Private Label Products and Consumer Income: Is There a Curvilinear Relationship?

Eugene Jones[⊕][a]

[a]*Associate Professor, Agricultural, Environmental and Development Economics, Ohio State University, 2120 Fyffe Road, Columbus, OH 43210, USA Phone:614-292-3543 Email: jones.73@osu.edu*

Abstract

Supermarket scanner data are analyzed for five product categories across three income groups to test the premise of a curvilinear relationship between income and private labels (PLs). The three income groups are lower–, moderate–, and higher-income consumers and the premise tested is that moderate-income consumers are far more inclined to purchase PLs than lower– and higher–income consumers. The five product categories selected for this study are: butter and margarine; frozen potatoes; ice cream; jams, jelly and peanut butter; and yogurt. Statistical results derived for these product categories offer no support for a curvilinear relationship between income and PLs. Lower-income consumers are shown to be more prone to purchase PLs than moderate– and higher-income consumers across all product groups.

Keywords: scanner data, lower-income, moderate-income, higher-income, curvilinear relationship, private labels, national brands

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[⊕]Corresponding author

Introduction

In a meta-analysis review of fifty-four papers that address purchases of private-label (PL) products, Sethuraman and Gielens (2014) conclude that these papers offer limited to no support for an inverse relationship between PL purchases and income. Indeed they conclude that these papers support the premise of a curvilinear relationship between PLs and income. Further, other researchers have published papers that support the premise of a curvilinear relationship between PLs and income (Dick et al. 1995; Fitzell 1992; Erdem and Keane 1996; Sinha and Batra 1995). Simply expressed, this relationship states that moderate-income consumers are inclined to purchase large shares of PLs, while higher– and lower-income consumers are inclined to purchase small shares. This purported purchase pattern is partly explained by factors such as household education, product familiarity, product image, perceived risk, perceived quality variability, and quality sensitivity (Sethuraman and Gielens 2014). In essence, lower-income consumers are more price-sensitive than moderate and higher-income consumers but all of the aforementioned factors serve to lessen the effects of income, thereby generating a curvilinear relationship between PLs and income (Dick et al. 1995; Fitzell 1992; Sethuraman and Gielens 2014; Erdem and Keane 1996; Sinha and Batra 1995).

The primary objective of this paper is to test the premise of a curvilinear relationship between income and PLs. This relationship is of interest to this researcher because of previous research conducted on consumer purchases across income groups has offered no support for this premise (Jones 2015; 2014; 2010). Yet, because previous work has focused on just two income groups, higher– and lower-income consumers, this premise could not be dismissed with absolute certainty. That is, there is the possibility that a more refined accounting of income groups could reveal different results. As such, this study tests the curvilinear premise by utilizing supermarket scanner data for five product groups across three income groups: higher–, moderate– and lower. These data are collected for 87 weeks over calendar years 2013–2014 and the product groups are: butter and margarine; frozen potatoes; ice cream; jams, jelly and peanut butter; and yogurt. These groups are selected because products within them not only have strong appeal to all consumers but they are purchased frequently by all households. In short, they are products for which weekly observations are available for households across all income groups. Census tract data from the 2010 U.S. census are used to identify income groups.

Socioeconomic Characteristics for Income Groups

Since the primary objective of this study is to test whether a curvilinear relationship exists between income and private labels, it is imperative that consumers be selected from a wide range of incomes. To this end, data used for this study are collected from six supermarket stores that serve higher–, moderate– and lower-income consumers. The six stores are not only owned by a single supermarket chain but they are all within a single pricing zone, meaning identical prices across all stores. Census data for 2010 are used to identify store selections and these data are shown in Table 1. These data describe residents who live within a three-mile radius of each store, as researchers have confirmed that most consumers confine their shopping to this limited area (Drewnowski et al. 2012). From the three groups of stores identified in Table 1, it can be seen that major differences exist in household and family incomes. For example, median family income averages $137,000 for shoppers surrounding the two higher-income stores; averages

$75,000 for shoppers surrounding the two moderate-income stores; and averages $43,000 for shoppers surrounding the two lower-income stores. These sharp differences in income offer strong support for segmenting consumers into the respective groups.

Table 1. Socioeconomic Characteristics for Residents within Three Income Areas.

Store Type	Population	Median HI	Median FI	% Pop >25 College Grad	% Pop in Poverty
High Income					
Store 1	15,403	103,793	126,414	66.2	4.5
Store 2	21,338	128,950	147,719	76.1	2.7
Moderate Income					
Store 1	27,309	71,884	80,220	28.0	5.1
Store 2	20,991	64,548	69,900	32.7	5.9
Low Income					
Store 1	21,802	33,818	39,651	15.6	28.1
Store 2	26,775	44,389	47,183	23.8	21.4

Notes. [1] Data taken from the 2010 Census Tract Survey for Franklin County, Ohio. Income is expressed in 2012 inflation adjusted dollars. [2] HI is household income. FI is family income.

Other variables in Table 1 that offer support for segmenting three groups of consumers include statistics identifying college graduates and population in poverty. As shown, 71% of residents above 25 who live within higher-income areas have obtained a college education. By contrast, this percentage is 30.3% for moderate-income consumers and just 19.7% for lower-income ones. Further, a much lower percentage of residents within higher income areas are living in poverty, as compared to residents in moderate– and lower-income areas. Specifically, 3.6% of higher income residents live in poverty, as compared to 5.5% and 24.8% respectively for moderate– and lower income residents. In short, these data support the justification for identifying this study as one that comprises three, distinct income groups.

Empirical Estimation and Results

A page limitation for this article limits the discussion in this section to a subset of the econometric results derived from the full dataset. A seemingly unrelated regression (SUR) model is estimated for a total of forty product groups across six stores. Product groups for ice cream were the largest, with eight national brands, two private label brands (regular and premium), and a few smaller national brands combined into a single product group. The next largest product groups of national and private label brands were: yogurt, with ten; jams, jelly and peanut butter, with nine; butter and margarine, with eight; and frozen potatoes, with two. As hypothesized, all own-price elasticities were negative and statistically significant, most at the .01 level. Further, more than eighty percent of the expenditure elasticities were positive and statistically significant at the .01 level. In short, the SUR models performed well for all product groups, providing R^2's that ranged from .59 to .92.

Since a key objective of this research is to test the hypothesis that a curvilinear relationship exists between income and private label products, results derived for this test are the primary focus of this section. A secondary focus is the responsiveness of consumers to purchases of PLs as relative prices change for NBs and PLs (pNB-pPL). For this secondary section, the discussion is

limited to two product groups: ice cream and yogurt. As shown in Table 2, results from this study do not support the premise of a curvilinear relationship between income and PLs. For the five product categories shown in the top portion of the table, moderate income consumers clearly purchase more PLs than higher-income consumers, with butter and margarine being an exception. While these results are consistent with one part of the hypothesis, results in the bottom portion of Table 2 clearly contradict the premise of a curvilinear relationship between PLs and income. That is, consumption of PLs does not turn downward as income declines. Indeed consumption accelerates quite sharply, especially when the subset of products lower-income consumers purchase is expanded to include lower-priced NBs. This expanded subset explains the statistically insignificant Z tests for butter and margarine, and yogurt.

Table 2. Statistical Tests of a Curvilinear Relationship between Income and Private Label Products.

Products	Obs.	Moderate Income				Higher Income				Z-Tests Mean Dif.
		Store 1		Store 2		Store 3		Store 4		
		Mean	STD	Mean	STD	Mean	STD	Mean	STD	Z-Value
Butter & Margarine	87	0.3662	0.0680	0.3585	0.0757	0.3551	0.0604	0.3750	0.0676	-0.184
Frozen Potatoes	87	0.6054	0.0360	0.5415	0.0393	0.4475	0.0368	0.4621	0.0377	14.773
Ice Cream	87	0.4607	0.0404	0.3422	0.0429	0.2874	0.0324	0.2917	0.0399	13.416
Jams, Jelly & Peanut Butter	87	0.4241	0.0438	0.3961	0.0369	0.3509	0.0316	0.3350	0.0279	8.928
Yogurt	87	0.1633	0.0161	0.1620	0.0159	0.1325	0.0108	0.1278	0.0096	11.578

Products	Obs.	Moderate Income				Lower Income				Z-Tests Mean Dif.
		Store 1		Store 2		Store 5		Store 6		
		Mean	STD	Mean	STD	Mean	STD	Mean	STD	Z-Value
Butter & Margarine	87	0.3662	0.0680	0.3585	0.0757	0.3286	0.0515	0.3548	0.0571	1.528
Frozen Potatoes	87	0.6054	0.0360	0.5415	0.0393	0.7199	0.0441	0.6521	0.0360	-13.509
Ice Cream	87	0.4607	0.0404	0.3422	0.0429	0.6605	0.0387	0.5469	0.0353	-23.986
Jams, Jelly & Peanut Butter	87	0.4241	0.0438	0.3961	0.0369	0.4603	0.0352	0.4818	0.0322	-7.682
Yogurt	87	0.1633	0.0161	0.1620	0.0159	0.1523	0.0148	0.1739	0.0194	-0.129

Two of the lowest-priced brands of margarine are Blue Bonnet and Country Crock and, as shown in Figure 1 and Figure 2, these brands represent large purchases for lower- and moderate-income consumers. Indeed prices of Blue Bonnet margarine are generally statistically insignificant from prices for PLs; and prices of Country Crock margarine are no more than two to three pennies higher per ounce than prices for PLs. As such, both brands have strong appeal to lower-income consumers. As shown in the figures, lower-income consumers purchase these NBs in far larger quantities than moderate– or higher-income consumers. Further, moderate-income consumers purchase them in far larger quantities than higher-income consumers and this behavior explains

the statistically insignificant Z-value of -.184 (Table 2). Similarly, the Z value of 1.528 reflects the strong preference that lower-income consumers have for lower-priced NBs of margarine. These results suggest that statistical analyses must go beyond parameter estimates and examine the finer details that are embedded in data. When lower-priced NBs are unavailable within a product group, then consumers express strong preferences for PLs, as shown for frozen potatoes, ice cream, and jams, jelly and peanut butter. To be clear, the results show that none of the five product groups offer support for a curvilinear relationship between income and PLs.
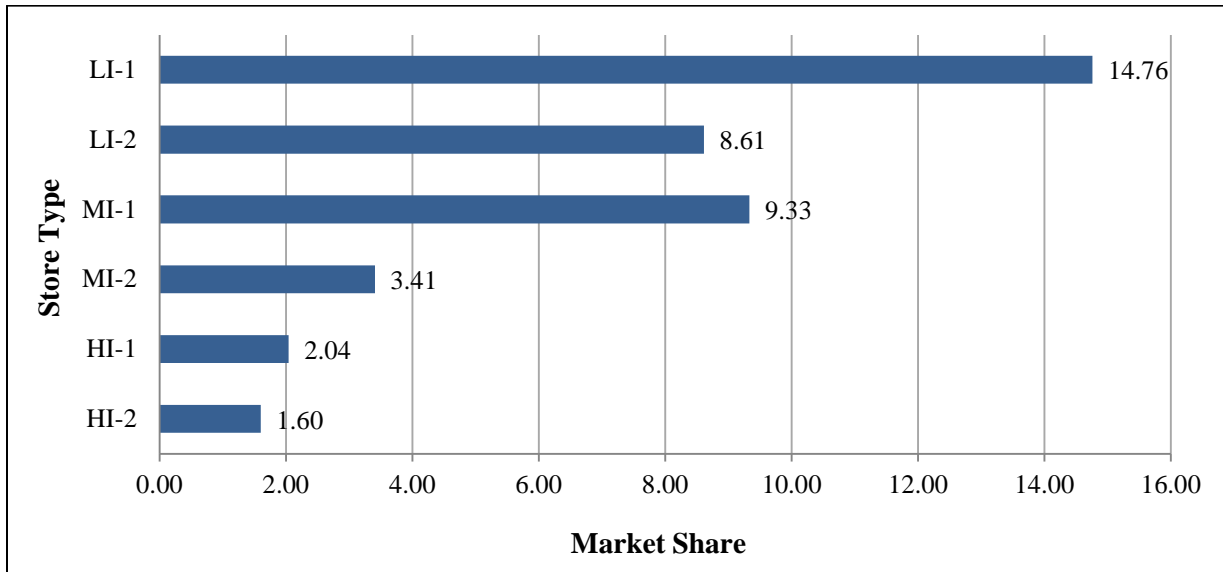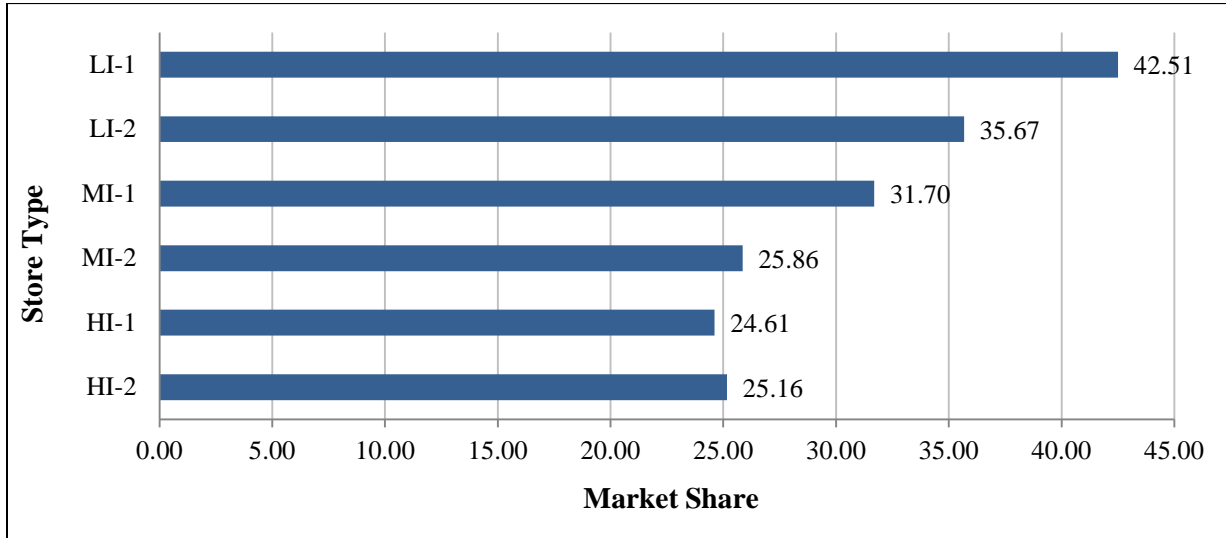

Figure 1. Market Shares of Lowest-priced National Brands of Margarine, Blue Bonnet.
Note. L1 and L2 are lower-income, M1 and M2 are moderate-income, H1 and H2 are higher-income.
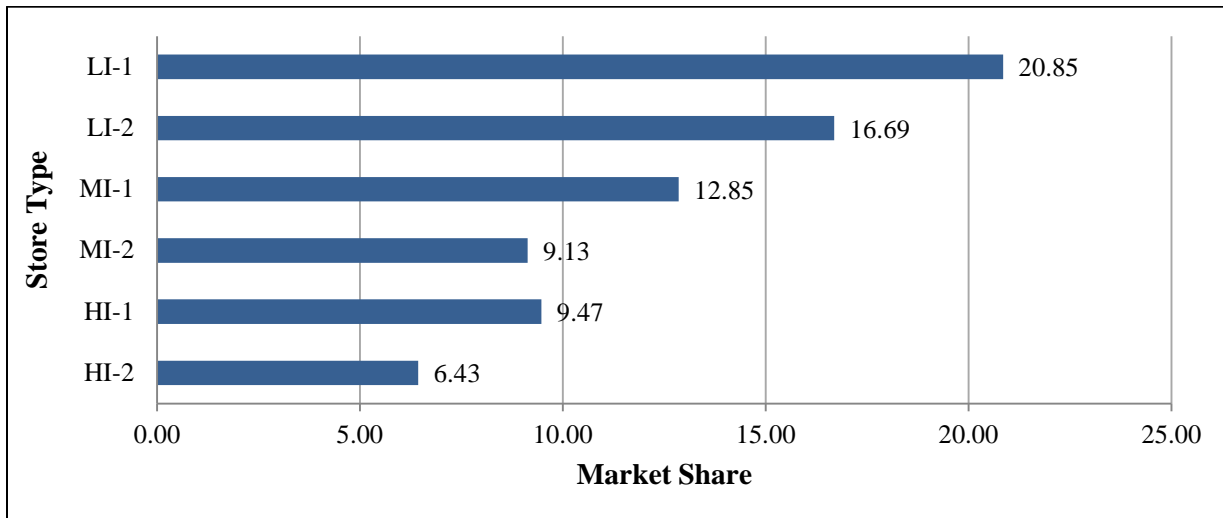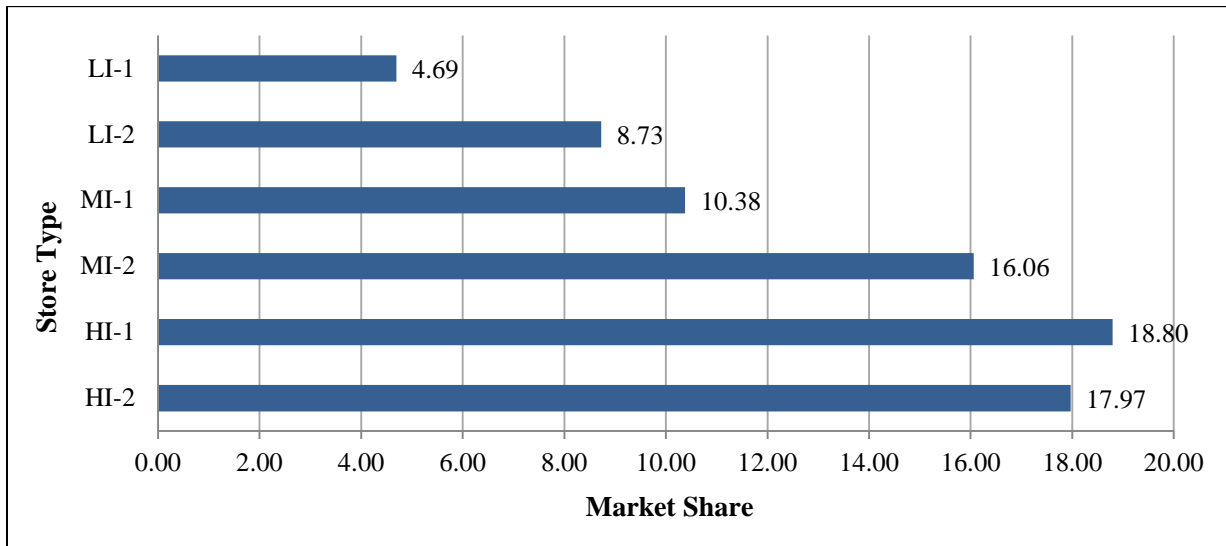

Figure 2. Market Shares of Lowest-priced National Brands of Margarine, Country Crook.
Note. L1 and L2 are lower-income, M1 and M2 are moderate-income, H1 and H2 are higher-income.

As shown in the bottom half of Table 2, no statistical difference exists in the purchase shares of PL yogurt for moderate– and lower-income consumers. By contrast, moderate-income consumers, as

expected, are shown to purchase far larger shares of PL yogurt than higher-income consumers. The unexpected small shares of PLs for lower-income consumers are easily explained by the purchased shares of Yoplait (Figure 3). Yoplait is a lower-priced NB of yogurt that is priced almost identical to the PL brand, especially during periods of price promotions. As evidence that lower-income consumers are attracted to Yoplait by its price, a comparison of consumer purchase behavior for Chobani, the highest-priced brand, is provided in Figure 4. As shown, lower-income consumers' purchased shares of Yoplait are nearly six times (5.82) as large as their purchased shares of Chobani. This suggests that lower-income consumers would purchase far larger shares of PL yogurt, in the absence of a lower-priced NB.

Figure 3. Market Shares for Lowest and Highest-priced NBs of Yogurt, Yoplait.
Note. L1 and L2 are lower-income, M1 and M2 are moderate-income, H1 and H2 are higher-income.

Figure 4. Market Shares for Lowest and Highest-priced NBs of Chobani Yogurt Market Shares.
Note. L1 and L2 are lower-income, M1 and M2 are moderate-income, H1 and H2 are higher-income.

A second hypothesis offered in the marketing literature is that PL shares are highly responsive to relative price changes for NBs and PLs, especially changes for leading national brands (Wang et al. 2007). For these analyses, PL quantity share is regressed against weighted price differences for all NBs and the regular PL brand of ice cream and yogurt. For both product categories, results are reported for just the top two NBs because retailers are supposedly more inclined to target leading national brands (Scott-Morton and Zettelmeyer 2004; Sayman et al. 2002). As shown in Table 3, the top two NBs of ice cream are Breyers and Edy's; for yogurt, these brands are Dannon and Yoplait. Market shares are reported for both NBs and PLs, as these shares provide insightful information for interpreting and understanding elasticity responses in the table.

Table 3. Market Shares and Price-Sensitivity Responses for Ice Cream and Yogurt by Brand

	Market Shares					
Ice Cream Brands	Higher Income Stores		Moderate Income Stores		Lower Income Stores	
	H1	H2	M1	M2	L1	L2
Bryers	13.05	11.83	12.20	11.52	8.62	10.01
Edy's	10.95	11.81	9.71	11.63	5.58	7.40
Private Label	28.95	28.59	45.94	33.98	65.90	54.52
	Price-Sensitivity Estimates					
Bryers	0.1514	0.1315	0.1267	0.1330	0.0601	0.0965
Edy's	0.1047	0.1399	0.0922	0.0922	0.0210	0.0765
Yogurt Brands	Market Shares					
Dannon	22.66	21.94	20.82	21.18	10.23	14.64
Yoplait	25.16	24.61	31.70	25.86	45.51	35.67
Private Label	12.74	13.23	16.27	16.13	15.11	17.24
	Price-Sensitivity Estimates					
Dannon	0.1949	0.1498	NSS	0.2573	NSS	NSS
Yoplait	0.1368	0.1560	0.2297	0.2253	0.2798	0.2065

Note. NSS = not statistically significant

Table 3 shows that there is a direct relationship between consumer price-sensitivity and income for two brands of ice cream. That is, with the share of PL ice cream as the dependent variable and price differentials as independent variables (pNB-pPL), higher-income consumers are shown to display more price-sensitivity toward the purchase of NBs than lower– and moderate-income consumers. On the surface, this finding seems counter-intuitive but a clearer picture is revealed when purchased shares of PLs are brought into the analyses. As shown in the table, shoppers within moderate– and lower-income stores purchase much larger shares of PLs and therefore they are less sensitive toward relative price changes (pNB-pPL). By contrast, shoppers of higher-income stores purchase larger shares of NBs and therefore relative price changes among the brands are more noticeable to them. In short, consumer price-sensitivity toward the purchase of PLs is a function of more than price differences between NBs and PLs. Specifically, consumers whose purchases consist mainly of PLs are less likely to respond to relative price changes than those who purchase smaller shares of PLs.

The bottom portion of Table 3 shows response rates for yogurt across income groups that are entirely different from those shown in the top portion of the table for ice cream. That is, there is an inverse relationship between price-sensitivity and income. A key difference between ice cream and yogurt is that PLs represent small shares for all income groups. Indeed the Yoplait brand represents a larger share than PLs for all income groups. As such, consumers are more aware of relative price changes between Yoplait and PLs and this leads lower-income consumers to express considerable price-sensitivity toward the purchase of PLs. For the second leading national brand of yogurt, Dannon, relative price changes between it and PLs do not generate a purchase response. This suggests that price changes for Dannon yogurt are less noticeable because consumers have most of their attention focused on Yoplait purchases. A similar pattern is observed for shoppers in one, moderate income store. For higher-income shoppers, less disparity in market shares exists for the two NBs and shoppers are shown to express price-sensitivity toward relative price changes for both brands. In short, market shares, whether NBs or PLs, can have an influence on the level of consumer price-sensitivity. Indeed price-sensitivity parameters can be misleading when they are interpreted independently of other relevant factors.

Conclusions

The premise advanced in the marketing literature that moderate-income consumers are far more inclined to purchase PLs than higher– and lower-income consumers is tested in this study. Supermarket scanner data for 87 weeks over the 2013-2014 calendar years are used for this study and these data cover five product groups: butter and margarine; frozen potatoes; ice cream; jams, jelly and peanut butter; and yogurt. Clear and convincing evidence is revealed to reject the premise of a curvilinear relationship for three of the five product groups: frozen potatoes; ice cream; and jams, jelly and peanut butter. Results for the other two categories are equally as convincing, once lower-priced national brands are factored into the analyses. Specifically, two lower-priced national brands of margarine, Blue Bonnet and Country Crock, have strong appeals to lower-income consumers and these consumers purchase large shares of these products. These lower-priced NBs are appropriately considered together with PLs because prices for them are almost indistinguishable from those for PLs. Similarly, the lower-priced NB of yogurt, Yoplait, is virtually identically priced with PLs, especially during periods of price promotions. In short, careful analyses of the data show that purchases for all product groups reject the curvilinear relationship between income and PLs.

Testing the premise of a curvilinear relationship between income and PLs is not a trivial issue, as the premise has important implications for supermarket sales and market planning. For example, the supermarket chain providing data for this study has stores across most geographic areas and many income groups. Thus, it is imperative that its stores are stocked with the appropriate combinations of NBs and PLs to maximize sales and profits. Findings from this study provide strong support for stocking lower-income stores with the large shares of PLs. By contrast, confirmation of a curvilinear relationship would have suggested a need to distribute larger shares of PLs to moderate-income stores. Admittedly results from this study are for a specific supermarket chain, covering a limited geographic area. Conclusions drawn from this study could be strengthened with results from a more comprehensive data set, say regional or national, as well as from a larger product group.

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