The Optimal Choice of Promotional Vehicles: Front-Loaded or Rear-Loaded Incentives?

Z. John Zhang; Aradhna Krishna; Sanjay K. Dhar


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We examine the key factors that influence a firm’s decision whether to use front-loaded or rear-loaded incentives. When using price packs, direct mail coupons, FSI coupons or peel-off coupons, consumers obtain an immediate benefit upon purchase or a front-loaded incentive. However, when buying products with in-pack coupons or products affiliated with loyalty programs, promotion incentives are obtained on the next purchase occasion or later, i.e., a rear-loaded incentive. Our analysis shows that the innate choice process of consumers in a market (variety-seeking or inertia) is an important determinant of the relative impact of front-loaded and rear-loaded promotions. While in both variety-seeking and inertial markets, the sales impact and the sales on discount are higher for front-loaded promotions than for rear-loaded promotions, from a profitability perspective, rear-loaded promotions may be better than front-loaded promotions. We show that in markets with high variety-seeking it is more profitable for a firm to rear-load, and in markets with high inertia it is more profitable to front-load. Model implications are verified using two empirical studies: (a) a longitudinal experiment (simulating markets with variety-seeking consumers and inertial consumers) and (b) market data on promotion usage. The data in both studies are consistent with the model predictions.

(Sales Promotions; Coupons; Loyalty Programs; Marketing Mix; Competitive Strategy)
purchases and reward the consumer on a future purchase occasion, i.e., a rear-loaded incentive.

Our objective in this paper is to examine the key factors that influence a firm's decision whether to use front-loaded or rear-loaded incentives from a profitability perspective. Previous research has examined this problem in the context of package coupons for a zero-order market—comparing the impact of peel-off coupons (front-loaded incentive) with on-pack and in-pack (rear-loaded incentives) coupons (Dhar et al. 1996). This research finds that in a zero-order market, rear-loaded incentives like in-pack coupons can lead to higher brand profits than front-loaded incentives like peel-off coupons only when the baseline share of the couponed brand is high. However, these findings cannot explain why we see that low-share brands also use rear-loaded incentives. Furthermore, empirical observation shows that the type of promotion vehicle used—immediate versus delayed value—often varies across categories with rear-loaded incentives used more widely in certain categories, e.g., ready-to-eat (RTE) cereal, and front-loaded incentives in other categories, e.g., facial tissue (please see data in Table 9). More generally, by restricting the analysis to a zero-order market, the findings in earlier research do not apply to the numerous product categories in which consumers exhibit either "variety-seeking" (inclination to switch brands over successive purchases) or "inertia-proneness" (inclination to repeat-purchase a brand over successive purchases). Prior empirical research has shown that variety-seeking behavior is dominant in several product categories, such as RTE cereal and soft drinks, while inertia-proneness is dominant in many other categories, such as facial tissue and liquid detergent (Givon 1984, Kahn et al. 1986). In a variety-seeking or inertial category, front-loaded or rear-loaded incentives externally affect the innate brand choice process in the category. Front-loaded incentives are effective in getting consumers to switch away from competing brands. On the other hand, rear-loaded incentives help in preventing consumers who have once bought the promoted brand from switching away on subsequent purchases, i.e., retaining consumers by rewarding their future purchases.

We use a Markov model to represent how front- and rear-loaded incentives affect choice probabilities for the promoted brand in both variety-seeking and inertia-prone choice environments. The equilibrium market share, purchases made on discount and profits for the promoted brand are derived from the long-run choice probabilities of the Markov model (Morrison et al. 1971, Feinberg et al. 1992). We find that while in both variety-seeking and inertial markets the overall sales impact and the sales on discount are higher for front-loaded promotions than for rear-loaded promotions, the relative advantage of front-loaded promotions depends on the degree of variety-seeking and inertia. From a profitability perspective, however, rear-loaded promotions can be better than front-loaded promotions—we show that in markets with high variety seeking, it is more profitable for a firm to rear-load, and in markets with high inertia it is more profitable to front-load. Our analysis suggests that managers should be more concerned about their choice between front- and rear-loaded promotions in a market where the level of variety seeking or inertia is high or increasing. Model predictions are verified using two empirical studies: (a) a longitudinal experiment (simulating markets with variety-seeking and inertial consumers) and (b) market data on promotion usage. The data in both studies are consistent with the model insights.

Our research draws upon and contributes to three streams of literature in marketing: effects of variety-seeking and inertia on consumer choice (e.g., Lattin and McAlister 1985, Kahn et al. 1986, Bawa 1990), timing of promotion impact (e.g., Raju et al. 1994, Krishna and Zhang 1999), and loyalty programs (e.g., Srinivasan et al. 1997, Kopalle and Neslin 1997). We extend previous literature by examining and modeling together variety-seeking/inertia behavior and the timing of promotion impact. Our analysis allows us to draw important managerial insights on how the timing of promotion impact affects a firm's sales and profitability of promotions in variety-seeking and inertial markets, and has implications for the choice and design of promotions.

2. Model

We start by analyzing a market comprised of two brands, Brands 1 and 2. In §3.2, we extend the analysis
Table 1  No-Promotion Purchase Probability

<table>
<thead>
<tr>
<th>Period 1</th>
<th>Buy</th>
<th>Brand 1</th>
<th>Brand 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period 0</td>
<td></td>
<td>$\frac{</td>
<td>V_S</td>
</tr>
<tr>
<td></td>
<td>Brand 1</td>
<td>$\frac{</td>
<td>V_S</td>
</tr>
</tbody>
</table>

Consumer Choices in the Absence of Promotions. In the absence of promotions, we assume that consumers exhibit first-order choice behavior: (a) variety-seeking (Givon 1984); or (b) inertia-purchasing (Jeuland 1979, Givon 1984). Let $\theta_i$ be the inherent preference for Brand 1, $0 \leq \theta_i \leq 1$. We assume that $\theta_i$ is stationary (Fader and Lattin 1993). Following previous research (Givon 1984), in Table 1 we represent brand purchase probabilities over two consecutive purchase occasions, Period 0 and Period 1. Variety-seeking and inertia-purchasing behavior are both represented in Table 1 by $0 < V_S \leq 1$ and $-1 \leq V_S < 0$, respectively. $V_S = 0$ represents zero-order behavior.

Promotions. For clarity of exposition, we follow a step-wise approach similar to that used in Raju et al. (1994) and examine the following cases to determine the effects of offering front- and rear-loaded promotions in variety-seeking and inertial choice environments.

- **Single Brand Promoting.** In §2.1, we initially assume that only Brand 1 offers promotions (either front- or rear-loaded) according to a Bernoulli process with probability $f$ on any purchase occasion. We use this scenario to develop the intuition behind our major results on how the timing of the promotion impact (front- versus rear-loaded promotions) interacts with the choice environment (variety seeking versus inertia).

- **Both Brands Promoting.** In §2.2, we extend our analysis to a market in which both brands can offer either front-loaded or rear-loaded promotions. We show that the results derived in the single-brand promotion scenario carries over to the case where the competing brand offers either front-loaded or rear-loaded promotions.

- **Strategic Choice of Promotional Vehicles.** In §2.3, we use the expressions derived in the earlier two cases to determine the equilibrium outcome when competing firms strategically choose between no promotions, front-loaded promotions, and rear-loaded promotions.

2.1. Single-Brand Promoting

*Modeling the Effects of a Front-Loaded Promotion.* Since a consumer can avail himself of the incentive offered by a front-loaded promotion immediately, it increases Brand 1’s current purchase probability. We assume that the increase is a function of the brand’s prior purchase probability and that $0 \leq c \leq 1$ represents the impact of the promotion, which increases in the percentage discount offered. Therefore, with a probability of $f$, $P(1|1) = a_{11} + c(1 - a_{11})$ and $P(1|2) = 1 - a_{22} + c a_{22}$, and with a probability of $1 - f$, no promotions are offered and $P(1|1) = a_{11}$ whereas $P(1|2) = 1 - a_{22}.^2$ Table 2 reports the composite brand purchase probabilities over two consecutive purchase occasions.

*Modeling the Effects of a Rear-Loaded Promotion.* Consumers can only avail themselves of the incentive offered by a rear-loaded promotion on a future purchase of the brand (when the incentive is redeemed). For simplicity, we assume that for rear-loaded promotions, the incentive is obtained on the next purchase of the promoted brand. Therefore, consumers who buy

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3 $P(i|j)$ is the probability of purchasing Brand $i$ given a purchase of Brand $j$ on the previous purchase occasion.
Table 2  

<table>
<thead>
<tr>
<th>Period</th>
<th>Buy</th>
<th>Brand 1</th>
<th>Brand 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period 0</td>
<td>Brand 1</td>
<td>$a_{11} + f(a_{11} - a_{11})$</td>
<td>$(1 - a_{11})(1 - fc)$</td>
</tr>
<tr>
<td></td>
<td>Brand 2</td>
<td>$1 - a_{22} + fca_{22}$</td>
<td>$a_{22}(1 - fc)$</td>
</tr>
</tbody>
</table>

Brand 1 in Period 0 get a rear-loaded promotion with a probability $f$ which they can redeem when repurchasing Brand 1 in the next period, Period 1. Therefore, with probability $f$, we assume that $P(1|1) = a_{11} + d(1 - a_{11})$, where $0 \leq d \leq 1$ represents the effect of the rear-loaded promotion, which increases in the percentage discount offered. With probability $1 - f$, $P(1|1) = a_{11}$, as no promotions are offered. Since consumers who buy Brand 2 in Period 0 do not get the promotion, $P(1|2) = 1 - a_{22}$. Table 3 reports the composite brand purchase probabilities over two consecutive purchase occasions.

2.1.1. Sales and Profit Impact of Front-Loaded and Rear-Loaded Promotions. The transition matrices in Tables 2 and 3 can be used to compute the long-run probabilities of purchasing Brand 1 (from which we can compute the sales and profit impact) when using front-loaded and rear-loaded promotions, respectively. This method has been used before in a number of studies in the sales promotion area (e.g., Kahn and Raju 1991, Feinberg et al. 1992). Following the interpretation in previous research (e.g., Kahn and Raju 1991), our use of the long-run probabilities of the aggregate switching matrices in Tables 2 and 3 for comparing the effects of promotions does not preclude accounting for heterogeneity across consumers in either brand preferences or variety-seeking/inertia levels. Consumers may have different $\theta_i$s and $|VS|_i$s that may cause the long-run probabilities obtained by examining switching behavior at the aggregate level to not equal the true long-run probabilities computed by separately accounting for heterogeneity (Morrison et al. 1971). However, suppose that within the variety-seeking (inertia) market, we can group consumers into $k$ homogenous segments each with its own brand preference and variety-seeking level. Then, Morrison et al. (1971) show that when all $k$ segments are in equilibrium the long-run probabilities obtained by using the aggregate switching matrix for the entire variety-seeking (inertia) market are equal to the true long-run probabilities. Furthermore, they show that even when the $k$ segments are not in equilibrium, the long-run probabilities obtained from the aggregate switching matrix are very close to the true long-run probabilities. In addition, in an extension of the basic model explicitly accounting for heterogeneity (please see §3.3), we find that the qualitative insights remain the same.

We define $[\text{Sales}]^{FL}$ and $[\text{Sales}]^{RL}$ to be Brand 1's sales with front- and rear-loaded promotions, respectively. From Tables 2 and 3 (normalizing the number of consumers to 1), we get

$$[\text{Sales}]^{FL} = \left[\frac{1 - a_{22} + fca_{22}}{1 + (1 - a_{11} - a_{22})(1 - fc)}\right], \quad (1)$$

$$[\text{Sales}]^{RL} = \left[\frac{1 - a_{22}}{1 + (1 - a_{11} - a_{22}) - fd(1 - a_{11})}\right]. \quad (2)$$

For front-loaded promotions, a fraction $f$ of the sales is on deal at steady-state. However, since rear-loaded promotions are redeemed on the next purchase of the brand, a fraction $f \times [(a_{11} + d(1 - a_{11})]$ of the sales is sold on deal. We define $[\text{Purch. w Disc.}]^{FL}$ and $[\text{Purch. w Disc.}]^{RL}$ to be the purchases made on discount of Brand 1 with front-loaded and rear-loaded promotions, respectively. Then

$$[\text{Purch. w Disc.}]^{FL} = f \times [\text{Sales}]^{FL}, \quad (3)$$

$$[\text{Purch. w Disc.}]^{RL} = f \times (a_{11} + d(1 - a_{11})) \times [\text{Sales}]^{RL}. \quad (4)$$

We define $M$ to be the normal margin for Brand 1 and

Table 3  

<table>
<thead>
<tr>
<th>Period</th>
<th>Buy</th>
<th>Brand 1</th>
<th>Brand 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period 0</td>
<td>Brand 1</td>
<td>$a_{11} + f(1 - a_{11})$</td>
<td>$(1 - a_{11})(1 - fd)$</td>
</tr>
<tr>
<td></td>
<td>Brand 2</td>
<td>$1 - a_{22}$</td>
<td>$a_{22}$</td>
</tr>
</tbody>
</table>
$K$ to be the unit cost of redemption (including the discount and any handling and administrative costs). The profit impact is:

$$[\text{Profits}]^i = M \times \text{[Sales]}^i - K \times \text{[Purch. w Disc.]}^i,$$

where $i = \{\text{FL, RL}\}$.

2.1.2. Model Implications. In comparing the relative impact of front- and rear-loaded promotions on a given brand, we assume that both promotions are offered with the same frequency, $f$, and that both have the same effect, i.e., $c = d$. Later, in §3.1, we examine the effects of relaxing this assumption. This allows us to determine the impact of promotional timing without confusing promotion type with other variables like magnitude or frequency.

Sales Impact of Front-Loaded vs. Rear-Loaded Promotions. Comparing the sales impact of front- and rear-loaded promotions in Equations (1) and (2) separately for markets with variety-seeking and inertial consumers, we get the following result.

PROPOSITION 1. For both variety-seeking ($0 < VS \leq 1$) and inertial ($-1 \leq VS < 0$) markets, $\text{[Sales]}^\text{FL} > \text{[Sales]}^\text{RL}$.

The proof is given in Technical Appendix A. This proposition suggests that front-loaded promotions lead to higher sales than rear-loaded promotions in both variety-seeking and inertial markets. The intuition is as follows. Front-loaded promotions affect all consumers (getting consumers to switch from the competing brand), irrespective of what they purchased on the last occasion. On the other hand, rear-loaded promotions can only affect consumers who bought the promoted brand on the last purchase helping to retain them on their next purchase. The switching effect of front-loaded promotions on all consumers out-performs the retention effect of rear-loaded promotions on the subset of consumers who purchased the promoted brand on a previous purchase.

Effects of the Variation in the Intensity of Variety Seeking/Inertia. Previous research has shown that there is considerable variation in the level of variety-seeking and inertia across different product categories (e.g., Givon 1984). We examine how the degree of variety-seeking (inertia) in a market affects the extent to which front-loaded promotions out-perform rear-loaded promotions. We find that as the degree of variety seeking (inertia) in a market increases, the sales impact advantage of front-loaded promotions over rear-loaded promotions decreases (increases), despite front-loaded promotions always leading to higher sales than rear-loaded promotions (see Figures 1(a) and 1(b)). The intuition is as follows. As the level of variety seeking (inertia) increases, consumers are less (more) likely to repeat purchase the same brand and are more (less) likely to switch between brands on their own without an incentive. Consequently, in high variety-seeking (inertia) markets, the “switching” effect of front-loaded promotions is less (more) effective in generating incremental sales, while the “retention” effect of rear-loaded promotions becomes more (less) effective in increasing sales.

Purchases Made on Discount with Front-Loaded vs. Rear-Loaded Promotions. Comparing the number of purchases made on discount with front- and rear-loaded promotions in Equations (3) and (4), separately, for variety-seeking and inertial markets, we get the following result.

PROPOSITION 2. For both variety-seeking ($0 < VS \leq 1$) and inertial ($-1 \leq VS < 0$) markets, $[\text{Purch. w Disc.}]^\text{FL} > [\text{Purch. w Disc.}]^\text{RL}$.

The proof is given in Technical Appendix B. Higher sales on discount occur with front-loaded (versus rear-loaded) promotions because when offered, they are available to all consumers, irrespective of what they purchased on the last occasion. However, rear-loaded promotions are only available to consumers who repeat purchase the brand. This holds for both variety-seeking and inertial consumers.

Impact on Profits. Not only do front-loaded promotions lead to higher overall sales for the promoted brand than rear-loaded promotions (Proposition 1), they also lead to higher sales on discount (Proposition
2. This suggests that a comparison of the relative profit impact may favor front-loaded promotions in certain situations and rear-loaded promotions in others. Comparing the profit impact for the two promotions leads to the following result.

**Proposition 3.**

(a) For any given level of inherent brand preference, promotion frequency and promotion impact, a high level of variety seeking (0 < VS ≤ 1) results in rear-loaded promotions being more profitable than front-loaded promotions.

(b) For any given level of inherent brand preference, promotion frequency and promotion impact, a high level of inertia (−1 ≤ VS < 0) results in front-loaded promotions being more profitable than rear-loaded promotions.

The proof is given in Technical Appendix C. Proposition 3 suggests that in a market with a high level of variety seeking (inertia), rear-loaded (front-loaded) promotions lead to higher profits for the promoted brand than front-loaded (rear-loaded) promotions. The intuition is as follows. When variety seeking in a market is high, consumers are more likely to switch brands on their own. In this situation, using front-loaded promotions (which get consumers to switch brands) results in the promotion subsidizing normal purchases that would have occurred anyway. Rear-loaded promotions, on the other hand, retain consumers on consecutive purchases and, in a market with variety seekers, prevent them from switching out. The higher the extent of variety seeking, the more (less) helpful the retention (switching) effect of the rear-loaded (front-loaded) promotion is in increasing the promoted brand’s purchases without subsidizing regular purchases, resulting in higher relative profits when using rear- versus front-loaded promotions. Alternatively, when the level of inertia is high, to generate the same number of incremental purchases, rear-loaded promotions subsidize more normal purchases than front-loaded promotions. Consequently, with higher inertia in the market, front-loaded promotions can lead to higher relative profits than rear-loaded promotions. We plot the difference in the profits with front- versus rear-loaded promotions against the degree of variety seeking/inertia in Figure 2.

2.2. Both Brands Promoting

Besides Brand 1, we now allow Brand 2 to promote using either (a) front-loaded or (b) rear-loaded promotions. Holding the promotion condition constant for Brand 2 (either front- or rear-loaded), we compare the relative impact of front- vs. rear-loaded promotions on Brand 1. We assume that both brands offer promotions according to independent Bernoulli processes with probability, $f_i; i = \{1, 2\}$. Tables 4–7 report the purchase probabilities for the four different promotion conditions.
Comparing Relative Impact of Promotions when Holding Competing Brand Promotion Constant.

Based on the transition matrices in Tables 4–7, we use the steady-state probabilities to derive expressions for the sales impact, sales on discount and profit impact under the different promotion conditions. Steady-state probabilities are reported in Technical Appendix D. Holding the promotion condition for Brand 2 to be the same (e.g. front-loaded or rear-loaded), we compare the expressions for front-loaded versus rear-loaded promotions on Brand 1. In making these comparisons, we assume that (a) promotions are offered with the same probability on both brands, i.e. \( f_1 = f_2 = f \) and (b) the coupon effects are the same for front- and rear-loaded promotions across both brands, i.e., \( c_1 = c_2 = d_1 = d_2 = d \). As the mathematical expressions were analytically intractable, we used numerical simulations to compare the relative impact of the two types of promotions by varying parameter values over their respective ranges. Results from the numerical simulations support the key qualitative insights provided in Propositions 1–3. The intuition for the results holding in the competitive scenario of both brands promoting is as follows.

When both brands promote, in addition to the effect of the choice environment (i.e., variety seeking or

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Purchase Probabilities with Front-Loading by Both Brands</th>
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<tbody>
<tr>
<td></td>
<td>Period 1</td>
</tr>
<tr>
<td></td>
<td>Buy</td>
</tr>
<tr>
<td>Period 0</td>
<td>Brand 1</td>
</tr>
<tr>
<td></td>
<td>Brand 2</td>
</tr>
</tbody>
</table>

Note: \( \lambda_i = f_i (1 - f_j) \) for \( i, j = 1, 2 \) and \( i \neq j \).
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Table 5  Purchase Probability if Brand 1 Rear-Loads and Brand 2 Front-Loads

<table>
<thead>
<tr>
<th>Period 0</th>
<th>Brand 1</th>
<th>Brand 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brand 1</td>
<td>(a_{11} + f_d(1 - a_{11}) - f_c a_{11} - a_{11} - f_d(1 - a_{11}) + f_c a_{11})</td>
<td>(a_{21} + f_c(1 - a_{21}))</td>
</tr>
<tr>
<td>Brand 2</td>
<td>(1 - a_{22} - f_d(1 - a_{22}) + f_c a_{22})</td>
<td>(a_{22} + f_d(1 - a_{22}) - f_c a_{22})</td>
</tr>
</tbody>
</table>

Inertia) observed in the single brand promoting case, the inherent brand preference also plays a role in affecting the choice between rear-loaded versus front-loaded incentives. Similar to the results for a zero-order market (Raju et al. (1996)), when the extent of variety seeking or inertia is low, a high-share brand would like to protect and retain its large base of customers using rear-loaded promotions from the competitive switching efforts of the competing low-share brand. The high-share brand has little to gain by using front-loaded promotions to switch the small number of customers that the competing brand has, and therefore finds it optimal to use rear-loaded promotions. By contrast, a low-share brand finds it optimal to use front-loaded promotions to switch the large number of customers for the competing large-share brand and does not stand to gain much by using rear-loaded promotions to retain its own small customer base.

However, when the extent of variety seeking is high, consumers switch brands on their own and inherent brand preference plays little role in determining long-run purchase probabilities. Therefore, in this case, regardless of the inherent brand preference, a brand is better off offering rear-loaded incentives to retain customers that switch to the brand, rather than using front-loaded incentives that would only subsidize normal purchases. Similarly, when the extent of inertia is high, regardless of the inherent brand preference, brands will offer front-loaded promotions to switch the competing brand’s customers, rather than offering rear-loaded promotions that would only subsidize normal purchases.

2.3. Strategic Choice of Promotional Vehicles
Here, we allow for strategic behavior on the part of the two brands by allowing each of them to choose between front-loaded promotions, rear-loaded promotions, or no promotions at all. More formally, we construct an infinitely repeated two-player game where competing brands repeatedly choose either front-loaded \((F)\), rear-loaded \((R)\), or no \((N)\) promotion on each purchase occasion. The payoffs in each period are given by the steady-state payoffs derived in Technical Appendix D from Tables 4–7. We define \(\Pi^i\) as the payoff where \(i = 1, 2\) indexes the brand, and \(j, k = F, R, N\) indexes the strategy choice of front-loaded, rear-loaded, or no promotion for Brands 1 and 2, respectively. Figure 3 represents the payoff matrix for the stage game. Since each player “playing its Nash strategy of the stage game from now on” constitutes a subgame perfect equilibrium for the infinitely repeated game (Fudenberg and Tirole 1991, p. 149), we can limit our attention to the Nash equilibrium of the stage game. In Technical Appendix D, we analytically show that when \(M > K, \Pi_{1F} > \Pi_{1R}, \Pi_{1F} > \Pi_{1N}, \Pi_{2F} > \Pi_{2R}, \Pi_{2F} > \Pi_{2N}\) as \(\nu S\) approaches -1. Therefore, an equilibrium of this stage game is that both

Table 6  Purchase Probability if Firm 1 Front-Loads and Firm 2 Rear-Loads

<table>
<thead>
<tr>
<th>Period 0</th>
<th>Brand 1</th>
<th>Brand 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brand 1</td>
<td>(a_{11} + f_c(1 - a_{11}))</td>
<td>(1 - a_{11} - f_c(1 - a_{11}))</td>
</tr>
<tr>
<td>Brand 2</td>
<td>(1 - a_{22} - f_d(1 - a_{22}) + f_c a_{22})</td>
<td>(a_{22} + f_d(1 - a_{22}) - f_c a_{22})</td>
</tr>
</tbody>
</table>
firms choose to front-load. Also, when \( M \leq fK \min\{1/(1 - \theta_1), 1/\theta_1\}, \Pi_1^{NN} > \Pi_1^{FN}, \Pi_1^{NN} > \Pi_1^{FR}, \Pi_2^{NN} > \Pi_2^{NR}, \Pi_2^{NN} > \Pi_2^{FR} \). In this case, since the normal margin is small, no promotion by both firms is an equilibrium. As shown in Technical Appendix D, no other equilibrium exists. This means that as long as the normal margin is large enough, \( M > \max\{K, fK \min\{1/(1 - \theta_1), 1/\theta_1\}\} \), the unique equilibrium of this stage game is that both firms choose front-loading.

Similarly, when \( \VS \) approaches 1, \( \Pi_1^{RR} > \Pi_1^{FR}, \Pi_1^{RR} > \Pi_1^{RF}, \Pi_2^{RR} > \Pi_2^{RF}, \Pi_2^{RR} > \Pi_2^{FR} \), and \( \Pi_1^{RR} > \Pi_1^{NN}, \Pi_2^{RR} > \Pi_2^{NN} \) if \( M \geq (2 - df)K \). Therefore, both firms choosing to rear-load is an equilibrium. An equilibrium in which none of the firms promotes exists if the normal margin is small, \( M \leq 2K \). There is no other equilibrium. Thus, again when the normal margin is large enough, in this case when \( M > 2K \), the unique equilibrium is that both firms choose to rear-load. More generally, since the payoff functions are continuous in \(|\VS|\), our conclusions also hold when \(|\VS|\) is close but not equal to 1. The equilibrium outcome that both brands will choose to rear-load (front-load) when the level of variety-seeking (inertia) in the market is high, is not surprising. Our analysis in §2.2 shows that a firm prefers to rear-load (front-load) when the level of variety seeking (inertia) is high irrespective of how the competing firm promotes. In other words, when the margin is high enough for promotion to be profitable, rear-loading (front-loading) is a dominant strategy for both firms when the level of variety seeking (inertia) is high.

3. Model Extensions

Our analysis in the previous section made some simplifying assumptions for ease of exposition and analytical tractability. In this section, we extend the model by relaxing some of the key assumptions, and examine the effect on the qualitative insights obtained from the model.

3.1. Promotion Effect Differs for Front- and Rear-Loaded Promotions (\( c \neq d \))

Our earlier analysis assumed that \( c = d \), i.e., the promotion effect does not depend on whether the
promotion is front- or rear-loaded. This assumption has also been used in previous research in this area (e.g., Raju et al. 1994, p. 151) and it enables us to focus only on the differences in the timing of the benefit offered by front-versus rear-loaded promotions, without any other confounding effects. In this section we examine what happens to the major results if \( c \neq d \).

As shown in Technical Appendix E, Propositions 1–3 continue to hold when \( c \neq d \). For front-loaded promotions to lead to higher sales and purchases made on discount than rear-loaded promotions, the effect of the front-loaded promotion needs to be greater than some cut-off value but does not need to be as high as the effect of the rear-loaded promotion. In this case, from a profitability perspective too, it is better to use a front-loaded (rear-loaded) promotion when the level of inertia (variety seeking) is high.

The equilibrium outcomes when firms choose between front-loaded, rear-loaded, or no promotion also remain the same as our earlier analysis for \( c = d \) in both variety-seeking and inertial markets. For an inertial market, the unique equilibrium of the stage game in Figure 3 is that both firms front-load when the margin is large enough to rule out a no-promotion equilibrium. This directly follows from the proofs of the inertial market scenario for the \( c = d \) case, where the equilibrium outcome does not depend on the magnitudes of \( c \) and \( d \).

On the other hand, for a variety-seeking market, we consider two cases: \( c < d \) or \( c > d \). Let us first consider the case when \( c < d \), i.e., front-loading has a smaller effect than rear-loading. As shown in Technical Appendix E, the competitive equilibrium of both firms rear-loading continues to hold in this case as long as the normal margin is large enough, \( M > 2K \). The condition on margins rules out the possibility of no-promotions by both firms as an equilibrium outcome.

In the other case, \( c > d \), i.e., front-loading has a stronger effect than rear-loading. In this case, front-loading becomes a viable strategy for both firms even in a variety-seeking market. However, both firms will choose rear-loading if the normal profit margin is within a specified range \( (M \in [2K, M]) \); details in Appendix E). The lower-bound ensures that promoting is more profitable than no promoting for the firms. The upper-bound ensures that the margin is not so large that both firms are motivated to use front-loaded rather than rear-loaded promotions in order to increase their sales.

3.2. Market with n Brands

We relax the assumption of a two-brand market and extend our base analysis with one brand promoting to a market with \( n \) brands. In the absence of promotions, the choice behaviors in variety-seeking and inertial markets can be represented by an \( n \times n \) matrix (see Givon 1984). In Technical Appendix F, we incorporate the effects of front- and rear-loaded promotions on brand purchasing. We use the long-run probabilities for deriving the impact of both these kinds of promotions. In a variety-seeking market, we get5

\[
[\text{Sales}]_{\text{FL}} = \left[ \frac{(1 - fc)\left[(1 - |VS|) \theta_i + \frac{|VS| \theta_i(n - 1)}{n - 2 + \theta_i}\right] + fc}{1 + \left(\frac{|VS| \theta_i(n - 1)}{n - 2 + \theta_i}\right)(1 - fc)} \right].
\]

\[
[\text{Sales}]_{\text{RL}} = \left[ \frac{(1 - |VS|) \theta_i + |VS| \theta_i\left(\frac{n - 1}{n - 2 + \theta_i}\right)}{1 + |VS| \theta_i\left(\frac{n - 1}{n - 2 + \theta_i}\right) - fd(1 - \theta_i + \theta_i|VS|)} \right].
\]

In an inertial market, we get

\[
[\text{Sales}]_{\text{FL}} = \left[ \frac{1 - (1 - \theta_i + |VS| \theta_i(1 - fc))}{1 - |VS|(1 - fc)} \right], 
\]

\[
[\text{Sales}]_{\text{RL}} = \left[ \frac{1 - (1 - \theta_i + |VS| \theta_i)}{1 - |VS|} \right].
\]

As a reviewer pointed out, one circumstance under which this might occur is that for the same discount magnitude, the exposure to rear-loaded promotions (e.g., in-pack coupons) within the home is more explicit and gains stronger response than that due to front-loaded promotions (e.g., peel-off coupons) within the store amidst the noise of shopping.

\[\]5 The formal derivations of the expressions are given in Technical Appendix F. Note that when \( n = 2 \), (6) and (7) reduce to (1) and (2), respectively, for a variety-seeking market.
SalesRL = \left[ \frac{\theta_i}{1 - fd(1 - \theta_i)} \right]. \quad (9)

The expressions for the number of purchases made on discount and profit impact are obtained by substituting the expressions for sales impact in (3), (4), and (5). Using these expressions, we find that all the key results in Propositions 1–3 continue to hold (analytical proofs in Technical Appendix F). This happens as the number of brands in the market mainly affects the distribution of the promotional impact across brands, but not the relative impact of front- versus rear-loaded promotions.

3.3. Heterogeneity
We explicitly allow for heterogeneity and examine its impact on the key insights from the model. To begin with, we assume that within a variety-seeking or inertial market, there are two subpopulations with different brand preferences and variety-seeking/inertia levels. We assume that a fraction \( \alpha \) of the population has a brand preference of \( \theta_i^V \) and variety-seeking/inertia level of \( |VS|^V \); the remaining \( 1 - \alpha \) fraction of the population has a different brand preference of \( \theta_i^I \) and variety-seeking/inertia level of \( |VS|^I \). We then determine the true steady-state probabilities for the entire population and use these to compare the effects of the two promotional vehicles. We find that the key insights in Propositions 1–3 continue to hold in this case (please see Technical Appendix G for analytical proofs). Intuitively, we would expect this outcome since our proofs for the basic model are for any segment. Therefore, when we aggregate sales and profits across different segments, the results hold for each of the individual segments, and therefore should hold for the aggregate.

More generally, we extend this analysis by using independent beta-distributions to account for heterogeneity in brand preference and variety-seeking/inertia levels. While the mathematical expressions are no longer analytically tractable, we use numerical integration and find that the key insights in Propositions 1–3 continue to hold in this more general case too.

4. Empirical Analysis
Our empirical analysis consists of two parts. First, we ran a longitudinal experiment in which we manipulated the choice environment and examined the relative impact of front- versus rear-loaded promotions against model predictions. This helps us to determine whether our model captures the key elements impacting brand choice when front- and rear-loaded incentives are offered in variety-seeking/inertia markets. Second, we collected market-level data on the extent to which firms employ front- versus rear-loaded promotions in product categories that we a priori know to be either variety seeking or inertial from previous research.

4.1. Experimental Study
We ran a longitudinal study in an experimental market with two brands, both of which offered promotions (either front- or rear-loaded). The brand choice environment was manipulated to be either variety seeking or inertial. For robustness, we ran the experiment in two different product categories—shampoo and furniture polish. Since the results were similar in both categories, we describe the experiment and report the results only for the shampoo category.

Procedure. One hundred and sixty student subjects were randomly assigned to one of eight experimental conditions—2 brand-choice conditions (variety-seeking and inertia) \( \times 2 \) promotion conditions on Brand 1 (front- and rear-loaded) \( \times 2 \) promotion conditions on Brand 2 (front- and rear-loaded). Subjects made weekly choices for a month between two hypothetical brands, described in detail by key attributes, a fictitious brand name, and price. The data were collected through survey questionnaires. In the front-loaded promotion conditions, subjects were offered an instant discount if they used the promotion. Mirroring our model assumptions, consumers were not aware of the rear-loaded promotion when offered. However, on the next purchase, they were told that they had a promotion offer from the previous purchase that they could use now. On each purchase occasion, subjects recorded the brand chosen and indicated whether they had used a promotion offer. The promotion discount was 25 cents—a 33% discount off the 75 cents regular price. Price discounts were randomly offered by us on 2 out of the 4 choice occasions, as per the Bernoulli assumption. No subjects acted as managers of the two firms. To simulate variety seeking and inertia, we used manipulations found to be success-
The Optimal Choice of Promotional Vehicles

Table 8 Results in the Shampoo Category

Baseline Shares: Headlines (H) = 0.37; Impression (I) = 0.63
Manufacturer Margin: = 52%

<table>
<thead>
<tr>
<th>Promotion Conditions</th>
<th>Market Share</th>
<th>Purchases w. Discount Share</th>
<th>Relative Profits ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>H</td>
<td>I</td>
<td>H</td>
</tr>
<tr>
<td>Front-Loaded</td>
<td>0.44</td>
<td>0.56</td>
<td>0.34</td>
</tr>
<tr>
<td>Rear-Loaded</td>
<td>0.29</td>
<td>0.71</td>
<td>0.02</td>
</tr>
<tr>
<td>Front-Loaded</td>
<td>0.58</td>
<td>0.42</td>
<td>0.43</td>
</tr>
<tr>
<td>Rear-Loaded</td>
<td>0.42</td>
<td>0.58</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Variety-Seeking

<table>
<thead>
<tr>
<th>Promotion Conditions</th>
<th>Market Share</th>
<th>Purchases w. Discount Share</th>
<th>Relative Profits ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>H</td>
<td>I</td>
<td>H</td>
</tr>
<tr>
<td>Front-Loaded</td>
<td>0.39</td>
<td>0.61</td>
<td>0.17</td>
</tr>
<tr>
<td>Rear-Loaded</td>
<td>0.14</td>
<td>0.86</td>
<td>0.04</td>
</tr>
<tr>
<td>Front-Loaded</td>
<td>0.77</td>
<td>0.23</td>
<td>0.38</td>
</tr>
<tr>
<td>Rear-Loaded</td>
<td>0.40</td>
<td>0.60</td>
<td>0.17</td>
</tr>
</tbody>
</table>

Inertia

<table>
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<tr>
<th>Promotion Conditions</th>
<th>Market Share</th>
<th>Purchases w. Discount Share</th>
<th>Relative Profits ($)</th>
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<tbody>
<tr>
<td></td>
<td>H</td>
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<td>Front-Loaded</td>
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<td>0.60</td>
<td>0.17</td>
</tr>
</tbody>
</table>

* Relative profits are computed using (rear-loaded, rear-loaded) as the baseline profits in the variety-seeking case and (front-loaded, front-loaded) in the inertial case.

ful in previous research (for details, see Kahn and Louie 1990).

Manipulation Checks. In a pretest, subjects made a series of 10 choices between the two brands, Headlines and Impression, being sold at regular price. Data from this pretest were used to assess whether the manipulation of the choice environment (variety seeking and inertia) was successful. In line with the model, the average length of the longest run was significantly higher (7.61 vs. 2.13; p < 0.01) and the average number of switches significantly lower (1.62 vs. 5.81; p's < 0.01) in the inertia condition than in the variety-seeking condition. The data suggests that the manipulations of the two choice environments were successful. We assessed inherent brand preferences by asking subjects in the pretest to allocate 100 points between the two brands. Headlines and Impression had approximate shares of 0.37 and 0.63, respectively—the inherent brand preferences were found to be quite similar across the four competitive promotion conditions.

Results. We summarize the results of the experiment in Table 8.

1. Sales. We find that front-loaded promotions lead to significantly higher market share (and hence sales) than rear-loaded promotions in both inertia (p < 0.01 for both brands) and variety-seeking conditions (p < 0.05 for both brands). These results are consistent with Proposition 1.

4 These checks have been used in previous research using such models (e.g., Kahn and Louie 1990). Using the estimation procedure described in Kahn et al. (1986), the aggregate variety-seeking and inertia parameters were estimated to be 0.29 and 0.22, respectively. The estimated parameters were similar across the four promotion conditions.

7 Since the qualitative results were the same across both promotion conditions for the competing brand, we pool the data across the two competitive promotion conditions.
2. Purchases Made on Discount. We find that the percentage of total purchases made on discount in the category (and hence sales on discount) were significantly higher with front-loaded versus rear-loaded promotions in both variety-seeking ($p < 0.01$ for both brands) and inertia ($p < 0.01$ for Headlines and $p < 0.05$ for Impressions) markets. These results are consistent with Proposition 2.

3. Profit Impact. We find that rear-loaded promotions lead to significantly higher profits than front-loaded promotions ($p < 0.05$ for both brands) in the variety-seeking condition. If both brands strategically choose between the two promotional vehicles, the profits in the four promotion conditions are such that both brands will choose to rear-load. In the inertia condition, we find that front-loaded promotions lead to significantly higher profits than rear-loaded promotions ($p < 0.01$ for both brands). In this market, the profits are such that both brands will choose front-loaded promotions when strategically choosing between the two promotional vehicles. These results are consistent with Propositions 3(a) and 3(b).

Collectively, the empirical results are consistent with the model’s predictions on the relative impact of front-loaded and rear-loaded promotions in variety-seeking and inertia markets.

4.2. Market Data on Promotion Usage
In this section, we employ market-level data to examine the extent to which firms use front- versus rear-loaded promotions in markets that we know a priori to be either variety-seeking- or inertia-prone. If the model serves as a descriptive model of firms’ decisions, brands are more likely to use rear-loaded (vs. front-loaded) promotions in variety-seeking categories, and more front-loaded (vs. rear-loaded) promotions in inertia categories. Based on previous research (Givon 1984, Kahn et al. 1986), we identified variety-seeking and inertia product categories. We focus our attention on promotion offers given on product packages, since both front- and rear-loaded promotions can be offered using the package. Front-loaded promotions are offered on the package in the form of peel-off coupons, price-packs (preprinted packages with reduced prices), or premiums. Rear-loaded promotions are offered on the package in the form of in-pack coupons, on-pack coupons, contests, or mail-in premiums that require repeat brand purchases. We collected data by surveying all brands for seven product categories that were sold in major grocery outlets in a large metropolitan city in the United States over a three-month period. We report the total number of promotion offers and the percentage of front- versus rear-loaded offers in each of the categories studied in Table 9. A chi-square test of the data shows that the use of front- versus rear-loaded promotions is systematically related to whether a category is inertial or variety-seeking ($\chi^2 = 202.54; p < 0.01$). In inertial categories, we find that 133 of the 159 promotion offers are front-loaded; while in variety-seeking categories, 182 of the 200 promotion offers are rear-loaded. The average percentage of front-loaded (rear-loaded) promotions offers in inertial (variety-seeking) categories is significantly higher than that in variety-seeking (inertia) categories ($p < 0.01$). This data is consistent with the predictions in Propositions 3(a) and 3(b).

Examining the data at the individual category level, we find that in each of the variety-seeking categories, the percentage of rear-loaded promotions is significantly higher than the percentage of front-loaded promotions (all $p’s < 0.01$). Similarly, in each inertia category, the percentage of front-loaded promotions is significantly higher than the percentage of rear-loaded promotions (for dog food, $p < 0.05$; all other $p’s < 0.01$). We also find that in the categories studied, the percentage of rear-loaded promotions has a correla-
tion of about 0.95 ($p < 0.01$) with the average variety-seeking/inertia parameter for the category (obtained from Givon 1984). The data are therefore consistent with the key predictions of our model.

5. Conclusions and Managerial Implications

In the last decade, the spending on consumer promotions has consistently increased over time. Furthermore, this trend is projected to continue, with more than 67% of firms surveyed by Cox Direct (1997) reporting that they will either increase or retain their current share allocation of the overall promotion budget to consumer promotions. Practitioners and sales promotions textbooks classify consumer promotions based on when they reward the consumer—immediate versus delayed value (Quelch 1989). In this study, we examine the key conditions under which firms would benefit from using either front- or rear-loaded promotions.

Previous research (in the context of package coupons) suggests that the inherent preference of the promoted brand should determine when brand managers use front- versus rear-loaded promotions, with rear-loaded promotions being better for a brand with high preference (Dhar et al. 1996). Our current analysis, however, shows that the innate choice process of the consumer, variety seeking versus inertia, is an important determinant of the relative impact of front-versus rear-loaded promotions, irrespective of the level of inherent brand preference. Front-loaded promotions are more profitable in inertial markets while rear-loaded promotions are more profitable in variety-seeking markets, with the choice being more crucial in categories with higher levels of variety seeking or inertia. Our analysis also suggests that either a high level of variety seeking or a high inherent preference can render rear-loaded promotions more profitable than front-loaded. The extent of variety seeking and inherent brand preference of the promoted brand compensate for each other. Intuitively, when the extent of variety seeking is high, front-loaded promotions subsidize a large proportion of regular purchases, since consumers would have switched brands on their own. Similarly, when the inherent brand preference is high, many consumers are inclined to purchase the brand without any promotional incentive, and hence front-loaded promotions again subsidize a high proportion of regular purchases. However, it is in these very circumstances that the retention effect of rear-loaded promotions is very effective, retaining consumers who would have otherwise switched out, leading to a higher level of nonsubsidized incremental purchases.

Our findings are particularly important in the light of recent developments in the areas of consumer promotions and retail management. Electronic check-out coupons (e.g., Catalina coupons) are being increasingly used by major manufacturers with about 27% of consumers receiving such coupons (Cox Direct 1997). These coupons offer discounts on a future purchase (rear-loaded promotion). When first introduced, these coupons were triggered by a current brand purchase (i.e., choice data on a single purchase occasion). More recently, coupons are issued to panelists based on purchase history data (processed in real-time) for multiple purchase occasions. Our analysis suggests that rear-loaded promotions are beneficial to brands only in variety-seeking markets—which can be assessed only with purchase data over multiple purchases (data that can be easily obtained with the current data-collection practice). Similarly, our research suggests that the use of in-store coupon dispensers (e.g., ActMedia), a practice made popular in recent times to offer coupons that can be used on the current purchase (front-loaded promotions), is more appropriate for inertia categories.

Based on our experimental data, the loss incurred when using front- versus rear-loaded promotions in variety-seeking categories and rear- versus front-loaded promotions in inertia categories can be as much as 47.1% of baseline profits. It is important to note that our findings are more relevant to mature product categories where promotions do not cause any increase in primary demand or category expansion (Neslin et al. 1985). A series of empirical studies on package coupons also did not observe front- and rear-loaded promotions to have any effect on category expansion (Dhar et al. 1996). Prior research suggests that the major effect of promotions is to cause brand-switching (i.e., to change the promoted brand’s purchase probability) and not so much to increase the purchase quantity (Gupta 1988, Neslin et al.
Our focus on consumer promotional vehicles excludes retail price promotions (that may also offer front-loaded incentives, e.g., temporary price reductions) in which the role of the retailer needs to be explicitly modeled. Our analysis focuses on an important aspect of consumer promotion design—the choice between promotional vehicles that vary in the timing of the promotional impact (Quelch 1989). However, our analysis does not include other promotional design decisions such as the magnitude of discount, the promotion frequency and the duration of the promotion. There is therefore considerable potential for future research to integrate our work on promotional timing with related previous work on discount magnitude and frequency issues for brand promotions. Despite these limitations, we believe that our research provides an understanding of the role that variety-seeking and inertial behavior play in affecting the relative effectiveness of consumer promotional vehicles. We hope that this understanding will be helpful to both future researchers and practitioners.  

8 Z. John Zhang is an Assistant Professor at the Graduate School of Business, Columbia University. Aradhna Krishna is an Associate Professor at the University of Michigan Business School. Sanjay K. Dhar is an Associate Professor of Marketing and Beatrice Foods Co. Scholar at the Graduate School of Business, The University of Chicago. The authors are listed in reverse alphabetical order and contributed equally to the project. Partial funding support for this work was provided to Sanjay K. Dhar by the Beatrice Foods Co. faculty research fund at the Graduate School of Business, The University of Chicago. The authors thank the departmental editor, the associate editor, and the two reviewers for many valuable comments that significantly improved the quality of the manuscript. This paper has also benefitted from helpful comments offered by the participants at the 1997 Marketing Science Conference, Berkeley, CA, and by Don Lehmann.

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1985, Krishna and Shoemaker 1992). Nonetheless, our model is more applicable to situations in which an increase in purchase quantity is less likely from consumer promotions. Our model is therefore not useful for bonus-packs where promotions may lead to multiple purchases.
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[Footnotes]

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