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The Many Faces of Competition

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Abstract

Despite a great deal of theoretical research on competition, there has been limited empirical work assessing the type of competitive interaction that actually exists in the marketplace. The empirical work that has been conducted has suggested that there is significant variation in the type of competitive interaction across categories and across marketing instruments. Consequently, the central objective of this paper is descriptive in nature—what *does* competition look like? Focusing on the competition that exists across strategic groups (Porter 1985), we categorize competitive interaction between private labels and national brands for each of 58 categories and four marketing instruments. Specifically, we look at five types of competitive interaction. Three, *cooperative, non-cooperative*, and *independent* (Nash) are symmetric in nature, while two, *leader-follower* (Stackelberg) and *dominant/fringe-firm*, are asymmetric.

The empirical results suggest that general comments or assumptions about competitive interaction can produce very misleading conclusions. There is no consistent pattern of competition that exists between private labels and national brands across categories. Further, the pattern of interaction is quite complex, while there is likely to be a significant variation across instruments within a category. National brand leadership is the most common form of interaction for each marketing mix variable. However, it characterizes only 19 out of 58 categories for regular price, and 16, 19, and 15 out of 58 categories for temporary price reduction, feature and display, respectively. Further, the interaction is idiosyncratic to the category, depending heavily upon the demand and competitive characteristics of the category. Implications for both game theorists and for managers are explored.

Key words: Competition, competitive strategy, private labels

1. Introduction

A central characteristic of competition is that firms are mutually dependent—the outcome of a marketing action by one firm depends to some extent on the reaction of its competitors. Previous theoretical research on competition has typically employed noncooperative game theory under Nash equilibrium (e.g., Lal 1990, Raju, Srinivasan and Lal 1990). In such models, the form of competitive interaction between firms is assumed (e.g., Stackelberg leader-follower behavior in Raju, Sethuraman and Dhar 1995 and Narasimhan and Wilcox 1998). While the assumptions of firm interaction in theoretical models of competition are often quite reasonable, there is limited empirical evidence regarding the type of competitive interaction that actually occurs between firms in the marketplace. Empiri-

cal research assessing competitive interaction, which did not even begin until the late 1970's and early 1980's (e.g., Gollop and Roberts 1979, Bresnahan 1981; see Bresnahan 1989), suggests that there is significant variation in the competitive interaction observed across categories and marketing mix instruments (Slade 1995). For example, Roberts and Samuelson (1988) find that cigarette advertising is cooperative, while Gasmi, Laffont and Vuong (1992) reject cooperative behavior in the soft-drink market. Slade (1995) finds that advertising in the market for saltine crackers lies somewhere between the two.

Given the number of firms in an industry, competition, or more appropriately, competitive response, can take on many forms. One way of examining competition is to distinguish between how firms compete between and across strategic groups in an industry (Porter 1985). For example, competition between national "branded" and store "private label" products has increased dramatically in recent years. Market leaders like Procter & Gamble and Eastman Kodak have decreased prices and altered promotional strategies in response to increased private label penetration in their markets (*Business Week*, May 2, 1994). Similarly, firms within a strategic group (e.g., two national brands) can also compete fiercely with each other. To illustrate, price cuts in the ready-to-eat cereal category by Post and Nabisco increased its market share from about 16 percent to over 20 percent, resulting in Kellogg's announcing a 20 percent across the board price cut due to declining shares of its major brands. To further complicate matters, the game being played within a strategic group may be very different from a game being played across strategic groups. For example, Coke and Pepsi may cooperate with each other when it comes to determining their promotion schedules but compete fiercely with any marketing response from a member outside the strategic group (e.g., a private label).[1]

Since the outcome of a firm's action depends at least partly upon the behavior of its rivals, it is important for firms to understand the nature of the game being played. Although competitive response can be understood along several different dimensions (e.g., Ramaswamy, Gatignon, and Reibstein 1994; Bowman and Gatignon 1996), an important first step in this direction requires an understanding about the type of interaction that actually occurs. Thus the objective of this paper is to *describe* the type of competition that exists across strategic groups. In particular, our focus is on the direction of the reaction in practice—is it a retaliatory move, accommodating in nature, or leader-follower in nature? This paper presents the results from a comprehensive study of competitive interaction across two strategic groups (national brands and private labels) for 58 categories and four marketing instruments (regular price, temporary price reduction, feature and display).[2]

Our attempt to empirically describe the pattern of competitive interaction is in part motivated by the fact that knowledge of such interaction can be very important for assessing the effectiveness of marketing efforts. For example, the net effect of a temporary price cut will depend in part upon whether or not rivals respond in kind (Putsis and Dhar 1997). Despite this, most previous work on promotions has focused on the demand side, ignoring the impact of competitive response.[3] Consequently, a broad-based general understanding of competitive interaction across categories, marketing instruments and strategic groups becomes extremely important for managers and researchers alike.

The remainder of the paper is organized as follows. Section 2 describes previous empirical research that has been conducted on the nature of the competitive interaction

between firms. Prior research suggests that competitive behavior varies considerably from category to category and across promotional vehicles. Based upon our empirical analysis, Section 3 describes in detail the competitive interaction that exists across 58 categories for broad strategic groups, using national brands and private labels as an example. Section IV addresses how the competitive interaction between strategic groups may depend upon the characteristics of the product category. Section V discusses the managerial importance of understanding how competitors interact, while Section VI discusses implications for future research on competition within this paradigm.

2. Previous research and the estimation of competitive interaction

Previous research assessing the competitive interaction between firms has essentially taken on three forms: non-nested model comparisons, conjectural variations, and time-series causal approaches.[4] Non-nested model comparisons entail deriving equilibrium conditions under the *assumption* of a certain type of firm behavior (e.g., Nash or Stackelberg). Using non-nested hypothesis tests of the type introduced by Vuong (1989), the objective is to test which form of noncooperative behavior best fits the data (since the equilibrium conditions are typically non-nested, relatively sophisticated non-nested hypotheses tests are needed). Examples of research of this type include Gasmi and Vuong (1991), Gasmi, Laffont and Vuong (1992) and Kadiyali, Vilcassim and Chintagunta (1996). Since a researcher infers firm behavior based upon the choice of which form of interaction fits the data best from a menu of competing possibilities, this approach is often referred to as the "menu approach."

By contrast, the conjectural variations approach treats firm conduct as a continuous parameter to be estimated (see, e.g., Bresnahan 1989 and Kadiyali, Vilcassim and Chintagunta 1998). Based on early work by Iwata (1974), and more recent work by Gollop and Roberts (1979), Spiller and Favaro (1984) and Gelfand and Spiller (1987), this approach entails the estimation of a conjectural variation or "conduct" parameter, which essentially measures deviation from Nash behavior.[5] That is, if both firms in a duopoly have estimated conduct parameters equal to zero, then Nash (or "independent") behavior is inferred. If only one firm had an estimated conduct parameter greater than zero, then a leader-follower relationship is inferred (we present a typology of interaction below). An advantage of this approach is that it does not assume a specific type of market interaction, rather it allows the research to let the data describe the market interaction (via the estimated conduct parameter). Since this approach entails the simultaneous estimation of the first order conditions directly, it is not identical to estimating each firm's reaction function. Kadiyali, Vilcassim and Chintagunta (1998) provide an excellent discussion regarding the interpretation of the conduct parameters, while Gasmi, Laffont, and Vuong (1992) employ both non-nested model comparisons and a conjectural variation approach. The interested reader may also want to look at the classic papers by Iwata (1974) and Bresnahan (1989).

Time series causal approaches employ time series data and causality tests such as Granger causality to infer causality in interaction. The intuition is simple: if firm two

reacts to changes in firm one's marketing actions, then firm two's reaction will be observed after firm one's behavior. This time-sequenced set of events implies that firm one is the leader and firm two the follower. Leeflang and Wittink (1992) use causality tests to infer firm reactions across marketing instruments. One potentially valuable use of causality tests is in inferring and confirming leader-follower relationships estimated by either a menu or a conjectural variations approach. An example of a recent study employing Granger causality is work by Raju and Hanssens (1994). Hanssens, et al., (1990, Chapter 5) present an excellent overview of causality tests.

Previous research has attempted to classify or categorize competitive interaction. For example, Raju and Roy (1997) define three forms of competitive interaction: independent (Nash), leader-follower (Stackelberg) and collusive. Under *independent* behavior, each player takes its rival's strategic actions as given and acts to maximize its own profits. Under *leader-follower* behavior, one firm acts as the leader (i.e., it does not react to it's rival's actions), while its rival follows changes in the leader's strategic behavior. Under *collusive* behavior, firms act to maximize joint profits. Kadiyali, Vilcassim and Chintagunta (1998) characterize competitive pricing behavior according to *Nash* (independent), *cooperative* (positive conduct parameters, i.e., both firm's pricing actions move together) and *competitive* behavior (negative conduct parameters). Ramaswamy, Gatignon, and Reibstein (1994), using PIMS data, recognized an inherent asymmetry in the inferred interactions: while simultaneous price increases might be evidence of coordinated behavior, simultaneous price cuts might be indicative of "retaliatory" behavior.

We begin by dividing competitive interaction into patterns that are symmetric versus those that are asymmetric.[6] For illustration, imagine a differentiated duopoly, with each firm producing one product and facing strategic promotion decisions. Symmetric interaction implies both firms respond to actions by its rival in a similar fashion. For example, *cooperative* promotions imply that promotional decisions are made in a coordinated fashion—if one firm increases its promotional intensity, the other *cuts* its promotional intensity to accommodate. Examples of this type of interaction might include the famed Coke-Pepsi alternating promotions. Alternatively, *non-cooperative* promotions imply that an increase (decrease) in the promotional intensity of one firm is met by an increase (decrease) in the promotional intensity of its rival. Two firms competing for end of year market share via extensive coupon drops would constitute non-cooperative behavior.[7] Finally, note that a lack of a response by both rivals is also symmetric. Thus, we will include a third form of symmetric behavior, *independent* (sometimes referred to as Nash), which implies a lack of response by both rivals. Independent behavior might be expected, for example, in markets where demand substitutability is weak. Here, since there is little or no cross-promotion response, the competitive response is also likely to be quite small.

We also consider two forms of asymmetric behavior. *Leader-follower* (Stackelberg) behavior implies that one firm reacts to changes in it's rival's actions (the "follower"), while the other (the "leader") does not. Often, private labels are thought to follow national brands' marketing efforts, although we allow for private labels to be a leader as well as a follower below. The final form of interaction allows for the case where two firm's competitive strategies may be opposite in direction, i.e., where one firm behaves cooperatively, while the other competes in a non-cooperative fashion. For example, one firm may simply

follow the actions of a stronger rival. A weaker, or "fringe" firm, may not be willing to take the dominant firm on directly, hence accommodating its larger rival's promotional efforts. However, firms with a "dominant" share position might fiercely defend its market position, taking on a non-cooperative stance. We will refer to this form of interaction as "*dominant/fringe-firm*" behavior (see, e.g., Spiller and Favaro 1984).

Now, imagine that the two firms in this duopoly have multiple marketing instruments at their disposal: regular price (P), temporary price reductions (γ), and non-price promotions (e.g., feature and/or display, denoted by μ). We will denote the competitive response of firm 1 to a change in firm 2's actions by the relevant partial derivative. For example, $\partial\gamma_1/\partial\gamma_2$ denotes the response of firm 1 to firm 2's temporary price reduction. Although cross-promotion response is certainly possible (Leeflang and Wittink 1992), we focus on like-instrument response here in the interest of parsimony.[8] We also note that cooperative price promotion, for example, does not necessarily imply cooperative non-price promotions. In practice, it may often be the case that firms compete vigorously on price (for example), but accommodate changes in the feature advertising of their rivals. Table 1 details the categorization discussed above in the context of the conduct parameters to be estimated. Note that since temporary price reductions are expressed as an average price *reduction*, the signs for this variable in Table 1 are opposite that of regular (nondeal) price.

Based upon this categorization, we set out to estimate the competitive interaction that actually exists across 58 food product categories, using national brands and private labels as an example. References to competitive interaction will follow the scheme characterized in Table 1, and as described above.

Table 1. Price and promotion response and implied market interactions.

Competitive interaction	Regular price	Promotion
	Symmetric Interaction	
Independent (Nash)	$\partial P_2/\partial P_1, \partial P_1/\partial P_2 = 0$	$\partial\mu_1/\partial\mu_2,\ \partial\mu_2/\partial\mu_1 = 0$ $\partial\gamma_1/\partial\gamma_2,\ \partial\gamma_2/\partial\gamma_1 = 0$
Cooperative	$\partial P_2/\partial P_1, \partial P_1/\partial P_2 > 0$	$\partial\mu_1/\partial\mu_2,\ \partial\mu_2/\partial\mu_1 < 0$ $\partial\gamma_1/\partial\gamma_2,\ \partial\gamma_2/\partial\gamma_1 < 0$
Non-Cooperative	$\partial P_2/\partial P_1, \partial P_1/\partial P_2 < 0$	$\partial\mu_1/\partial\mu_2,\ \partial\mu_2/\partial\mu_1 > 0$ $\partial\gamma_1/\partial\gamma_2,\ \partial\gamma_2/\partial\gamma_1 > 0$
	Asymmetric Interaction	
National Brand Leader, Private Label Follower	$\partial P_2/\partial P_1 \neq 0,\ \partial P_1/\partial P_2 = 0$	$\partial\mu_2/\partial\mu_1 \neq 0,\ \partial\mu_1/\partial\mu_2 = 0$ $\partial\gamma_2/\partial\gamma_1 \neq 0,\ \partial\gamma_1/\partial\gamma_2 = 0$
Private Label Leader, National Brand Follower	$\partial P_2/\partial P_1 = 0,\ \partial P_1/\partial P_2 \neq 0$	$\partial\mu_2/\partial\mu_1 = 0,\ \partial\mu_1/\partial\mu_2 \neq 0$ $\partial\gamma_2/\partial\gamma_1 = 0,\ \partial\gamma_1/\partial\gamma_2 \neq 0$
National Brand Dominant, Private label Fringe	$\partial P_2/\partial P_1 > 0, \partial P_1/\partial P_2 < 0$	$\partial\mu_2/\partial\mu_1 < 0,\ \partial\mu_1/\partial\mu_2 > 0$ $\partial\gamma_2/\partial\gamma_1 < 0,\ \partial\gamma_1/\partial\gamma_2 > 0$
Private Label Dominant, National Brand Fringe	$\partial P_2/\partial P_1 < 0, \partial P_1/\partial P_2 > 0$	$\partial\mu_2/\partial\mu_1 > 0,\ \partial\mu_1/\partial\mu_2 < 0$ $\partial\gamma_2/\partial\gamma_1 > 0,\ \partial\gamma_1/\partial\gamma_2 < 0$

Key: P denotes regular price
γ denotes temporary price reductions
μ denotes non-price promotions (e.g., feature and/or display)

3. The categorization of competitive interaction for private labels and national brands

A. The many faces of competition—data and methodology

The primary data used for this study are quarterly IRI data on food products across 59 geographic markets and 58 categories from 1992. The data contain most standard IRI measures such as feature and display activity, regular price, price promotions, and unit and volume sales figures.[9] In addition, we combined this data with independent data from *Progressive Grocer* on the demographic characteristics of the IRI geographic markets, providing annual information on each market's population, income and age distribution, and ethnicity (only information on the percent of the local market of Hispanic decent is available). Finally, we obtained the measures (factor scores) on impulse buying behavior and the ability of consumers to stockpile items for each category from Narasimhan, Neslin and Sen (1996). Table 2 provides summary statistics on the set of variables used in the study (PL for private label and NB for national brand).

A system of structural equations was estimated for national brand and private label marketing actions for price and for each of the three promotional vehicles (temporary price reduction, display and feature) employing three stage least squares. The series of ten structural equations (four for the private label marketing variables, four for the national

Table 2. Summary statistics for variables used in empirical analysis.

Variable	Units	Definition	Mean	Std Dev
BR SALES	millions	BR Unit Sales	4.71	5.29
PL SALES	millions	PL Unit Sales	1.36	1.99
BR PRICE	dollars	BR Unit Price	2.02	0.80
PL PRICE	dollars	PL Unit Price	1.60	0.78
BRPRICEREDN	dollars	Weighted Average Price Reduction	0.42	0.18
PLPRICEREDN	dollars	Weighted Average Price Reduction	0.22	0.04
BR FEATURE	percent	% Sold on Feature	6.67	4.42
PL FEATURE	percent	% Sold on Feature	5.87	4.51
BR DISPLAY	percent	% Sold on Display	11.29	8.53
PL DISPLAY	percent	% Sold on Display	11.06	6.76
IMPULSE	scale	Impulse Scale	−0.02	0.35
STOCK	scale	Stockpiling Scale	−0.06	0.36
HHI	index	Herfindahl Index	180.56	105.64
NBRANDS	integer	Number of Brands	40.22	35.10
PLSHARE	percent	PL Share (%)	0.23	0.14
PL DISTN	percent acv	PL % ACV	75.35	28.32
GROCCR4	percent	Local Retail CR4	68.34	11.93
SUPER	percent	% Sold at Supermarket	72.78	5.13
BRVPERU	volume	Average Volume/Unit	1.72	4.00
PLVPERU	volume	Average Volume/Unit	1.71	3.02
INCOME	thousands	Mean Income	37.38	5.06
AGE	years	Mean Age	33.46	2.33
POP	millions	Population	2.71	2.80
HISPANIC	percent	% Hispanic	8.12	12.73

brands, along with two linearly specified demand equations) are derived directly from the relevant first order conditions (the Appendix provides additional detail on the equations estimated).[10] A parameter estimated in each of these equations is the conduct parameter for each firm (national brand and private label) for each promotional vehicle. As discussed above, this approach allows us to *estimate* the nature of the competitive interaction instead of specifying the type of interaction *a priori*. These parameters allow for the possibility of a variety of market interactions, including each of the relationships detailed in Table 1 above.

Estimation of the conduct parameters was performed separately for each of 58 food product categories, resulting in 58 separate empirical estimates (one for each category) of the competitive interaction (e.g., $\partial P_1/\partial P_2$) for each of the four promotional vehicles.

B. The many faces of competition—what does competitive interaction look like?

For each marketing mix variable, we categorized each product category into the five distinct forms of competitive interaction outlined in Table 1. Table 3 summarizes the results across the categories and the rest of this section is devoted to describing the competitive interaction between private labels and national brands in these 58 categories. Sections V and VI below discuss the normative implications of this characterization of competition.

Table 3 suggests that there are significant differences across categories and across promotional instruments. Analysis of competitive interaction is more often performed for a single category (Gasmi, Laffont, Vuong 1992) or for one marketing mix variable (Kadiyali, Vilcassim and Chintagunta 1998). Conducting an analysis across 58 categories and for multiple instruments presents some interesting situations that usually do not arise in other studies. For example, since firm reactions for each promotion vehicle will depend upon a variety of factors including the demand response to that promotion (Bulow, Geanakopolis and Klemperer 1985), we would naturally expect the observed conduct to vary from one type of promotion to the next, even within a given category. Thus, it is entirely possible, even likely, if the national brand is a price leader, that we would observe some

Table 3. Distribution of estimated implied market interactions across the 58 categories

	Price	Predn	Feature	Display
Symmetric				
INDEPENDENT	4	10	19	9
COOPERATIVE	7	7	6	7
NON-COOPERATIVE	16	10	8	6
Asymmetric				
NB LEADER	19	16	19	15
PL LEADER	3	6	1	7
NB DOMINANT	8	8	3	9
PL DOMINANT	1	1	2	5

other behavior (e.g., independent) in display.[11] *A priori*, there is absolutely no theoretical reason why we would observe "consistent" response from one type of promotion to the next.

Table 3 suggests that national brand leadership is indeed the most common form of interaction for each marketing mix variable. However, it characterizes only 19 out of 58 categories for regular price, and 16, 19, and 15 out of 58 categories for temporary price reduction, feature and display, respectively. In fact, we estimated that private label price leadership characterized three categories (milk, frozen plain vegetables and fresh breads) and 6, 1 and 7 categories, respectively for temporary price reduction, feature and display. Not surprisingly, a number of categories (16) were characterized by non-cooperative price interaction. Aggregating across the four marketing mix variables, national brand leadership was the most common form of interaction (69 observations), independent behavior the next most common (42), followed by non-cooperative interaction (40), dominant-fringe firm relationships (37), cooperative interaction (27) and private label leadership (17), respectively. It is also interesting to note the differences in competition observed across marketing instruments. National brand price leadership and non-cooperative interaction were common (35 categories) for price, while national brand leader and independent behavior were most common in feature advertising.

4. Characteristics of competitive interaction

The review presented above was intended to be purely descriptive—what *does* competitive interaction look like in practice? These results suggest that there is considerable variation in the competitive interaction between branded products and private labels (and across categories). Before one assumes a specific form of interaction in a theoretical model or anticipates a rival's action in practice, the form of competitive interaction should be considered very carefully.

Several different factors may determine how competitors react to a rival's actions. In an attempt to determine the major factors influencing the type of interaction observed, we expressed each form of competitive interaction as a function of three broad categories of competitive influences. In the interest of brevity, we present and discuss the results for only one common form of interaction, namely *non-cooperative* behavior, below. The three sets of factors that we postulate to impact the likelihood of observing *non-cooperative* behavior are:

1. *Category Characteristics*. We expect that the greater the ability of consumers to stockpile (STOCK) a product and the higher the likelihood of impulse purchase (IMPULSE), the more likely the category is to exhibit non-cooperative firm behavior. The intuition for this is that since short-term promotions will be more effective in these categories, they should be more competitively contested. If one firm engages in a short-term promotion, its rival will generally find it difficult to stand by while its share is eroded by the (relatively effective) promotion of its rival.
2. *Firm and Market Power Characteristics*. A second key factor influencing rivalry is the degree of market power between strategic groups. Markets with a disperse share struc-

ture lack a dominant firm by definition. We expect that such categories, lacking a dominant firm with a high degree of market power, are more likely to exhibit non-cooperative firm behavior. More specifically, the number of brands in the category (NBRANDS) and the share of private labels in the category (PLSHARE) are expected to be positively related to the likelihood of non-cooperative firm behavior.

3. *Demand Characteristics*. A key factor that influences reactions is the nature of market interdependence. As alluded to above, the higher the demand promotion elasticity, the more promotions will be competitively contested. Consequently, we expect that the higher the own and cross promotion elasticity, the higher the likelihood of non-cooperative firm behavior. We created four price elasticity variables for each of the three promotional vehicles (for example, BRODE, BRCDE, PLODE, and PLCDE in the display equation). For these twelve variables, PL denotes Private Label, BR national BR and, O for Own, C for Cross, D for Display, F for Feature, PR for price reduction and E for Elasticity. Thus, BRODE, in the first column of Table 4, for example, represents national Brand Own Display Elasticity. We expect that all twelve coefficients will be positive in sign.

Our analysis proceeded as follows. A binary variable representing non-cooperative interaction for each marketing mix instrument (e.g., for feature advertising, NONCOOP = 1 if non-cooperative interaction was observed) was expressed as a logistic function of the above set of category characteristics. Table 4 presents these results.

The results in Table 4 suggest that the actual form of the interaction is idiosyncratic to the category, largely determined by the characteristics of that category. All coefficients were of the predicted sign, with most being significant at $\alpha = .05$ or better. The implication is straightforward: managers operating in categories with a) products that are more easily stockpiled or that are more likely to be impulse purchases, b) products that have a higher promotional elasticity, and c) a larger number of brands and greater private label penetration, are more likely to experience non-cooperative promotions response.

Table 4. Logistic regression linking category characteristics competitive interaction.

Dep. Var:	Non-Cooperative Display		Dep. Var:	Non-Cooperative Feature		Dep. Var:	Non-Cooperative Price Reduction	
Variable	β	Wald	Variable	β	Wald	Variable	β	Wald
IMPULSE	1.764	2.122	IMPULSE	1.931	5.713	IMPULSE	0.184	1.953
STOCK	2.499	2.407	STOCK	7.241	5.634	STOCK	3.451	6.114
NBRANDS	0.011	0.332	NBRANDS	0.050	3.105	NBRANDS	0.022	1.556
PL$SHARE	14.380	3.199	PL$SHARE	3.542	0.384	PL$SHARE	6.758	3.303
BRODE	26.523	0.484	BROFE	5.802	0.066	BROPRE	0.654	2.432
BRCDE	150.576	3.921	BRCFE	39.189	2.291	BRCPRE	0.738	3.903
PLODE	73.036	2.214	PLOFE	2.520	0.018	PLOPRE	0.013	0.023
PLCDE	15.000	1.936	PLCFE	20.724	1.993	PLCPRE	0.021	1.110
Constant	1.949	1.262	Constant	−6.419	5.291	Constant	−3.946	4.080
Chi-Square	32.046		Chi-Square	21.419		Chi-Square	20.926	
Significance	0.070		Significance	0.006		Significance	0.007	

5. Discussion and managerial implications

It should be clear from the empirical results that general comments or assumptions about the competitive interaction between private labels and national brands can produce very misleading conclusions. Consistent with previous research on the type of competition within a strategic group, there is no one pattern of competition that exists between private labels and national brands across categories. Further, the pattern of interaction is quite complex, with significant variation across instruments within a category.

The results are consistent with the notion that competitive rivalry is not symmetric and that not all marketing mix actions require a similar response. For example, we estimated that dominant-fringe firm behavior characterized nine categories for both regular price and temporary price reductions, five categories for feature and fourteen categories for display. For both regular price and temporary price reductions, all but one category was characterized by national brand dominance.

In other ways, the results contradict previous notions of competitive interaction between private labels and national brands, as well as the balance of market power between them. Until recently, it was generally believed that national brands had balance of market power and that private labels were relatively weak brands. Clearly this is not the case. The number of categories where private labels are passive followers are small in number. In certain categories, private labels play lead role in pricing and promotion, while they place a significant role in most categories. Private label market share and distribution appear to play a significant role in this regard—categories with a higher private label share and distribution were less likely to play a follower role for each of the four marketing instruments.

We believe that all of this suggests that competitive interaction in any category is the result of a complex set of variables and influences. Demand side factors, market and industrial structure, firm "personality," and category characteristics all interact in a complex fashion to determine strategic behavior. Further, each marketing mix instrument is likely to be used as a strategic weapon for different objectives, suggesting that firms may very well take different competitive stances with each instrument. Given that previous research has also found that competitive interaction is likely to vary across categories and across competitive instruments, we believe that our finding of a diverse set of competitive interactions is real. However, to date, little research has been conducted that attempts to explain *why* firms act as they do. What determines when a cooperative stance is optimal? What settings encourage independent (Nash) response? It seems to us that such an analysis is needed *before* an assumption of, e.g., Nash or Stackelberg behavior is assumed in a game theory model. Our initial attempt to explain the determinants of one form of competitive interaction (Table 4 above) is intended to be a preliminary (empirical) step in this direction.

All of this suggests that the ultimate impact of a marketing action should not be evaluated solely by the demand-side considerations, but also by considering the likely response of a firm's rival. Not only will such a response occur in most instances, the direction of the response can impact the effectiveness of the promotion (Putsis and Dhar 1997, Leeflang and Wittink 1992). Further, the likelihood of the type of competitive

response will be strongly influenced by the characteristics of the category—categories with high demand response and a disperse market structure are more likely to exhibit competitive firm behavior. Managers need to take the direction and magnitude of the competitive response into account in evaluating the likely impact of a change in the firm's marketing mix.

Finally, the empirical results should send a caution to game theorists regarding the assumptions made about firm behavior in most game theory models. Casual assumptions based upon anecdotal evidence about firm behavior in a market may lead to normatively incorrect conclusions. It is important to understand the type of interaction that actually takes place (through the use of empirical estimates of the sort presented here) before actually developing a model of firm interaction. Once the type of interaction that occurs in practice is understood, models of optimal firm reactions and strategic behavior given the likely rival response become all the more important.

6. Conclusions, limitations and implications for future research

This paper has empirically described the nature of competitive interaction between national brands and private labels across multiple product categories. While our focus has on describing the nature of competitive moves, a natural issue that arises is whether these moves are optimal for a firm's viewpoint. We have attempted to answer the question "How do firms react" not "How should firms react." We provide some insight into this question by relating category characteristics to the form of interaction observed. However, several different issues need to be addressed before one can be certain about what the optimal response should be. For instance, does the competitive interaction within a strategic group differ from the interaction estimated for between strategic groups (i.e., national brands and private labels)? The answer to this question will also depend on what exactly is incorporated into the firm's objective function (i.e., profits versus market share). Our intuition suggests that since brands within a strategic group are more substitutable in terms of consumer demand, the response is more likely to be determined by a focusing on market share. In contrast, competitive response between strategic groups is more likely to be determined by concerns of the bottom line.

There is clearly a great deal of future research needed on competitive interaction, and we believe that these results provide a clear direction for this research. For example, how might firms signal the game in such a way that produces an outcome that maximizes its profit *given the game currently being played* in that category? What happens to the game being played if a new entrant joins the competition and does this change from one type of (preexisting) competition to another? Does demand shifts and cross-category effects influence the nature of the game being played and the optimal strategic response of players in that category?

As a descriptive study, we find that a diverse set of interactions characterize strategic firm behavior. Although the relatively diverse set of competitive interactions found here is consistent with previous research, the results should be viewed with some caution. For example, the asymmetries suggested by Ramaswamy, Gatignon and Reibstein (1994)

imply that each of the categorizations made here might include multiple sets of responses. A price cut may be a different instrument and may imply a different competitive response than a price increase, for example. Here, the time sequence of events becomes important. Weekly data, perhaps at the store-level combined with Granger-causality tests might be helpful in discerning these differences. Clearly, our quarterly data aggregated at the market-level is less than ideal for this purpose. However, we note that a detailed time series analysis using weekly store data and Granger causality tests would be extremely onerous if conducted across all of the 58 markets and 135 categories used in our analysis.

Finally, we noted above that the results also suggest that competitive interaction varies across the marketing instruments. Thus, firms may *not* cooperate in their advertising expenditures (both Coke and Pepsi may increase advertising during summer months), but cooperate in the allocation of their promotion dollars (alternate promotions). An important issue that arises is whether retailers can coordinate behavior in a manner that addresses total category profits and revenue. If one assumes that retailers control the timing of promotions for both national brands and private labels, several interesting possibilities emerge. For example, the retailer may organize promotions and displays in a manner that creates a win-win situation for all the players concerned depending on the category characteristics. Furthermore, if market interdependence occurs across categories, it suggests that a firm's action should take into account the nature of interaction and act accordingly. For instance, manufacturers of fabric softeners may decide to promote their product in response to a major campaign by a detergent maker. A question that naturally arise is how might firms signal the game in such a way that produces an outcome that maximizes its profit given the game being played. Clearly, this article suggests that competitive interaction is an important phenomenon that has only recently begun to be understood and exploited by marketers.

Appendix—Empirical estimation

Employing a simple duopoly model and a traditional conjectural variations approach (Iwata 1974, Bresnahan 1989, Gasmi, Laffont and Vuong 1992), the following framework was used as the basis for the empirical analysis. Employing the notation of Section II and designating the national brand as firm 1 and the private label as firm 2, the set of structural equations can be stated as follows (following Iwata (1974), the equations represent two demand equations followed by the set of first order conditions):[12]

$$Q_1 = \alpha_0 + \alpha_1 P_1 + \alpha_2 P_2 + \alpha_3 \gamma_1 + \alpha_4 \gamma_2 + \alpha_5 \mu_1 + \alpha_6 \mu_2 \tag{A1}$$

$$Q_2 = \beta_0 + \beta_1 P_1 + \beta_2 P_2 + \beta_3 \gamma_1 + \beta_4 \gamma_2 + \beta_5 \mu_1 + \beta_6 \mu_2 \tag{A2}$$

$$\begin{aligned} P_1 &= -[Q_1/(\partial Q_1/\partial P_1)] - (MC_1 + \gamma_1 + \alpha\mu_1) \\ &= -[Q_1/(\alpha_1 + \alpha_2(\partial P_2/\partial P_1))] - (MC_1 + \gamma_1 + \alpha\mu_1) \end{aligned} \tag{A3}$$

$$\gamma_1 = -[Q_1/(\partial Q_1/\partial\gamma_1)] + (P_1 - MC_1 - \alpha\mu_1)$$
$$= -[Q_1/(\alpha_3 + \alpha_4(\partial\gamma_2/\partial\gamma_1))] + (P_1 - MC_1 - \alpha\mu_1) \quad \text{(A4)}$$

$$\mu_1 = [(P_1 - \gamma_1 - MC_1)/\alpha] - [Q_1/(\partial Q_1/\partial\mu_1)]$$
$$= [(P_1 - \gamma_1 - MC_1)/\alpha] - [Q_1/(\alpha_5 + \alpha_6(\partial\mu_2/\partial\mu_1)] \quad \text{(A5)}$$

$$P_2 = -[Q_2/(\partial Q_2/\partial P_2)] - MC_2$$
$$= -[Q_2/(\beta_2 + \beta_1(\partial P_1/\partial P_2))] - MC_2 \quad \text{(A6)}$$

$$\gamma_2 = [\{-Q_2 + (k_1P_1(\alpha_4 + \alpha_3(\partial\gamma_1/\partial\gamma_2)))\}/\{\beta_4 + \beta_3(\partial\gamma_1/\partial\gamma_2)\}] + (k_2P_2 - \beta\mu_2), \quad \text{(A7)}$$

$$\mu_2 = [\{(k_1P_1(\alpha_6 + \alpha_5(\partial\mu_1/\partial\mu_2))) - \beta Q_2\}/\{\beta(\beta_6 + \beta_5(\partial\mu_1/\partial\mu_2))\}] + [(k_2P_2 - \gamma_2)/\beta] \quad \text{(A8)}$$

The set of terms $\{\alpha_0, \ldots, \alpha_6\}$, $\{\beta_0, \ldots, \beta_6\}$, $\{k_1, k_2, \alpha, \beta, MC_1$ and $MC_2\}$ represent parameters to be estimated. In addition, $\Phi(2 \rightarrow 1) \equiv \{(\partial P_2/\partial P_1), (\partial\gamma_2/\partial\gamma_1), (\partial\mu_2/\partial\mu_1)\}$ and $\Phi(1 \rightarrow 2) \equiv \{(\partial P_1/\partial P_2), (\partial\gamma_1/\partial\gamma_2), (\partial\mu_1/\partial\mu_2)\}$ represent the relevant set of conjectural variation or "conduct" parameters.[13] These conduct parameters, continuous parameters to be estimated, represent the "expectations" that a firm has about the reactions of its rivals. Firms hold certain beliefs about their rivals, with these beliefs being realized in equilibrium. Thus, in equilibrium, these conduct parameters are consistent and can be used to infer actual market behavior (Bresnahan 1989).[14]

The objective was to estimate these structural equations directly, thereby obtaining estimates of the conduct parameters above. In doing so, a series of identifying restrictions (following Kadiyali, Vilcassim and Chintagunta 1998) were placed on the system and various instruments were used in order to allow estimation. See Putsis and Dhar (1997) for details on each player's relevant profit maximization, and on the specific set of identifying restrictions and instruments used in the empirical analysis.

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Notes

1. Spiller and Favaro (1984) make a similar argument, distinguishing across two groups, one a "dominant" and the other a "fringe" group.
2. Since it is not possible to draw general conclusions from the limited empirical research on competition conducted to date, we begin at a broad, macro level, focusing on competition between strategic groups. We do this as a first attempt to present a general characterization of competition, with the recognition that future research should also focus on the competition between firms (within strategic groups) and recognize the role that retailers play in the competitive environment in more detail.
3. Blattberg and Neslin (1990) do not even discuss competitive interaction. Leeflang and Wittink (1992), point out that "Conclusions about the relative attractiveness of alternative marketing programs may change once competitive reactions are incorporated." Further, they conjecture that incorporating competitive reactions make it likely that conclusions regarding the attractiveness of alternative marketing programs will "change systematically and in perhaps unexpected ways." However, they go no further than to point out the potential importance of competitive interactions for promotion.
4. See Raju and Roy (1997) for a comparison of the relative advantages and disadvantages of these approaches.
5. Note that Nash behavior is typically defined by the absence of a competitive response. For example, Nash-Bertrand behavior implies the absence of a price response. We will generally use the term "independent" in this paper, although Nash and independent can be used interchangeably in this context (as in Raju and Roy 1997).
6. In our attempt to categorize competitive interaction below, we have tried to be as descriptive as possible, while also following previous research (e.g., Ramaswamy, Gatignon, and Reibstein 1994, Raju and Roy 1997, Kadiyali, Vilcassim and Chintagunta 1998). Note that non-cooperative interaction can be consistent with both the "retaliatory" and "cooperative" behavior suggested by Ramaswamy, Gatignon, and Reibstein (1994). We thank an anonymous reviewer for pointing this out and we discuss this further in the Discussion section below.
7. We note that for price decisions, these definitions will be reversed. That is, cooperative pricing implies that prices rise and fall together, while non-cooperative pricing implies that they move in opposite directions. Also, note that each form of symmetric interaction is symmetric in direction, but not necessarily in magnitude.
8. The final system of equations has also been derived and estimated allowing for cross-instrument response, with the estimations using the set of cross-equation restrictions detailed in Kadiyali, Vilcassim and Chintagunta (1998). The inclusion of the cross-instrument reactions could not be justified statistically (the total sum of square residuals is approximately 7% lower (lower in all but two categories) under like-like reactions than under cross-instrument response).
9. Consistent with our objective of exploring competitive interaction between strategic groups and consistent with previous research (e.g., Sethuraman and Mittelstaedt 1992, Slade 1995, Putsis and Dhar 1997), composite branded and private label variables were created for the 58 product categories and 59 markets. For example, aggregate private label and national brand variables were created for share, price and price reduction. Private label (national brand) share is sum of all private label (national) volume shares in the ith market, jth category. Private label (national brand) price is the volume-weighted average price of all private labels (national brands) in the ith market, jth category. The two price reduction variables are volume-weighted percent price reduction for all private label and branded products, respectively.
10. The interested reader should refer to the Appendix and to Putsis and Dhar (1997) for additional details on the empirical estimation. For details on the econometric issues of estimating the conduct parameters from the first order conditions and some perspective on interpreting the parameters, see the classic papers by Iwata (1974) and Bresnahan (1989), as well as a recent paper by Kadiyali, Vilcassim and Chintagunta (1998).
11. This is consistent with previous research. For example, Gasmi, Laffont and Vuong (1992) allow for different behavior in price and advertising (e.g., their model M5, p. 303, allows for collusion in advertising and competition in prices).

12. In the interest of parsimony, we include only "like-like" instrument responses. We also estimated the system allowing for cross-instrument reactions through the use of identifying restrictions. However, the inclusion of the cross-instrument responses could not be justified statistically. Also, note that μ denotes both feature and display so that μ_1 (A4) and μ_2 (A7) actually represent four equations in total.
13. Note that this formulation, expanded to include multiple instruments and the presence of an active retailer, is essentially the same as Kadiyali, Vilcassim and Chintagunta (1998) and Gasmi, Laffont and Vuong (1992), pp. 297–301.
14. Note that the partial derivatives above representing each of the conjectures are identical to the conjectural variation parameters from previous studies (e.g., γ in Iwata, 1974). Using this approach, we do not estimate reaction functions (we estimate the first-order conditions directly), so in this sense, the use of the partial derivatives may seem a bit misleading. We do this for two reasons. First, the notation above accurately represents the fact that we are estimating actual market behavior (or "what firms do as the result of these expectations [about rivals behavior]," Bresnahan 1989, p. 1029). Second, given the number of conduct parameters addressed in the present study, the notation employed above is much more straightforward.

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