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# Reciprocal Spillover Effects: A Strategic Benefit of Brand Extensions

A commonly advanced rationale for the proliferation of brand extensions is companies' motivation to leverage the equity in established brands, thereby developing profitable products relatively easily. A more interesting strategic argument for brand extensions that has been advanced is that extensions would favorably affect the image of the parent brand and thereby influence its choice. In this research, the authors investigate the existence of such reciprocal spillover effects emanating from the advertising of a brand extension. The authors use scanner panel data and study spillover effects of advertising on brand choice. They develop implications for brand and product line management.

In recent years, there has been a plethora of line and brand extensions. Between 1977 and 1984, 40% of the 120 to 175 new brands introduced each year in supermarkets were extensions (Aaker 1990). One commonly advanced rationale for this proliferation of extensions is companies' motivation to leverage the equity in established brands and develop profitable products relatively easily (Morein 1975). A second motivation for extensions is to affect the image of the umbrella brand favorably, which thereby influences sales in other categories. Aaker (1996) offers several examples in which existing products obtain this reciprocal benefit from brand extensions. He suggests that Gallo opted to attach its name with a "jug-wine" reputation to its line of upscale, corked wines, Ernest and Julio Gallo Varietals, to improve the quality perception of its low-end wine product. In another example, Contadina, which was perceived as a strong canned-foods brand with an authentic Italian heritage, was revitalized by its entry into fresh refrigerated pastas and sauces.

If introduction of a brand extension can produce such (reciprocal) spillover benefits to existing products, it can be expected that advertising of the brand extension will also have a positive spillover effect on sales of existing products. For example, Aaker (1996) suggests that advertising of the brand extension Hidden Valley Honey Dijon Ranch salad dressing made the advertising for the Hidden Valley brand group more effective. Such advertising spillover effects would also have implications for allocation of advertising budget among the new brand extension and existing products with the same brand name. However, it is surprising that there is little documentation of the existence of advertising spillover effects in academic literature in spite of the availability of high-quality, single-source scanner panel data. In the only field research known to us, Sullivan (1990) studies the effect on the demand of used Jaguar models arising from the introduction of a new Jaguar model. Her results can be interpreted as somewhat mixed. Although she found that the event of introduction of the new model increased demand for used Jaguar models (positive spillover), advertising of the new Jaguar model depressed demand for used Jaguars (negative spillover). If the event of product introduction is considered an "information shock" and advertising represents a more steady flow of information, similar effects for both forms of information should be expected. However, Sullivan does not find such a result. A possible reason is that Sullivan does not separate the negative substitution effect that arises from a brand extension, depressing sales of existing products from a likely positive spillover effect. Thus, unlike the spillover effect of information shock caused by a product introduction, spillover effects from ongoing advertising may not be strong enough to overwhelm a substitution effect.

In this article, we separate the substitution and spillover effects by estimating demand at the disaggregate level using ACNielsen's single-source scanner panel data. We find that the advertising of brand extensions produces significant reciprocal spillover that favorably affects the choice of the parent brand. Thus, we find empirical support for the anecdotal evidence presented previously. Our separation of spillover and substitution effects may enable us to find a positive spillover effect of advertising, in contrast to Sullivan (1990) who finds a negative spillover effect for Jaguar advertising.[1]

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[1]Category differences (yogurt is a category we analyze) probably account for some of the differences between Sullivan's (1990) results and ours. In a category such as yogurt, a consumer can purchase both parent (low-fat yogurt) and extension (non-fat yogurt), as a result of complementarity or variety-seeking behavior. In such a case, positive spillover effects may be enhanced. We thank an anonymous reviewer for suggesting the role of category differences.



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In contrast to our use of disaggregate data, Sullivan uses aggregate data from published sources. Tellis and Weiss (1995) suggest that aggregation may lead to bias in estimating the effects of advertising. Our use of disaggregate data also provides a strong test for the existence of advertising spillover effects because advertising effects have been difficult to establish with such data (Tellis and Weiss 1995). In a laboratory study, Morrin (1999) finds that advertising of a brand extension facilitates recall of the parent brand. However, our research focuses on brand choice and examines the advertising effect of both a brand and its extension in a field setting.

In the remainder of this article, we present the conceptual background that pertains to spillover effects. We then develop the empirical models and present the analysis and results. Finally, we discuss the managerial implications of our findings and limitations of our study and offer a brief conclusion.

## Conceptual Background

### *Spillover Advertising Effect*

Advertising spillover becomes relevant when a brand name is used on two or more products that are separately advertised. Consider two products, A and B, that carry an umbrella brand name in common (e.g., Yoplait yogurt and Yoplait non-fat yogurt). We conceptualize a spillover effect as the impact of Product A's (B's) advertising on the utility to the consumer of Product B (A). In general, the spillover effects between products may not be symmetric. In particular, we distinguish between the spillover effects from advertising of the parent (the product that originally used the brand name) and those from advertising of the child or extension (the line or brand extension). We refer to the former effect as the *forward spillover effect* and the latter effect as the *reciprocal spillover effect*. The definition of parent as the product that originally used the brand name is similar to the definition of "core" brand in Keller and Aaker's (1992) study. In a more theoretical sense, we consider the parent as the product most closely associated with the umbrella brand name in the consumer's mind (Farquhar, Herr, and Fazio 1990; Morrin 1999). This perspective is similar to the concept of a flagship product used by John, Loken, and Joiner (1998) or "instance dominance" used by Herr, Farquhar, and Fazio (1996).

We offer several commercial examples in which a positive reciprocal spillover effect is anticipated. There are two main theoretical reasons to expect such a positive reciprocal spillover effect. First, a positive spillover effect would be consistent with the existence of economies of information in advertising when an umbrella or "range" brand is applied to different products (Aaker 1996; Morein 1975). Indeed, in an empirical study, Smith (1992) finds that advertising expenditures for umbrella-branded products are lower, which is consistent with economies of information. As Aaker (1996, p. 295) notes, such economies are realized because "the fixed cost of maintaining a brand name can be spread across different businesses." The implication of this rationale is that umbrella-branded products benefit one another with their advertising because of positive spillover effects, resulting in less advertising expenditure for each product. In a similar vein, Morein (1975) suggests that economies of information are realized because an advertised product produces a "halo effect" that increases sales of other umbrella-branded products. Thus, we expect both reciprocal and forward spillover effects to be positive because of economies of information.

Although the economies of information argument is intuitively reasonable, the specific mechanism through which advertising spillover or halo occurs is not clear. Wernerfelt's (1988) analysis of umbrella branding suggests one such mechanism. Using a signaling model, Wernerfelt theorizes that umbrella-branded products are perceived to offer higher quality because profits from other umbrella-branded products act as a "performance bond" for the quality of any of the umbrella-branded products. In other words, if a low-quality product is offered with an umbrella brand name, it leads consumers to conclude that all other products with the same brand name are also of low quality, which thus threatens the profits from these other products. Therefore, a firm would optimally extend an established brand name only to high-quality products, thus rendering consumers' perceptions (that umbrella-branded products are of high quality) accurate. Wernerfelt's analysis offers a mechanism by which advertising can spill over and enhance sales for other umbrella-branded products.[2] Essentially, the advertising of other products with the same brand name makes consumers aware of the performance bond at stake for the firm, thereby increasing quality perceptions of unadvertised products and enhancing their sales. In summary, the theory of economies of information suggests positive reciprocal and forward spillover effects.

Second, Anderson (1983) offers a consumer memory–based explanation for the existence of reciprocal spillover effects with the associative network theory. Brand associations in consumer memory are a key component of brand equity and brand-related effects (Aaker 1996). The associated network theory has been particularly useful in analyzing the effect of brand associations (see, e.g., Herr, Farquhar, and Fazio 1996; John, Loken, and Joiner 1998; Keller 1993; Morrin 1999). This theory conceptualizes knowledge about a brand as being a network of nodes (or concepts) connected by links, which represent associations between the concepts. Moreover, the strength of a link is a measure of the association strength between the concepts. Thus, the brand (e.g., Yoplait), the parent (e.g., Yoplait [regular] yogurt), and the brand or line extension (e.g., Yoplait non-fat yogurt), as well as beliefs about the brand, are conceptualized as nodes in a knowledge network, and the links between the nodes vary in strength. A consumer retrieves a particular piece of knowledge from memory when the corresponding node is activated above a threshold level, through priming by external cues such as advertising or by "spreading" activation from other linked nodes. The extent of spreading activation to a new node increases with the strength of the link between

[2]In experimental studies, Dacin and Smith (1994) find that consumers' evaluation of the quality of an umbrella-branded product increases with the number of products using the same brand name. Because several products using the same brand name imply a bigger performance bond, the result appears to support Wernerfelt's (1988) analysis. See also Erdem (1998).

the new node and the previously activated node. A stronger link facilitates the spreading activation to the new node above the threshold to be retrieved from memory.

Because we expect the parent to be strongly associated with the brand in consumers' memories, the link between the parent node and the brand node is likely to be strong (Farquhar, Herr, and Fazio 1990). When exposure to advertising of the brand extension activates the brand node, the activation will likely spread to the parent because of the strength of the link between the two nodes. The resulting retrieval of the parent will produce a positive spillover effect. In this manner, exposure to advertising of Yoplait non-fat yogurt may activate the parent category, regular yogurt, through activation of the Yoplait name because the Yoplait node is strongly linked to the regular yogurt node. Thus, we form the following hypothesis for the reciprocal spillover effect:

$H_1$: Both the economies of information theory and the associated network theory suggest that the reciprocal spillover effect, that is, the spillover effect of exposure to advertising of a child on the revealed preference for a parent, is positive.

Consider the forward spillover effect of parent's advertising on the choice of the child. As previously discussed, arguments based on economies of information favor a positive forward spillover effect. Moreover, such arguments do not suggest any asymmetry in the magnitudes of forward and reciprocal spillover effects. In particular, Wernerfelt (1988) argues that both the parent and child are perceived to be of high quality as a result of umbrella branding, which suggests that the forward and reciprocal effects are equal in magnitude. In contrast, although the associated network theory favors a positive forward spillover effect, it suggests that the forward spillover effect is weaker than the reciprocal spillover effect.[3] In particular, exposure to the parent's advertising will activate the brand node, whence activation will spread to the child, with potential for a positive spillover effect. However, because the child is newer, the link between brand name and child is likely to be weaker than the link between brand name and parent, especially in the early stages of introduction of the child. Activation of the child node may not always exceed the threshold level needed for retrieval from memory. Therefore, exposure to parent's advertising is less likely to activate the child in consumers' memories as compared with the effect of the child's advertising on activation of the parent. Thus, the associated network theory suggests that the forward spillover effect is likely to be positive but weaker than the reciprocal spillover effect.

$H_2$: Both the information economies theory and the associated network theory suggest that the forward spillover effect, that is, the spillover effect of exposure to advertising of a parent on the revealed preference for a child, is positive.

$H_3$: If the theory of information economies holds, both forward and reciprocal spillover effects will be equal in magnitude.

$H_4$: If the associated network theory of consumer memory holds, the forward spillover effect will be weaker than the reciprocal spillover effect.

# Empirical Model

## *Model Specifications*

We use the multinomial logit model to study the impact of advertising and other marketing variables on consumer choice.[4] The logit model has been extensively applied in marketing literature (e.g., Guadagni and Little 1983; Kanetkar, Weinberg, and Weiss 1992; Krishnamurthi and Raj 1991; Tellis 1988). With this model, the probability that household i chooses brand j on choice occasion t is given by

$$(1) \qquad P_{ijt} = \frac{\exp(U_{ijt})}{\sum_{n=1}^{J} \exp(U_{int})},$$

where J is the number of products, and $U_{ijt}$ is the (revealed) indirect utility of household i for product j on choice occasion t. We use two formulations of $U_{ijt}$ here. In the first formulation, we use brand loyalty to capture unobserved heterogeneity in preferences across households as do Guadagni and Little (1983) and Kanetkar, Weinberg, and Weiss (1992). Thus, $U_{ijt}$ is given by

$$(2) \qquad U_{ijt} = \alpha_j + \sum_{k=1}^{m} X_{ijkt}\beta_k + \varepsilon_{ijt}.$$

In this equation, $\alpha_j$ is the intercept for brand j, and $X_{ijkt}$ is the value of the explanatory variable k for household i and product j on choice occasion t. The parameter $\beta_k$ is the unknown coefficient of explanatory variable k that is to be estimated, and $\varepsilon_{ijt}$ is the random error that follows an extreme value distribution. The household's brand loyalty is one of the m explanatory variables in Equation 2 and is computed from household purchase history as described by Guadagni and Little (1983). Thus, brand loyalty $L_{ij,t}$ for household i toward brand j at purchase occasion t is given by

$$(3) \qquad L_{ij,t} = \alpha L_{ij,t-1} + (1 - \alpha)Y_{ij,t-1},$$

where $Y_{ij,t-1} = 1$ if brand j is purchased at purchase occasion $t - 1$ and 0 otherwise, and $\alpha$ is the smoothing constant. Following Gupta (1988), we use $\alpha = .8$.

Recent research suggests that the previous brand loyalty measure, which has traditionally captured household heterogeneity in logit models, biases parameter estimates because of correlation of the measure with the error term (e.g., Chintagunta, Jain, and Vilcassim 1991; Gonul and Srinivasan 1993). Thus, we use a second formulation of utility that captures heterogeneity in intrinsic preference across households using the latent class approach proposed by Kamakura and Russell (1989). Given that recent research by Ailawadi, Gedenk, and Neslin (1999) finds little difference in the estimated response elasticities across different methods of

[3]We thank an anonymous reviewer for pointing out the different predictions of the two theories regarding the relative magnitudes of the forward and reciprocal spillover effects.

[4]We focus on brand choice because, using coffee data, Gupta (1988) finds that brand-switching accounts for 84% of the overall sales increase due to promotions.

incorporating heterogeneity, the Kamakura–Russell (K–R) approach has the advantage of being computationally less burdensome. Thus, we use a second formulation,

$$(4) \qquad U_{isjt} = \alpha_{sj} + \sum_{k=1}^{m} X_{ijkt}\beta_k + \varepsilon_{ijt}.$$

In this equation, $U_{isjt}$ is the indirect utility to household i for product j on choice occasion t, and household i belongs to latent household segment s, s = 1, 2, ..., M. The parameter $\alpha_{sj}$ is the intrinsic preference of household segment s for brand j and replaces the brand loyalty measure in this model. Other terms in Equation 4 have similar interpretations to those in Equation 3. We determine the parameters and the proportion of the latent segments $f_s$ using a maximum likelihood procedure. The number of segments, M, is selected to minimize Schwarz's (1978) Bayesian information criterion (BIC).

### Data

We estimated the previous models using the ACNielsen scanner panel data for two product-markets: yogurt in the Springfield, Mo., market and powdered detergents in the Sioux Falls, S.Dak., market. Although household purchase data in this data set are available between January 1986 and August 1988, the data used for estimation pertain to the period between September 1987 and August 1988, during which household exposure to advertising was recorded. However, we used purchase data before the estimation period to calibrate loyalty of sample households.

Choosing brand or line extensions for analysis involves some judgment. At the extreme, each item with a distinct Universal Product Code can be considered a brand or line extension. Thus, we used prior knowledge to identify significant extensions (from a consumer perspective) on which to focus. For example, in yogurts, prior knowledge suggests that extension of a brand into the non-fat yogurt subcategory is important. As another criterion, we considered an extension significant if it was advertised separately. After we identified significant extensions, we considered a purchase of any Universal Product Code for each brand a purchase of that brand. We ignored brand sizes for reasons similar to those offered by Kanetkar, Weinberg, and Weiss (1992). First, advertising focuses on brands and not package sizes. Second, package size decisions are not likely to be purchase-to-purchase decisions according to the literature (Blattberg, Eppen, and Lieberman 1981; Krishnamurthi and Raj 1988; Tellis 1988).

For purposes of manageability, we restricted the study to brands with share of purchases exceeding 5% and their extensions. The resulting set yielded nine and six brands, respectively, in the yogurt and powdered detergent categories. For yogurt, spillover advertising came from line extensions within the category. Thus, there was advertising from line extensions in the Dannon and the Yoplait families of brands. However, for powdered detergents, spillover advertising came from liquid detergents. In this case, there was advertising from brand extensions in the liquid detergent category for the Cheer, Surf, and Tide brands. Table 1 identifies the selected brands and provides descriptive statistics, advertising exposures, and introduction dates for yogurts. Table 2 provides the same information for detergent brands. From households that purchased only the selected brands, we removed light-user households, which we define as those that made less than eight purchases in the entire period for which purchase data were available or less than three purchases in the estimation period. After removing purchases used for loyalty calibration, in the yogurt category we were left with 157 households that accounted for 1674 purchases in the estimation period. The corresponding numbers in the powdered detergents category were 163 households and 1336 purchases.

### Explanatory Variables

*Own advertising*: This variable captures the effect of a brand's own advertising on its utility to the household. Similar to Tellis and Weiss (1995), we formulated advertising as a stock variable that is an exponentially weighted average of past exposures and current exposures. The current exposure, $A_{ij,t}$ of household i to product j's own advertising at purchase occasion t, was measured by the number of television advertisements that a household was exposed to in the time period between the previous purchase and the current purchase occasion. This definition of current household advertising exposure is similar to that used by Kanetkar, Weinberg, and Weiss (1992). Also, similar to Kanetkar, Weinberg,

**TABLE 1**
**Yogurt Brands: Descriptive Statistics**

| Yogurt Product | Share (Percentage) | Price per Ounce (Dollars) | Display* | Feature* | Number of Advertising Exposures |
|---|---|---|---|---|---|
| Dannon low-fat (prior to 1981)** | 11.77 | .084 | 0 | .023 | 154 |
| Dannon non-fat (1987) | 1.97 | .074 | 0 | 0 | 0 |
| Dannon fresh flavors (around 1985) | 3.58 | .081 | 0 | .021 | 36 |
| Dannon mini-pack (1985) | .12 | .133 | 0 | 0 | 68 |
| Nordica low-fat | 18.51 | .065 | .0305 | .220 | 2 |
| Wells-Bunny low-fat | 8.18 | .053 | .0203 | .056 | 66 |
| Weight Watcher's | 11.41 | .076 | .0024 | .030 | 344 |
| Yoplait non-fat (1986) | 9.80 | .106 | .0018 | .019 | 296 |
| Yoplait (1976-77) | 34.65 | .100 | .0024 | .035 | 121 |

*Proportion of purchase occasions in estimation-period data.
**Numbers in parentheses indicate estimated introduction dates of the brands.

**TABLE 2**
**Detergent Brands: Descriptive Statistics**

| Detergent Brand | Share (Percentage) | Price per Ounce (Dollars) | Display* | Feature* | Number of Advertising Exposures |
|---|---|---|---|---|---|
| Bold powder | 10.46 | .052 | .0082 | .0067 | — |
| Cheer powder (1950) | 2.04 | .049 | .0239 | .0247 | 82 |
| Oxydol powder | 8.94 | .053 | .0052 | .0060 | 111 |
| Purex powder | 8.76 | .030 | .0449 | .0254 | — |
| Surf powder (before 1985) | 10.15 | .047 | .0284 | .0419 | 95 |
| Tide powder (1946) | 59.64 | .040 | .0861 | .1871 | 172 |

*Proportion of purchase occasions in estimation-period data.
Notes: Number of advertising exposures for Cheer liquid, Surf liquid, and Tide liquid is 43, 39, and 28, respectively. Numbers in parentheses in the first column indicate estimated introduction dates of the brands. Estimated introduction dates for Cheer liquid, Surf liquid, and Tide liquid were 1986, 1988, and 1984, respectively.

and Weiss, we considered a household to have been exposed to an advertisement if the television set was tuned to the advertisement for more than half the advertisement's duration. Let $AS_{ij,t}$ be the stock of own-advertising exposures for product j for household i at purchase occasion t. As in Tellis and Weiss's (1995) study, $AS_{ij,t}$ is given by

$$AS_{ij,t} = \lambda AS_{ij,t-1} + (1 - \lambda)A_{ij,t}. \quad (5)$$

The element $AS_{ij,t-1}$ is the advertising stock for product j, household i, and purchase occasion t – 1. The parameter $\lambda$ is a smoothing constant to be determined.

*Spillover advertising*: We examined the order of entry of products that share the same brand name and designated the product that originally used the brand name as the parent. We inferred introduction dates of products on the basis of the earliest date the product occurred in the data set. In cases in which the products were available from the beginning of the data collection period, we consulted trade magazines to ascertain the order of introduction of products. Tables 1 and 2 give estimated introduction dates of umbrella-branded products.

In all cases, the parents identified in this manner appear to be the product that is most closely associated with the brand name, consistent with our theoretical perspective. The relatively high market shares of the parent in all cases also supports this view. For example, in the Dannon brand family, Dannon low-fat yogurt was deemed the parent, and Dannon mini-pack, Dannon non-fat, and Dannon fresh flavors as its children. In the other case of multiple products with a common brand name in the yogurt data, Yoplait yogurt was considered the parent of Yoplait non-fat yogurt. The remaining three products in yogurt data are stand-alone products with no parent or children. In the powdered detergent data, none of the six brands had significant extensions in the same category; however, some benefited from spillover advertising of branded relatives in the liquid detergent category. In this case, all powder brands were considered parents. For example, Tide Liquid is the child of Tide Powder (the parent).

In product j's utility function, a parent spillover advertising variable measured stock of exposures of household i to advertising of the parent of product j at purchase occasion t. Similarly, a child spillover exposure variable in product j's utility function measured stock of advertising exposures of product j's children for household i at purchase occasion t. In both cases, the stock variable was an exponentially weighted average of past stock and current exposures as in Equation 5 with the same smoothing constant $\lambda$ as was used for own advertising.

Although the spillover advertising variables capture spillover effects in our model, the own-advertising variable captures the substitution effect from a brand's advertising. Thus, we separately estimate the substitution and spillover effects by including both advertising variables in our model and using household scanner-panel data. In contrast, Sullivan (1990) could not distinguish between these two effects in her measurement of spillover effects: Her data show the aggregate impact of both effects.

*Consumer sales promotion*: We employed two separate 0/1 (absence/presence) variables. They were features and in-store displays.

*List price*: As in Tellis and Weiss's (1995) study, this variable represents the price before coupons for the product at purchase occasion t and is expressed in dollars per ounce.

*Coupon value*: The data provide information on the value of coupons redeemed with purchase, but they have no information on coupon availability to households. As do Gonul and Srinivasan (1993), we assume that if a manufacturer's coupon was redeemed for a brand in a particular week, it is available to all households during that week. For store coupons, we assume that if a store coupon was redeemed for a brand in a week, that coupon was available to all households shopping that store during that week.

*Brand loyalty*: When we estimated the model given by Equation 2, we used brand loyalty given by Equation 3 as an explanatory variable. We used the first five purchases of a household or all of a household's purchase before the estimation period (whichever was larger) for calibrating the loyalty measure for each household.

## Analysis and Results

As do Tellis and Weiss (1995), we estimated different logit models using values of the advertising carryover parameter $\lambda$ that varied from 0 to 1 in increments of .1. We found that

a value of .5 for $\lambda$ provided the best fit on the basis of the BIC for both yogurt and detergent. Thus, we set $\lambda$ equal to .5 throughout our analysis.[5]

### *Yogurt Data*

In Table 3, we present the estimation results for a sequence of models leading up to the full model, M2, containing brand loyalty, display, feature, list price, coupon value, own advertising, spillover advertising from children (child-advertising), spillover advertising from parent (parent-advertising), and the brand dummies (Guadagni and Little 1983).[6] List price, coupon value, brand loyalty, display, and feature are strongly significant in all models and have the expected signs. Consistent with the scanner literature on advertising effects (e.g., Tellis and Weiss 1995), own advertising is not significant in the different models. The coefficient of child-advertising is relevant to us in the context of $H_1$. In both M1 and M2, the coefficient of child-advertising is positive and strongly significant ($p < .006$). Thus, the results suggest the existence of a significant and positive reciprocal spillover effect.

As can be seen from M2, the coefficient of parent-advertising is not statistically significant, thus $H_2$ is not supported. This result, combined with the finding of a significant, positive reciprocal spillover effect, offers some support for the associated network theory hypothesis, $H_4$. Although a one-tailed significance test of the difference in the coefficients of parent-advertising and child-advertising in M2 (using the estimated variance–covariance matrix for the vector of coefficients) rejects the null hypothesis of no difference in the coefficients ($p < .06$), a two-tailed test marginally fails to reject the null hypothesis ($p = .11$). Given the directional prediction of $H_4$, we believe that a one-sided test is more appropriate in this case. Overall, given the lack of significance of parent-advertising in comparison with the strong significance of child-advertising, and given the previous results of the one-sided test, we conclude that our results weakly favor the associated network theory hypothesis, $H_4$, over the information economies hypothesis, $H_3$.[7] The $\rho^2$ values in Table 3 suggest a good fit of the models. We performed predictive validation on a holdout sample as a further test of a model with spillover effects. In Table 3, the likelihood ratio test rejects model M0 in favor of model M1 ($\chi^2 < .01$), though we fail to reject model M1 in favor of model M2. Thus, model M1 seems to offer the best fit to the data. To test further the appropriateness of this model, we used models M0 and M1 calibrated on a randomly selected estimation sample of 110 households to make market share predictions in the remaining separate holdout sample of 47 households. (The results from the estimation sample of households were similar to those of the overall sample: Model M1 was favored over model M0 and child-

[5]A long stream of literature suggests that the effect of advertising repetition produces a greater response (e.g., attitude, purchase intention, sales) among consumers loyal or familiar with the advertised brand than among consumers who are not (Calder and Sternthal 1980; Raj 1982; Sawyer 1973; Tellis 1988). In our analysis, we tested for such effects by including loyalty × advertising variables for both own advertising and spillover advertising. None of the interactions was significant, so we present the results without these interactions. Another stream of literature suggests that advertising has an indirect effect on utility through its effects on price-sensitivity (e.g., Kanetkar, Weinberg, and Weiss 1992; Krishnamurthi and Raj 1985). Similar to Kanetkar, Weinberg, and Weiss (1992), we modeled this effect using a list price × own-advertising interaction term. We found that the interaction was not significant and have chosen to present the results without these interaction terms.

[6]We omit the brand intercept parameters in the presentation of all results to conserve space.

[7]This conclusion is not critical to our central finding that reciprocal spillover effects exist. If the null hypothesis, $H_3$, is instead deemed to be supported by virtue of the two-sided test, we would infer that the forward spillover effect is of comparable magnitude to the reciprocal spillover effect, thereby supporting the information of economies hypothesis. Thus, the outcome of the comparison between parent-advertising and child-advertising is mainly of theoretical interest.

**TABLE 3**
**Brand Loyalty Models—Yogurt Brands**
**Parameter Estimates (t-Ratio)**

| Variables | Model M0 | Model M1 | Model M2 |
|---|---|---|---|
| Brand loyalty | 4.7027 (38.750) | 4.7201 (38.678) | 4.7160 (38.645) |
| Display | 1.0813 (3.478) | 1.1118 (3.571) | 1.1090 (3.565) |
| Feature | .5863 (3.698) | .5773 (3.641) | .5782 (3.648) |
| List price | −31.591 (−6.342) | −31.978 (−6.408) | −31.912 (−6.397) |
| Coupon value | 54.978 (8.876) | 55.451 (8.938) | 55.388 (8.929) |
| Own advertising | .1515 (1.178) | .1625 (1.147) | .1852 (1.305) |
| Child-advertising | | .3971 (2.996) | .3775 (2.752) |
| Parent-advertising | | | −.3698 (−.782) |
| LL (n = 1674) | −1366.9 | −1363.1 | −1362.7 |
| $\rho^{2*}$ | .530 | .531 | .531 |
| $\chi^2$ (−2LL)** | 2733.8 | 2726.2 | 2725.4 |
| BIC | 1418.9 | 1418.7 | 1422.1 |

*$\rho^2$ values are with respect to model with brand intercepts only.
**Likelihood ratio test rejects model M0 in favor of model M1 ($p < .01$), whereas model M1 is not rejected in favor of model M2.
Notes: LL = log-likelihood.

advertising was significant.)[8] Marketing literature has customarily characterized the accuracy of market share predictions using measures such as root mean square error (RMSE) and mean absolute deviation (MAD) (e.g., Montgomery 1997). The RMSE penalizes larger deviations in predictions more than MAD does. The RMSE between predicted and actual market shares in the holdout sample deteriorates by 15.2% to a value of .811 with model M0, from a value of .704 obtained with M1. The MAD between predicted and actual market shares in the holdout sample deteriorates by 15.03% to a value of .680 with model M0, from a value of .591 obtained with M1. A chi-square test of the difference in market share predictions between the two models M0 and M1 rejects the hypothesis that there is no difference between the two predictions ($\chi^2$ with 8 degrees of freedom [d.f.] = 25.157, $p < .005$), showing that the improvement in prediction is statistically significant. We also compared disaggregate predictions of models M0 and M1 in the validation sample at the individual choice level using hit rates as suggested by Gensch (1987). To compute the hit rates, we defined the predicted choice on each purchase occasion as the alternative with the highest predicted probability based on the model (M0 or M1). We then compared the predicted choice with the actual choice for each purchase occasion to obtain a hit rate (percentage of choices correctly predicted). Computed in this manner, the hit rate improved from 73.3 for model M0 to 74.0 for model M1. We found the improvement in disaggregate prediction of model M1 over M0 to be statistically significant using the Krishnan test of strength of prediction at the individual choice level ($p < .007$) (for additional details on the Krishnan test, see Gensch 1987). Thus, the predictive results further support the model with reciprocal spillover effect, M1. Using standard tests from the literature, we eliminated alternative explanations for our results such as collinearity, influential observations, or outliers.

The K–R model estimated on yogurt data yielded five preference segments on the basis of minimization of the BIC. We present the results of the full model here. The estimated parameters in Table 4 reveal that child-advertising is positive and significant ($p = .03$), whereas parent-advertising is not significant. In contrast to the brand loyalty models, own advertising is significant ($p = .04$) in the K–R model. Because the K–R model avoids potential bias in parameter estimates that are possible with the brand loyalty model, it appears that own-advertising effects may be significant. Overall, it is reassuring that the results on spillover advertising from the K–R model are consistent with those of the brand loyalty model.

[8]In Tables 3 and 5, we present the estimation results using data from all households to maintain comparability with the K–R models, in which the additional data were helpful, considering the large number of parameters estimated with those models.

**TABLE 4**
**K–R Heterogeneity Model—Yogurt Brands**

| Variables | Parameters | t-Ratio |
|---|---|---|
| Display | .9215 | 3.229 |
| Feature | .4656 | 3.432 |
| List price | –40.8099 | –8.069 |
| Coupon value | 60.2923 | 9.883 |
| Own advertising | .2478 | 2.014 |
| Child-advertising | .3120 | 2.152 |
| Parent-advertising | –.2840 | –.671 |

### *Detergent Data*

Results of the brand loyalty model are presented in Table 5. The parent-advertising effect was not estimated with this data because we modeled the choice of powdered detergents alone (there were too few observations of liquid detergent choices for us to model their purchase). Child-advertising is again positive and significant in this category ($p < .002$), whereas own advertising is not significant. The likelihood ratio test rejects model M0 in favor of model M1 ($\chi^2 < .005$). Similar to the procedure for yogurt, we used models M0 and M1 calibrated on a randomly chosen estimation sample of 100 households to make market share predictions in the remaining separate holdout sample of 63 households. (The results from the estimation sample of households were similar to those of the overall sample: Model M1 was favored over model M0 and child-advertising was significant.) The RMSE between predicted and actual purchase shares in the holdout sample deteriorates by 12.2% to a value of .852 with model M0, from a value of .759 with model M1. The MAD between predicted and actual market shares in the holdout sample deteriorates by 10.7% to a value of .613 with model M0, from a value of .554 obtained with M1. A chi-square test of the difference in market share predictions between the two models M0 and M1 rejects the hypothesis that there is no difference between the two predictions ($\chi^2$ with 5 d.f. = 13.376, $p < .025$), showing that the prediction improvement is statistically significant. Disaggregate predictions for detergents, as measured by the hit rate, improved from 83.2 for model M0 to 84.1 for model M1. We found the improvement in disaggregate prediction of model M1 over M0 to be statistically significant using the Krishnan test of strength of prediction at the individual choice level ($p < .001$). Thus, the prediction results affirm the model with (reciprocal)

**TABLE 5**
**Brand Loyalty Models—Detergent Brands**
**Parameter Estimates (t-Ratio)**

| Variables | Model M0 | | Model M1 | |
|---|---|---|---|---|
| Brand loyalty | 4.887 | (26.583) | 4.927 | (26.486) |
| Display | 1.6629 | (6.104) | 1.6463 | (6.034) |
| Feature | .9115 | (3.561) | .9452 | (3.686) |
| List price | –92.652 | (–8.802) | –92.540 | (–8.759) |
| Coupon value | 153.148 | (10.217) | 155.385 | (15.103) |
| Own advertising | .1133 | (.568) | –.0761 | (–.343) |
| Child-advertising | | | 1.7804 | (3.137) |
| LL (n = 1336) | –551.5 | | –547.4 | |
| $\rho^{2*}$ | .692 | | .694 | |
| $\chi^2$ (–2LL)** | 1103 | | 1094.8 | |
| BIC | 591.1 | | 590.6 | |

*$\rho^2$ values are with respect to model with brand intercepts only.
**Likelihood ratio test rejects model M0 in favor of model M1 ($p < .005$).
Notes: LL = log-likelihood.

spillover effects as being the most consistent with the data. Again, using standard tests we eliminated alternative explanations for our results such as collinearity, influential observations, or outliers.

The K–R model estimated on these data yielded seven preference segments by means of the BIC. Parameter estimates of the K–R model are presented in Table 6. Consistent with results of the brand loyalty model, child-advertising is once again positive and significant ($p = .03$), whereas own advertising is not significant.

## Discussion

### *Managerial Implications*

We estimated spillover effects in two different product categories and geographic markets, using two different ways of representing unobserved heterogeneity. Our results provide strong and consistent support to the hypothesis of a positive spillover effect from advertising of a child on choice of a parent brand (reciprocal spillover effect). Thus, exposure to advertising of Yoplait non-fat yogurt, for example, had a positive effect on the choice probability of its parent, Yoplait yogurt, by households. However, we did not find evidence to support the existence of forward spillover effects (i.e., advertising of a parent increasing the choice probability of a child). This result is consistent with the prediction of associated network theory that forward spillover effect would be weaker ($H_4$). Statistical testing weakly supports this hypothesis while contradicting the expectation of symmetric spillover effects based on information economies ($H_3$). The principal theoretical rationale for a weaker forward spillover effect was that parent's advertising might not evoke the child in the consumer's mind as much as the child's advertising would evoke the parent.

Consistent with previous studies (Kanetkar, Weinberg, and Weiss 1992; Tellis 1988; Tellis and Weiss 1995), the effect of own advertising is weak or nonexistent. In particular, own advertising has a positive, significant effect for yogurt in some models, but has no significant effect in detergents. The significance of reciprocal spillover effects when own-advertising effects are weak or nonexistent can be ascribed to both the newness of child-advertising and the flagship nature of the parents that benefit from the spillover. Because of their flagship position for the umbrella brand, parents can gain considerably, if not the most, from the news value and interest generated by the advertising of the child (Aaker 1996). Indeed, the newness and freshness of child-advertising may make such advertising more effective in garnering attention for the parent than the parent's own advertising. In summary, spillover effect from a child may be of equal or greater importance than a parent's own advertising. A key managerial implication of this finding concerns the allocation of advertising spending between the parent and its children. To the extent that the parent benefits from the advertising of its children and to the extent that such spillover advertising may be more effective in increasing the choice share of the parent, less advertising money may be allocated to the parent.

The productivity or effect size of an advertising exposure can be best captured by the brand-choice elasticities, which measure the increase in choice probability (purchase share) that results from increase in exposure. We follow the method used for computing choice elasticity for feature advertising in the literature (Chintagunta 1993; Chintagunta, Jain, and Vilcassim 1991) by calculating advertising (own or spillover) elasticity as the fractional relative change in the probability of purchase due to an advertising exposure. As an illustration of the effect size comparison, in Table 7 we present the relative productivity of a parent brand's own advertising and spillover advertising of a child, for the two parent yogurt brands, Dannon low-fat and Yoplait. We computed the elasticities using parameters from the brand loyalty model.[9] Although the own-advertising effect was not significant in the brand loyalty model, we have chosen to present the point elasticity for own advertising for comparison. For interested readers, we also provide the 95% confidence intervals for the choice elasticities.

As an example, the choice elasticity for Dannon low-fat's own advertising in Table 7 should be interpreted as follows: One exposure to Dannon low-fat advertising results in an average increase of 5.7% in its choice probability. The table shows that spillover advertising from its children has an impact on purchase share of Dannon low-fat that is more than twice the impact of Dannon low-fat's own advertising. In the case of Yoplait, spillover advertising from Yoplait non-fat has nearly twice the impact on purchase share of Yoplait, as does Yoplait's own advertising. Therefore, opti-

**TABLE 6**
**K–R Heterogeneity Model—Detergent Brands**

| Variables | Parameters | t-Ratio |
|---|---|---|
| Display | 1.4875 | 5.179 |
| Feature | .9402 | 3.553 |
| List price | −136.0419 | −12.161 |
| Coupon value | 166.0217 | 17.020 |
| Own advertising | .0959 | .496 |
| Child-advertising | 1.4658 | 2.089 |

[9]Ailawadi, Gedenk, and Neslin (1999) find that different heterogeneity formulations cause little change in elasticity estimates.

**TABLE 7**
**Productivity Comparison of Own and Spillover Advertising for Yogurts**

| | Choice Elasticity of Parent Brand | |
|---|---|---|
| Parent Brand | Parent's Own Advertising | Spillover Child-Advertising |
| Dannon low-fat | .057 | .144 |
| | [−.046, .171] | [.043, .255] |
| Yoplait | .041 | .079 |
| | [−.027, .093] | [.017, .144] |

Notes: 95% confidence intervals are in brackets.

mal allocation of advertising spending may favor the line extensions in the case of both Dannon and Yoplait.[10]

Analogous productivity comparisons for detergent advertising (Table 8) yield conclusions similar to that for Yoplait advertising. The main difference between the detergent and the yogurt results is the somewhat higher magnitude of the reciprocal spillover elasticities for detergents. We believe that this outcome may be due to the presence of fewer brands in the detergent category, which makes advertising exposures more productive. However, consistent with the yogurt results, the reciprocal spillover has a greater impact on the purchase share of parents than the respective parent's own advertising, for all three extended brands of powdered detergents. The apparent managerial implication is that these brands are better off devoting relatively more advertising spending to the newer brand extensions. Morrin (1999) reaches the opposite conclusion that shifting of advertising funds to extensions may hurt the parent. However, she studies the effect of brand extension advertising on recall and recognition of the parent rather than its choice. It is possible that advertising of the child may change beliefs about the parent and thus influence its overall evaluation and choice, without affecting recall or recognition. For example, advertising of the extension may increase perceptions of parent quality (Dacin and Smith 1994; Wernerfelt 1988) or parent innovativeness. In such a case, a strong reciprocal spillover effect on a parent's evaluation may more than compensate for a weaker spillover effect on recall of the parent (as Morrin finds), resulting in a overall spillover elasticity that is greater than the parent's own-advertising elasticity (as we find). The different conclusions between our studies may also be due to the attention to advertising that was forced on subjects in Morrin's laboratory study, while it is possible that advertising of newer brand extensions command greater attention from the audience in real-world settings (Pieters, Rosbergen, and Wedel 1999).

The existence of beneficial spillover effects from brand extensions suggests an additional strategic benefit of introducing line or brand extensions (Aaker 1990). This strategic benefit may be distinguished from and may supplement the commonly advanced rationale for line or brand extensions, which is to satisfy new market segments profitably by leveraging existing brand equity. Proliferation of brand extensions may have another strategic benefit, which is to crowd the product space and deter entry (Schmalensee 1978).

The information in Tables 7 and 8, when combined with the introduction dates from Tables 1 and 2, yields the following interesting observation: The superiority of reciprocal spillover advertising in comparison with a brand's own advertising is greatest for recently introduced brand extensions and, at least within a given product category, tends to diminish more or less monotonically with age of the extension. This conclusion is consistent with the intuitive expectation that with passage of time, the child's advertising may provide less by way of new information that may influence the choice of the parent. Also, as time passes, the child may gain a stronger presence in the consumer's mind and be less likely to evoke the parent with its advertising. The associated network theory predicts that such inhibition of the parent in consumers' memories will result from a strengthening of the link between the brand and child nodes. A caveat to our previous conclusion regarding the relation between the spillover effect and age of the child is that it comes from a cross-brand comparison and not a within-brand comparison. Further research might examine this issue with more extensive longitudinal data. Overall, it is important to note that a positive and statistically significant reciprocal spillover effect was observed over a wide variety of relative introduction times of the parent and child in the two categories.

### *Methodological Advantages and Limitations of the Study*

The advantage offered by the high quality of scanner panel data is well known. However, the household-level data also help mitigate the problem of reverse causality faced with advertising studies using aggregate data. This problem arises because managers might set advertising budgets as a percentage of sales or market share. As Tellis (1988, p. 142) points out, "it is unlikely that managers set advertising exposures in expectation of purchases at such disaggregate levels" (individual household levels). Tellis also indicates that between-brand analysis with such data provides greater power and efficiency than a separate analysis for each brand.

As with typical econometric studies, the conclusions from our study should be considered tentative subject to replication by other studies using different models or methodologies or by replication in other product-markets. Furthermore, our results may be sensitive to the level of advertising by competing brands observed in the categories and markets we examined.[11] Although we used a variety of tests to verify that a few influential observations did not affect the pattern of our findings, it would nevertheless be worthwhile to replicate our analysis with categories having a greater number of advertising exposures. Future studies

[10]A more formal analysis of the implication of spillover effects for advertising allocation, using an analytical model, can be obtained directly from the authors on request.

**TABLE 8**
**Productivity Comparison of Own and Spillover Advertising for Detergents**

| | Choice Elasticity of Parent Brand | |
|---|---|---|
| Parent Brand | Parent's Own Advertising | Spillover Child-Advertising |
| Cheer | n.s. | .600 [.160, 1.273] |
| Surf | n.s. | .893 [.236, 1.956] |
| Tide | n.s. | .145 [.056, .229] |

Notes: 95% confidence intervals are in brackets. n.s. = not significantly different from zero.

[11]We thank an anonymous reviewer for pointing out this limitation.

could also explore how advertising content affects spillover effects.

## Conclusions

In this article, we study the reciprocal spillover effect of advertising of a line or brand extension on the choice of the parent brand. Using scanner panel data on two product categories and in two geographical markets, we find evidence for a significant reciprocal spillover effect. Indeed, we find that such spillover advertising can increase the choice probability of the parent more than is possible with the parent's own advertising. Our results suggest that firms should favor the line or brand extension with a greater allocation of the advertising budget than otherwise. These results also indicate a new strategic benefit from line or brand extensions whereby a firm introducing the extensions can expect positive reciprocal spillover effects for the parent brand.

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