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Prior empirical literature states that asymmetry in cross-price effect favors the high-share brand. That is, when high-share brands discount, they have a greater impact on low-share brands than the reverse. This conclusion is based on consideration of cross-price elasticities. The authors point out that focusing on cross-price elasticities for assessing asymmetry is inappropriate for determining the incremental profitability from price promotions. Instead, asymmetries should be investigated in absolute cross-price effects, that is, change in market share of a competing brand for a unit price change of the focal brand. The authors theoretically and empirically demonstrate that asymmetry reverses when absolute cross-price effect is considered. That is, the absolute cross-price effect of a price reduction of a low-share brand on the market share or sales of a high-share brand is greater than the reverse. The authors discuss the implications of the findings and future research directions.

The Asymmetric Share Effect: An Empirical Generalization on Cross-Price Effects

Studying patterns in cross-price effects enables managers and researchers to understand brand price competition and market structure, thereby providing guidance for pricing and promotion strategies. Blattberg and Wisniewski (1989) introduced the concept of asymmetric price effect, which states that a price cut by a high–price-tier (high quality) brand affects the sales or market share of a low–price-tier (low quality) brand more so than the reverse. This topic has generated substantial interest among researchers who have provided theoretical and empirical support for the phenomenon (e.g., Allenby and Rossi 1991; Hardie, Johnson, and Fader 1993; Kamakura and Russell 1989; Sivakumar and Raj 1997). Bronnenberg and Wathieu (1996), however, argue that the asymmetric price effect can go either way—that is, favor the lower-priced brand or the higher-priced brand—depending on the price–quality positioning of the brands. Recently, Sethuraman, Srinivasan, and Kim (1999) meta-analyzed 1060 cross-price effects from 280 brands and found that the asymmetry holds with cross-price elasticities (percentage change in sales or market share of a brand for 1% change in price of a competing brand) but tends to disappear with absolute cross-price effects (change in market share or sales of a brand for unit price change of a competing brand).

The purpose of this article is to provide theoretical and empirical support for asymmetry in cross-price effects that can arise from another aspect of a brand, namely, its market share. Why is market share an important characteristic? Even though it is not a decision variable per se, managers devise marketing strategies depending on whether the brands in question are high-share (leading) brands or low-share (follower) brands (see, e.g., Kotler 1997, Ch. 13). Researchers also attempt to understand how market share moderates the impact of marketing actions on sales. In particular, several researchers (e.g., Bolton 1989; Kamakura and Russell 1989; Sethuraman 1995) have ascertained how brand shares may affect own- and cross-price effects. Others have discussed how brand share may influence optimal pricing decisions (e.g., Zenor 1994). Because of its importance,

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empirical researchers routinely report brand shares in their articles.

Research on the relationship between brand share and asymmetry in cross-price effect is limited. Kamakura and Russell (1989, p. 386) state that high-share brands have greater clout and can hurt other (smaller) brands when they promote, but they are less vulnerable to smaller brands' discounts. The authors base their conclusion on their empirical result that the aggregate cross-price elasticity of high-share brands' discount on the share of smaller brands is greater than the reverse. Sethuraman (1995, p. 284) finds that leading national brands with the highest market shares are likely to take substantial sales from private labels because the average cross-price elasticity of their discounts on private label sales is .67. However, leading brands are less vulnerable to private label discounts because the average cross-price elasticity of private label price discount on sales of leading brands is only .32. In a similar vein, Chintagunta (1993, p. 200) and Cotterill, Putsis, and Dhar (2000, p. 127) find that the cross-price elasticity of high-share brands' price cut on the market share of low-share brands is greater than the reverse.

Although the generalization emanating from this literature is that asymmetry favors the high-share brands, there has been no formal theoretical analysis or meta-analysis that investigates whether there are systematic differences in cross-price effects due to market share differences. More important, the empirical conclusion is based on cross-price elasticities. As Mela, Gupta, and Lehmann (1997), Sethuraman, Srinivasan, and Kim (1999), and Sivakumar and Raj (1997) point out, focusing on cross-price elasticities is not appropriate, particularly when assessing asymmetry. This is because the same amount of change in market share (percentage) points looms larger when expressed as a percentage of the smaller brand's share compared with the larger brand's share. Stated differently, asymmetry is automatically introduced simply because the market share of the affected brand appears in the denominator of the cross-price elasticity expression. Therefore, focusing on absolute cross-price effect—that is, the change in market share (percentage points) of a competing brand resulting from a change in price of the promoting brand—is more appropriate for assessing asymmetry. In addition, as we show in the next section, the absolute cross-price effect is the more appropriate measure than cross-price elasticity for assessing the profitability due to price discounts.

An important question then is whether asymmetry favors the high-share brand when measured in terms of absolute cross-price effects. In this article, we investigate this issue and find that the asymmetry reverses—that is, favors the low-share brand—with absolute cross-price effects. In particular, we show theoretically and demonstrate empirically that the absolute cross-price effect due to the price reduction of a low-share brand on the market share of a high-share brand is greater than the reverse. We call this phenomenon and empirical generalization the *asymmetric share effect*.

Our article contributes to the literature in several ways. First, it provides a formal analysis of asymmetry that arises because of market share differences—much of the research on asymmetry has focused on price (quality) differences. Second, contrary to conventional wisdom, it shows that the asymmetry favors the low-share brand when absolute cross-price effect is considered. Third, we test the empirical generalizability of the asymmetric share effect through a meta-analysis of cross-price effects on 530 brand-pairs from 19 different grocery product categories. As Bass (1995) notes, the building blocks of science are empirical generalizations, defined as patterns of regularity that repeat over different circumstances. Finally, we point out that, because market share can systematically influence cross-price effects, any empirical test of the asymmetric price effect should take into account market share differences as well. We conduct such a test and confirm Sethuraman, Srinivasan, and Kim's (1999) finding that the asymmetric price effect tends to disappear with absolute cross-price effects.

The article is divided as follows: First, we argue as to why the absolute cross-price effect is the more appropriate measure in the evaluation of the profitability of price discounts. Second, we provide theoretical support for the asymmetric share effect. Third, we empirically test the asymmetric effects using data from a large number of studies. We conclude by discussing the implications, limitations, and future research directions.

ABSOLUTE CROSS-PRICE EFFECT OR CROSS-PRICE ELASTICITY?

Should a manufacturer consider absolute cross-price effect (γ) or cross-price elasticity (η) for making price promotion decisions? We argue in this section that the absolute cross-price effect is a more appropriate measure than cross-price elasticity for assessing the profitability due to price discounts. As explained subsequently, changes in manufacturer profits are more directly reflected by changes in absolute cross-price effects.

Consider a two-brand market in which one brand (HS) has high market share (m_{HS}) and the other brand (LS) has low market share (m_{LS}). We assume for the present that both brands have the same regular price (p), offer the same absolute discount (δ), and obtain the same unit gross margin (g) after discount. Let the total category sales be Q.

There are two ways that sales of a brand can increase because of a price cut: (1) brand switching and (2) category expansion that arises from increased purchase incidence and/or increased quantity of purchase. Gupta (1988) and Bell, Chiang, and Padmanabhan (1999) have shown that price promotions have a relatively small effect on category expansion compared with brand switching. Therefore, we isolate and study the profitability due to brand switching only.

The absolute cross-price effect ($\gamma_{HS \rightarrow LS}$) of the price reduction δ of the high-share brand on the market share of the low-share brand is given by $\Delta m_{LS}/\delta$, where Δm_{LS} is the change (decrease) in market share of the low-share brand. Thus $\Delta m_{LS} = (\gamma_{HS \rightarrow LS})\delta$. Because we are dealing with a two-brand market, the decrease in market share of the low-share brand is the same as the increase in market share of the high-share brand; that is, $\Delta m_{HS} = \Delta m_{LS} = (\gamma_{HS \rightarrow LS})\delta$.

Therefore, the incremental profit for the high-share brand from its discount is given by

$$(1)\quad \Delta\Pi_{HS} = [(g \times m_{HS} \times Q) + (g \times \gamma_{HS \rightarrow LS}\,\delta \times Q)] - (g + \delta) \times m_{HS} \times Q, \text{ or}$$

$$(2)\quad \Delta\Pi_{HS} = (g \times \gamma_{HS \rightarrow LS} - m_{HS})\,Q\delta.$$

Similarly, when the low-share brand discounts, its incremental profit due to brand switching from the high-share brand is

(3) $$\Delta\Pi_{LS} = (g \times \gamma_{LS \to HS} - m_{LS})\, Q\delta.$$

The first term in the parenthetic expressions of Equations 2 and 3 represents the contribution gain due to brand switching. The second term represents the loss due to existing consumers availing of the discount. The second term is larger for the high-share brand. The intuition is that high-share brands have greater loss because of the larger number of their regular consumers availing of the discount. We show in this article that incremental profits favor the low-share brand from a brand-switching standpoint as well (the first terms in Equations 2 and 3); that is, $m_{HS} > m_{LS} \Rightarrow \gamma_{LS \to HS} > \gamma_{HS \to LS} \Rightarrow \Delta\Pi_{LS} > \Delta\Pi_{HS}$.

What happens when we consider cross-price elasticities (η)? By definition, $\gamma_{HS \to LS} = \eta_{HS \to LS} \times (m_{LS}/p)$. Therefore, rewriting Equation 2 in terms of elasticities, incremental profit for the high-share brand when it discounts is

(4) $$\Delta\Pi_{HS} = [g \times \eta_{HS \to LS} \times (m_{LS}/p) - m_{HS}]\, Q\delta.$$

Similarly, incremental profit for the low-share brand when it discounts is

(5) $$\Delta\Pi_{LS} = [g \times \eta_{LS \to HS} \times (m_{HS}/p) - m_{LS}]\, Q\delta.$$

The second term remains the same as before, favoring the low-share brand's promotions. However, because of the competing brand's share in the first term, asymmetry in cross-price elasticities (favoring the high-share brand) is not a direct indicator of asymmetries in incremental profits; that is, $m_{HS} > m_{LS} \Rightarrow \eta_{HS \to LS} > \eta_{LS \to HS}$ does not imply that $[g \times \eta_{HS \to LS} \times (m_{LS}/p)] > [g \times \eta_{LS \to HS} \times (m_{HS}/p)]$.

In the real world, there are several other factors to consider in the analysis of the profitability of price promotions. Prices and gross margins may be higher or lower for the high-share brand than for the low-share brand. In particular, the high-share brand may have a lower unit cost because of economies of scale and therefore enjoy a higher gross margin. Manufacturers should consider category expansion effects other than brand switching. It is possible that retailers, to increase store traffic, pass through more of the trade deals offered by larger brands. These actions, in turn, may affect optimal discount decisions. Nevertheless, purely from a cross-price effect or brand-switching standpoint, the basic premise of our argument holds, namely, that asymmetry in absolute cross-price effects (favoring the low-share brand) is more relevant than asymmetry in cross-price elasticities for making price promotion decisions. We now show that the asymmetry in absolute cross-price effects favors the low-share brand.

THEORETICAL ANALYSIS OF ASYMMETRY

Consider a market with n brands. Let u_i denote a consumer's utility for brand i at its normal price p_i (u_i is assumed to be nonnegative). We assume that the probability (θ_i) that the customer would choose brand i is given by Luce's (1959) choice model:

(6) $$\theta_i = \frac{u_i}{\sum_{i=1}^{n} u_k}.$$

We capture consumer heterogeneity as do Bass, Jeuland, and Wright (1976) by assuming that the utilities $(u_1, u_2, \ldots, u_n)$ are independently (across brands) gamma-distributed with shape parameters $(\alpha_1, \alpha_2, \ldots, \alpha_n)$. As do Bass, Jeuland, and Wright (1976), we assume that the scale parameter of the gamma distribution is the same across brands.

These assumptions lead to the probability distribution $(\theta_1, \theta_2, \ldots, \theta_n)$ being Dirichlet-distributed across consumers (Goodhart, Ehrenberg, and Chatfield 1984). The Dirichlet distribution for choice probabilities has been shown to have strong empirical validity for grocery products (Ehrenberg 1988; Goodhart, Ehrenberg, and Chatfield 1984). The Dirichlet distribution has also been shown to be a consequence of rational choice behavior (Vanhonacker and Winer 1990). The market share of brand i is given by (Bass, Jeuland, and Wright 1976)

(7) $$m_i = \frac{\alpha_i}{\sum_{k=1}^{n} \alpha_k}.$$

Because our focus is the asymmetry between any two brands i and j, we let

$$\alpha_o = \sum_{\substack{k=1 \\ k \neq i,j}}^{n} \alpha_k$$

(o denotes other brands) so that

(8) $$m_i = \frac{\alpha_i}{\alpha_i + \alpha_j + \alpha_o} \text{ and}$$

(9) $$m_j = \frac{\alpha_j}{\alpha_i + \alpha_j + \alpha_o}.$$

Now suppose brand i offers a finite (i.e., not infinitesimal) promotional price discount = δ. We assume that the utility of brand i increases from u_i to $u'_i = u_i + \beta\delta$, where β is the price sensitivity parameter. The promotional price reduction δ is common across consumers, but the price sensitivity parameter β would be expected to vary across consumers. We assume that $(\beta\delta)$ is gamma-distributed independently[1] of the utilities $\{u_i\}$ with λ as the shape parameter.[2] It is consistent and reasonable to expect that $(\beta\delta)$ also has the same scale parameter as does $\{u_i\}$.[3] However, the equality of scale

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[1]Kim, Blattberg, and Rossi (1995, p. 293) report that they find no relationship between price sensitivity and brand preferences. Allenby and Rossi (1999, p. 68) report correlations between brand preference and price sensitivity for three ketchup brands to be –.32, –.39, and –.07. This corresponds to an average (absolute) correlation of .26, or proportion of explained variance of only 7%.

[2]The coefficient of variation (standard deviation/mean across consumers) of the incremental utility $(\beta\delta)$ distribution is $1/\sqrt{\lambda}$. In particular, when the price discount $\delta \to 0$, $\lambda \to 0$ so that the coefficient of variation goes to infinity. Therefore, the proposed model is inappropriate for examining asymmetry in the limiting case as $\delta \to 0$.

[3]As do Bass, Jeuland, and Wright (1976), we have assumed that different brands' utilities $\{u_i\}$ at different prices $\{p_i\}$ all have the same scale parameter. Therefore, it is consistent and reasonable to expect that the utility $u'_i = u_i + \beta\delta$ at price $p_i - \delta$ is also gamma-distributed with the same scale parameter. If u_i and $u_i + \beta\delta$ are both gamma-distributed with same scale parameter, it can be shown that $(\beta\delta)$ is also gamma-distributed with the same scale parameter (proof is available from the authors).

parameter assumption is not critical for obtaining the asymmetric share effect result. Extensive simulations conducted using a wide range of parameter values (details are available from the authors) showed that the asymmetric share effect result always holds even if ($\beta\delta$) has a scale parameter different from those of $\{u_i\}$.

If u_i is distributed as gamma with shape parameter α_i and ($\beta\delta$) is gamma-distributed independently of the utilities $\{u_i\}$ with shape parameter λ but with the same scale parameter, then the distribution of u'_i is gamma with shape parameter $(\alpha_i + \lambda)$ (Rice 1995, p. 145). Thus, the market share of brand j changes to

$$(10)\qquad m'_j = \frac{\alpha_j}{(\alpha_i + \lambda) + \alpha_j + \alpha_o}.$$

The change in market share of brand j due to brand i's price promotion is $\Delta m_j = m_j - m'_j$. The absolute cross-price effect ($\gamma_{i \to j}$) of the price reduction of brand i on the market share of brand j is defined as

$$\gamma_{i \to j} = \frac{\Delta m_j}{\delta} =$$

$$\frac{\alpha_j}{\delta}\left(\frac{1}{\alpha_i + \alpha_j + \alpha_o} - \frac{1}{\alpha_i + \lambda + \alpha_j + \alpha_o}\right), \text{or}$$

$$\gamma_{i \to j} = \frac{\alpha_j}{\delta} \times \frac{\lambda}{(\alpha_i + \alpha_j + \alpha_o)\,(\alpha_i + \alpha_j + \alpha_o + \lambda)}.$$

Substituting Equation 9 into this equation, we get

$$(11)\qquad \gamma_{i \to j} = \frac{m_j}{\delta} \times \frac{\lambda}{(\alpha_i + \alpha_j + \alpha_o + \lambda)}.$$

Likewise, the absolute cross-price effect of the price reduction δ of brand j on the share of i is

$$(12)\qquad \gamma_{j \to i} = \frac{m_i}{\delta} \times \frac{\lambda}{(\alpha_i + \alpha_j + \alpha_o + \lambda)}.$$

From Equations 11 and 12, it follows that

$$(13)\qquad \gamma_{i \to j} > \gamma_{j \to i} \text{ whenever } m_i < m_j.$$

We call the inequality in Equation 13 the asymmetric share effect. That is,

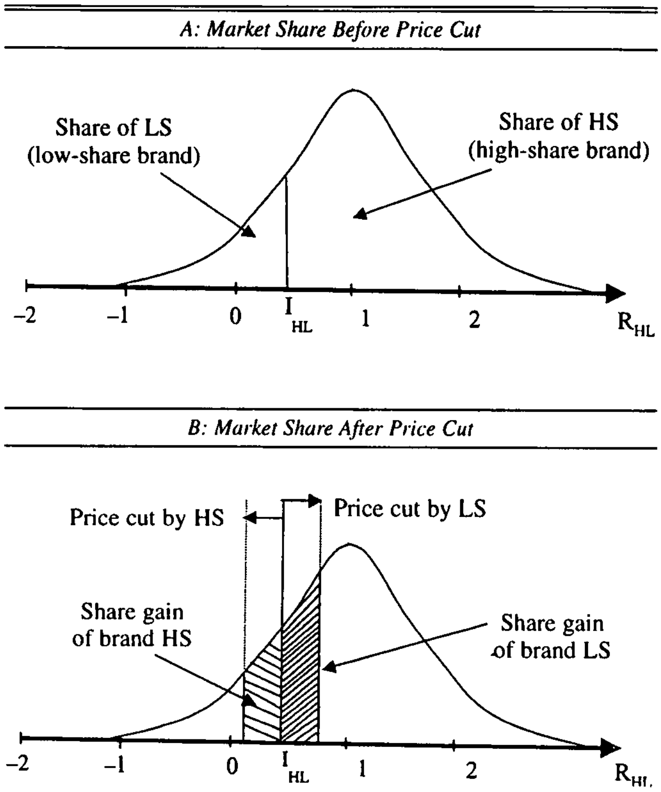
> H_1: The absolute cross-price effect of a price reduction of a low-share brand (LS) on the market share of a high-share brand (HS) is greater than the reverse; that is, $\gamma_{LS \to HS} > \gamma_{HS \to LS}$.

The absolute cross-price effect in our Dirichlet model is directly proportional to the market share of the brand whose sales are affected. Thus, the intuition for the asymmetric share effect is that a low-share brand has a greater pool of consumers to draw from when it discounts than does a high-share brand.

Whereas our theory follows from Luce's (1959) choice model, Abe (1998) offers an alternative explanation for the asymmetric share effect based on a distribution of relative intrinsic preferences. Denote the intrinsic preference of brand i as v_i so that the utility at normal price $u_i = v_i - \beta p_i$. Therefore, $v_i = u_i + \beta p_i$. Relative (intrinsic) preference ($) for a consumer between two brands i and j is defined as the difference $R_{ij} = (v_i - v_j)/\beta = [(u_i - u_j)/\beta] + p_i - p_j$. The consumer will purchase brand i if $u_i > u_j$, or $R_{ij} > p_i - p_j$, and will purchase brand j if $R_{ij} < p_i - p_j$. The indifference point occurs when $R_{ij} = p_i - p_j = I_{ij}$. Abe (1998) estimates the distribution of R_{ij} across consumers from panel data for 30 brand-pairs in two product categories using a semiparametric Bayesian approach. The brands include national as well as store brands. In all 30 brand-pairs, he finds the relative preference distribution to be approximately unimodal and symmetric. In this case, it can be shown that the low-share brands will gain more share from the high-share brands, as shown in Figure 1.

Figure 1

ABE'S (1998) MODEL



R_{HL} = Difference in intrinsic preference ($) between high-share brand (HS) and low-share brand (LS).
I_{HL} = Price difference between brands HS and LS = $p_{HS} - p_{LS}$.

Figure 1, Panel A, indicates the market shares of two brands, a high-share and a low-share one, before the price cut. The area under the bell curve to the right of the indifference point represents the high-share brand's customers at normal prices; the area to the left of the indifference point represents the low-share brand's customers. For example, the high-share brand could be the national brand and the low-share brand the private label. When the high-share brand discounts, the indifference point moves to the left, thus giving more share for the high-share brand (Figure 1, Panel B). When the low-share brand discounts, the indifference point moves to the right, thus giving more share for the low-share brand (Figure 1, Panel B). It is apparent that the gain in share of the low-share brand due to a finite (i.e., not infinitesimal) price cut is larger than the gain in share of the high-share brand due to the same finite price cut.

Abe's (1998) analysis assumes that the distribution across consumers of the difference between the utilities of the high-and low-share brands is approximately unimodal and symmetric.[4] Our theoretical result using the gamma distribution assumes only unimodally distributed preferences; that is, the assumption of symmetry is not required. There are situations in which the unimodality assumption may be strongly violated and the asymmetry in cross-price effects may be reversed (see the "Discussion and Conclusion" section). However, it is worthwhile to point out that the state-of-the-art models of heterogeneity (e.g., Allenby and Rossi 1999) make the unimodality assumption.

Two additional assumptions underlie our theoretical analysis and Abe's (1998) analysis. As is the case in the real world, price discount needs to be finite (i.e., not infinitesimal). Furthermore, the theoretical analysis is based on brand-switching considerations only; category expansion effects are not considered.

In the following section, we meta-analyze cross-price effects from 15 studies and show that the asymmetric share effect holds across a wide variety of product categories and markets.

EMPIRICAL ANALYSIS

Data

Sethuraman, Srinivasan, and Kim (1999) collected extensive data on cross-price effects from published studies to test the empirical generalizability of the asymmetric price effect. However, they do not consider market share differences. We use the same data set to test the asymmetric share effect. The data come from 15 studies published between 1970 and 1996. These 15 studies analyze 72 data sets comprising 19 grocery product categories, 280 brands, and 1060 cross-price effect estimates (530 pairs). The data come from a variety of data sets including store-level and panel data from different markets. In each study, the respective authors estimated the cross-price effects using a variety of models, including linear, log–log, attraction, and logit models. Some authors reported absolute cross-price effects ($\gamma_{i\rightarrow j}$), whereas others reported estimates of cross-price elasticities ($\eta_{i\rightarrow j}$). When the authors reported elasticities, the corresponding absolute cross-price effect is computed using the standard formula $\gamma_{i\rightarrow j} = \eta_{i\rightarrow j}(m_j/p_i)$. Sethuraman, Srinivasan, and Kim (1999) provide a more detailed description of the meta-analysis data set.

Consistent with prior literature, the average cross-price elasticity of high-share brand's price cut on the sales of low-share brand is greater than the opposite (i.e., mean $\eta_{HS\rightarrow LS} = .60 >$ mean $\eta_{LS\rightarrow HS} = .42$). The asymmetry in absolute cross-price effect (γ), however, goes in the opposite direction, consistent with our theory (i.e., mean $\gamma_{LS\rightarrow HS} = .069 >$ mean $\gamma_{HS\rightarrow LS} = .043$).

Test of the Asymmetric Share Effect

The asymmetric share effect hypothesis is related to direction of asymmetry and can be stated as follows: For two brands i and j with market shares m_i and m_j, respectively,

$$m_i \lesseqgtr m_j \Rightarrow \gamma_{i\rightarrow j} \gtreqless \gamma_{j\rightarrow i}.$$

[4]Abe's (1998) result holds even if the distribution in Figure 1, Panel A, is unimodal and negatively skewed (i.e., the longer tail is on the left-hand side).

Because the dependent variable is binary, we use the following binary logit model (not to be confused with the multinomial logit brand choice model) to test the asymmetric share effect. The probability of cross-price effect $\gamma_{i\rightarrow j}$ being greater than $\gamma_{j\rightarrow i}$ is modeled as

$$\text{(14)} \qquad \Pr(\gamma_{i\rightarrow j} > \gamma_{j\rightarrow i}) = \frac{e^w}{1 + e^w},$$

where

$$\text{(15)} \qquad w = b_0 + b_1[D(m_i < m_j)] + b_2[D(p_i > p_j)] + \text{other covariates},$$

where

$D(m_i < m_j)$ = dummy variable = 1 if $m_i < m_j$, 0 otherwise.
$D(p_i > p_j)$ = dummy variable = 1 if $p_i > p_j$, 0 otherwise.

Dummy variable $[D(m_i < m_j)]$ captures the asymmetric share effect. A positive coefficient (b_1) would indicate that low-share brands are more likely to have a higher cross-price effect, validating the asymmetric share effect hypothesis. Dummy variable $[D(p_i > p_j)]$ captures the asymmetry arising because of price differences. The asymmetric price effect (Blattberg and Wisniewki 1989) states that high-priced brands would have a greater cross-price effect, indicating a positive coefficient (b_2). Sethuraman, Srinivasan, and Kim (1999) state that the asymmetry tends to disappear in absolute cross-price effects. However, they do not include the covariate of market shares in their empirical test. Therefore, it is of interest to test the direction of asymmetric price effect with market share included as a covariate.

The other covariates used in the model are the same as in Sethuraman, Srinivasan, and Kim's (1999)—the number of brands in the product category, dummy variables to account for differences in functional forms (e.g., linear, semilog) used in the studies included in the meta-analysis, dummy variables for capturing product category differences (e.g., fabric softener, orange juice), and dummy variables to capture chain/store differences in cases in which the same product was analyzed in multiple stores. We do not have specific interest or expectations about the nature of impact of these covariates on the dependent variable. We included them to parallel Sethuraman, Srinivasan, and Kim's study and to estimate the unique effects due to relative market shares and prices after adjusting for product and method differences. We repeated the analysis without these covariates. The qualitative results do not change—the asymmetric share effect continues to be strong and statistically significant.

Data sets. The 15 studies in the database fall into three categories:

1. Logit models: Six studies that estimate cross-price effects with consumer panel data using heterogeneous logit choice models.
2. Market share models: Three studies that estimate cross-price effects with aggregate (store- or market-level) market share data using attraction or double-log models.
3. Sales models: Six studies that estimate cross-price effects with aggregate sales data using linear, semi-log, or double-log models.

We estimate the binary logit model in Equations 14 and 15 for each of the data sets and for all 530 brand-pairs combined.

Table 1

ASYMMETRIES IN ABSOLUTE CROSS-PRICE EFFECTS: BINARY LOGIT MODEL RESULTS

Data Set	Number of Observations (Pairs)	Estimate (Standard Error)		Model Fit (U^2)
		Share Effect (b_1)	Price Effect (b_2)	
Logit	92	1.94 (.55)**	–.87 (.64)	.16
Share	136	.67 (.39)*	.63 (.45)	.11
Sales	302	.83 (.28)**	.33 (.28)	.09
All	530	.95 (.21)**	.30 (.22)	.10
Price tier: 20% price differential	198	.86 (.39)*	.54 (.56)	.26
National Brand–Store Brand	127	.75 (.46)*	.54 (.69)	.19

*Significant at the $p < .05$ level, one-tailed test.
**Significant at the $p < .01$ level, one-tailed test.

Table 1 presents the binary logit model results for these four data sets. In all four data sets, the coefficient of share effect is positive and statistically significant, consistent with the asymmetric share effect hypothesis.[5] The coefficient of price effect is positive, as predicted by the asymmetric price effect (except in the case of the logit model, where it is negative), but not statistically significant, which thus reconfirms Sethuraman, Srinivasan, and Kim's (1999) result.

Asymmetric price effect, however, is often stated to exist among brands in different price tiers. To capture the price-tier effect, we repeated the analysis with only observations in different price tiers. At what prices should a brand be classified as a higher– or a lower–price-tier brand? This decision is subjective. In Blattberg and Wisniewski's (1989) seminal article, the average price differential between brands in two adjacent price tiers tends to be in the 15% to 30% range. We used a 20% price differential to separate price tiers. We estimated model (Equation 14) by including only the i–j brand-pair observations in which the price differential $[(p_H - p_L)/p_H] > .2$ (20%). The results are reported in Table 1. Again, the coefficient of share effect is positive and significant. The coefficient of price effect increased in magnitude but is not significant.

Price-tier competition is also conceptualized in terms of competition between high-priced national brands and low-priced store brands. Therefore, we performed another analysis with merely the national brand–store brand pairs. The results (Table 1) are similar to the price-tier data sets. The coefficient of the share effect is positive and significant. The coefficient of the price effect has the positive sign, consistent with the asymmetric price effect, but is not significant.

The model fit U^2 ranges from .09 to .26. Given the estimation error in cross-price effects, we believe that this range of values is reasonable. It is similar to the R^2 values from other meta-analytic studies on price effects (e.g., Sethuraman, Srinivasan, and Kim 1999: .12 to .41; Tellis 1988: .29). In summary, the empirical analysis provides strong support for the asymmetric share effect, and the result is robust across estimation models and data sets.

DISCUSSION AND CONCLUSION

Most of the literature on asymmetries in cross-price effects focuses on price differences—the asymmetric price effect. This article focuses on asymmetry because of another important brand characteristic—market share. There is a general belief in the literature regarding cross-price effects that asymmetry favors the high-share brand, because (1) it has been observed empirically that the cross-price elasticity due to a price cut of a high-share brand on the sales of a low-share brand is greater than the reverse, and therefore (2) high-share brands have greater clout and lower vulnerability compared with low-share brands, consistent with the market share = market power notion.

This article challenges the conventional wisdom and notes that the asymmetry favors the high-share brands only in terms of cross-price elasticities. We argue that when profit maximization is the objective and gross margin from incremental unit sales is equal across brands, absolute cross-price effect is the more appropriate measure for assessing asymmetry. When measured in terms of absolute cross-price effects, asymmetry reverses—that is, favors the low-share brand. In particular, we show theoretically that when (1) the utility distribution across consumers is unimodal (gamma-distributed), (2) price discounts are finite (i.e., not infinitesimal), and (3) price promotions mainly influence brand switching (and not category expansion), the absolute cross-price effect of a price reduction of a low-share brand on the market share of a high-share brand is greater than the reverse. We call this phenomenon the asymmetric share effect. The intuition is that a low-share brand has a greater pool of consumers to draw from when it discounts than does a high-share brand.

We meta-analyzed 1060 cross-price effects on 530 brand-pairs from 19 different grocery product categories and found a significant asymmetric share effect. In contrast, the asymmetric price effect was not statistically significant, which confirms Sethuraman, Srinivasan, and Kim's (1999) result.

Taken together, our theory, Abe's (1998) explanation, and the present empirical analysis provide converging evidence for the asymmetric share effect. However, asymmetry may not always favor the low-share brand. Further research can test the robustness of the asymmetric share effect and iden-

[5]Had we calculated the cross-price effects in the logit model data sets using derivatives (i.e., infinitesimal price discounts), they should be symmetric by theory (Sethuraman, Srinivasan, and Kim 1999), barring rounding and calculation errors, so that there should be no statistically significant asymmetric share effect. In 28 of the 92 pairs in the logit data set, the cross-price effects had been calculated using derivatives. (For the remaining 64 pairs, the cross-price effects had been calculated using finite changes in prices.) When we estimated the model using only these 28 observations, the coefficient of asymmetric share effect became statistically insignificant.

tify conditions when the asymmetry can go the other way—favor the high-share brand. This would be in the spirit of the research by Bronnenberg and Wathieu (1996) and Lemon and Winer (1993), who identify the conditions when the asymmetric price effect may be reversed. Two specific issues are particularly germane to this line of research: nonunimodal markets and income effect.

Nonunimodal Markets

Our theoretical result holds when the market can be viewed as consumers with unimodal preference distributions. Hierarchical Bayes models (Allenby and Rossi 1999) of brand preferences and price sensitivities have been shown to capture market-level heterogeneity quite well. In these models, it is typical to assume that brand preferences and price sensitivities are normally distributed; these assumptions are similar to our gamma-distribution assumptions. Consequently, we expect the unimodal distribution to be a reasonable representation of utilities in several markets.

However, if the unimodality assumption does not hold, the asymmetric share effect may or may not hold. For example, consider a sharply segmented national brand/store brand market in which there is a larger segment (60%) that is totally loyal to national brand and a smaller switching segment (40%) in which the store brand enjoys a 70:30 share advantage.[6] In the loyal segment, by definition, both absolute cross-price effects (national→store, store→national) would be negligible. The asymmetric share effect would mean that, in the switching segment, the national brand would have a greater absolute cross-price effect because it is the low-share brand. When we aggregate the cross-price effects across the two segments, the national brand would have a greater cross-price effect because it is only the switching segment that contributes to the cross-price effects. However, the two segment sizes are such that the national brand has a higher aggregate market share ($.6 + .4 \times .3 = .72$, or 72%). This example illustrates that high-share brands may sometimes have a greater cross-price effect if the unimodality assumption is strongly violated.

Income Effect

Our theoretical analysis does not incorporate income effect. Income effect can influence market share changes (Allenby and Rossi 1991) but is even more likely to increase category sales. Although the brand substitution effect may be greater for the low-share brands, category expansion due to price cuts may be greater for high-share brands than for low-share brands. If this is the case, the net effect on sales due to discounting may be greater for high-share brands. However, as Gupta (1988) and Bell, Chiang, and Padmanabhan (1999) find, the category expansion effect due to price discount is relatively small compared with the brand-switching effect. In any case, our theory and assertions are primarily related to market share movements and not to sales movements. However, note that empirically, the asymmetric share effect holds in sales models as well (Table 1).

[6]Note that in this example, the gamma-distribution assumptions do not hold for the market as a whole but may hold within the switching segment (and, in a degenerate sense, within the loyal segment).

Developing Marketing Implications

Our focus in this article is to highlight the phenomenon of asymmetric share effect and add to the understanding of patterns in cross-price effects. An important next step is to understand its marketing implications. Other things being equal, our findings suggest that the low-share brand would have a greater incentive to discount because it can attract a larger pool of consumers. In contrast, a retailer has an incentive to discount the high-share brand to promote store traffic. (The retailer also has the incentive to promote the typically low-share store brand because of its higher margins.) More rigorous game-theoretic analysis incorporating retail competition would help translate the observed asymmetric share effect into marketing recommendations.

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