NB is insignificant, meaning that there is no significant difference between NB responses to PL promotions or PL responses to NB promotions. Given that retailers have several incentives to offer and promote PLs and that NB promotions typically results in more brand switching away from PLs than the converse, I expected this coefficient to be positive and significant. The most plausible explanation of this finding goes hand-in-hand with the explanation of the finding with respect to storability. Namely, that retailers are most careful to promote PLs at the same time as key NB substitutes in order to minimize brand switching and maintain PL market share.

Market concentration, as measured by the Herfindahl, has a strong and significant negative effect on NB/PL promotional competition. This finding is in line with expectations, as increased concentration tends to lead to significantly higher NB prices, which increases the NB/PL margin and reduces retailers' incentives to promote PLs competitively relative to NBs. The presence and market share of Wal-Mart has a small but significant negative effect on NB/PL competition. This may be attributed to the fact that supermarkets offer fewer promotions overall when competing with Supercenters. Median household income has a small but significant positive effect on NB/PL competition. This finding runs contrary to ex ante expectations and may reflect the ongoing effort on the part of retailers to improve the quality and penetration of PLs. PLs are likely to sell strongly in cities with relatively low incomes, and therefore

supermarket managers today may be engaging in stronger efforts to coordinate promotions in order to maximize PL sales in areas of higher income.

In sum, the GLS results indicate that the nature of the interaction between NB and PL promotions is competitive rather than accommodating. Steiner noted that competition between NBs and PLs within product categories is optimal for social welfare. The results support the notion that retailers are aware of the fact that NB promotions, while effective for a number of competitive objectives, can be harmful to PL sales. Across the entire supermarket, PL promotions are significantly more likely to be in sync with NB promotions than we would expect if the two labels were priced and promoted independently of each other.

The National Brand/Private Label Price and Promotional Margins

This study expands the literature on the National Brand/Private Label price margin in two key ways. First, it uses a data set of significantly wider scope than any previously used in the topic of NB/PL food retail. Second, it examines the margin and its principal determinants in today's food retailing environment, in which PLs have approached NBs in terms of quality, exist in nearly all product categories throughout the supermarket, and continue to gain market share relative to NBs across the country. In this section I also examine the determinants of the differences between NBs and PLs in terms of promotional activity.

The NB/PL margin is useful for a number of reasons. From the viewpoint of consumers, it is fundamental in quantifying the savings that can be achieved by purchasing PLs rather than NBs. From the viewpoints of retailers and researchers, price margin can be very illustrative in understanding the success of PLs within product categories. In their review of the literature on PLs, BBR noted that researchers have found a link between PL market share and the NB/PL

price margin, across product categories. Higher PL markets are associated with smaller NB/PL margins. While this may seem counterintuitive given that small price differences across labels have been shown to result in consumers selecting NBs, it's important to understand that over time the brand equity of PLs will increase if quality is high enough relative to NB substitutes. Therefore when supermarket prices reflect consumers' understanding of the quality of products within categories, an equilibrium is reached wherein high-quality (low-quality) PLs have high (low) sales and are priced accordingly, resulting in lower (higher) NB/PL margins.

A cross-category analysis of the NB/PL margin that controls for a number of likely predictors of supermarket prices can shed light on areas in the supermarket where PLs are performing strongly today and where they have gained ground in the last two decades. Moreover, comparisons of the NB/PL margin with PL sales can highlight where supermarkets have the potential to improve their category management and profitability. If PLs are underperforming in product categories with relatively low NB/PL margins, then PL sales would likely benefit from increasing the margin. Alternatively, PL sales would be less likely to suffer and profits would increase from increasing the PL price in categories featuring strong PL sales and relatively high NB/PL margins.

Given that price promotions, redeemable with club cards, constitute a major determinant of the prices that consumers pay in conventional supermarkets, any thorough examination of the differences between NBs and PLs must also account for promotional activity. Promotions are typically defined and described by two key attributes, their frequency and depth. Therefore the econometric analysis in this section measures the magnitude and key determinants of the differences between NBs and PLs in terms of promotional frequency. The NB/PL promotional

frequency and depth margins have the potential to offer insights into the overall strategies of supermarket managers with respect to category management.

The estimation strategy with respect to NB/PL margins assumes that retailers set prices and promotions simultaneously, a notion confirmed by the fact that both Safeway and Albertsons roll out new prices and promotions on a storewide basis once per week. Therefore the shelf price, the promotional status, and the depth of the promotion if enacted are all decided simultaneously for products within stores. Therefore I model the shelf price margin, the promotional frequency margin, and the promotional depth margin across NBs and PLs as being jointly endogenous. Many of the principal determinants of the NB/PL margins, as suggested by the literature, are also relevant in this estimation. However one important addition to the model construction in this section is the NB promotional frequency. Several studies (BBF, Jedidi, Mela, and Gupta, 1999) have shown that high promotional frequency for NB products can diminish brand equity relative to competing brands in the long run and in turn lower shelf prices. Therefore NB promotional frequency is used as an explanatory variable in the NB/PL price margin equation.

Formally, the shelf price difference for NB/PL product pairing *i* in city *j* is given by:

$$(2) \quad ShelfDif_{i,j} = \beta_0 + \beta_1 Safeway_i + \beta_2 Herf_{i,j} + \beta_3 WalShare_{i,j} + \beta_4 MHI_{i,j} + \beta_5 NBFreq_{i,j} + \beta_6 Select_i + \beta_7 NumNB_{i,j} + \beta_8 Online_i + \boldsymbol{\beta_D Depts} + u_{i,j}$$

where the dependent variable, *ShelfDif*, is the percentage difference in average NB shelf price and average PL shelf price for the product pairing *i* in city *j*, over the entire time series. That is,

$$ShelfDif_{i,j} = \frac{\overline{NB\ Shelf\ Price}_{i,j} - \overline{PL\ Shelf\ Price}_{i,j}}{\overline{NB\ Shelf\ Price}_{i,j}}$$

Given that a single PL product can be paired up with multiple NB substitutes within categories, the dataset used to estimate equation 2 contains one unique observation per NB product and city.

Select is a binary equal to one if the PL product in pairing *i* bears the Safeway SELECT label, which the firm uses to differentiate its high-quality PLs from its standard PLs, which bear only the Safeway name. SELECT products are uniformly more expensive than standard PL substitutes, yet still cheaper than NBs. Equation 2 also includes a vector of departmental binaries to account for and measure department-specific characteristics across the supermarket. Given that the promotional frequency is a simple function of the number of times retailers place a given item on promotion, *NBFreq* is endogenous to this model. Therefore the estimation strategy for equation 2 must account for this right-hand-side endogenity.

The promotional percentage differences between NBs and PLs for product pairing *i* in city *j* are given by:

(3) $$FreqDif_{i,j} = \gamma_0 + \gamma_1 Safeway_i + \gamma_2 Herf_{i,j} + \gamma_3 WalShare_{i,j} + \gamma_4 MHI_{i,j} + \gamma_5 Select_{i,j} + \gamma_6 NumNB_{i,j} + \gamma_7 Online_i + +\boldsymbol{\gamma_D Depts}\, e_{i,j,t}$$

(4) $$DepthDif_{i,j} = \delta_0 + \delta_1 Safeway_i + \delta_2 Herf_{i,j} + \delta_3 WalShare_{i,j} + \delta_4 MHI_{i,j} + \delta_5 Select_{i,j} + \delta_6 NumNB_{i,j} + \delta_7 Online_i + +\boldsymbol{\delta_D Depts}\, v_{i,t}$$

where *FreqDif* and *DepthDif* are the percentages differences between NB and PL promotional frequency and promotional depth, respectively, for product match *i* at time *t.* Table 6.6 provides selected summary statistics for the variables pertinent to equations 2, 3, and 4 that were not discussed in detail above with respect to promotional interaction. It is interesting to note that the average difference in mean shelf and promotional prices are closer to the 30 percent benchmark found by ANG (2001) than are the figures reported in table 6.1. The values in table 6.1 were calculated across all observations, therefore giving more weight to those products available consistently throughout the time series. The higher margins in table 6.6 suggest that NB/PL price differences are higher among seasonal, niche, and fringe products.

Table 6.6: Summary Statistics for Variables Used in Equations 2, 3, and 4.

Variable	Units	Mean	St. Deviation	Minimum	Maximum
MeanShelfDif	%	0.272	0.135	0.001	0.927
MeanPromoDif	%	0.305	0.140	0.001	0.921
Number NBs	Count	9.100	4.616	1.000	20.000
NB Frequency	%	0.467	0.292	0.000	1.000
FreqDif	%	-0.170	0.296	-1.000	1.000
DepthDif	%	0.007	0.120	-0.584	0.590

The optimal estimation strategy for equation 2 must account for the right-hand-side endogeneity stemming from the inclusion of the *NBFreq* variable. Even though the sample size for these regressions is large (n > 30,000), a systems approach for equations 2, 3, and 4 can yield efficiency gains by accounting for covariances across the error terms of the equations. Two estimation strategies that meet the criteria of correcting for regressor endogeneity and accounting for error term covariances are three-stage least squares (3SLS) and generalized method of moments (GMM).

One potential shortcoming of the 3SLS regression method is that it assumes no heteroskedasticity within the error covariance matrix. The general White test performed on ordinary least squares estimations of equations 2, 3, and 4 indicated the possibility of heteroskedasticity among the error terms, suggesting that the standard errors of the 3SLS results may be biased and inconsistent. Therefore rather than using a 3SLS systems approach I estimate equation 2 using two-stage least squares (2SLS), corrected for heteroskedasticity, and equations 3 and 4 using GLS with White's corrected standard errors. The weighting matrix of the GMM estimation uses White's correction for heteroskedasticity and therefore allows for the three equations to be estimated as a system in order to achieve potential efficiency gains. Table 6.7 reports the results of estimating equation 2 using heteroskedasticity-corrected 2SLS and GMM.

Table 6.7: 2SLS and GMM Results for Equation 2, the Determinants of the NB/PL Shelf Price Margin.

	2SLS	**GMM**

	Coefficient	T-statistic	Coefficient	T-statistic
Intercept	0.2943***	51.88	0.2857***	30.86
Baby	0.1848***	16.33	0.1756***	12.56
Baking & Cooking	-0.0527***	-12.25	-0.0540***	-5.63
Boxed Dinners	0.0394***	6.18	0.0330***	3.03
Beverages	0.0519***	17.32	0.0474***	6.09
Breakfast Foods	-0.0018	-0.32	-0.0005	-0.06
Canned Goods	-0.0051	-1.48	-0.0012	-0.15
Condiments	-0.0375***	-11.40	-0.0360***	-4.26
Coffee & Tea	-0.0280***	-7.62	-0.0134*	-1.69
Dairy	-0.0222***	-7.11	-0.0314***	-4.26
Salad Dressing	-0.0693***	-17.34	-0.0815***	-11.10
Frozen Food	0.0095***	2.70	0.0117	1.47
General Merchandise	0.2383***	6.31	0.2435***	37.70
Meat & Seafood	0.0182**	2.30	0.0086	0.68
Packaged Bread	0.0667***	11.78	0.0762***	7.10
Produce & Floral	0.0084	0.73	-0.0284	-0.93
Soup & Chili	-0.0136***	-3.32	-0.0118	-1.20
Snack	0.0250***	-6.56	-0.0198**	-2.44
Safeway	0.0139***	7.48	0.0125***	3.41
Herfindahl	0.0372*	1.73	0.0367*	1.66
Wal-Mart	-0.0000	-0.57	0.0000	0.11
MHI	0.0000	0.38	0.0000	0.52
PromoFreq	-0.0736***	-26.21	-0.0596***	-9.32
Select	-0.0648***	-26.11	-0.0566***	-11.22
Number NBs	-0.0003*	-1.79	-0.0005	-1.26
Online	-0.0009	-0.60	-0.0006	-0.40
Adj. R^2	12.87		12.38	
N	30,215		30,215	

***: Coefficient is significant at the 0.01 level. **: At the 0.05 level. *: At the 0.10 level.

While there are differences across estimation methods in terms of the t-statistics, there is very little difference between the 2SLS and GMM results with respect to the signs and magnitudes of the coefficients. The reference department in this estimation is spices and seasonings, and the results indicate that there are highly significant differences across departments in the NB/PL margin. The highest overall margins are seen the non-food departments of general merchandise and baby care. Among the food departments, margins are widest for beverages and packaged bread. Margins are thinnest among condiments, salad toppings, and coffee. Keeping in mind the argument that NB/PL price margins can be indicative

of quality differences, cola has been cited by *Consumer Reports* as a product for which PLs fall short of NBs in quality, while PL ketchup has regularly tied or even bested NB ketchup in blind taste tests.

Margins are over one percent wider at Safeway, when considering only the Safeway flagship brand of PLs. The margin falls by approximately six percent when considering Safeway's SELECT line of products, which provides interesting insights into the pricing strategies of a chain with vertically differentiated PLs. Prices, overall, are slightly higher at Albertsons. Therefore the results suggest that Safeway prices its standard brand of PL products lower than its NBs, relative to Albertsons' single PL brand, though it prices its SELECT line far more competitively with NBs. Safeway advertises its SELECT brand as being of higher quality than its standard store brand. Ten percent of the Safeway PL products sampled in this analysis are of the SELECT label.

NB promotional frequency reduces the NB/PL, as expected. A one percent increase in NB promotional frequency is associated with a decrease in the margin between six and seven percent. This finding supports the notion that the brand equity for heavily promoted NB products may be reduced in the long run, leading consumers to have lower perceptions of quality or value and thereby closing the NB/PL margin. The effect of the total number of NB substitutes in product categories is significant according to the 2SLS results and insignificant, but by either estimation method the effect is less than one hundredth of a percent, indicating that this is not an important determinant of NB/PL margins. As shown in figure 6.1 above, the number of NBs by category is associated with increased promotional activity, but this does not translate into a significant change in the price margin across labels.

Among market condition and demographic variables, only market concentration as measured by the Herfindahl Index is significant. A one percent increase in the Herfindahl Index is associated with an approximately 3.6 percent increase in the NB/PL margin, indicating that the price gap is wider in more concentrated cities, another finding in line with expectations. The market share of Wal-Mart and income do not significantly affect the margin, nor does the presence of two retailers engaging in online retail.

Figure 6.3 shows the expected NB/PL shelf price margin at conventional supermarkets, by department and averaged across chains, using the 2SLS results. Each expectation is taken at the average of the continuous explanatory variables and the Safeway SELECT label was not included in the calculations. The non-food departments of baby care and general merchandise, which feature few PL products relative to most other departments, have NB/PL shelf price margins around 45 and 50 percent, respectively. Boxed dinners, beverages, packaged breads, and snacks all hover around the 30 percent mark determined by ANG (2001). The remainder of the departments have expected margins significantly below 30 percent, providing further evidence that PLs are closing the gap with NBs in terms of quality and price.

Figure 6.3: Expected National Brand/Private Label Price Margin, by Department.

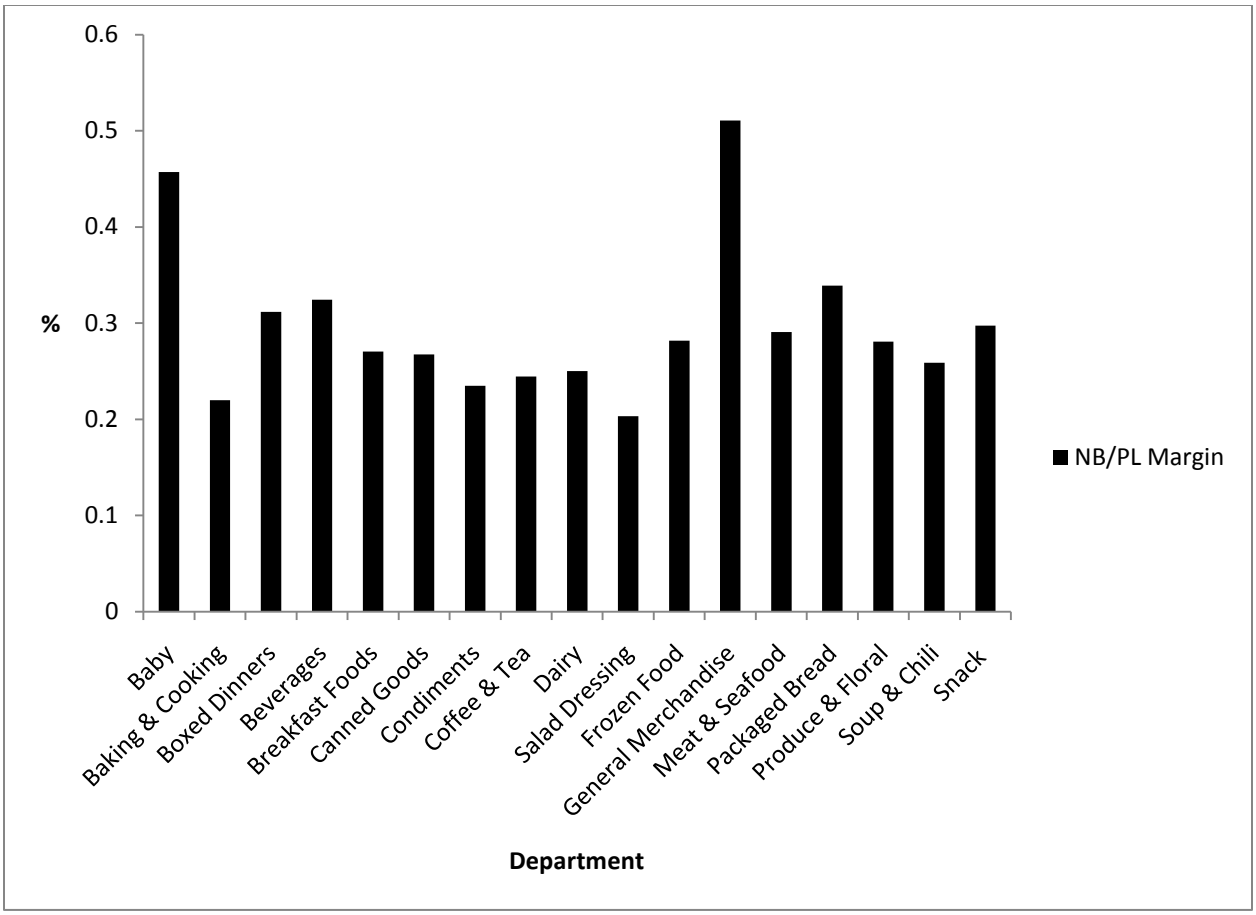


Table 6.8 reports the results of estimating equations 3 and 4 using GLS and GMM. Among the frequency and depth equations there is somewhat more divergence between the coefficient estimations across methods than seen above for price margins, but the two specifications tell very similar stories. Overall, the promotional frequency for PLs is higher than it is for NBs by a wide margin, though promotional depth is significantly higher for NBs by a slimmer margin and is actually lower for several departments. The departmental binaries reveal significant variation throughout the supermarket for both equations.

Table 6.8: GLS and GMM Results for Equations 3 and 4, the Determinants of NB/PL Differences in Promotional Activity.

	GLS		**GMM**	
	Frequency	Depth	Frequency	Depth
Intercept	-0.2093***	0.0304***	-0.2447***	0.0226***

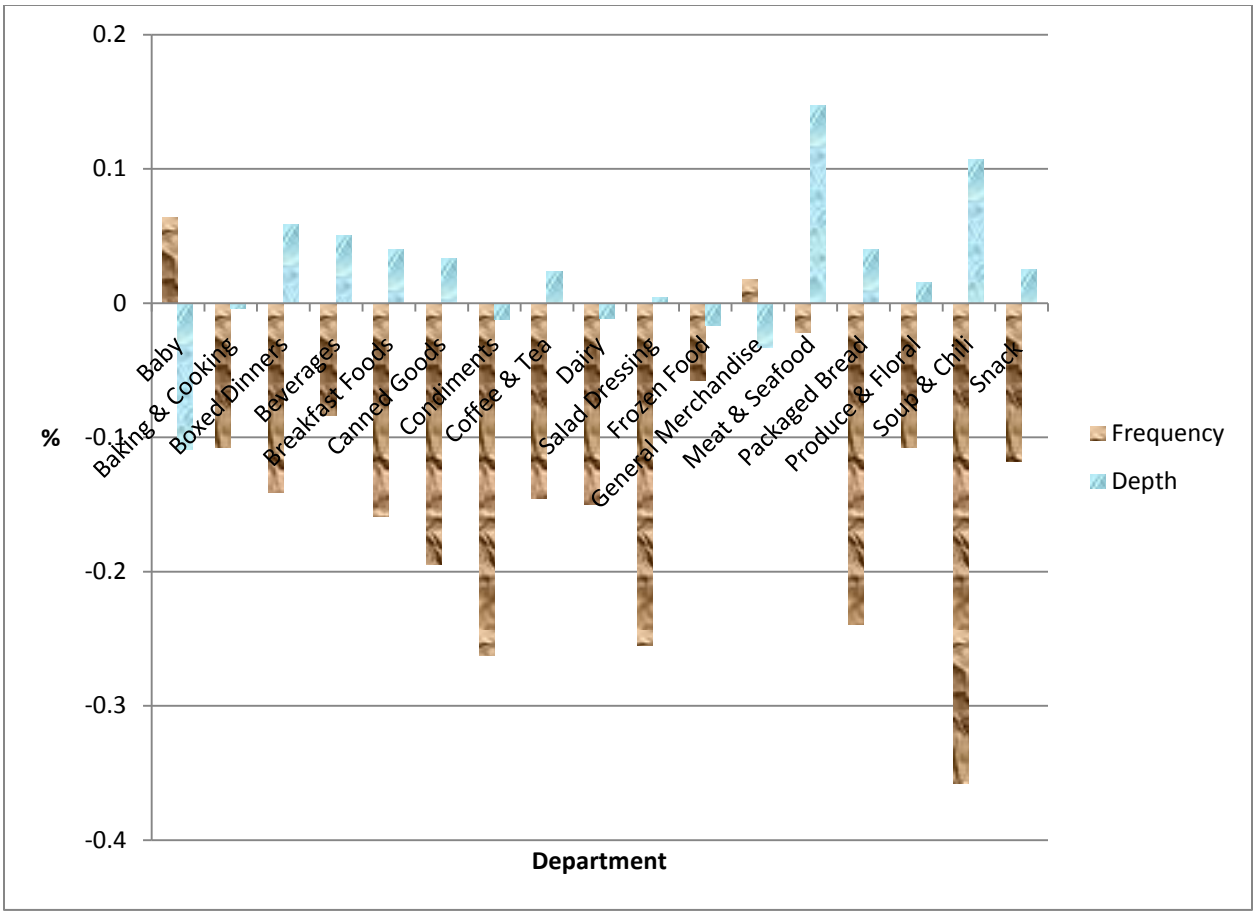
	(-17.56)	(6.21)	(-12.85)	(2.94)
Baby	0.2468***	-0.1401***	0.2569***	-0.1375***
	(10.21)	(-14.06)	(5.56)	(-5.45)
Baking & Cooking	0.0752***	-0.0352***	0.0750***	-0.0375***
	(8.20)	(-9.32)	(4.22)	(-4.88)
Boxed Dinners	0.0416***	0.0272***	0.0140	0.0226**
	(3.05)	(4.85)	(0.36)	(1.98)
Beverages	0.0992***	0.0192***	0.1519***	0.0216***
	(15.74)	(7.39)	(11.16)	(4.03)
Breakfast Foods	0.0239**	0.0086*	0.0010	0.0082
	(1.97)	(1.71)	(0.04)	(0.82)
Canned Goods	-0.0121*	0.0025	-0.0274	0.0082
	(-1.63)	(0.82)	(-1.59)	(1.18)
Condiments	-0.0799***	-0.0430***	-0.1016***	-0.0475***
	(-11.41)	(-14.03)	(-6.59)	(-8.16)
Coffee & Tea	0.0370***	-0.0074**	0.0192	-0.0270***
	(4.71)	(-2.29)	(1.21)	(-3.40)
Dairy	0.0327***	-0.0428***	0.1101***	-0.0465***
	(5.02)	(-15.96)	(7.47)	(-9.38)
Salad Dressing	-0.0723***	-0.0268***	-0.0561***	-0.0198**
	(-8.48)	(-7.64)	(-3.41)	(-2.25)
Frozen Food	0.1249***	-0.0481***	0.2054***	-0.0424***
	(17.27)	(-16.12)	(13.13)	(-6.60)
General Merchandise	0.2007***	-0.0644*	0.1785***	-0.0701***
	(2.49)	(-1.94)	(14.61)	(-15.07)
Meat & Seafood	0.1611***	0.1164***	0.1437***	0.1232***
	(9.54)	(16.72)	(5.36)	(8.51)
Packaged Bread	-0.0568***	0.0086*	-0.0972***	0.0039
	(-4.70)	(1.74)	(-4.56)	(0.38)
Produce & Floral	0.0752***	-0.0159	-0.0079	-0.0175
	(3.02)	(-1.55)	(-0.12)	(-0.65)
Soup & Chili	-0.1750***	0.0757***	-0.2978***	0.0672***
	(-31.79)	(21.22)	(-19.38)	(8.49)
Snack	0.0645***	-0.0057*	0.0662***	-0.0041
	(7.94)	(-1.69)	(3.22)	(-0.57)
Safeway	0.0047	-0.0304***	0.0498***	-0.0248***
	(1.17)	(-18.60)	(6.09)	(-7.47)
Select	-0.0041	0.0131***	-0.0183*	0.0067
	(-0.77)	(6.01)	(-1.68)	(1.35)
Number NBs	0.0018***	-0.0007***	0.0026***	0.0003
	(5.01)	(-4.28)	(2.92)	(0.80)
Herfindahl	0.0150	0.0139	0.0668	0.0271
	(0.33)	(0.73)	(1.35)	(1.35)
Wal-Mart	-0.0002	-0.0000	-0.0001	0.0000
	(-1.03)	(-0.25)	(-0.40)	(0.17)
MHI	0.0002	0.0001	0.0002	0.0002**

	(1.03)	(1.56)	(1.21)	(2.35)
Online	0.0065**	0.0021*	0.0056*	0.0029**
	(2.04)	(1.64)	(1.68)	(2.07)
Adj. R^2	11.20	10.39	7.18	9.47
N	30,215	30,215	30,215	30,215

***: Coefficient is significant at the 0.01 level. **: At the 0.05 level. *: At the 0.10 level.
Heteroskedasticity-corrected standard errors are in parentheses.

The promotional frequency margin is somewhat higher and the promotional depth margin is lower at Safeway stores, but these are figures to watch closely as the chain continues to roll out its EDLP program. Under EDLP, the difference in promotional frequency or depth between NBs and PLs would be expected to be close to zero as promotional activity would be minimal for all products. The number of NB substitutes widens the frequency margin only slightly, by less than one hundredth of one percent, though this effect is statistically significant. Overall the demographic and market condition variables are insignificant in explaining the frequency and depth margins, indicating that differences between NBs and PLs in terms of promotional activity are determined primarily by departmental characteristics as well as efforts on the part of retailers to increase PL market share. Figure 6.4 reports the expected promotional frequency and depth margins, by department, based on the results of estimating equations 3 and 4.

Figure 6.4: Expected National Brand/Private Label Promotional Frequency and Depth Margins, by Department



As before with the expected price margins, the promotional margins are taken at the means of the continuous explanatory variables and averaged across chains, using the coefficients from the GLS regressions. The negative values for the frequency margin indicate that promotional frequency is considerably higher for PLs than NBs for most departments, most strikingly for the coffee and tea, general merchandise, packaged bread, and soup and chili departments. The margins for promotional depth are considerably smaller in magnitude, and for most departments promotional depth is greater for NBs than it is for PLs. In the meat and seafood as well as soup and chili departments, the margin exceeds 10 percent, but for most other departments the NB promotions are deeper by five percent or less.

Conclusions

Using a unique and rich data set of prices and promotions spanning over 250 product categories at the Safeway and Albertsons chains, this study provides insights into several research questions pertaining to NBs and PLs. Overall, the results suggest that PLs have become significant components in the competitive toolbox of supermarket managers. The price margin between NBs and PLs has fallen significantly below prior estimates in the literature, indicating that PLs are increasing in both quality and market share relative to NBs within product categories. PLs are subject to a pricing strategy previously unseen in the economic and marketing literature in that certain PL products are on promotion virtually constantly. This phenomenon is more likely to occur in product categories with a large number of competing NB brands, suggesting that in many cases PLs are being priced and promoted to maximize penetration.

The contingency analysis indicates that competition between NBs and PLs in terms of promotional timing is significant in that close NB and PL substitutes are considerably more likely to be on promotion simultaneously than would be expected if they were priced independently. In general such a practice does not conform to standard category management on the part of food retailers and provides further evidence that managers are seeking to maximize sales of PLs relative to NBs.

The pricing and promotional margins between NBs and PLs vary widely across supermarket departments. Market concentration and NB promotional frequency are important determinants of the NB/PL price margin but demographics and market conditions have very little explanatory power for differences in promotional frequency and depth. For the most part, PL products are promoted much more often than are comparable NB products, while NB promotions are slightly deeper than PL promotions.

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Appendix 6.A: The Cities Sampled

City	Zip Code	Chain	Population	Median Household Income ($)
Boise, ID	83705	Albertsons	185,787	42,432
Palm Springs, CA	92262	Albertsons	42,807	43,800
Salt Lake City, UT	84101	Albertsons	178,858	37,287
Los Angeles, CA	90023	Both	3,849,378	42,667
Las Vegas, NV	89103	Both	478,434	47,863
Portland, OR	97213	Both	537,081	42,287
San Diego, CA	92114	Both	1,256,951	55,637
Seattle, WA	98101	Both	582,424	49,297
Vancouver, WA	98660	Both	158,855	40,743
Sacramento, CA	95815	Safeway	453,781	44,867
San Jose, CA	95113	Safeway	929,936	70,291
San Francisco, CA	94102	Safeway	744,041	57,496
Washington, DC	20001	Safeway	581,531	47,221
Tucson, AZ	85701	Safeway	518,956	34,241
Philadelphia, PA	08026	Safeway	1,448,394	32,573
Baltimore, MD	21075	Safeway	631,366	32,456
Fresno, CA	93650	Safeway	466,714	37,800