Competitive Reactions and the Cross-Sales Effects of Advertising and Promotion

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Abstract

How do competitors react to each other's price-promotion and advertising actions? How do these reactions influence the net sales impact we observe? We answer these questions by performing a large-scale empirical study of the short-run and long-run reactions to promotion and advertising shocks in over 400 consumer product categories, over a four-year time span.

Competitive reaction can be passive, accommodating or retaliatory. We first develop a series of expectations on the type and intensity of reaction behavior, and on the moderators of this behavior. These expectations are assessed in two ways. First, vector-autoregressive models quantify the short-run and long-run effect of a promotion or advertising action on competitive sales and on competitive reactions. By cataloging the numerical results, we are able to formulate empirical generalizations of reaction behavior ("how do they react?"). Second, we estimate structural models of reaction intensity, in function of various market and competitive characteristics ("what are the drivers of reaction?"). Finally, by comparing our findings on reaction behavior with those on promotion and advertising effectiveness, we are able to evaluate competitive reaction behavior ("are they reacting as they should?").

A major finding is that competitive reaction is predominantly passive. When it is present, it is usually retaliatory in the same instrument, but accommodating or retaliatory in a different instrument. There are very few long-run consequences of any type of reaction behavior. We also report on several moderating effects that are in line with expectations, and that support the presence of a certain amount of rationality in competitive reaction behavior.

The net impact of the over-time effects of advertising and price-promotion attacks, competitive reactions and the sales effectiveness of each, is that competitors' sales are generally *not* affected, and especially not in the long run. We weigh the evidence that this sales neutrality is "natural" (i.e., due to the nature of consumer response) versus "managed" (i.e., due to the vigilance and effectiveness of competitors), and conclude in favor of the former.

1. Introduction

In consumer and business markets alike, we observe a never-ending sequence of marketing actions and competitive reactions that eventually shape both the structure of a market and the performance of its participants. New products are launched, distribution is developed, advertising campaigns are initiated, prices adjusted, etc. The market-response literature has made substantial progress in quantifying the typical short-run performance effects of such marketing actions and reactions, and we have begun to understand some of their long-run consequences as well (e.g., Hanssens, Parsons and Schultz 2001; Leeflang et al. 2000).

In this repetitive marketing game, managers need to know whether or not marketing reactions are necessary (i.e., essential to the long-run survival of their brands) or discretionary, i.e., they may have desirable short-run outcomes, but are inconsequential to the brand's long-run competitive position. This is a difficult task, as it entails knowledge about the direction of a competitive effect (beneficial, harmful or neutral), its duration, as well as the effectiveness of competitive response for both retaliating and accommodating behavior. Absent such knowledge, it is not surprising that empirical studies find systematic deviations between actual vs. Nash-optimal marketing spending levels in competitive markets. For example, some competitors may behave sub-optimally while others are supra-optimal, i.e., they fare better than they should (e.g., Carpenter et al. 1988).

Our paper begins this process by examining the way in which competitors react to two of the most prevailing forms of marketing activity, price promotions and advertising. We examine cross-sales and competitive reaction elasticities due to price promotion or advertising attacks, both in the short and the long run, and quantify the moderating impact of a variety of brand and category factors influencing the magnitude of these elasticities.

Our study is based on all major participants in over 400 consumer product categories in The Netherlands, sampled weekly over a four-year period. We focus on the top 3 brands in each category and measure promotion and advertising reaction behavior, while controlling for the rest of the marketing mix, i.e. distribution coverage, new-product introductions, feature and display support. To that effect, we use long-term time-series modeling that measures the short- and long-run differential impact of promotion and advertising attacks, in terms of sales response as well as competitive response. The breadth (number of product categories and brands) and detail (full marketing mix) of our data set leads to a first major contribution of the study: a rich set of empirical generalizations on the intensity, duration and effectiveness of different competitive reactions. As a second contribution, we link this extensive set of response and reaction elasticities to a number of theory-based brand and category characteristics, to test under what circumstances competitive reactions are most likely to be incurred and to be effective. Finally, the combined evidence from our empirical generalizations and our subsequent hypotheses tests allows us to infer whether cross-sales effects are primarily due to the nature of consumer response or due to competitors' vigilance.

The remainder of the paper is organized as follows. In the next section, we lay out the conceptual framework guiding our research. Using this framework, we develop predictions concerning main effects of price promotions and advertising on cross-sales and reactions of competing brands, as well as the role of factors that can increase or reduce these effects. Next, we describe the data set and the methodology, and we report the results. The final section discusses the findings, draws conclusions and provides suggestions for future research.

2. Conceptual Framework on Competitive Reactions and Cross-Sales Effects

Figure 1 depicts the conceptual framework that guided our research. We examine the effect of a shock in price promotions and advertising by brand A (the Attacker) on the sales of rival brand D (the Defender) as well as on the intensity of D's competitive reaction to the shock by A. In this study, price promotions are temporary price reductions offered to the consumer while advertising refers to mass-media advertising. Competitive reactions using the same two instruments, price promotions or advertising, are studied next. The effects of a price promotion or advertising shock by brand A on brand D's competitive reaction and sales are allowed to be moderated by brand and category characteristics.

--- Figure 1 about here ---

2.1. Effect of price promotion and advertising on cross-sales and reactions of competing brands

Cross-sales effects. Expectations about the effects of a price promotion or advertising shock by brand A on the sales of brand D can to a large extent be derived from the own-sales effects of these marketing efforts. If the own-sales effect is small, the cross-sales effect is expected to be even smaller. A similar observation applies to the impact of regular price changes, for example the meta-analytic own elasticities reported in Tellis (1988) tend to be considerably higher than the cross-elasticities reported in Sethuraman, Srinivasan and Kim (1999, Table 3).

Price promotions are known to result in a substantial, albeit typically temporary, own-sales increase at the brand level (Blattberg, Briesch, and Fox 1995). On the other hand, the short-run effect of advertising on own sales is often small, especially for well-established, mature brands as examined in this study (Lodish et al. 1995). It has been argued that advertising has a larger long-run sales effect. However, Deighton, Henderson and Neslin (1994) found that advertising did not have a significant effect on repeat purchase, a main requirement for long-run effectiveness. This suggests that the long-run own sales effects of advertising can be expected to also be modest.

Based on the discussion of own-sales effects, we expect that in general, the short-run cross-sales effects of price and advertising are larger than the corresponding long-run cross-sales effects, and that the cross-sales effect of price promotions (especially in the short run) is larger than the cross-sales effect of advertising.

Competitive reactions. When a competing brand initiates a price or advertising shock, how do other brands respond? Key issues in this respect include whether the defender uses the same instrument as the attacker (simple reaction) or a different instrument (multiple reaction) and how intense the competitive reaction by the defending brand will be. The intensity of the response can range from very accommodating (e.g., substantially decreasing advertising in response to an advertising shock), to passive (no reaction), to strong retaliation (e.g., substantially increasing advertising in response to an advertising shock).

We expect that absence of a reaction to a competitive attack is most common, while accommodating reactions are least common (Leeflang and Wittink 1996, Robinson 1988). Further, we propose that competitive *actions* with price promotions generate more frequent as well as stronger competitive *retaliations* than competitive actions using advertising. Managers have a limited span of attention and time, so they will attend only to certain competitive actions. More visible actions, which generate higher levels of awareness, have a greater likelihood of attracting competitors' response, and price actions are especially visible (Chen and Miller 1994, Leeflang and Wittink 2001). Further, price actions can directly affect the business' bottom line, their impact is relatively easily determined, and they tend to be more provocative (Chen and MacMillan 1992).

Third, we propose that competitive *reactions* with price promotions are more prevalent than reactions with advertising. It is plausible that if managers notice a competitive attack and intend to respond, they will be inclined to use an instrument that typically yields fast results. From their previous experience, they will have noticed that price promotions usually yield faster results than advertising (cf. Blattberg, Briesch and Fox 1995, Lodish et al. 1995). When we combine this proposition with the previous one, it suggests that price-promotion *reactions* to price-promotion attacks should be more prevalent than any other action-reaction combination.

2.2. Factors affecting the cross-sales effect of price promotions and advertising

Key factors affecting the impact of a price promotion or advertising shock by the attacking brand A on the sales of the defending brand D encompass characteristics of the attacking and the defending brand –including the brands' equity, whether they are a private label or a national brand, and their relative position on price and advertising - and the intensity of the competitive reaction of brand D on the competitive attack by brand A.

Brand equity. Carpenter et al. (1988) noted that not all brands are affected equally by competitive marketing actions. We argue that if a brand has high equity, it will be less vulnerable to competitive actions. We further propose that its own competitive moves will have a greater negative effect on the sales of other brands. A high-equity brand is characterized by high consumer awareness and strong, positive associations (Aaker 1991). High brand awareness increases the likelihood that the brand is included in the consideration set of the consumer (Nedungadi 1990) and positive brand associations provide reasons to buy the brand and constitute the basis for brand loyalty (Jacoby and Chestnut 1978). Thus, the higher a brand's equity, the smaller its vulnerability to price promotions or advertising attacks while its own attacks should have a greater effect on sales of other brands.

Private label vs. national brand. Previous research has revealed an asymmetric pattern of switching between private labels and national brands. Marketing activities (price promotions) by national brands affect sales of private labels more than vice versa (Allenby and Rossi 1991, Blattberg and Wisniewski 1989). This is explained by the fact that national brands are typically of higher quality than private labels. If a high-quality national brand is temporarily decreased in price, it allows consumers who currently buy the lower-quality private label to trade up on quality. A price promotion of a lower-quality private label also increases the brand's attractiveness but does not generate any additional favorable quality effect. As pointed out by Sivakumar and Raj (1997), moving from high to low quality does not have the favorable psychological connotation associated with moving from low to high quality, as consumers prefer high quality to low quality.

Given the recent increase in quality of private labels (Zimmerman 1998), one may wonder whether this effect still holds true. However, we argue that the argument above not only applies to quality but also to image/emotional benefits. National brands typically provide more emotional benefits than private labels (Kapferer 1997), and as such moving from a private label to a national brand is still more desirable from a psychological perspective than vice versa. Thus, we expect that if the competitive attack is carried out by a private label, it will have a less negative effect on the sales of competing brands than when the attack is carried out by a national brand. Conversely, if the defender is a private label, its sales will be more affected than when it is a national brand.

Asymmetric and neighborhood price promotion effects. Several authors have pointed out that the relative prices of competing brands affect the cross-sales effects of price promotions. Sethuraman, Srinivasan, and Kim (1999) distinguished between two types of cross-price effects due to the relative prices of competing brands: the asymmetric and the neighborhood effect.

The *asymmetric* price effect says that a price promotion by a higher-priced brand affects sales of a lower-priced brand more than vice versa. This is explained by the notion that higher priced brands are typically also of higher quality (Shapiro 1983, Tellis and Wernerfelt 1987). While consumers who currently buy the low-priced, low-quality brand will be interested in trading up on quality if the price of the higher-priced, higher-quality brand is temporarily decreased, fewer people will be willing to trade down on quality, even if the brand is cheaper than before, because the quality is simply less than deemed acceptable (Blattberg and Wisniewski 1989)[1].

The *neighborhood* price promotion effect states that brands that are farther apart in price have weaker cross-price promotion effects than brands that are closer to each other (Sethuraman, Srinivasan, and Kim 1999). This neighborhood effect can be explained using the argument developed by Bronnenberg and Wathieu (1996). They showed analytically that the impact of a price discount of a brand on the sales of another brand is negatively related to the difference in quality between the two brands. That is, the smaller the quality difference, the stronger the cross-sales effect. Due to the expected positive association between quality and price, we expect that the closer in price the attacking and the defending brand are, the more the sales of the defending brand will be affected by the price promotion of the attacking brand.

Asymmetric and neighborhood advertising effects. The argument based on positive associations between price and quality can be extended to advertising. As early as 1953, Chamberlin (1953, p. 7) argued that "it doesn't pay to advertise a poor product." Klein and Leffler (1981) and Kihlstrom and Riordan (1984) derived analytically that advertising should be positively related to quality. Marquardt and McGann (1975) and Archibald, Haulman, and Moody (1983) provided empirical evidence of the positive association between advertising and quality. Hence, it is plausible that the asymmetric and neighborhood effects will also be observed for advertising. We hypothesize that an advertising shock by a heavily advertised brand has a larger adverse effect on sales of a less-advertised brand than the reverse (asymmetric effect). Further, we expect that brands that are farther apart in advertising expenditure exhibit weaker cross-advertising sales effects than brands that are closer to each other (neighborhood effect).

Competitive reaction of defender. The net effect of a marketing action such as a price promotion or advertising shock on the sales of a competing brand depends in part on the way the competing brand responds (Putsis and Dhar 1998). Stronger retaliation to the attack should have a positive effect on the sales of the defender, i.e., we expect that any decline in sales will be smaller and any increase will be larger.

Table 1A summarizes our predictions concerning factors affecting the effect of price promotion/advertising shocks by the attacking brand on the sales of a defending brand.

2.3. Factors affecting the intensity of competitive reactions to price promotions and advertising

As mentioned earlier, we study the intensity of competitive reactions to price promotions and advertising attacks with the same instruments. The organizational decision making literature suggests that three fundamental underlying behavioral drivers of competitive reaction are awareness of the competitive attack, motivation to react, and ability to react (Chen 1996, Chen, Smith, and Grimm 1992, Dutton and Jackson 1987). These three drivers are reflected in the specific factors affecting the intensity of competitive reactions to price promotions and advertising discussed below, and provide a conceptual rationale for the specific predictions made.

More specifically, we submit that intensity of competitive reaction is influenced by the characteristics of the attacking and the defending brand - including the market power of the attacking brand, the power asymmetry between attacker and defender, and whether attacker/defender are a private label or a national brand -, category characteristics such as market concentration and category growth, and the change in sales of the defender caused by the competitive attack – i.e., the impact of the competitive attack.

Market power of the attacking brand. For at least two reasons, we expect that the intensity of retaliation of the defending brand to a competitive move by the attacking brand increases with the market power of the attacking brand. First, more powerful brands are more visible, meaning that their competitive actions are more often noticed. Awareness of competitive moves is a necessary condition for a reaction to occur (Chen, Smith, and Grimm 1992). Second, competitive attacks by powerful brands are perceived to be more threatening to the defender (Gatignon and Reibstein 1997). Social conflict theory posits that the greater the perceived threat posed by an actor, the greater the motivation of other actors to react in kind (Deutsch 1969, Deutsch and Krauss 1962). Similarly, in strategy research, Dutton and Jackson (1987) proposed that competitors are motivated to take stronger retaliatory action if they view the action as threatening.

Power asymmetry. Consistent with work in sociology (e.g., Emerson 1962, Bacharach and Lawler 1981) we argue that the intensity of retaliation by the affected entities (i.e., brands) depends on power *structure*. Whereas the large threat posed by a powerful attacking brand constitutes a strong *motivation* to react (see above), the power of the defending brand relative to the attacking brand is a crucial component of the defender's *ability* to react. Thus, not only does the market power of the attacking brand matter, but the difference in market power between the attacking and defending brand – called *power asymmetry* or power imbalance (Molm 1990) – is important as well.

Relative power theory argues that the greater the asymmetry in power favoring the attacker, the smaller the likelihood that the defender will retaliate (Emerson 1972). Indeed, the defender wants to avoid the risk of incurring overwhelming retaliation in turn. On the other hand, the more powerful the defender vis-à-vis the attacker, the greater the likelihood that the defender will retaliate if attacked (Cook and Emerson 1978, Rubin and Brown 1975). Relatively powerful defenders have less reason for restraint and fear retaliation less. Kumar, Scheer, and Steenkamp (1998) found support for relative power theory in an interorganizational context. In this study, we apply relative power theory to competition between brands.

Private label vs. national brand. We argue that, in general, there is less competitive reaction associated with private labels, both when the private label is the attacker and when it is the defender. The primary reason is that the motivation to react will be less in case of private labels. When a private label makes a competitive move, it may be seen as less threatening by other private labels compared to when a national brand makes a competitive move. Indeed, within-store purchase influences are typically stronger (Kahn and McAlister 1997) and hence, private labels may compete less directly with each other than with national brands. National brands are less likely to retaliate to private labels than to other national brands since they have much to gain from a collaborative relation with retailers. Their relationship is better described by co-opetition than by competition (Steenkamp and Dekimpe 1997). Moreover, in case of a reaction with price promotions, both the national brand's motivation and its ability to react to an attack by a private label are restricted. Indeed, price promotions require retailer cooperation which is less likely to be forthcoming when it concerns a response to a competitive move by the retailer's own brand.

When considering the role of the defender, it is also plausible that private labels react less to competitive attacks than national brands. If the attacker is a national brand, then that brand as well as the retailer selling it might benefit from the additional sales generated from the increased marketing effort. Moreover, given the considerable control the retailer has over the marketing (especially pricing/price promotion) activities of the national brands, it may feel less threatened. When the attacking brand is a private label, the defending private label may feel less threatened as argued above.

Market concentration. In concentrated markets, it is easier to monitor the competition. This makes it more likely that moves of rival brands are noticed, which is a necessary requirement for initiating a competitive response (Chen, Smith, and Grimm 1992). Thus, we expect that competitive reactions are generally more likely in markets with fewer brands. On the other hand, economic theory suggests that in concentrated markets, profit margins are higher. Companies may be less motivated to engage in a price war in concentrated markets because it dissipates attractive high margins (Ramaswamy, Gatignon, and Reibstein 1994). They are relatively more likely to retaliate with other marketing instruments. Ramaswamy, Gatignon, and Reibstein (1994) found that in industrial markets, market concentration had a negative impact on the likelihood of price retaliation and a positive impact on the likelihood of retaliation with marketing communication (i.c., sales force). Putsis and Dhar (1998) found that, in consumer product categories, non-cooperative response to price promotions is more likely with a larger number of brands.

Building on this work, we expect that market concentration has a positive effect on the intensity of retaliation with advertising and a negative effect on the intensity of retaliation with price promotions.

Category growth. If category sales are flat, competitive actions quickly become a zero-sum game in which the attacking brand's sales gains are the defending brand's sales losses. In such low-growth markets, the defender will be highly motivated to respond aggressively to protect sales volume (Aaker and Day 1986). On the other hand, market growth is a critical structural indicator of future potential profits, hence brands in high-growth categories should be more motivated to retaliate in order to defend their position (Gatignon, Weitz, and Bansal 1990).

The empirical evidence is mixed as well. In consumer markets, Robinson (1988) found that competitive retaliation to new-product introductions was stronger in growing markets, while a study of industrial firms by Ramaswamy, Gatignon, and Reibstein (1994) found that retaliation with salesforce (price) was more (less) common in high-growth markets. Given these two contradictory theoretical views on the impact of category growth on reaction intensity and inconclusive empirical evidence, we examine the effect of category growth in an exploratory fashion.

Cross-sales effect. We expect that the higher the short-term decline in sales of the defending brand due to a competitive move by the attacking brand, the more intense the retaliation by the defender. In Chen and MacMillan's (1992) work, the loss of sales due to a competitive move is actually a precondition for any reaction to occur. The significant negative effect on sales reveals that something important is at stake. The defending brand will perceive the attack as detrimental to its own position and hence has a greater motivation to retaliate (Chen and Miller 1994). Furthermore, the resulting decline in its own short-term sales is readily visible to the defending brand, which makes the reaction more likely. Consistent with this hypothesis, Leeflang and Wittink (2001) found that the greater the cross-brand elasticity, the greater the corresponding reaction elasticity. Since long-term effects are more difficult to observe first-hand, we do not expect this cross-sales effect to hold in the long run.

Table 1B gives an overview of our predictions concerning factors affecting the intensity of retaliation by the defending brand to a competitive price promotion/advertising shock.

--- Table 1 about here ---

3. Data & Methodology

3.1. Data description

Data are available on 442 frequently-purchased consumer-good categories in the Netherlands.[2] These categories correspond to IRI's classification in different product types, and give a quasi-complete coverage of the goods offered in a typical supermarket. The data set, which was obtained from IRI/Europanel (for volume sales, price, distribution coverage, new-product-introduction, and feature-and/or-display information) and the BBC research agency (advertising), covers 4 years of weekly scanner data, and is described in more detail in Nijs et al. (2001). For each of these categories, the top 3 brands are considered, provided they obtain an average share of at least 5% over the sampling period. The breadth (number of categories) as well as detail (full marketing mix) of the data at hand allows us to not only derive extensive empirical generalizations on the nature of competitive reactivity, but should also allow us to test the framework outlined in Section 2.

3.2 Derivation of cross-sales and reaction elasticities

Long-run time-series techniques are used to derive our focal constructs, i.e., the cross-sales elasticities for both advertising and price-promotions, along with the corresponding (simple and multiple) reaction elasticities. Each of these elasticities is estimated for both the short and the long run, for the different brand-combinations in each of the categories in our data set. In a second step, these elasticity estimates become the dependent variables in a structural model that links them to the set of covariates described in our conceptual framework.

A six-equation VARX model with the logarithm of sales, price and advertising expenditures of two brands (*i* and *j*) as endogenous variables, and their distribution coverage, feature and display, feature activity only and display activity only as exogenous variables, is used to link performance and control variables.[3] VARX models are specified in levels, differences, or error-correction format, depending on preliminary unit-root and cointegration tests (Powers et al. 1991). The different options taken in the implementation of these tests are summarized in Table 2.

--- Table 2 about here ---

The most general VARX model thus obtained is given in Equation (1). In this equation, it is assumed that all variables have a unit root, and that an equilibrium or cointegrating relationship exists between the different variables. If no such relationship is found, all α-parameters (which measure the speed of adjustment to the long-run equilibrium) are restricted to zero. If some of the variables are found to be stationary, they are specified in the levels rather than in the first differences. For mixed models in levels and differences, we test for cointegration among the latter, and restrict the α-parameters of the former to zero. If an endogenous variable is found not to have a deterministic trend in the data-generating process (based on the procedure described in Enders 1995), the corresponding δ-parameter is set to zero, as are all the ξ-parameters when the category did not witness a major new-product introduction. The new-product introduction is captured through a step dummy when dealing with stationary series, and as a pulse dummy variable in case of unit-root series.

$$
\begin{bmatrix} \Delta\ln S_{i,t} \\ \Delta\ln ADV_{i,t} \\ \Delta\ln P_{i,t} \\ \Delta\ln S_{j,t} \\ \Delta\ln ADV_{j,t} \\ \Delta\ln P_{j,t} \end{bmatrix}
=
\begin{bmatrix}
c_{0,S_i} + \sum_{s=2}^{13} c_{s,S_i} SD_{st} + \delta_{S_i} t + \xi_{S_i} NPI_t \\
c_{0,ADV_i} + \sum_{s=2}^{13} c_{s,ADV_i} SD_{st} + \delta_{ADV_i} t + \xi_{ADV_i} NPI_t \\
c_{0,P_i} + \sum_{s=2}^{13} c_{s,P_i} SD_{st} + \delta_{P_i} t + \xi_{P_i} NPI_t \\
c_{0,S_j} + \sum_{s=2}^{13} c_{s,S_j} SD_{st} + \delta_{S_j} t + \xi_{S_j} NPI_t \\
c_{0,ADV_j} + \sum_{s=2}^{13} c_{s,ADV_j} SD_{st} + \delta_{ADV_j} t + \xi_{ADV_j} NPI_t \\
c_{0,P_j} + \sum_{s=2}^{13} c_{s,P_j} SD_{st} + \delta_{P_j} t + \xi_{P_j} NPI_t
\end{bmatrix}
+ \sum_{l=1}^{8}
\begin{bmatrix} \phi_{11}^{l} & \cdots & \phi_{16}^{l} \\ \vdots & \ddots & \vdots \\ \phi_{61}^{l} & \cdots & \phi_{66}^{l} \end{bmatrix}
\begin{bmatrix} \Delta\ln S_{i,t-l} \\ \Delta\ln ADV_{i,t-l} \\ \Delta\ln P_{i,t-l} \\ \Delta\ln S_{j,t-l} \\ \Delta\ln ADV_{j,t-l} \\ \Delta\ln P_{j,t-l} \end{bmatrix}
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$$
+ \begin{bmatrix}
\alpha_{S_i} & 0 & 0 & 0 & 0 & 0 \\
0 & \alpha_{ADV_i} & 0 & 0 & 0 & 0 \\
0 & 0 & \alpha_{P_i} & 0 & 0 & 0 \\
0 & 0 & 0 & \alpha_{S_j} & 0 & 0 \\
0 & 0 & 0 & 0 & \alpha_{ADV_j} & 0 \\
0 & 0 & 0 & 0 & 0 & \alpha_{P_j}
\end{bmatrix}
\begin{bmatrix} e_{S_i,t-1} \\ e_{ADV_i,t-1} \\ e_{P_i,t-1} \\ e_{S_j,t-1} \\ e_{ADV_j,t-1} \\ e_{P_j,t-1} \end{bmatrix}
+ \begin{bmatrix} \gamma_{11} & \cdots & \gamma_{18} \\ \vdots & \ddots & \vdots \\ \gamma_{61} & \cdots & \gamma_{68} \end{bmatrix}
\begin{bmatrix} \Delta\ln Dist_{i,t} \\ \Delta\ln F_{i,t} \\ \Delta\ln D_{i,t} \\ \Delta\ln FD_{i,t} \\ \Delta\ln Dist_{j,t} \\ \Delta\ln F_{j,t} \\ \Delta\ln D_{j,t} \\ \Delta\ln FD_{j,t} \end{bmatrix}
+ \begin{bmatrix} \mu_{S_i,t} \\ \mu_{ADV_i,t} \\ \mu_{P_i,t} \\ \mu_{S_j,t} \\ \mu_{ADV_j,t} \\ \mu_{P_j,t} \end{bmatrix}
\qquad (1)
$$

where *S* is volume sales, *P* is price, *ADV* denotes advertising expenditures, *DIST* is distribution coverage, *FD* is feature and display, *F* is feature activity only, *D* indicates display activity only, and *NPI* denotes a new-product introduction. Deterministic components include an intercept

($c_{0,.}$), trend (t) and seasonal dummy variables (SD_{it}), while $\lfloor \mu_{S_{i,t}} \mu_{ADV_{i,t}} \mu_{P_{i,t}} \mu_{S_{j,t}} \mu_{ADV_{j,t}} \mu_{P_{j,t}} \rfloor' \sim$ **N($\vec{0}$,Σ).**

From these VARX models, impulse-response functions are derived which trace the over-time incremental effect of a competitive action (see Bronnenberg et al. 2000 or Dekimpe and Hanssens 1999 for a detailed exposition). These impulse-response functions are obtained as the difference between two forecasts: (1) an unconditional forecast (i.e., an extrapolation) which gives the levels of the performance and marketing variables (in logarithms) that are expected based on the available information up to period $t-1$, and (2) a conditional forecast, obtained after a competitive action in period t is taken into account. Competitive actions are defined as unexpected one-unit deviations (shocks) in the attacking brand's advertising and/or price level. The successive differences (i.e., at period t, $t+1$, $t+2$, …) between both forecasts constitute the impulse-response functions (IRFs). Given that we work in log-log space, impulse-response estimates have been shown to be elasticities at the unit-shock level, enabling cross-category comparisons (Nijs et al. 2001). The IRFs tracing the incremental effect of a competitive action by brand i on the sales performance of another brand j (i.e., on S_j) give the *cross-sales elasticities (ε)*, while IRFs that track the incremental impact on P_j and ADV_j give the corresponding *reaction elasticities (η).* This procedure resulted in 2012 pairwise cross-sales elasticity estimates (and corresponding reaction elasticities), from which 158 outlying cases were removed due to extreme elasticity values.

Figure 2 shows some IRFs obtained from the Dutch toilet-tissue market. The different panels illustrate the cross-sales impact on (Panel A) and the reactions (Panels B & C) of the leading national brand following a price promotion by a challenger, the second-largest national brand. Two reaction patterns stand out: a considerable advertising reaction, albeit with a two-month delay, and accommodating behavior in terms of price (i.e., instead of matching the initial price promotion, prices are increased somewhat). The latter reaction is surprising, especially when considering the substantial impact of the defender's price promotions on its own sales (Panel E).

--- Figure 2 about here ---

Impulse-response functions contain many estimates, i.e., one difference or incremental impact per future period. To make a comparison across multiple categories more manageable, we follow Nijs et al. (2001) and derive two summary statistics from each impulse-response function: (1) the asymptotic value, which measures the persistent or long-run effect, and (2) the net effect over the dust-settling period, which is the time needed for the IRF to stabilize, which captures the short-run impact. In Figure 2, the long-run impact is zero, i.e., neither sales nor the competitive advertising or price levels stabilize at a higher level after the initial price promotion. The relevant short-run effects are indicated by the shaded areas in Figure 2.

In case of very infrequent advertisers (in our case defined as having less than 25 instances of advertising), insufficient variability is available in the data to reliably estimate all the ϕ parameters associated with that endogenous variable. In those instances, advertising for that brand is treated as an exogenous variable (unless no advertising at all was used over the considered time span, in which case the variable is completely omitted from the model specification), whose over-time impact is subsequently derived in IRF format using the procedure described in Pesaran and Shin (1998).[4] In this way, even if the attacking brand is an infrequent advertiser, one can still derive the defending brand's reaction and cross-sales elasticity to the advertising attack. Only when the infrequent advertiser is the defending brand, no reaction elasticity is derived.

3.3. Explaining cross-sales and reaction elasticities

To explain the variability in cross-sales effectiveness and competitive intensity, we stack the corresponding elasticities, and link them in a structural model to the covariates of our conceptual framework (see Figure 1). Four structural models are estimated, which differ in time dimension, short run (SR) versus long run (LR), and in terms of the competitive shock instrument considered: price or advertising. Each model consists of three equations, corresponding to the following three endogenous variables: (i) a cross-sales elasticity (ε), (ii) a reaction elasticity describing the intensity of reaction by means of price promotions ($\eta_{P,P}$ for a reaction to a competitive price promotion or $\eta_{P,ADV}$ for a reaction to a competitive advertising shock), and (iii) a reaction elasticity for the intensity of reaction by means of advertising changes ($\eta_{ADV,P}$ or $\eta_{ADV,ADV}$). For expository purposes, we consider the model describing the short-run reaction to a price promotion. The following structural model is then estimated through weighted two-stages least squares, in which advertising and price reaction elasticities are coded in such a way that an increase in their value is associated with a more intense retaliation. Similarly, advertising and promotional cross-sales elasticities are coded so that a more negative number corresponds to a larger drop in sales after the attacking brand's advertising or promotional increase.[5, 6]

$$
\begin{bmatrix} \varepsilon_{S,P}^{SR} \\ \eta_{P,P}^{SR} \\ \eta_{ADV,P}^{SR} \end{bmatrix} = \begin{bmatrix} a_S \\ a_P \\ a_{ADV} \end{bmatrix} + \begin{bmatrix} 0 & b_{1,2} & b_{1,3} \\ b_{2,1} & 0 & 0 \\ b_{3,1} & 0 & 0 \end{bmatrix} \begin{bmatrix} \varepsilon_{S,P}^{SR} \\ \eta_{P,P}^{SR} \\ \eta_{ADV,P}^{SR} \end{bmatrix}
$$

$$
+ \begin{bmatrix} c_{1,1} & c_{1,2} & c_{1,3} & c_{1,4} & c_{1,5} & c_{1,6} & 0 & 0 & 0 & 0 \\ 0 & 0 & c_{2,3} & c_{2,4} & 0 & 0 & c_{2,7} & c_{2,8} & c_{2,9} & c_{2,10} \\ 0 & 0 & c_{3,3} & c_{3,4} & 0 & 0 & c_{3,7} & c_{3,8} & c_{3,9} & c_{3,10} \end{bmatrix} \begin{bmatrix} BE_A \\ BE_D \\ PL_A \\ PL_D \\ NB_P \\ AS_P \\ Power_A \\ PA_{A-D} \\ Conc \\ Growth \end{bmatrix} + \begin{bmatrix} v_{S,P}^{SR} \\ v_{P,P}^{SR} \\ v_{ADV,P}^{SR} \end{bmatrix} \qquad (2)
$$

where BE_i (i=A,D) is a given brand's equity, PL_i an indicator variable to denote the private-label/national-brand nature of brand *i*, NP_p and AS_p are used to measure, respectively, the neighborhood and asymmetry effect for price, $Power_A$ measures the market power of the attacking brand, while PA_{A-D} gives the power asymmetry of the attacker versus the defender, Conc is a market-concentration measure and Growth denotes the average growth rate in the category. Details on the specific operationalization of these different constructs are given in measurement appendix A.

Similar structural models are estimated for the short-run effects of an advertising shock, and for the long-run impacts of, respectively, price-promotion and advertising shocks. Since we do not have access to information on private label advertising, the private label variables are to be removed from the structural models where advertising is the initiating instrument. The parameters $b_{2,3}$ and $b_{3,2}$ are restricted to zero to ensure the model is identified. However, we can still infer joint decision making in advertising and promotion reactions from the corresponding element of the residual correlation matrix (cf. Powers et al. 1991).

Finally, it is worth noting that the effective sample size may vary across different moderator equations, and may in some cases be lower than 1854. This is due to the fact that some brands advertise regularly, other brands advertise infrequently, while still other brands never advertise. We obviously cannot make inferences about the potential effectiveness of non-advertisers, while, as indicated in the modeling section, we cannot estimate reliably the extent of advertising reactivity by infrequent advertisers. We refer to the table below for a detailed discussion of the different cases and their implications for sample size.

	Issue	Implications for sample size
Regular advertisers		
Attacker	No problem	Included in all moderator analyses
Defender	No problem	Included in all moderator analyses
Infrequent advertisers		
Attacker	No problem*	Included in all moderator analyses
Defender	Not estimable	Excluded from all equations that include *reactions* with advertising
Zero advertisers		
Attacker	Not applicable	Excluded from all equations that include *attacks* with advertising
Defender	No problem (reaction elasticity = 0)	Included in all moderator analyses

* Derived using the Pesaran and Shin (1998) procedure.

4. Competitive Reaction and Cross-Sales Effects

The first-stage empirical results are shown in Table 3 (effects due to price promotion shocks) and in Table 4 (effects due to advertising shocks). In each case, we classify various reaction behaviors and estimate their effect size. When relevant, we also report separate results for the subgroup of frequent (>25 instances) advertisers. We first derive some generalizations on the intensity of reaction, duration of reaction, and choice of marketing instrument, and compare them to our hypotheses. We then examine the net cross-sales effects of competitive reactions, in magnitude as well as duration. In addition, we report on the effectiveness of the defender's price promotions and advertising on own demand in Table 5. These results provide insight into the (likely) effectiveness of reactions by the defender to an attack.

--- Tables 3 and 4 about here ---

4.1. Generalizations on competitive reactions

Dominant short-run reaction form. Competitive reactions can be retaliatory, accommodating or simply absent. Our first result is that, consistent with our hypothesis, the predominant form of reaction to advertising and price promotion attacks is no reaction at all. Indeed, 53.7% of price promotion attacks receive no short-run promotion reaction, and 85.1% of price promotion attacks receive no advertising reaction. By the same token, 82.5% of advertising attacks receive no advertising reaction, and 68.3% of advertising attacks receive no promotion reaction. When we focus on reactions with the advertising weapon for brands that are "regular" advertisers - defined as at least 25 incidences of advertising spending over the four-year period - a passive reaction remains the most common one. More specifically, among regular advertisers, price promotion (advertising) attacks result in advertising reactions in only 41.4% (46.5%) of the cases.

Simple versus multiple reaction. Simple-reaction patterns tend to be retaliatory in nature, but multiple reactions are as often retaliatory as they are accommodating. Significant short-run promotion reactions to promotion attacks are nearly twice as likely to be retaliatory than accommodating (30.4% vs. 15.9%). Advertising reactions to advertising attacks are four times more likely to be retaliatory (37.0% vs. 9.5% for regular advertisers). In contrast, advertising reactions to price promotions are about equally often retaliatory as accommodating (7.8% vs. 7.2% overall, and 21.5% vs. 19.9% for regular advertisers). Similarly, promotion reactions to advertising attacks are only slightly more retaliatory (17.3% vs. 14.4% among regular advertisers). In conclusion, while managers tend to react in the same direction with the same instrument, there is little consensus on how to react with different marketing instruments.

Type of attack. In comparing retaliations to price promotion attacks vs. advertising attacks, the former are much stronger, which is consistent with our expectations. The average short-run promotion retaliation elasticities are 1.49 for promotion attacks vs. 0.000 for advertising attacks by regular advertisers. By the same token, the mean advertising retaliation elasticities are 79.6 for promotion attacks vs. 0.59 for advertising shocks by regular advertisers.[7]

Short run versus long run. While long-run reactions are much weaker than their short-run counterparts, they follow the same pattern, i.e., if one is higher, so is the other. As a result, the average simple short-run promotion reaction elasticity of 0.50 is only 0.01 in the long run. The mean simple, short- and long-run advertising reaction elasticities for regular advertisers are 0.28 and 0.000, respectively. Thus, managers in competitive settings are typically short-run oriented and their reactions have little effect on their long-run marketing spending behavior.

4.2. Generalizations on Cross-Sales Effects

Whether or not competitive reaction is economically beneficial or even necessary depends on the effectiveness of both the action and the reaction (Leeflang and Wittink 1996). The VARX models described in Section 3 provide short-run and long-run estimates of the *total* competitive effect of the initial attack.That is, after all response and reaction effects have been accounted for, how much net benefit or harm occurs to the defending brand? In addition, the VARX models also estimate the total own-sales effects of promotion and advertising.

Own effects. We observe (see Table 5), first, that the own-sales effects of promotions are much stronger than those of advertising, in the short run and in the long run. This is consistent with our hypothesis and helps explain why reactions to price promotions are generally stronger than reactions to advertising. The average own-sales promotion elasticities are 3.94 (short run) and 0.05 (long run). The advertising elasticities for regular advertisers are 0.003 (short run) and 0.000 (long run).

--- Table 5 about here ---

Competitive effects. By contrast, the *net* competitive effect of marketing attacks is predominantly *sales neutral* in the short run. Across all brands studied, 60.4% of promotion attacks have no impact on the sales of the defending brand (Table 3). Similarly, for regular advertisers 72.7% of the advertising attacks have no significant cross-sales impact (see Table 4). Furthermore, when focusing on the remaining cases where significant cross-sales effects were observed, they divide out almost evenly between competitive benefit and competitive harm: price promotion attacks are beneficial in 20.4% of the cases and harmful in 19.2%. The impacts for advertising attacks are 14.5% and 12.8%. This raises the question to what extent managers' currently adopted reaction rules which are reflected in the net effect one obtains, contribute to the predominant pattern (>80%!) of either sales neutrality or competitive benefit, or whether this pattern is mostly attributable to the nature of consumer response. In the latter case, neutrality (benefits) would result from patterns of consumer response where positive category-demand effects balance (outweigh) negative market-share effects. The results of our second-stage analysis, which focus on the moderators of competitive reaction behavior, will help us sort out these possibilities.

In this section, we have examined the cross-sales elasticities and competitive reaction elasticities due to a competitive attack using price promotion or advertising. We observe considerable variation in the *short-run* elasticities. In the next section, we will investigate key brand and product category sources of this variation. Tables 3 and 4, however, also reveal that *long-run* cross-sales and competitive reaction effects occur only in a minority of cases and the average magnitude of the effects is very small. Thus, there is not enough variation to meaningfully estimate a structural model of long-term effects moderators. Indeed, no significant effects were found in such a model involving long-run elasticities. Nevertheless, from a strategic perspective, these exceptional cases are very important, especially those where brands suffer long-run damage to their market position. We will therefore conduct in Section 5.3. a set of simple statistical comparisons between long-term means in order to provide exploratory insights into the determinants of long-term damage.

5.Moderator Effects

5.1. Moderators of the short-term cross-sales effects of price promotions and advertising

Table 6 reports the results of the second-stage weighted two-stage least squares analysis for the short run cross-sales equations due to a price promotion shock and due to an advertising shock.

--- Table 6 about here ---

Price promotions. Consistent with expectations, the brand equity of the defender has a positive effect on the cross-sales elasticity ($b = 0.004$, $p < 0.05$). Further, the higher the brand equity of the attacker, the more negative the cross-sales elasticity ($b = -0.003$, $p < 0.10$). These results indicate that the defender's sales decline due to a competitive price promotion is larger when the defender is a low-equity brand or the attack is carried out by a high-equity brand. Furthermore, if the defender is a private label, the cross-sales elasticity is more negative than when it is a national brand ($b = -0.253$, $p < 0.01$), which is in line with our predictions.

Contrary to expectations, when the attacker is a private label, the cross-sales elasticity also is more negative ($b = -0.241$, $p < 0.01$). One possible explanation for this result might be based on Colombo and Morrison (1989). In their work, the market can be divided into two groups of consumers, those who tend to be loyal to one brand ("loyals") and those who are not loyal to any brand and are prone to switch between brands ("switchers"). Although it is a somewhat simplified view of the market, it has proven remarkably robust and useful in strategic marketing analyses. Private labels still tend to be quite often "fighter brands," i.e., brands that command a relatively low degree of brand loyalty, but with a high ability to attract switchers in the marketplace (Steenkamp and Dekimpe 1997, Wileman and Jary 1997). Consequently, an attack by a private label should have significant adverse cross-sales effects (due to the private label's high ability to attract switchers). On the other hand, private labels should be more vulnerable to attacks by other brands because of their higher proportion of nonloyals who are more inclined to switch to another brand when that offers an attractive deal.

We find no support for the neighborhood effect or the asymmetry effect. The intensity of competitive retaliation with price promotion has a significant positive effect on the cross-sales elasticity of the defender ($b = 0.882$, $p < 0.10$). Thus, intense retaliation to a competitive price promotion reduces the negative sales effects due to that attack. In contrast, the intensity of advertising reaction is not related to the promotion's cross-sales elasticity.

Based on the *t*-ratios, the brand-equity and private-label nature of the attacking and defending brands are the two key factors affecting the cross-sales impact of a price promotion. The latter result is especially interesting as we control for the asymmetric and neighborhood effect of price. This suggests that there is a lot more to private labels than the mere price notion typically emphasized in the literature to date.

Advertising. We find support for the neighborhood effect. Consistent with expectations, the smaller the difference in advertising effort between attacker and defender, the more negative the cross-sales elasticity ($b = -0.004$, $p < 0.10$). The asymmetry effect is in the expected direction but is only marginally significant (b = -0.001, p = 0.12). In a price-promotion context, Sethuraman, Srinivasan, and Kim (1999) also found in a price promotion context that the asymmetry effect was weaker. The intensity of advertising reaction is not related to the advertising cross-sales elasticity. However, the intensity of competitive retaliation with price promotion has a significant positive effect on the cross-sales elasticity of the defender (b = 1.452, p < 0.10). Thus, intense retaliation with price promotion to a competitive advertising attack reduces the negative sales effects due to that attack. The effect of the defender's brand equity is not significant. Finally, the attacker's brand equity has a positive cross-sales effect (b = 0.000, p < 0.01). This finding is contrary to our expectation and might be explained by advertising's primary-demand effect.

5.2. Moderators of the short-term intensity of competitive reaction

Table 7 reports the results of the moderator analysis on the short-run promotion and advertising reaction elasticities in response to both a price-promotion shock and an advertising shock.

--- Table 7 about here ---

Competitive reaction to price promotions. The moderator effects are summarized in columns 2 and 4 of Table 7. While no significant effects are found for advertising reaction, we find a number of interesting effects for a price-promotion reaction to an attack with price promotion.

Consistent with expectations, the more powerful the attacker, the greater is the price promotion reaction elasticity (b = 0.175, p < 0.01). This indicates that, relative to a weaker brand, a powerful brand initiating a price promotion should count on more aggressive retaliation using the same instrument by other brands in the category. However, power asymmetry also matters. Controlling for the market power of the attacker, the greater the power disadvantage of the defender vis-à-vis the attacker, the less likely that the defender will retaliate (b = -0.087, p < 0.05). This is consistent with our expectation derived from relative power theory.

As predicted, a price promotion initiated by a private label evokes less retaliation than a promotion attack by a national brand (b = -0.065, p < 0.01). Similarly, a private label reacts less aggressively to a price promotion than a national brand does (b = -0.040, p < 0.05). Support is also found for our expectation that in concentrated markets, reactions with price promotions are less aggressive (b = -0.012, p < 0.01). Furthermore, we find support for the contention that reaction elasticities are higher in growing categories (b = 9.241, p < 0.05). Finally, the larger the adverse effect of a competitive price promotion on the sales of the defending brand, the more intense it retaliates with price promotion, and vice versa for beneficial effects (b = -0.021, p < 0.01).

The residual correlation between the price-promotion reaction elasticity and the advertising reaction elasticity is 0.097. This indicates that the intensities of promotion and advertising reactions to promotion attacks are, for all practical purposes, independent of each other.

Competitive reaction to advertising. Columns 6 and 8 in Table 7 show the results of the moderator analyses of promotion and advertising reactions to advertising attacks. As predicted, the more powerful the attacker, the more aggressive the reaction to an advertising shock. We find this competitive reaction effect both for price promotion (b = 0.001, p < 0.10) and for advertising (b = 0.786, p < .01). Furthermore, the more powerful the attacker vis-à-vis the defender, the less aggressive the competitive reaction to an advertising attack with advertising (b = -0.241, p < 0.10). Similarly, the greater the power asymmetry favoring the attacker, the less aggressive the competitive reaction with price promotion, although the effect is only marginally significant (b = -0.000, p = 0.11).

We expected that competitive reactions with price promotion (advertising) are less (more) aggressive in more concentrated categories. However, we find that, for reactions with price promotions (b = -0.000, p < 0.05) as well as reactions with advertising (b = -0.026, p < 0.01), competitive reaction is less aggressive in more concentrated markets.

In growing categories, we observe less aggressive reactions with advertising in response to an advertising attack (b = -43.891, p < 0.01). Furthermore, when sales of the defending brand decline due to an advertising shock, there is more aggressive reaction with advertising and vice versa (b = -16.868, p < .05). The residual correlation between the price promotion and advertising reaction elasticities is 0.116.

5.3. Determinants of long-run cross-sales effects

Our study has found only a small number of cases were competitive action has a permanent impact on the sales of the defending brands. These exception cases are strategically very important, especially those where competitive action ultimately leads to permanent damage to a rival brand's sales. Table 8 provides a limited statistical profile of these cases relative to all others, in the form of a series of comparisons between means.

For long-run cross-sales effects of price promotions, we find that permanently damaged brands are more accommodating with price promotions ($p < 0.001$) and have lower brand equity ($p < 0.010$). In addition, significant long-run damage occurs more often when the attacker is a private label ($p<.10$). For long-run cross-sales effects of advertising, we again find that permanently damaged brands tend to have lower brand equity ($p < 0.10$). In addition, the brand-equity of the attacker tends be lower as well ($p < 0.05$).

These descriptions of competitive actions with long-run damage are in line with our results from the short-run moderator analyses. On the defender's side, they highlight the importance of brand equity to protect its competitive position. On the attacker's side, they may point to the untapped market potential advantage of less established brands, in line with Bolton (1989). We therefore offer the tentative generalization that larger brands are better able to defend their position, but less established brands are better able to gain permanent ground by aggressive marketing.

--- Table 8 about here ---

6. Discussion and Conclusions

Overall, we have established that the most common form of competitive reaction is passive (i.e., no reaction). When reactions do occur, they respond more often to price promotions than to advertising. Same-instrument reactions are generally retaliatory, while different-instrument reactions can be either retaliatory or accommodating. All forms of competitive reaction are largely restricted to short-run movements without long-run consequences.

While marketing campaigns are often own-sales effective, especially price promotions, their influence on competitors' sales is generally weak, e.g., cross-sales promotion and advertising effects are zero in 60% and 73% of the cases, respectively. The moderator analysis sheds light on situations when the cross-sales decline is greater. In case of an attack with a price promotion, the defending brand is hurt more when the attacker has high brand equity, the defender has low brand equity, the attacker is a private label, the defender is a private label, and when the defender reacts less aggressively with price promotions. For an attack with advertising, cross-sales decline is greater when the two brands were closer together in advertising expenditure and when the attack is carried out by a low equity brand.

This study also provides insights into another fundamental question in brand competition: Why do some actions fail to elicit retaliation from competitors while others provoke an aggressive response? We find that, in general, simple reactions with price promotion and/or advertising are stronger when the attacker is more powerful, power asymmetry is not (overly) in favor of the attacker, the attack is carried out by a national brand, the category is less concentrated, and when negative cross-sales effects occur. Interestingly, when negative cross-sales effects occur, this increases the intensity of simple competitive retaliation, but not multiple reactions. Presumably, managers of the affected brand notice the negative cross-sales effect due to an attack with a given instrument, conclude that it is an effective weapon (because sales of their own brand decline) and therefore choose to respond with this weapon. These patterns suggest that competitive retaliation behavior is "rational" in the sense that it occurs when the brand has the motivation and the ability to react. That is, reaction is driven by perceptions that the defending brand's sales need to be and can be protected.

Notwithstanding this apparent rationality in competitive reaction behavior, we find (based on *t*-value comparisons) that, compared to the other moderating effects, it has only a modest impact on the change in net sales of the defending brand. Indeed, *the predominant reason for the cross-sales neutrality of marketing attacks lies in the nature of consumer response, rather than the vigilance of competitors*. Specifically, in those cases where price-promotion shocks had no significant cross-effect, more than 55% were characterized by no reaction with promotion and more than 80% by no reaction with advertising. Similarly, in those instances where advertising attacks were cross-sales neutral, almost 70% had no promotion reactions, while close to 80% had no advertising reactions. Hence, the lack of a significant cross-sales effect cannot be attributed to successful retaliation. These findings contrast sharply with insights from the management literature. For example, in an influential conceptual article, Chen (1996, p. 109) stated that "the ultimate effectiveness of an action depends largely on the defenders' response." We find no support for this claim, at least not at the most basic level of competition, viz., advertising and promotion rivalry between company brands.

While no reaction is the dominant competitive response mode, the question remains what the consequences are when managers do opt to retaliate. The Table below shows that these consequences critically depend on the sign of the cross-sales impact of the attack. Indeed, retaliation to harmful attacks rarely has a positive impact on own sales (e.g., a mere 7% of the advertising retaliations to a harmful advertising attack is own-sales effective), whereas retaliation to a beneficial attack has a positive impact in a majority of cases (e.g., 57% of the advertising retaliations to a beneficial advertising attack is own-sales effective). When averaged across the four different retaliation scenarios in the table, only 17% of retaliations to harmful competitive attacks are effective, compared to 64% of retaliations to beneficial competitive attacks. Therefore, *the major beneficial consequence of retaliation is not the avoidance of negative cross-effects, but rather the amplification of positive cross-effects.* Sales expansive effects of attacks make room for sales-effective retaliation, whereas damaging brand-switching effects hamper effective retaliation. The implication, subject of course to a brand's structure of profit margins, is an apparent managerial paradox: *it is better to react in order to amplify gains than to stem losses.*

		Attack causes…	
		Hurt	**Gain**
Retaliation to price promotion	*... with price promotion*	34%	87%
	... with advertising	21%	70%
Retaliation to advertising	*... with price promotion*	11%	43%
	... with advertising	7%	57%
Weighted mean		17%	64%

Last, but not least, we comment on the apparent short-run nature of competitive reaction. Short-run reaction does not necessarily imply myopic behavior. In the case of advertising, long-run own-sales effects are virtually non-existent, therefore no long-run competitive reaction is needed. In the case of price promotion, the long-run cross-sales effects are also rare, but if they do occur, they are often associated with significant short-run effects (the correlation is 0.42). Furthermore, when a significant long-run promotion effect occurs, it is almost always preceded by a significant short-run effect of the same direction (96% of harmful cases and 84% of beneficial cases, with no direction reversals). Even though many of these effects die out, making competitive retaliation discretionary from a long-run perspective, managers may still prefer to act in a "better safe than sorry" mode and interpret the *observed* short-term harm as a *signal* of potential long-term threat. This is especially true since the economic consequences of persistent revenue loss are generally larger than those of temporary (or even sustained) excessive promotion spending.

Several areas for future research remain open. First, we now focus on the top three brands. A more complete picture on the size and duration of the cross-sales effects, as well as the extent of price and advertising reactivity, would be obtained by also considering some of the smaller brands. In doing so, we would likely obtain more variability in both the endogenous and exogenous variables of the second-stage structural models, which might in turn result in more significant effects. Second, several observations in our structural model may violate the independence assumption, as most brands appear in multiple observations. For instance, a price shock by brand *i* may have a cross-sales effect on both brand *k* and brand *l* in the category, causing these observations to be related. Farley and Lehmann (1986) note in this respect that the bias due to non-independence may not be serious if the number of correlated observations is small relative to the total number of observations. This clearly applies to our study. The number of correlated observations was six or less versus a total number of 1814 observations. Nevertheless, it would be preferable to account for correlated observations. Sethuraman, Srinivasan, and Kim (1999) describe a generalized least-squares procedure to take these dependencies into account. We are not aware, however, of extensions of their unweighted single-equation methodology to our weighted multiple-equation setting.[8]

Third, we had no information on private label advertising. Even if these data were available, it is not easy to assign advertising effort to the private label in specific categories. As the same private label may be much more successful and credible in some categories than in others (Steenkamp and Dekimpe 1997), it might be that general advertising promoting the private label of the retailer is not equally effective in each category. More research is needed to investigate the relation between corporate private label advertising and its role in specific categories. This issue will become more important in the future as advertising for private labels, while still quite rare, is increasing (Zimmerman 1998). Fourth, our data were aggregated along multiple dimensions. For instance, all analyses were conducted at the brand rather than the SKU level, and involved an aggregation across multiple stores. While Nijs et al. (2001) showed (in the context of their primary-demand analyses) that the likely biases from these aggregation operations are small, more research is needed to also establish this in our setting. Finally, more work is needed to generalize our findings to other countries.

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Appendix A – Measurement

Private label vs. national brand. We use a dummy variable to capture the distinction between private labels and national brands. This variable takes on a value of 1 if the brand is a private label, and 0 if it is a national brand.

Brand equity of the attacker and the defender. Inspired by Yoo, Donthu, and Lee (2000), we use the weighted distribution coverage of the brand as a proxy for brand equity. Yoo et al. argued that higher distribution intensity implies that consumers need sacrifice less in time and effort to acquire the product. They noted that (p. 199) "As distribution intensity increases, therefore, consumers have more time and place utility and perceive more value for the product."

Neighborhood and Asymmetry effect for price promotions. To capture the influence of the price promotion neighborhood and asymmetry effects, we use the definition developed in Sethuraman, Srinivasan, and Kim (1999). The price distance between two brands is measured by $(1 - P_L / P_H)$, where P_L is the average price of the lower-priced brand and P_H is the average price of the higher-priced brand. For interpretational convenience, the sign of the variable is reversed such that a positive change in the value of this variable indicates a smaller price distance (neighborhood effect). The asymmetry effect, in turn, is defined as $(1 - P_L / P_H) \cdot DUMHL_P$, where $DUMHL_P$ is equal to 1 when the attacking brand has the highest average price and 0 otherwise.

Neighborhood and Asymmetry effect for advertising. For advertising we adapt the definition used for the neighborhood and asymmetry variables for price promotion described above. For the neighborhood effect, we calculate $(1 - A_L / A_H)$ where A_L denotes the total advertising expenditure of the least advertised brand and A_H captures the total advertising expenditures of the most advertised brand. For interpretational convenience, the sign of the variable is again reversed to obtain the neighborhood effect. In a similar manner, we define the asymmetry effect for advertising by $(1 - A_L / A_H) \cdot DUMHL_A$, where $DUMHL_A$ takes on a value of 1 when the attacker is the most heavily advertised brand, and is equal to 0 in value when the attacking brand is less heavily advertised than the defending brand.

Market power attacker. The power of the brand that initiated the marketing attack (either a price promotion or an advertising shock) is measured by the brand's average market share.

Power asymmetry attacker vs. defender. In line with our definition of market power, power asymmetry is measured by the difference in market share between the attacker and the defender (cf. Molm 1990).

Market concentration. Following Bell, Chiang, and Padmanabhan (1999), concentration in category is captured through a count of the number of brands with a market share exceeding 1%. Note that for interpretational convenience, the sign of this variable is reversed such that a positive change in the value of this variable is associated with an increase in market concentration.

Category growth. The extent of sales growth in a category is measured by the mean of the log transformed category sales series in differences. It can easily be shown (see Franses 1998) that this metric is approximately equivalent to the growth rate in sales. An advantage of this measure is that it can be easily applied to both stationary and evolving series, irrespective of the deterministic components contained in the data generating process.

Figure 1: Conceptual Framework

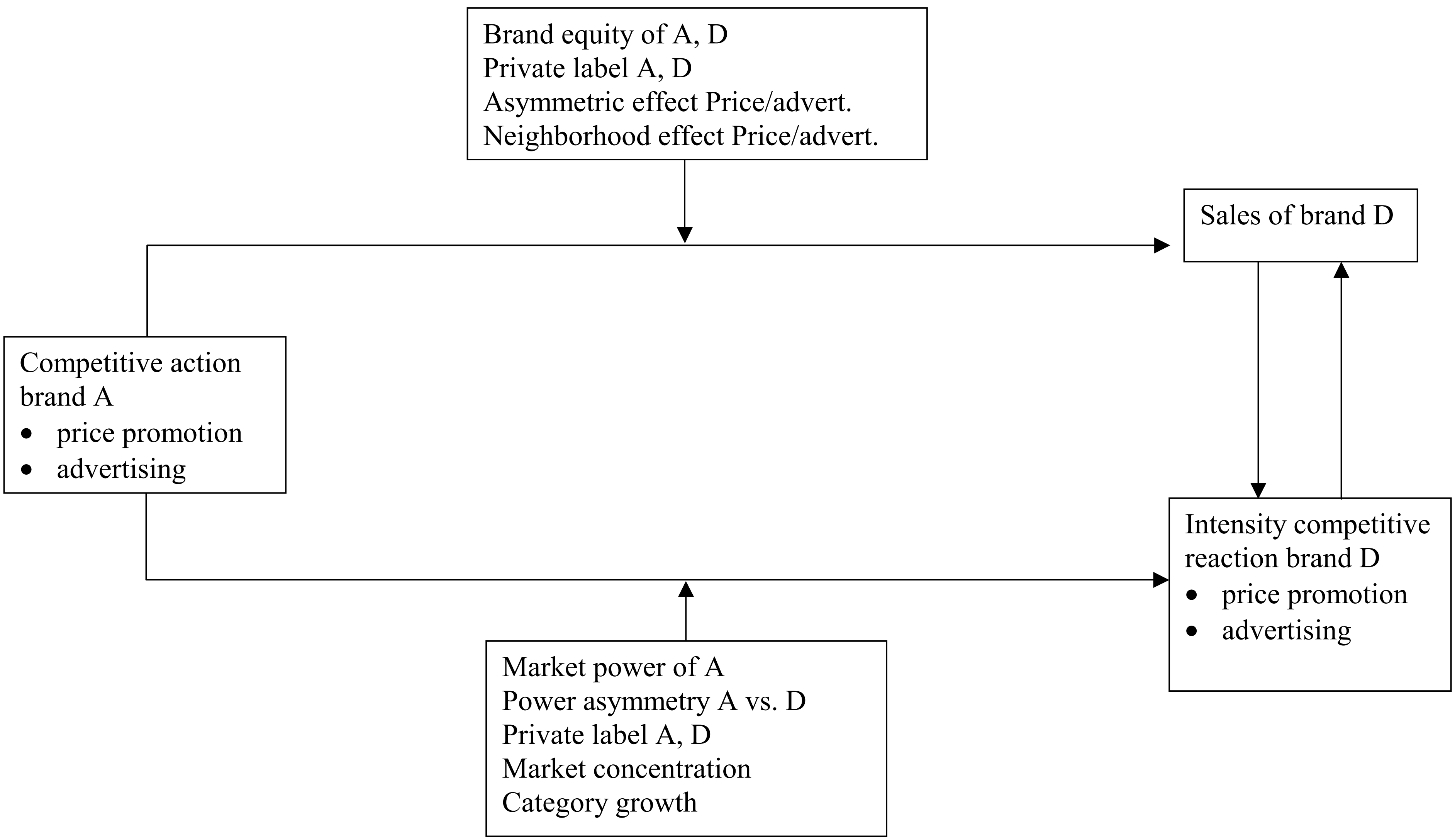
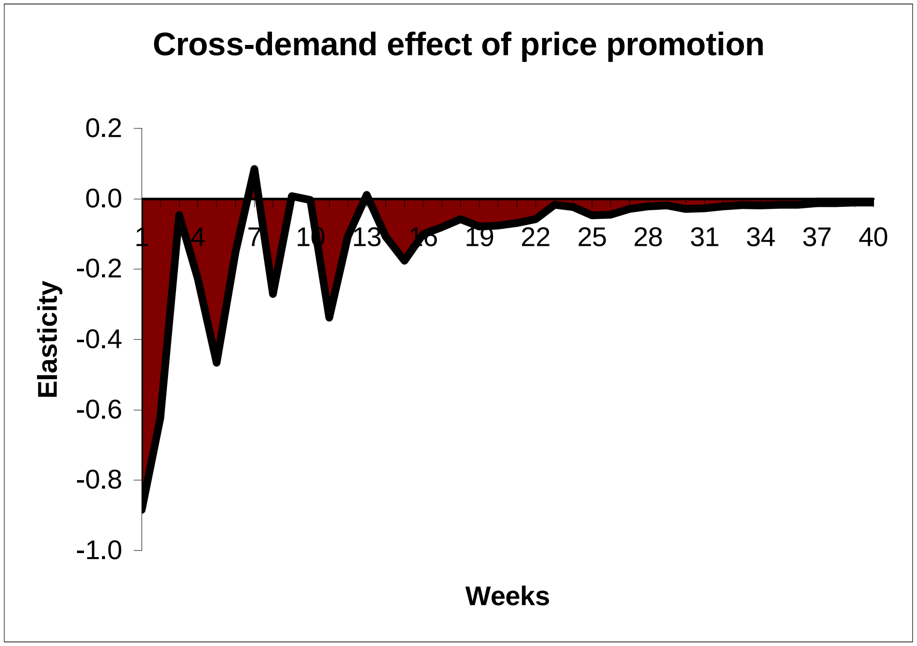
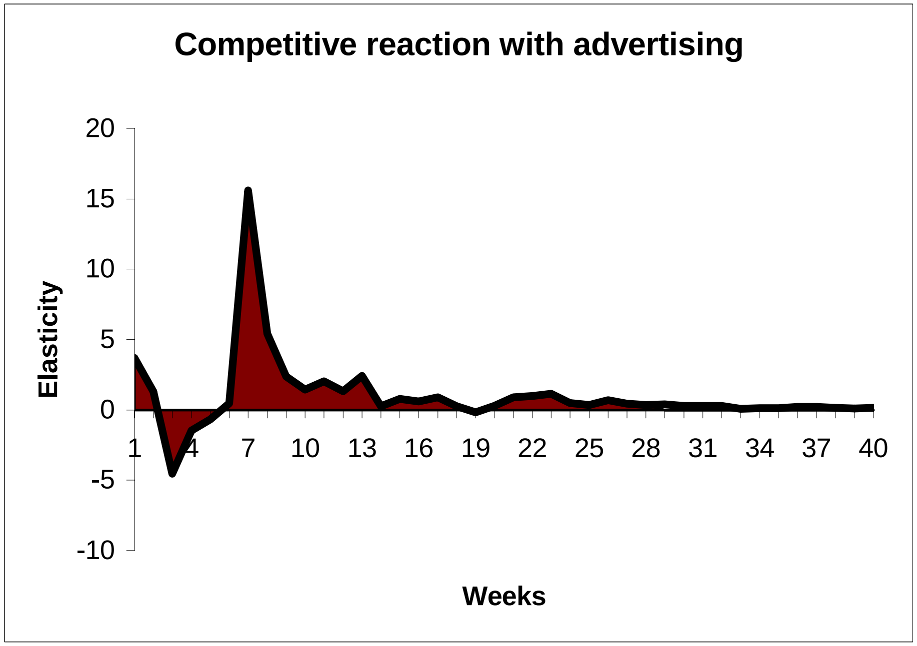


Figure 2A: Impact of a price promotion attack on sales of the defender



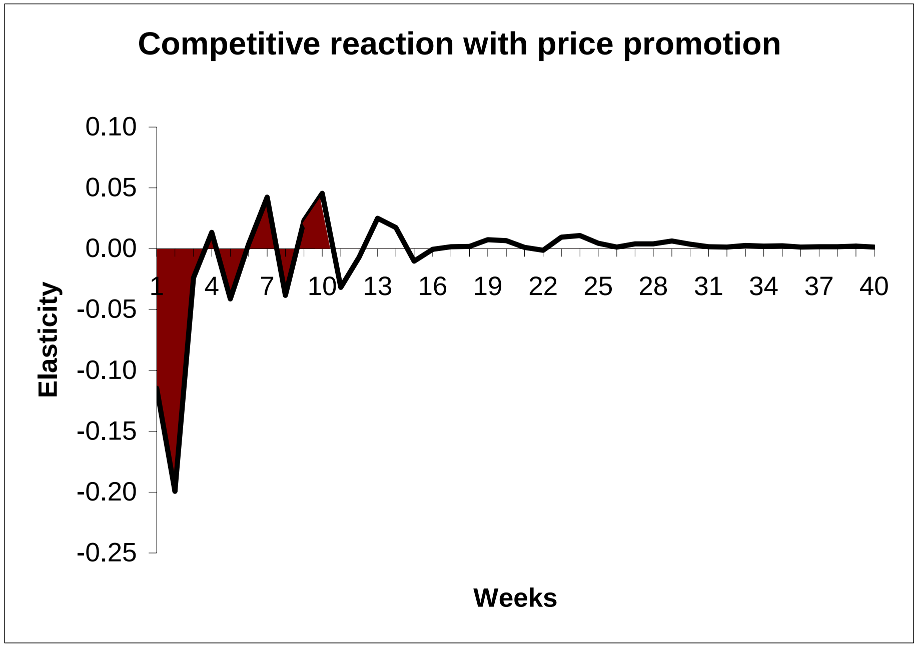
Note: dust-settling ends in period 36

Figure 2B: Intensity of the defender's response with advertising



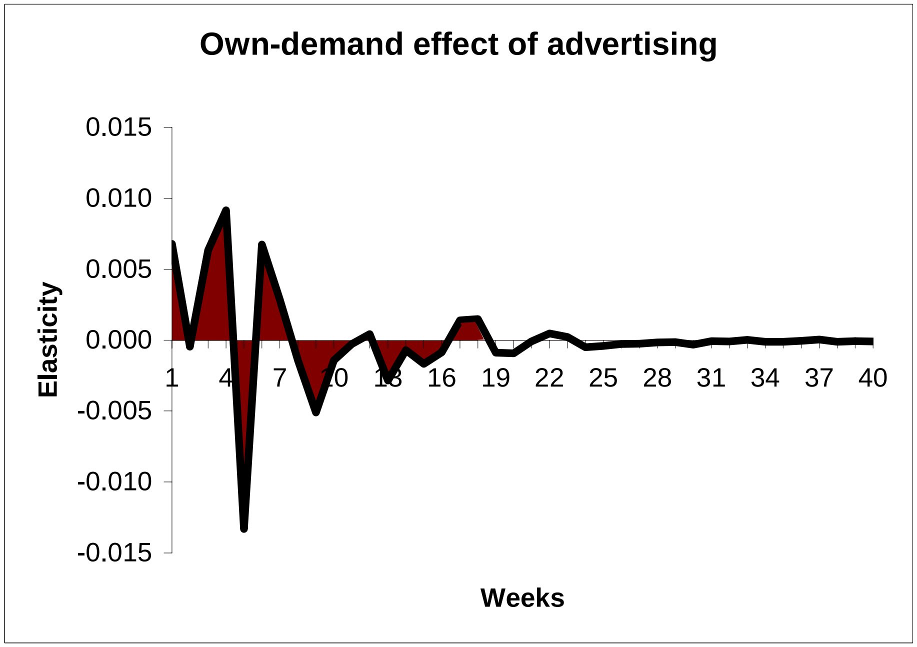
Note: dust-settling ends in period 29

Figure 2C: Intensity of the defender's response with price promotion



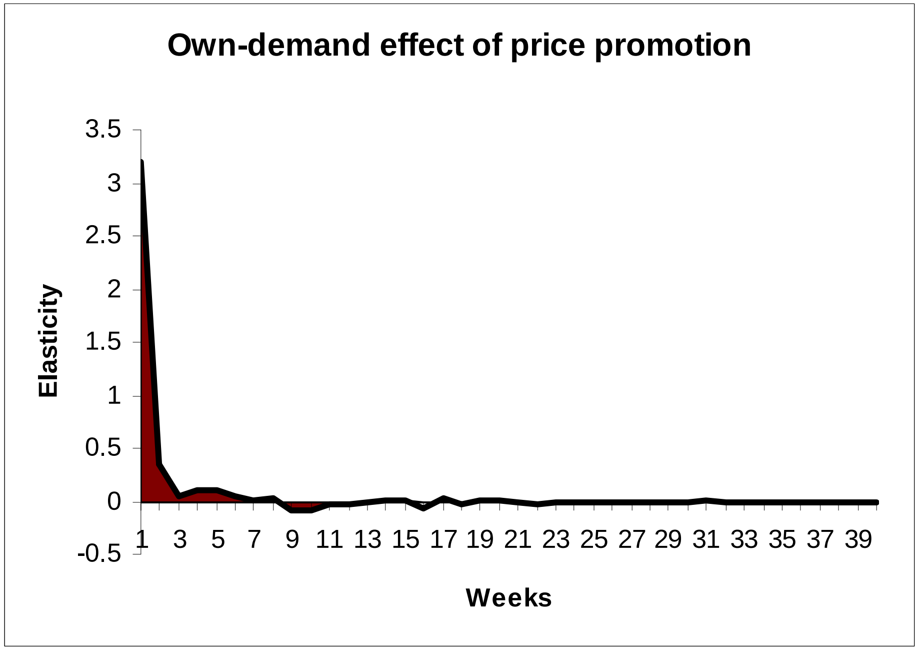
Note: dust-settling ends in period 10

Figure 2D: Effectiveness of the defender's advertising on demand



Note: dust-settling ends in period 18

Figure 2E: Effectiveness of the defender's price promotion on demand



Note: dust-settling ends in period 16

Table 1A: Expected effect of key determinants of cross-sales effect of defender

Determinant	Expected sign
Brand equity attacker [1)]	-
Brand equity defender [2)]	+
Private label attacker	+
Private label defender	-
Neighborhood effect price promotions	-
Asymmetry effect price promotions	-
Neighborhood effect advertising	-
Asymmetry effect advertising	-
Intensity competitive reaction price promotion	+
Intensity competitive reaction advertising	+

1) Read as: the higher the brand equity of the attacker, the more negatively (less positively) the sales of the defender are affected.

2) Read as: the higher the brand equity of the defender, the less negatively (more positively) the sales of the defender are affected.

Table 1B: Expected effect of key determinants of intensity of competitive reaction by defender

Determinant	Expected sign
Market power attacker [1)]	+
Power asymmetry attacker vs. defender	-
Private label attacker	-
Private label defender	-
Market concentration	- (price) / + (adv.)
Category growth	?
Cross-sales effect (SR)	-

[1)] Read as: the higher the market power of the attacker the more aggressive (less accommodative) the competitive reaction by the defender.

Table 2: Specification of the stage-1 VARX models

		OPTIONS TAKEN
Unit-root tests	Regular unit root test	ADF; max 8 lags; SBC lag selection criterion; inclusion of deterministic seasonal dummies; inclusion of deterministic trend based on Enders (1995) procedure.
	Structural-break unit-root test	Exogenous break allowed for NPI through the Perron (1989, 1990) test.
Cointegration tests		Johansen's (1988) FIML approach; trend and intercept in cointegrating relationship; most significant cointegration vector withheld.
VAR model	Endogenous variables	Sales, price, and advertising for both the attacking and the defending brand (6). In case of infrequent advertisers (< 25 instances), advertising for that brand is treated as exogenous.
	Exogenous variables	Distribution, feature and display, feature only and display only, for both the attacking and defending brand (8).
	Parameterization level	Order = 8; autoregressive parameters with $\|t\|<1$ restricted to zero; no lagged effects for exogenous variables.
	Deterministic components	Deterministic seasonal dummies; deterministic trend included based on UR test results; step dummy for NPI in I(0) series, pulse dummy for NPI in I(1) series.
IRF determination	Variable shocked	Price & advertising.
	Derivation of shock vector	Simultaneous shocking approach described in Dekimpe and Hanssens (1999); procedure of Pesaran and Shin (1998) when infrequent advertising spending is treated as exogenous variable
	Determination of standard errors	Monte-Carlo simulation, 250 iterations.
	Derived summary statistics	Persistent effect and net effect over the dust-settling period; the dust-settling period is defined based on four consecutive IRF estimates that are not significantly different from their convergence value.

Table 3: Cross-sales effects of and reactions to price promotion shocks

Table 3A: Percentage significant short-run estimates following an attack with price promotion

Short-run cross-sales effect	**Non-significant**	**Negative cross-sales elasticity**	**Positive cross-sales elasticity**
	60.41%	19.15%	20.44%
	Non-significant	**Retaliation**	**Accommodation**
Short-run reaction			
… with price promotion	53.73%	30.36%	15.91%
… with advertising (all)*	85.06%	7.77%	7.17%
… with advertising (regular advertisers)	58.60%	21.52%	19.88%

* Cases with no advertising at all during the sample period and brands with very infrequent advertising (i.e., less than 25 weeks) are counted in the non-significant category.

Table 3B: Estimated short-run elasticities following an attack with price promotion

Cross-sales effect	**Mean cross-sales elasticity**	**Mean negative cross-sales elasticity**	**Mean positive cross-sales elasticity**
	0.064 (positive)	3.315	3.286
	Mean reaction elasticity	**Mean retaliation elasticity**	**Mean accommodation elasticity**
Short-run reaction			
… with price promotion	0.500 (retaliation)	1.490	0.895
… with advertising (all)	1.376 (accommodation)	79.554	93.118
… with advertising (regular advertisers)	3.814 (accommodation)	79.554	93.118

Table 3C: Percentage significant long-run estimates following an attack with price promotion

Cross-sales effect	**Non-significant**	**Negative cross-sales elasticity**	**Positive cross-sales elasticity**
	97.15%	1.29%	1.56%
	Non-significant	**Retaliation**	**Accommodation**
Long-run reaction			
… with price promotion	91.42%	5.29%	3.29%
… with advertising (all)*	99.99%	0.01%	0.00%
… with advertising (regular advertisers)	99.86%	0.14%	0.00%

* Cases with no advertising at all during the sample period and brands with very infrequent advertising (i.e., less than 25 weeks) are counted in the non-significant category.

Table 3D: Estimated long-run elasticities following an attack with price promotion

Cross-sales effect	**Mean cross-sales elasticity**	**Mean negative cross-sales elasticity**	**Mean positive cross-sales elasticity**
… in the long run	0.004 (positive)	0.452	0.570
	Mean reaction elasticity	**Mean retaliation elasticity**	**Mean accommodation elasticity**
Long-run reaction			
… with price promotion	0.010 (retaliation)	0.160	0.096
… with advertising (all)	0.008 (retaliation)	13.313	4.05
… with advertising (regular advertisers)	0.022 (retaliation)	13.313	4.05

Table 4: Cross-sales effects of and reactions to advertising shocks

Table 4A: Percentage significant short-run estimates following an attack with advertising

Cross-sales effect	**Non-significant**	**Negative cross-sales elasticity**	**Positive cross-sales elasticity**
	72.71%	12.83%	14.46%
	Non-significant	**Retaliation**	**Accommodation**
Short-run reaction			
… with price promotion	68.33%	17.31%	14.36%
… with advertising (all)*	82.49%	13.95%	3.56%
… with advertising (regular advertisers)	53.51%	37.03%	9.46%

* Cases with no advertising during the sample period and brands with very infrequent advertising (i.e., less than 25 weeks) are counted in the non-significant category.

Table 4B: Estimated short-run elasticities following an attack with advertising

Cross-sales effect	**Mean cross-sales elasticity**	**Mean negative cross-sales elasticity**	**Mean positive cross-sales elasticity**
	0.001 (positive)	0.013	0.013
	Mean reaction elasticity	**Mean retaliation elasticity**	**Mean accommodation elasticity**
Short-run reaction			
… with price promotion	0.000 (accommodation)	0.000	0.000
… with advertising (all)	0.105 (retaliation)	0.592	0.254
… with advertising (regular advertisers)	0.279 (retaliation)	0.592	0.254

Table 4C: Percentage significant long-run estimates following an attack with advertising

Cross-sales effect	**Non-significant**	**Negative cross-sales elasticity**	**Positive cross-sales elasticity**
	98.67%	0.92%	0.41%
	Non-significant	**Retaliation**	**Accommodation**
Long-run reaction			
… with price promotion	96.03%	1.83%	2.14%
… with advertising (all)*	0.00%	0.00%	0.00%
… with advertising (regular advertisers)	0.00%	0.00%	0.00%

* Cases with no advertising during the sample period and brands with very infrequent advertising (i.e., less than 25 weeks) are counted in the non-significant category.

Table 4D: Estimated long-run elasticities following an attack with advertising

Cross-sales effect	**Mean cross-sales elasticity**	**Mean negative cross-sales elasticity**	**Mean positive cross-sales elasticity**
… in the long run	0.001 (negative)	0.013	0.013
	Mean reaction elasticity	**Mean retaliation elasticity**	**Mean accommodation elasticity**
Long-run reaction			
… with price promotion	0.000 (accommodation)	0.000	0.000
… with advertising (all)	0.000 (non-response)	0.000	0.000
… with advertising (regular advertisers)	0.000 (non-response)	0.000	0.000

Table 5: Own-sales effects of price promotion and advertising shocks

Table 5A: Percentage significant short-run estimates of advertising and price promotion on own-sales

	Non-significant	Positive own-sales elasticity	Negative own-sales elasticity
… of price promotions	30.96%	63.54%	5.50%
… of advertising	67.00%	20.45%	12.55%

Table 5B: Elasticity estimates of short-run advertising and price promotion on own-sales

	Mean own-sales elasticity	Mean positive own-sales elasticity	Mean negative own-sales elasticity
… of price promotions	3.944 (positive)	5.752	3.989
… of advertising	0.003 (positive)	0.017	0.014

Table 5C: Percentage significant long-run estimates of advertising and price promotion on own-sales

	Non-significant	Positive own-sales elasticity	Negative own-sales elasticity
… of price promotions	94.99%	4.15%	0.86%
… of advertising	98.23%	1.28%	0.49%

Table 5D: Elasticity estimates of long-run advertising and price promotion on own-sales

	Mean own-sales elasticity	Mean positive own-sales elasticity	Mean negative own-sales elasticity
… of price promotions	0.046 (positive)	0.876	0.604
… of advertising	0.000 (positive)	0.002	0.002

Table 6: Effects of key determinants of cross-sales effects

Determinant	**Cross-sales elasticity of price promotion** (N=1506)		**Cross-sales elasticity of Advertising** (N=816)	
	Parameter	*t-value*	*parameter*	*t-value*
Brand equity attacker	-0.003[c]	-1.378	0.000[a]	2.882
Brand equity defender	0.004[b]	2.325	-0.000	-0.437
Private label attacker	-0.241[a]	-2.343		
Private label defender	-0.253[a]	-2.884		
Neighborhood effect price promotions	-0.127	-0.620		
Asymmetry effect price promotions	0.146	0.622		
Neighborhood effect advertising			-0.004[b]	-2.148
Asymmetry effect advertising			-0.001	-1.181
Intensity competitive reaction with price promotion	0.882[c]	1.568	1.452[c]	1.287
Intensity competitive reaction with advertising	-0.003	-0.193	0.002	0.687

[a] = $p < .01$
[b] = $p < .05$
[c] = $p < .10$
[*] All tests are one-sided

Table 7: Effects of key determinants of intensity of competitive reaction

Determinant	**Reaction to price promotion**				**Reaction to advertising**			
	… with price promotion (N=1854)		… with advertising (N=1506)		… with price promotion (N=982)		… with advertising (N=816)	
	parameter	*t-value*	*Parameter*	*t-value*	*parameter*	*t-value*	*parameter*	*t-value*
Market power attacker	0.175[a]	2.438	-80.562	-1.213	0.001[c]	1.423	0.786[a]	2.797
Power asymmetry attacker vs. defender	-0.087[b]	-1.844	24.516	0.736	-0.000	-1.232	-0.241[c]	-1.536
Private label attacker	-0.065[a]	-2.554	10.532	1.065				
Private label defender	-0.040[b]	-1.833	6.527	0.512				
Market concentration	-0.012[a]	-6.723	1.488	0.850	-0.000[b]	-2.089	-0.026[a]	-4.686
Category growth	9.241[b]	2.230	-499.519	-0.191	0.019	0.916	-43.891[a]	-3.691
Cross-sales effect	-0.021[a]	-2.464	-1.272	-0.082	0.012	0.875	-16.868[b]	-2.216

[a] = $p < .01$
[b] = $p < .05$
[c] = $p < .10$
[*] All tests are one-sided, except for category growth

Table 8: Mean deviations as key determinants of long-run cross-sales effects

Determinant	**Cross-sales elasticity of price promotion**			**Cross-sales elasticity of advertising**		
	mean 1	*mean 2*	*p-value*	*mean 1*	*mean 2*	*p-value*
Brand equity attacker	63.616	66.003	0.571	62.153	76.527	0.026
Brand equity defender	59.346	66.963	0.067	59.642	71.361	0.077
Private label attacker**	0.340	0.224	0.053			
Private label defender**	0.180	0.222	0.477			
Neighborhood effect price promotions	0.251	0.259	0.750			
Asymmetry effect price promotions	0.126	0.127	0.984			
Neighborhood effect advertising				0.919	0.828	0.164
Asymmetry effect advertising				0.968	0.914	0.280
Intensity of long-run competitive reaction *with* price promotion	0.064	-0.013	0.000	0.000	0.000	0.878
Intensity of long-run competitive reaction *with* advertising	-0.102	0.020	0.327	0.000	0.000	0.393

* *p*-values are 2-sided

** Test for equality of proportions used.

note: *mean 1* is the mean value of the moderator variables for those cases where sales of a competitor were significantly hurt in the long run. *mean 2* is the mean value of the moderator variables for all other cases.

Footnotes

[1] There is similarity between the asymmetric effect and the private label vs. national brand effect, as private labels are often – but certainly not always– lower in price than national brands (Steenkamp and Dekimpe 1997). Indeed, some authors have largely equated the two effects by operationalizing the asymmetric effect in a national brands versus private labels context (Allenby and Rossi 1991, Blattberg and Wisniewski 1989). However, although related, the two phenomena are certainly not identical. As noted above, the quality of private labels is often close to the quality of national brands, and the price gap is sometimes very small (Steenkamp and Dekimpe 1997, Zimmerman 1998). Further, some people have a preference for private labels because it facilitates decision making, they purchase the private label as a choice heuristic (Ailawadi, Neslin, and Gedenk 2001).

[2] These 442 categories are selected from a broader database of 560 categories, using the following criteria: the top three brands have a combined market share in excess of 15 percent and each brand has nonzero weekly sales throughout the period.

[3] To avoid over-parameterization, we do not estimate a nine-equation model with the sales, advertising and price series of the top three brands as endogenous variables. In that case, every additional autoregressive lag would result in the estimation of 81 additional parameters. Instead, we estimate 3 six-equation models, covering, respectively, brands (1,2), (1,3) and (2,3).

[4] Hence, depending on whether or not the attacking and defending brand are infrequent advertisers, a six, five or four-equation model is estimated.

[5] A weighted estimation procedure is used to account for the fact that the endogenous variables are estimated quantities. Weights are the inverse of the standard error of an equation's dependent variable. In one instance (advertising response to a price promotion attack), White's test showed no evidence of heteroskedasticity, in which case the observations were not weighted (see Narasimhan, Neslin, and Sen 1996 or Nijs et al. 2001 for a similar procedure).

[6] The following subscripts are used for the exogenous variables: *A* for Attacking brand and *D* for Defending brand.

[7] The unusually high advertising reaction elasticity in response to price shocks come from the possibility of high spending jumps or cuts, for example from 50 GRPs to 300 GRPs.

[8] Sethuraman et al. (1999) apply *either* a weighted least squares procedure to account for the fact that their dependent variables are estimated quantities, *or* the generalized least squares procedure on unweighted data to correct for dependencies among the observations. Their results were found to be robust across both procedures.

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