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Effect of Store Brand Introduction on Channel Price Leadership: An Empirical Investigation

Hwan Chung [a,*], Eunkyu Lee [b,c]

[a] *Konkuk University, 120 Neungdong-ro, Gwangjin-gu, Seoul 05029, Republic of Korea*
[b] *Syracuse University, 721 University Avenue, Syracuse, NY 13244, USA*
[c] *Korea University, 145 Anam-ro, Seongbuk-gu, Seoul 02841, Republic of Korea*

Abstract

In this study, we conduct an empirical investigation of the impact of store brand introductions on the price leadership relations in a distribution channel between a retailer and national brand manufacturers. We analyze a multi-product category retail database from a major grocery chain, which captures both a period before and a period after the introduction of a store brand in each product category. By applying the time series approach to this data set, we show that store brand introductions frequently lead to price leadership changes, generally in a more favorable direction for the retailer than for the national brand manufacturer, evidenced by either the decay of the manufacturers' price leadership or the rise of the retailer's price leadership. However, such a change is not universal but tends to be concentrated among a certain quality tier of national brands, which is not always the low-tier, but sometimes the top-tier despite the low-price low-quality position of the store brand. The patterns detected in the data suggest that these changes are likely to reflect the retailer's strategic effort to reshape the price leadership environment in a product category aided by the enhanced bargaining power and managerial sophistication that accompanied the store brand introductions.

Keywords: Distribution channels; Price leadership; Store brands; Time series; Retail pricing

Introduction

The proliferation of store brands (SBs) has fundamentally impacted the relationship between manufacturers and retailers. Retailers are now allocating an increasing share of their already scarce shelf space to private labels, thus making national brand (NB) manufacturers vulnerable to power of retailers to demand steep discounts (Financial Times, April 13, 2009; Karp 2012; Matlack and Tiplady 2005). For NB manufacturers, a SB means not only fiercer competition for shelf space but also the pressure to accept smaller margins, because SB products set price ceilings (Creswell 2000; Martin and Brat 2010). On the other hand, retailers typically enjoy increased margins on NBs after the introduction of SB (Narasimhan and Wilcox 1998; Sayman, Hoch, and Raju 2001). Furthermore, a retailer actively dealing with SB suppliers may gain deeper knowledge of the manufacturers' cost structures. All these factors point to the possibility of significant changes in the channel price leadership status between NB manufacturers and retailers after SB introductions.

During the last two decades or so, scholars have paid increasing attention to the diverse channel price leadership and their impact on channel performance. For instance, Choi (1991) theoretically analyzed three possible price leadership scenarios between a manufacturer and a retailer: the absence of a channel price leader (the "Vertical Nash" game, labeled VN hereafter), the manufacturer's price leadership over the retailer (the "Manufacturer Stackelberg" game, labeled MS hereafter), and the retailer's price leadership over the manufacturer (the "Retailer Stackelberg" game, labeled RS hereafter). He found that these channel price leadership scenarios have a significant impact on channel member prices and profits, and consequently on their optimal channel strategies. Lee and Staelin (1997) extend the study of these three channel pricing games and show that the impact of price leadership on the profitability of individual channel members is moderated by the type of vertical strategic interactions present in the channel. Trivedi (1998) examines

* Corresponding author.
E-mail addresses: hchung526@konkuk.ac.kr (H. Chung), elee06@syr.edu (E. Lee).

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the effects of the two Stackelberg leadership scenarios on channel members' performances considering competition at both manufacturer and retailer levels. Shi, Zhang, and Ru (2013) theoretically explore how the inclusion of demand uncertainty affects the relationship between the type of channel price leadership and performance of channel members. On the empirical side, Cotterill and Putsis (2001) analyze twleve retailer–manufacturer relationships in six product categories and reveal the existence of VN and MS games. In addition, Kuiper and Meulenberg's (2004) time series analysis of an agricultural product market suggests the existence of a "retailer dominance" relationship; here, the manufacturers are forced to become price takers.

Despite the significance of SB business and its potential impact on channel price leadership between manufacturers and retailers, insufficient attention has been paid to the impact of a SB introduction on channel price leadership in the literature. Many theoretical studies have examined various SB management issues by either assuming manufacturers' channel price leadership (i.e., the MS game) both before and after SB entry (e.g., Du, Lee, and Staelin 2005; Raju, Sethuraman, and Dhar 1995; Sayman, Hoch, and Raju 2001) or applying the Nash bargaining game framework (e.g., Scott Morton and Zettelmeyer 2004). Consequently, they fail to acknowledge the possibility of a SB introduction reshaping the pattern of vertical price leadership. Similarly, Ru, Shi, and Zhang (2015) analyze how the introduction of SB affects the strategic interaction between a retailer as price leader and a manufacturer as price follower (i.e., assuming the RS game), and show that the SB entry can have a positive effect on the performance of NB manufacturers under certain conditions. Choi and Fredj (2013) investigate the price competition under different price leadership scenarios in a market composed of two competing retailers selling their SB and an NB supplied by a common manufacturer. None of these previous theoretical studies addresses the potential impact of a SB introduction on channel price leadership changes.

Empirical evidence indicates that the entry of SBs indeed affects the strategic interaction in pricing between NB manufacturers and retailers, but leaves it unclear whether the impact clearly involves changes of price leadership in the channel. In particular, Chintagunta, Bonfrer, and Song (2002) show that following a SB introduction, manufacturers set their wholesale prices in a more "accommodating" fashion for retailers. Similarly, Meza and Sudhir (2010) find that retailers with SBs can benefit from lower their NB wholesale prices, which can be interpreted as the retailers' gain of bargaining power after SB introductions. Thus, these empirical studies provide evidence that SB introductions generally modify the pricing interactions in the favorable direction for retailers. Nevertheless, they fall short of explicitly linking the observed changes in channel members' pricing behavior to channel price leadership changes.

In this study, we address this gap in the literature, and present a direct empirical investigation of the impact of a SB introduction on the channel price leadership situation between a retailer and NB manufacturers. We take a purely empirical approach of time series analysis to identify the leader–follower patterns between NB manufacturers' wholesale pricing decisions and the corresponding retail pricing behavior in multiple product categories before and after the introduction of SB in each category. In the process, we seek to contribute to the literature of store brand management and channel price leadership in several ways. First, this study is the first to investigate the impact of a SB introduction on channel price leadership explicitly. Our analysis produces empirical evidence that SB introductions frequently lead to changes in price leadership patterns between NB manufacturers and retailers. The specific changes we detect from the data are generally in the direction of either NB manufacturers' loss of price leadership or the retailer's gain of price leadership. In this way, we show that the changes in channel members' pricing behaviors after SB entries reported in previous empirical studies are partly due to switches in price leadership between NB manufacturers and retailers.

Second, our study shows that the above-mentioned general pattern is not uniformly applicable to all NBs. Instead, we find evidence that price leadership switches after SB introductions tend to take place in a targeted way, affecting certain NBs only. Prior research has suggested that the introduction of a SB improves the retailers' bargaining positions mainly against low-tier NB manufacturers (e.g., Meza and Sudhir 2010; Pauwels and Srinivasan 2004). This is not surprising given the low-quality low-price positions of many SBs. Thus, one might expect to observe price leadership changes mainly for low-tier NBs when SBs enter the category. Interestingly, our analysis shows that, even if the SB's entry is at the lowest quality and price position in the category, it may cause price leadership changes not necessarily for low-tier NBs, but, sometime for top-tier NBs.

Thus, the impact of a SB introduction on price leadership pattern for NBs is not constrained by the proximity in brand position between an NB and the SB. Instead, the retailer appears to possess some amount of power to select certain NBs strategically and change price leadership situations for them. This result has some resemblance to the previous analytical studies (Choi and Coughlan 2006; Du, Lee, and Staelin 2005; Sayman, Hoch, and Raju 2001; Scott Morton and Zettelmeyer 2004) that generally advocate positioning a SB against a target NB. Unlike their stylized models composed of only two NBs, however, we analyze data that include a larger number of NBs in each category, and, show the differential impact of a SB introduction across different quality tiers of NBs within a product category.

Third, we further look into the tier of NBs that experience price leadership changes in favor of the retailer after SB introductions, and identify their distinctive characteristics in comparison with other NBs. In particular, we find that, when the top-tier NBs have the majority market share of the category before the SB entry, a SB introduction leads to price leadership changes in favor of the retailer for the top-tier NBs but not for the low-tier NBs. Otherwise, the retailer enjoys favorable price leadership changes for low-tier NBs after SB introductions. Between these two opposing cases, we observe other interesting differences in retail margin and market shares. In general, these observations suggest that retailers may focus their efforts to change price leadership situations for the most strategically significant tier of NBs in each category.

Our study is exploratory in nature. Previous studies and existing theories offer little guidance on how a retailer selectively

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chooses (or should choose) a subset of suppliers to change channel price leadership patterns at the time of store brand introductions. Therefore, we do not develop and test formal hypotheses. Instead, we adopt a purely empirical approach without imposing any theoretical structure on our model, thereby letting the data speak for themselves on what happens to channel price leadership when store brands are introduced. After reporting our findings, we offer some speculative discussions about the retailer's strategic behavior of targeting selected NBs for price leadership changes. However, the verification of our speculations and deeper investigation of other possible factors leading to channel price leadership changes are deferred to future research.

At a broad level, our study contributes to the literature on store brand management by providing an expanded view of the impact of a SB introduction on channel price leadership and the strategic opportunities it provides for retailers. The existing literature has addressed various issues related to the impacts of store brand introductions and optimal strategies on channel members' decisions. SB introductions can enhance profits not only for retailers (Raju, Sethuraman, and Dhar 1995) but also for NB manufacturers as SB suppliers, resulting in more complex vertical relationships in channel systems (Bergès-Sennou 2006; Chen et al. 2010; Kumar, Radhakrishnan, and Rao 2010; Soberman and Parker 2006). In addition, much prior research investigated a retailer's optimal strategies for SB management, which includes the optimal positioning of SBs (e.g., Amaldoss and Shin 2015; Choi and Coughlan 2006; Du, Lee, and Staelin 2005; Fousekis 2010; Sayman, Hoch, and Raju 2001; Scott-Morton and Zettelmeyer 2004) and shelf-space allocation for NBs and SBs (Amrouche and Zaccour 2007). For NB manufacturers in the face of new competition from SBs, various defensive strategic options, such as NB positioning and cooperative advertising, have been analyzed (e.g., Bontems, Monier-Dilhan, and Requillart 1999; Karray and Zaccour 2006; Nasser, Turcic, and Narasimhan 2013). Our study points out that, when analyzing such strategic issues, one must keep in mind of the possible change of price leadership within the channel moderating the channel members' behavior and performance.

In the rest of the paper, we present our empirical examination of how SB introductions affect channel price leadership patterns between a retailer and its NB suppliers. We first describe the data with their descriptive statistics. Next, we present the main empirical analysis and findings. We conclude the paper with a discussion on the implications of our findings and directions for future research.

Data

We analyze a multi-category, multi-store retail database from a grocery chain, Dominick's Finer Foods, provided by the University of Chicago. Being one of the two largest supermarket chains in the metropolitan Chicago area, the chain had a total of 96 stores around the area at the time of data collection. The data include detailed weekly sales records of a very large number of stock-keeping units (SKUs) in multiple product categories, along with the corresponding price and retail margin information. From the retail margin information, we can calculate the wholesale prices, and thus analyze the strategic pricing interactions between NB manufacturers and the retailer. The calculated wholesale price is the average acquisition cost (AAC) of the current inventory of each SKU to the retailer, which may differ from the actual wholesale price for the week. Nevertheless, Dominick's optimal inventory management typically results in a quick reflection of any unobserved wholesale price change and trade promotions in the acquisition cost, assuring the usefulness of the calculated wholesale prices (Besanko, Dubé, and Gupta 2005; Chevalier, Kashyap, and Rossi 2003).

The data collection period spanned 7 years, during which SBs were introduced into several product categories. This allows us to conduct "before vs. after store brand" comparisons in multiple categories. In particular, four categories, canned tuna (solid white), paper towels, toothbrushes, and liquid soap, contained a sufficient number of observations both before and after SB introduction, with no other extraneous events to potentially cause drastic pricing behavior changes (e.g., the introduction/withdrawal of NBs, the introduction of another vertically differentiated SB, etc.). Since our focus is the pricing interaction between NB manufacturers and the retailer, we performed the analysis at the brand level, as opposed to the SKU level. For example, our interest is in what happens to the price leadership relationship between the retailer and the supplier of Dial brand liquid soap products, rather than whether the price leadership situation for 7.5 oz pump bottles of Dial liquid soap with aloe is different from that for 52 oz refill bottles of Dial liquid soap with coconut mango fragrance. Thus, we normalize the price across different package sizes by using unit prices at both the retail and wholesale levels. Specifically, we use per ounce prices for the tuna and liquid soap categories, prices per roll for paper towel brands, and price per piece for toothbrushes. Although we find this price normalization necessary and beneficial for efficient investigation of our research questions, we acknowledge that it may dilute the effects of SB introductions on NB prices at the SKU level, if some NBs offer multiple products over a wide range of price tiers. All the price data are aggregated across stores in the chain. The potential for a store aggregation bias was limited because Dominick's used the uniform product and chain-wide promotional strategies during the data collection period (Hoch et al. 1995; Pauwels and Srinivasan 2004).[1] Table 1 reports the descriptive statistics for all the major NBs in these four product categories for periods before and after a SB introduction.

Following the lead of Pauwels and Srinivasan (2004), we classified all the major NBs in each category as either top-tier or low-tier brands based on their retail prices shown in Table 1. For instance, in the canned tuna category, Starkist, Bumble Bee, and Chicken of the Sea represent the top-tier NBs, and 3-Diamond and Geisha are classified as low-tier NBs based on their price points. For paper towel, Bounty and Viva are the top-tier, and

[1] This does not mean that all stores within Dominick's chain set the same prices for all SKUs. For example, prices can vary across stores due to controlled pricing experiments.

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Table 1
Descriptive statistics.

Brand		Average retail price ($/unit)[b]	Average wholesale price ($/unit)	Average retail margin ($/unit)	Average weekly sales (unit)
A. Canned tuna (solid white)[a]					
Starkist	Before	0.269 (0.013)[c]	0.207 (0.014)	0.062	17,758 (4,777)
	After	0.251 (0.009)	0.195 (0.007)	0.056	21,358 (5,020.2)
Bumble bee	Before	0.263 (0.014)	0.200 (0.016)	0.063	25,336 (11,610)
	After	0.242 (0.008)	0.180 (0.007)	0.062	34,190 (8,604.7)
Chicken of the sea	Before	0.258 (0.033)	0.188 (0.021)	0.070	14,329 (6,405.1)
	After	0.250 (0.012)	0.192 (0.016)	0.058	8,280.3 (3,321.3)
3-Diamond	Before	0.237 (0.012)	0.159 (0.021)	0.078	13,514 (6,334.1)
	After	0.215 (0.008)	0.158 (0.006)	0.057	9,861.2 (2,541.1)
Geisha	Before	0.218 (0.011)	0.167 (0.009)	0.051	37,000 (10,820)
	After	0.205 (0.007)	0.162 (0.006)	0.043	26,161 (6,086.1)
Dominick	After	0.185 (0.011)	0.138 (0.005)	0.046	4,230.9 (2,749)
B. Paper towels[d]					
Bounty	Before	0.941 (0.079)	0.806 (0.061)	0.135	37,748 (19,097)
	After	0.981 (0.088)	0.854 (0.067)	0.127	42,123 (18,250)
Viva	Before	0.929 (0.090)	0.787 (0.082)	0.142	21,995 (15,524)
	After	0.936 (0.145)	0.794 (0.119)	0.142	19,058 (12,140)
Scott	Before	0.846 (0.053)	0.727 (0.045)	0.119	41,797 (18,513)
	After	0.869 (0.139)	0.745 (0.103)	0.124	22,166 (11,259)
Brawny	Before	0.784 (0.039)	0.613 (0.037)	0.171	17,063 (10,170)
	After	1.032 (0.132)	0.825 (0.126)	0.207	6,065.4 (19,185)
Dominick	After	0.523 (0.060)	0.364 (0.049)	0.159	17,037 (17,047)
C. Toothbrush[e]					
Oral-B	Before	2.141 (0.168)	1.459 (0.127)	0.682	2,271.2 (1,143.1)
	After	2.260 (0.210)	1.434 (0.083)	0.826	2,113.3 (764.8)
Reach	Before	1.702 (0.080)	1.136 (0.055)	0.566	2,508.3 (798.1)
	After	1.974 (0.213)	1.185 (0.062)	0.789	2,032.5 (708.4)
Colgate	Before	1.528 (0.121)	0.947 (0.077)	0.581	3,073.7 (1,168.4)
	After	1.752 (0.198)	1.054 (0.125)	0.698	3,165.6 (843.7)
Butler	Before	1.384 (0.110)	0.707 (0.118)	0.677	313.5 (339.8)
	After	1.424 (0.150)	0.831 (0.103)	0.593	571.7 (374.0)
Dominick	After	1.337 (0.150)	0.546 (0.037)	0.791	622.3 (419.9)
D. Liquid soap[f]					
Dial	Before	0.177 (0.015)	0.124 (0.010)	0.053	17,972 (5,616.9)
	After	0.141 (0.007)	0.106 (0.006)	0.035	20,754 (7,263)
Ivory	Before	0.163 (0.013)	0.127 (0.011)	0.036	14,975 (3,042.4)
	After	0.142 (0.012)	0.108 (0.011)	0.034	12,813 (4,002.8)
Softsoap	Before	0.139 (0.014)	0.089 (0.013)	0.050	31,831 (13,671)
	After	0.104 (0.010)	0.073 (0.007)	0.031	52,731 (11,592)
Clean & smooth	Before	0.106 (0.012)	0.076 (0.011)	0.030	19,263 (9,225.8)
	After	0.114 (0.006)	0.079 (0.010)	0.035	7,365.6 (2,636.4)
Dominick	After	0.102 (0.009)	0.047 (0.001)	0.055	6,915.3 (6,618.8)

[a] There is no other brand in solid white canned Tuna.
[b] Unit: Oz. for canned tuna and liquid soap, "roll" for paper towel.
[c] Standard deviations are shown in parentheses.
[d] Average weekly sales of all the other paper towel brands: 117,165 units before SB, 62,016 units after SB.
[e] Average weekly sales of all the other toothbrush brands: 2,128.4 units before SB, 1,684.6 units after SB.
[f] Average weekly sales of all the other liquid soap brands: 19,932.8 Oz before SB, 7,101.1 Oz after SB.

Scott and Brawny are the low-tier brands. The toothbrush category consists of one top-tier brand, Oral-B, and three low-tier brands, Reach, Colgate, and Butler. Finally, in the liquid soap category, Dial and Ivory belong to the top-tier, while Softsoap and Clean & Smooth belong to the low-tier. In each of these categories, SB entered as the lowest-priced brand, causing the sales of the low-tier NBs to generally decline after SB introduction as shown in the table, which is consistent with Pauwels and Srinivasan's (2004) finding. Other minor NBs with less significant market shares existed in the paper towel, toothbrush, and liquid soap categories, but were not included in our analysis.

Given our interest in investigating the pricing interactions between the NB manufacturers and the retailer before and after SB introductions, we computed contemporaneous correlations between the wholesale price and the retail margin for each of the seventeen major NBs in the four product categories, both before and after the SB introduction, as summarized in Table 2. From this table, we make the following observations:

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Table 2
Correlation analysis results (wholesale price & retail margin).

Brand	Before	After
A. Canned tuna [solid white]		
Starkist	−0.674***	−0.313***
Bumble bee	−0.632***	−0.578***
COS	0.658***	−0.747***
3-Diamond	−0.837***	−0.502***
Geisha	−0.394***	−0.589***
Dominick	–	0.001
B. Paper towel		
Bounty	0.293***	0.386***
Viva	−0.237***	0.296***
Scott	0.159	0.584***
Brawny	−0.565***	−0.343***
Dominick	–	−0.055
C. Toothbrush		
Oral-B	−0.176	0.524***
Reach	−0.322**	0.739***
Colgate	−0.156	0.142
Butler	−0.468***	0.031
Dominick	–	0.162**
D. Liquid soap		
Dial	0.215***	−0.471***
Ivory	−0.138	0.133
Softsoap	−0.379***	0.304***
Clean & smooth	−0.165**	−0.816***
Dominick	–	0.336***

** Significant at 5%.
*** Significant at 1%.

1. The correlations are generally negative before the SB introductions.
2. For seven NBs, the correlations were negative both before and after the SB introductions. Among those cases, the absolute magnitude of correlation coefficients decreased for five NBs (Starkist, Bumble Bee, 3-Diamond, Brawny, and Butler) and increased for two NBs (Geisha and Clean & Smooth) after SB introductions.
3. For six NBs, the negative correlations before SB introduction changed to positive correlations after SB introduction. For four of those cases (Viva, Oral-B, Reach, and Softsoap), the correlations were statistically significant, while the remaining two (Colgate and Ivory) did not exhibit statistically significant correlations.
4. For the remaining four NBs, the correlations are positive before the SB introductions. For Bounty and Scott paper towels, the positive correlation coefficients increased in magnitude, whereas, for COS and Dial brands, the positive correlations changed to negative correlations after SB introductions.

The above correlational patterns are not adequate for providing any conclusive messages regarding the causal relationship between SB introductions and channel price leadership. Nevertheless, we note four important facts that motivate us to conduct a more formal and in-depth investigation of the subject. First, the prevalence of the negative correlations, especially before SB introductions, suggests that vertical strategic interactions between the NB manufacturers and the retailer generally follow the pattern of vertical strategic substitutability (VSS hereafter), which refers to a channel member's best reaction to its channel partner's margin increase by reducing its margin. Lee and Staelin (1997) show that VSS provides the necessary and sufficient condition for the profitability of channel price leadership. Therefore, our data appear to capture market environments in which the channel members generally have positive incentives to become price leaders and may treat channel price leadership as an important strategic issue. On the other hand, Lee and Staelin (1997) also show that exercising price leadership may not be profitable in case of vertical strategic complementarity (VSC), where the best reaction to a channel partner's margin increase is to increase one's own margin. In this study, the few cases of a positive correlation between a wholesale price and a retail margin are consistent with vertical strategic complementarity (VSC). However, we cannot rule out the possibility that there may be other factors (e.g., economic factors such as inflation, stages of business cycle, etc.) which can also lead to the positive correlation without the presence of VSC.

Second, the substantial changes in the correlations after the SB introductions, not only in magnitude but also in directions, suggest potential impact of SB introductions on strategic pricing interactions between the NB manufacturers and the retailer. Combine this with the strategic importance of channel price leadership reflected by the above-discussed VSS patterns, and it is plausible to expect changes in channel price leadership after SB introductions. More specifically, given the enhanced bargaining power and better knowledge of the manufacturers' cost structure that a retailer may gain through SB introductions, one can reasonably expect weakened leadership of NB manufacturers, strengthened leadership of the retailer or both.

Third, Table 2 shows substantial variability of the correlation changes across NBs within each product category, which suggests differential impacts of SB introductions across competing NBs within a category. Thus, instead of analyzing the general change for each category, we need to investigate the impact of a SB introduction on channel price leadership for each NB.

Fourth, and finally, Table 2 also shows substantial variability in how SB introductions affect the price correlations across the four product categories. This suggests that, despite the low-quality, low-price position of the SBs in the dataset, the impact of a SB introduction on channel price leadership may not always manifest itself for low-tier national brands, but, instead, show different patterns across product categories. Given these cross-category variations, it will be desirable to conduct an additional analysis to explore the category specific characteristics that drive the observed variations.

Empirical Analysis

Analysis Method

To examine the effect of a SB introduction on channel price leadership, we used the time series approach. This approach is based on the idea that the price follower reacts to the leader's pricing action that has taken place first. Therefore, the fol-

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lower's reaction should be observed after the leader's action in time series data. If a manufacturer is a price leader and a retailer is the follower, for instance, a causal flow would be detected in the direction "from the wholesale price to the retail price" in a sequential fashion, and not in the other direction (Putsis and Dhar 1998). The time series approach has been used widely for the study of various marketing issues in the literature (Dekimpe and Hanssens 2000). Spurred by the increasing availability of time series data and the need for identifying clear causal directions from the complex linkages among market and strategy variables, an increasing number of researchers employ time series techniques such as Granger causality and vector autoregressive models to detect lead-follow relationships among market players and to analyze the effects of marketing actions on market responses and firm performance (e.g., Horvath, Leeflang, and Otter 2002; Krider et al. 2005; Nijs et al. 2001; Pauwels, Hanssens, and Siddarth 2002; Pauwels and Srinivasan 2004; Srinivasan et al. 2004). By taking this approach, we seek to identify the price leader–follower patterns in our data in a purely empirical way, without imposing any theoretical framework or assumptions. An alternative approach to our time series method would be the new empirical industrial organization (NEIO) method. In the NEIO approach, empirical tests can be conducted either by estimating the individual parameters measuring the channel members' pricing behavior (the conjectural variations approach; e.g., Chintagunta, Bonfrer, and Song 2002; Kadiyali, Chintagunta, and Vilcassim 2000; Meza and Sudhir 2010) or by comparing the overall performance across a menu of competing model specifications, based on alternative price leadership assumptions (the menu approach; e.g., Cotterill and Putsis 2001; Sudhir 2001). As stated above, our choice of the time series approach over NEIO reflects our interest in a more direct method for testing the leader–follower relationship without imposing restrictive assumptions on the estimation model as the NEIO approach requires (Chintagunta, Bonfrer, and Song 2002; Mazzeo 2006). In addition, the time series approach, by focusing on the manufacturer–retailer pricing interaction for one NB at a time, allows us to analyze product categories with a large number of NBs. In contrast, the NEIO method seeks to simultaneously estimate the strategic interrelationships among all the decision variables in the category, which drastically increases the number of parameters to be estimated as the number of competing brands increases. Consequently, some of the product categories in our data set have too few observations to accommodate this approach.

Furthermore, the variability of pricing interactions across different NBs within each category, shown in Table 2, is consistent with the empirical finding of Draganska, Klapper, and Villas-Boas (2010) that bargaining power of a retailer is not an inherent firm characteristic, but rather depends on the negotiating partner in manufacturer-retailer relationships. Therefore, we need to allow for different price leadership situations across the competing NBs within each category (e.g., Starkist can be a price leader over Dominick's while Bumble Bee might be a price follower under Dominick's price leadership). This makes the NEIO menu approach very difficult to use, due to the combinatorially increased number of potential competitive equilibria (Kadiyali, Sudhir, and Rao 2001). The combination of these reasons led us to rely on the time series approach. Roy, Kim, and Raju (2006) applied both the time series approach and the NEIO methods to understand competitive conduct in five different product industries and discussed nicely strength and weaknesses of each method. They found that, by and large, the results obtained from the time series Granger causality tests are consistent with those of the NEIO methods.

The Granger causality test has two major methods: the Pierce–Haugh test and the Sims test. In this paper, we mainly consider the former method, following Roy, Hanssens, and Raju (1994) and Roy, Kim, and Raju (2006). The basic idea of the Pierce–Haugh test is that if the wholesale price (retail price) does not Granger cause the retail price (wholesale price), then the cross-correlation between the lagged values of the pre-whitened wholesale price (retail price) and retail price (wholesale price) measured by the Pierce–Haugh test statistic following the χ^2 distribution should not be significantly different from zero (Aaker, Carman, and Jacobson 1982). We apply this test in the same way conducted by Aaker, Carman, and Jacobson (1982), to the "before-SB" period and the "after-SB" period for each of the four product categories, and examine the impact of a SB introduction on the channel price leadership in each category. In addition, we compare the results across the product categories and try to see how this effect is moderated by category-specific characteristics. In order to apply this approach, each price series in our data was pre-whitened by the appropriate ARIMA model for the series. The two most frequently used models were AR(1) (for 15 price series) and ARIMA(0,1,1) (for 9 price series), but other variations such as AR(2), ARIMA(1,1,1), and ARMA(1,1) were used for different price series.[2]

Results

For each of the seventeen NBs selected for our investigation, we applied the Pierce–Haugh test to identify the price leadership status between the NB manufacturer and Dominick's before and after the SB introduction, leading to the estimation of a total of 34 time-series models. To perform the test, we used the wholesale price and retail price variables lagged by 4–8 weeks for residual cross-correlation to determine the right length of lags based on statistical significance. Since the statistical power of a cross-correlation test is low (Hanssens, Parsons, and Schultz 1990), we regarded the rejection of the null hypothesis at the 10% significance level as the indication of the existence of causality. After determining the appropriate length of lags, we performed the Pierce–Haugh test to identify the lead-follow relationship between the wholesale price and the retail price for each NB. The results are presented in Table 3.

The test results in Table 3 reveal that the channel price leadership scenario frequently changes after a SB introduction. For the canned tuna category shown in Table 3A, the manufacturers of three leading NBs, Starkist, Bumble Bee, and 3-Diamond,

[2] Details of the pre-whitening procedure are available from the authors upon request.

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Table 3
Pierce–Haugh test results.

Brand	Before		After	
	Wp → Rp	Rp → Wp	Wp → Rp	Rp → Wp
A. Canned tuna [solid white]				
Starkist	χ^2 (6) = 11.94* (P-value = 0.063)	χ^2 (6) = 1.04 (P-value = 0.983)	χ^2 (6) = 8.29 (P-value = 0.217)	χ^2 (6) = 3.59 (P-value = 0.731)
	Manufacturer leadership		No channel price leader	
Bumble bee	χ^2 (6) = 14.44** (P-value = 0.025)	χ^2 (6) = 7.33 (P-value = 0.291)	χ^2 (6) = 10.14 (P-value = 0.118)	χ^2 (6) = 6.71 (P-value = 0.348)
	Manufacturer leadership		No channel price leader	
COS	χ^2 (6) = 3.16 (P-value = 0.787)	χ^2 (6) = 8.49 (P-value = 0.203)	χ^2 (6) = 2.78 (P-value = 0.835)	χ^2 (6) = 6.78 (P-value = 0.341)
	No channel price leader		No channel price leader	
3-Diamond	χ^2 (8) = 31.13*** (P-value <0.01)	χ^2 (8) = 1.47 (P-value = 0.993)	χ^2 (8) = 19.47** (P-value = 0.012)	χ^2 (8) = 38.25*** (P-value <0.01)
	Manufacturer leadership		No channel price leader	
Geisha	χ^2 (4) = 3.88 (P-value = 0.422)	χ^2 (4) = 9.04* (P-value = 0.059)	χ^2 (4) = 11.24** (P-value = 0.024)	χ^2 (4) = 4.57 (P-value = 0.334)
	Retailer leadership		Manufacturer leadership	
B. Paper towel				
Bounty	χ^2 (6) = 4.21 (P-value = 0.648)	χ^2 (6) = 11.43* (P-value = 0.076)	χ^2 (6) = 7.81 (P-value = 0.251)	χ^2 (6) = 2.19 (P-value = 0.901)
	Retailer leadership		No channel price leader	
Viva	χ^2 (6) = 8.35 (P-value = 0.213)	χ^2 (6) = 7.15 (P-value = 0.307)	χ^2 (6) = 5.37 (P-value = 0.497)	χ^2 (6) = 7.71 (P-value = 0.260)
	No channel price leader		No channel price leader	
Scott	χ^2 (4) = 2.59 (P-value = 0.628)	χ^2 (4) = 1.48 (P-value = 0.830)	χ^2 (4) = 6.38 (P-value = 0.172)	χ^2 (4) = 3.90 (P-value = 0.419)
	No channel price leader		No channel price leader	
Brawny	χ^2 (8) = 10.49 (P-value = 0.232)	χ^2 (8) = 9.28 (P-value = 0.319)	χ^2 (8) = 4.92 (P-value = 0.765)	χ^2 (8) = 18.91** (P-value = 0.015)
	No channel price leader		Retailer leadership	
C. Toothbrush				
Oral-B	χ^2 (6) = 2.75 (P-value = 0.839)	χ^2 (6) = 0.92 (P-value = 0.988)	χ^2 (6) = 2.88 (P-value = 0.824)	χ^2 (6) = 7.92 (P-value = 0.244)
	No channel price leader		No channel price leader	
Reach	χ^2 (8) = 17.52** (P-value = 0.025)	χ^2 (8) = 10.39 (P-value = 0.239)	χ^2 (8) = 11.85 (P-value = 0.158)	χ^2 (8) = 15.11* (P-value = 0.057)
	Manufacturer leadership		Retailer leadership	
Colgate	χ^2 (6) = 10.37 (P-value = 0.110)	χ^2 (6) = 2.87 (P-value = 0.825)	χ^2 (6) = 7.85 (P-value = 0.249)	χ^2 (6) = 8.61 (P-value = 0.197)
	No channel price leader		No channel price leader	
Butler	χ^2 (8) = 17.30** (P-value = 0.027)	χ^2 (8) = 5.59 (P-value = 0.693)	χ^2 (8) = 2.82 (P-value = 0.945)	χ^2 (8) = 4.25 (P-value = 0.833)
	Manufacturer leadership		No channel price leader	
D. Liquid soap				
Dial	χ^2 (4) = 5.69 (P-value = 0.223)	χ^2 (4) = 1.45 (P-value = 0.835)	χ^2 (4) = 0.77 (P-value = 0.942)	χ^2 (4) = 8.14* (P-value = 0.086)
	No channel price leader		Retailer leadership	
Ivory	χ^2 (4) = 1.57 (P-value = 0.813)	χ^2 (4) = 3.42 (P-value = 0.489)	χ^2 (4) = 0.27 (P-value = 0.991)	χ^2 (4) = 1.81 (P-value = 0.769)
	No channel price leader		No channel price leader	
Softsoap	χ^2 (6) = 11.01* (P-value = 0.088)	χ^2 (6) = 10.42 (P-value = 0.108)	χ^2 (6) = 5.38 (P-value = 0.495)	χ^2 (6) = 7.30 (P-value = 0.294)
	Manufacturer leadership		No channel price leader	
Clean & smooth	χ^2 (8) = 21.26*** (P-value <0.01)	χ^2 (8) = 31.74*** (P-value <0.01)	χ^2 (8) = 13.61* (P-value = 0.092)	χ^2 (8) = 14.94* (P-value = 0.060)
	No channel price leader		No channel price leader	

Notes: Wp: wholesale price, Rp: retail price; the arrow indicates the direction of causality.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

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were price leaders to the retailer before the SB introduction, indicated by the significant causality from wholesale prices to retail prices but not vice versa. After the SB introduction, however, none of these NB manufacturers retained price leadership over the retailer. Instead, no causality is found in either direction for Starkist and Bumble Bee, indicating a reduced reactivity in price between the channel members. For 3-Diamond, causality is observed in both directions after the SB entry, which reflects more symmetric active price interactions between the manufacturer and the retailer. In contrast, for Geisha, a major low-tier NB in the category, the retailer's price leadership before the SB introduction, indicated by a causal direction from the retail price to the wholesale price, changed to the manufacturer's price leadership after the SB introduction. Overall, we detect the general weakening of the NB manufacturer price leadership after the SB introduction in the canned tuna category.

We find quite different results for the paper towel category shown in Table 3B, in which none of the NB manufacturers show significant price leadership before the SB introduction. Instead, Bounty, one of the top-tier NBs, exhibited the retailer's price leadership before the SB introduction, indicated by the causal direction from the retail price to the wholesale price. However, this retailer price leadership disappeared after the SB introduction. On the contrary, the results of Brawny indicate that the absence of a channel price leader before the SB introduction changed to the retailer's price leadership after the SB introduction. Overall, the paper towel category showed much less significant price reactivity compared to the canned tuna category, including two NBs, Viva and Scott, showing no discernable leader–follower causality before and after the SB introduction.

Table 3C shows the general weakening of the NB toothbrush manufacturers' price leadership after the SB introduction, similar to the canned tuna category, but with two interesting differences. First, while the loss of manufacturer price leadership was observed mainly for top-tier NBs in the canned tuna category, it happened only for the low-tier NBs in the toothbrush category. Second, for the case of Reach, there was a shift of price leadership from the manufacturer before the SB introduction to the retailer after the SB entry. Lastly, the results for the liquid soap category in Table 3D shows that the absence of a price leader over Dial before the SB introduction changed to the retailer's price leadership after the SB entry. On the other hand, for Softsoap, a low-tier NB, the manufacturer's price leadership before the SB entry ceased to exist after the SB was introduced.

Discussion

Summary of Main Findings

By applying the time series analysis approach to a data set that contains the wholesale and retail pricing interactions between NB manufacturers and a retailer in multiple product categories, we provide direct evidence of the channel price leadership changes for the majority (but not all) of the NBs, ten out of seventeen, after SB introductions. Regarding these ten cases of price leadership changes, we note the following four facts. First, the most common price leadership pattern before the SB introduction was manufacturers' price leadership, observed for six out of the ten NBs. Surprisingly, none of the six NB manufacturers who exercised price leadership before the SB introduction maintained price leadership after SB introduction. Instead, we found either the absence of the price leader (for Starkist, Bumble Bee, 3-Diamond, Butler, and Softsoap) or the retailer's price leadership (for Reach) after the SB introduction. In short, the most common pattern of price leadership change was the disappearance of NB manufacturers' price leadership after SB introductions.

Second, in addition to the loss of NB manufacturers' price leadership discussed above, we also find that the absence of a price leader before the SB introduction changed to the retailer's price leadership after the SB entry for two NBs, Brawny paper towel and Dial liquid soap. Thus, for eight out of the ten NBs that exhibited price leadership changes, either the manufacturer's price leadership disappeared or the retailer's price leadership emerged after the SB introduction, showing a general direction toward weakened manufacturer leadership, strengthened retailer leadership or both. Assuming that a channel member is better off by exercising price leadership than being a price follower, our finding implies that price leadership changes stemming from SB introductions are generally in favor of the retailer. This argument has some intuitive appeal, given the retailer's increased channel power (e.g., Meza and Sudhir 2010; Pauwels and Srinivasan 2004) and improved managerial sophistication that are expected after SB introductions. Thus, the SB introductions appear to have provided the retailer with strategic opportunities to reshape the price leadership situations within the category to its advantage in the majority of the cases.

Third, it is also worth commenting on the high frequency of the cases showing the absence of channel price leadership in Table 3, which accounts for nine out of the seventeen relationships before and fourteen out of seventeen after SB introductions. In contrast, we detected only two cases of retailer price leadership and one case of manufacturer leadership after the SB introductions. On surface, this appears to suggest that carrying own SBs often enabled the retailer to take away a price leadership position from the manufacturer, but rarely shifted the power balance sufficiently to allow the retailer to become a channel price leader. Another possibility is that the generally decreased market shares of the NBs after the SB introductions might have reduced the channel members' incentives toward price leadership for the NBs. Moreover, from a game theoretic point of view, it is not very practical to expect a channel member to be able to force the other to become the leader. Thus, in the VSC environment, in which a channel member prefers to follow the other player's leadership, the game may end up a follower–follower game, as found for the majority of the VSC cases in our data. Regardless of the true underlying causes, the high proportion of the cases with no significant causal directions should not detract from the implications of other findings.

Fourth, the general direction of price leadership changes discussed above is not universal for all NBs, but applies selectively to a subset of the NBs in each category. This suggests that, when facing an opportunity created by a SB introduction, a retailer is not equally motivated or able to change the price leadership

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situation across all the NBs in the category. Given the expected administrative cost and potential channel conflict involved in changing price leadership, it is not surprising that a retailer might have to select a small number of "target NBs" to focus its effort to change the price leadership situation. Interestingly, despite the SB's position as the lowest priced brand in each of the four categories, the manufacturer's loss of price leadership or the retailer's gain of price leadership after SB entries are not limited to the low-tier NBs, but also apply to some top-tier NBs. This is in contrast to the impact of a SB introduction on the sales of the incumbent NBs, which is generally more pronounced for low-tier NBs (Pauwels and Srinivasan 2004). Thus, a retailer's strategic benefit of introducing SBs appears much more than sales gains at the expense of the NBs closely mimicked by the SBs. Instead, our results suggest that SB introductions might provide the retailer with a much broader opportunity to reshape the product category environment to its advantage.

Retailer's Strategic Choice on Channel Price Leadership

Due to its exploratory nature and data limitations, as discussed in the Introduction section, our study falls short of providing conclusive evidence for the retailer's strategic choices that lead to the particular price leadership change patterns detected by our empirical analysis. Nevertheless, a more detailed investigation of our data provides additional support for the plausibility of our argument regarding the retailer's strategic targeting of selected NBs for price leadership changes. We discuss these details below. First, we note that the directional changes of price leadership in our results are remarkably consistent with the strategic implications of the types of vertical strategic interaction suggested by Lee and Staelin (1997). Specifically, eight out of the ten cases of price leadership changes reported in Table 3 are in the directions that would be predicted by Lee and Staelin's (1997) results. In particular, for the eight NBs that exhibited price leadership changes in the retailer's favor, Table 2 suggests that the type of vertical strategic interaction before SB introductions was VSS (vertical strategic substitutability), which makes channel price leadership profitable, with only one exception, Dial liquid soap. In the case of Dial, we note the price correlations of Table 2 implying VSS after the SB introduction in the category, which may also justify the retailer's incentive for exercising price leadership. For the two cases of price leadership changes that weakened the retailer's price leadership, the case of Bounty paper towel shows the retailer's choice that is consistent with the implications of Lee and Staelin's (1997) study, since the price correlations in Table 2 suggest VSC (vertical strategic complementarity), which makes channel price leadership unprofitable. On the other hand, the case of Geisha tuna, which shows the NB manufacturer gaining price leadership after the SB introduction under VSS, does not fit the predicted direction. The overall consistency of these results with the implications of the previous theoretical study suggests that the channel price leadership changes after the SB introductions in our data are not random but, instead, driven by the rational strategic behavior of the retailer supported by the improved bargaining power and managerial sophistication.

Second, regarding the strategic targeting of selected NBs, we also find some evidence that the retailer tends to focus on changing the channel price leadership for the tier of NBs that has a greater profit impact in each category. As shown in Table 4, the top-tier canned tuna NBs account 53.2% of the category sales before the SB introduction.[3] Therefore, while weakening the manufacturers' price leadership or strengthening the retailer's price leadership would have improved the retailer's profitability for all the NBs characterized by VSS according to Table 2 (i.e., Starkist, Bumble Bee, 3-Diamond, and Geisha), it is understandable why such changes were more concentrated on the top-tier NBs than the low-tier NBs. In the paper towel category, the top-tier NBs accounted for only 25.3% of the category sales before the SB introduction, and the best-selling top-tier NB, Bounty, exhibited the pattern of VSC according to Table 2. Thus, it is not surprising that the retailer's price leadership gain was observed for a low-tier brand that was characterized by VSS, Brawny. In the toothbrush and liquid soap categories, the low-tier brands accounted for large combined market shares (57.3% and 49.1%, respectively in Table 4) before the SB introductions, with mostly VSS in the pricing interactions between the manufacturers and the retailer (Table 2). Therefore, as expected, the majority of the low-tier brands (Reach, Butler, and Softsoap) in these categories experienced changed price leadership in the favorable direction for the retailer.

Table 4 also shows that the retail unit margin of Dominick's SB is lower than the average margin of NBs in the canned tuna category, whereas the retail margin of SB is close to or even higher than the margin of NBs in the other three categories. The low retail margin (along with it low market share) of the SB canned tuna may indicate the relatively low profitability of the low-tier canned tuna market in general, whereas stronger SB performances in the other categories indicate a more attractive low-tier market. If so, it suggests the possibility that the retailer has a strong incentive to exercise price leadership or take away the price leadership from the manufacturer for the critical NB tier that has superior market shares, unit profitability or both. In general, these arguments provide plausible explanations for why channel price leadership changes are observed for low-tier NBs in some categories and for top-tier NBs in others.

Related with the above discussion is the case of Geisha canned tuna, in which the manufacturer gained price leadership after the introduction of the SB (Table 3) despite VSS implied by the correlation coefficient (Table 2). This unexpected result might reflect the retailer's low incentive for exercising price leadership over an NB belonging to a non-critical tier after the SB introduction. The low retail margin and noticeable decrease in sales of Geisha after the SB introduction further support this speculation. In order to test the robustness of the Pierce–Haugh test results in Table 3, we also applied an alternative approach of time series analysis, which is the vector autoregressive (VAR) model. As required by this methodology, we applied this model to the stationary series in our data and conducted the standard

[3] Similar information (dollar volume) can be found in Pauwels and Srinivasan (2004).

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Table 4
Retail margin and market share between different tier NBs.

Marketing variable			Canned tuna	Paper towel	Toothbrush	Liquid soap
Retail margin ($/unit)[a]	Before	Top-tier	0.064	0.138	0.682	0.045
		Low-tier	0.058	0.134	0.580	0.042
	After	Top-tier	0.059	0.132	0.826	0.035
		Low-tier	0.047	0.142	0.720	0.031
		Dominick	0.046	0.159	0.791	0.055
Market share (%)[b]	Before	Top-tier	53.2%	25.3%	22.1%	31.7%
		Low-tier	46.8%	25.0%	57.3%	49.1%
	After	Top-tier	61.3%	36.3%	20.7%	31.2%
		Low-tier	34.6%	16.8%	56.6%	55.8%
		Dominick	4.1%	10.1%	6.1%	6.4%

Notes: a. Weighted average retail margin per unit. b. Market share in units: sum of average weekly sales of analyzed each tier of NBs/sum of average weekly sales of all brands in a category.

Table 5
Granger causality test using the VAR model (canned tuna [solid white]).

Brand	F Statistic			
	Before		After	
	Wp → Rp	Rp → Wp	Wp → Rp	Rp → Wp
Starkist	5.23*** (P-value <0.01)	0.23 (P-value = 0.918)	0.51 (P-value = 0.476)	1.03 (P-value = 0.312)
Bumble bee	3.35*** (P-value <0.01)	1.04 (P-value = 0.397)	2.08 (P-value = 0.152)	0.01 (P-value = 0.933)
COS	3.59** (P-value = 0.015)	1.15 (P-value = 0.329)	Nonstationary series	
3-Diamond	2.87** (P-value = 0.012)	0.30 (P-value = 0.933)	Nonstationary series	
Geisha	0.82 (P-value = 0.364)	8.53*** (P-value <0.01)	5.69*** (P-value <0.01)	1.25 (P-value = 0.289)

Notes: Wp: wholesale price, Rp: retail price; the arrow indicates the direction of causality.
** Significant at 5%.
*** Significant at 1%.

Sims test. As shown in Table 5, the Sims test generally provides consistent results with the Pierce–Haugh test.[4]

Managerial Implications

Our empirical findings of channel leadership changes after SB introductions have some interesting implications for retail practitioners. First, they indicate that the strategic benefits of SBs for retailers are not limited to increased sales, store loyalty, and enhanced retail margin, as demonstrated in previous studies, but also include an opportunity for retailers to reshape their leader–follower relationships with NB manufacturers. On this matter, retail managers are advised to pay particular attention to the type of vertical strategic interactions and the relative market shares between the top-tier brands and the low-tier brands to identify the critical NB tiers, from which the maximum benefit can be received from channel price leadership change.

Second, the changes in channel price leadership in a direction favorable to the retailer might serve as additional evidence that the introduction of a SB provides retailers with increased channel power. Our data does not contain any information pointing to the sources of the retailer power increase, but it is not difficult to consider potential sources such as tighter shelf space scarcity and intensified brand competition within the category after SB introductions. In addition, Anderson, Day, and Rangan (1997) state that "big resellers enhance their relative power by increasing their knowledge of: (1) their suppliers' costs—because they may be negotiating to buy private-label products from these same suppliers, (2) their own operations—by taking advantage of transaction processing systems that can capture and interpret sales data about each item and merge it with cost information, (3) and their customers' needs." SB introductions can provide retailers valuable strategic opportunities to harness these sources of channel power via improved managerial sophistication.

Directions for Future Research

For marketing academics, our study challenges the assumption of the stability of channel price leadership (which typically sees manufacturers as the price leaders), which has been made in previous theoretical or empirical research on SB-related issues. In addition, our empirical findings suggest the retailer often engages in different leader–follower relationships across multiple NB manufacturers within the category, both before and after SB introductions. This is in contrast to the typical theoretical channel models assuming a uniform leadership scenario across competing manufacturers, and points to the need for more rigorous studies on asymmetric price leadership structures in future research. We hope some of those future studies will seek deeper theoretical insights into the key determinants of the retailer's

[4] Our results show that the Sims test provides statistically stronger results than does the Pierce–Haugh test, which is consistent with the discussions of Hanssens, Parsons, and Schultz (1990).

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strategic choices regarding channel price leadership after SB introductions. Our study focuses on reporting an interesting empirical phenomenon with some plausible explanations, but falls short of providing clear theoretical understanding of the underlying factors that need to be investigated in future studies.

Our empirical analysis is also limited by the data including four product categories from one grocery chain. Expanding the analysis to other product categories and other retailers will enhance the generalizability of the results. In particular, our analysis was limited to the situation where SB was introduced as the lowest-priced brand in the category. Given the growing trend of increasing SB quality and marketing a line of multiple SBs within a product category, the investigation of the channel price leadership issue within a model reflecting such realities will be interesting. In addition, simultaneous consideration of the retailer's strategic decisions over SB positioning and channel price leadership might lead to new strategic recommendations based upon deeper understanding of the interaction between these two topics that have been studied in separation.

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