

Research Note

Trading Up: A Strategic Analysis of
Reference Group Effects

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Reference groups influence product and brand evaluations, especially when the product is a publicly consumed luxury good. Marketers of such luxury goods need to carefully balance two important social forces: (1) the desire of leaders to distinguish themselves from followers and (2) the countervailing desire of followers to assimilate with leaders. In this paper, we examine the theoretical implications of these social forces for firm prices, product design, and target consumer selection. We show that the presence of reference group effects can motivate firms to add costly features, which provide limited or no functional benefit to consumers. Furthermore, reference group effects can induce product proliferation on one hand and motivate firms to offer limited editions on the other hand. We find that offering a limited edition can increase sales and profits. In some cases, reference group effects can even lead to a buying frenzy.

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1. Introduction

Social groups influence product and brand evaluations. Consumers are especially susceptible to reference group effects when the product is a publicly consumed luxury (Bearden and Etzel 1982, Childers and Rao 1992). For example, the elite seek goods that will distinguish them from the masses. But the masses, who look up to the elite, may follow their choices, and thereby eliminate these external distinctions (Simmel 1957, Bourdieu 1984, Bryson 1996). The desire of elite consumers to be different from followers and the countervailing goal of followers to emulate leaders pose several marketing challenges.

Firms adopt various strategies to handle such reference group effects. Some firms focus their marketing efforts on the top end of the market and even limit the production of their goods. In 2003, Mötet Hennessy Louis Vuitton (LVMH) launched a limited edition of "Cherry Blossom." Murakami bags. Similarly, Hermès has a two-year waiting list for its Birkin handbag priced at more than \$6,000 (Branch 2004). This raises the question of whether it is a profitable strategy for a firm to offer a limited edition of its products. If so, when should a firm offer limited editions? While some manufacturers prefer to limit their sales, some fashion designers like Vera Wang, are selling their products through mass merchandisers like

Kohl's (Agins 2007). These divergent business practices raise the question as to when it is profitable to bring class to the masses. Another intriguing aspect of many luxury goods is that they often have expensive features that offer limited functional benefits. The \$4,000 gold, ostrich-rimmed Theda bag of LVMH is in great demand and is reported to have a very healthy profit margin. This raises the next question: What drives firms to add unique and costly product features that offer little functional value?

To better understand the behavioral basis of reference group effects, we turn to the extensive literature in psychology and sociology on social comparison (see Hyman 1942, Brewer and Weber 1994, DiMaggio 1977; see Kimmelmeier and Oyserman 2000 for a review). People make social comparisons and such comparisons affect self-evaluation and behavior. In some social contexts, consumers engage in upward social comparisons with their aspirational group. When it is possible to emulate the actions of the aspirational group, such a comparison can lead to assimilation in behavior (Lockwood and Kunda 1997). In other social situations, individuals may make downward social comparisons with a lower social group. Sociologists report that such downward comparisons lead to "aesthetic distancing" and "symbolic exclusion" in the behavior of the

higher social group (Bourdieu 1984 and Bryson 1996). Thus social comparison has two important behavioral consequences: (1) individuals making social comparisons may assimilate with the higher social group or (2) contrast with the lower social group.¹

Overview. The purpose of our paper is to investigate the implications of reference group effects for firm behavior. We consider a market where two groups of consumers enter the market sequentially. The first group enters the market earlier because of its higher social position and discerning taste. We label this group leaders. As this group wants to contrast itself from the followers who enter in the second period, they value the product *less* if many followers adopt the same product later. The followers, on the other hand, value the good *more* if more leaders adopt the product. The followers might emulate the behavior of leaders, in part, to feel closer to their aspirational group, and thus improve their self-esteem (Cialdini and Trost 1998). In marketing its goods, the firm must carefully weigh two counterbalancing forces: (1) the desire of the leaders to distinguish from the followers and (2) the opposing desire of followers to assimilate with the leaders. Using a game-theoretic model, we explore how a firm can potentially manage these social forces by appropriately selecting its target consumers, designing its product, setting its prices, and limiting the availability of its goods. Thus our work is in the tradition of research that attempts to incorporate psychological and sociological realism into economic models (see, for example, Carpenter and Nakamoto 1990; Becker and Murphy 2000; Rabin 2002; Amaldoss and Jain 2005a, b; Syam et al. 2008).

Our analysis offers some useful insights on how reference groups affect firm behavior. First, the strength of assimilation and contrast effects can significantly influence firm profits and prices. For example, as the leaders' desire to distinguish from the masses increases, it may be profitable for the firm to charge higher prices and limit sales of the product to leaders alone. However, when the desire to assimilate is sufficiently strong, it might be profitable to seed the leader market by subsidizing their purchases and later reap profits from the followers. Second, we identify conditions under which it may be profitable for the firm to bring class to the masses. Third, we show that sometimes it is profitable for the firm to add unique and costly product features that offer little functional value. This could potentially explain why

sometimes products have costly features, which have limited functional use even when there is no competition and consumers do not desire these additional features. Fourth, we show that, even when there is no heterogeneity in consumer preference for quality, firms may find it profitable to introduce multiple identical products in the presence of reference group effects. Thus, reference group effects might partially explain why we observe product proliferation in the luxury goods market. Fifth, we show that offering a limited edition of a product can increase total sales and firm profits. These improved profits are a direct consequence of the reference group effects captured in our model, and absent social effects a limited edition strategy offers no additional benefits in our framework. Finally, we establish conditions under which a firm might deliberately sell less than the total demand for the product, and thereby create a "buying frenzy."

Related Literature. As noted earlier, our work draws on the psychology literature on social comparison. However, unlike this literature, we are interested in product evaluation rather than evaluation of the self. In the marketing literature, reference group effects have been examined by several researchers. For example, Bearden and Etzel (1982) examined product and brand decisions of a panel of 645 consumers and found that reference group effects are stronger for publicly consumed brands. Childers and Rao (1992) replicated the earlier study with a sample of 345 American and Thai consumers and obtained similar results.

Our work is also related to economic analyses of social interaction (see Manski 2000 for an overview). Leibenstein (1950) highlighted the importance of social factors in consumption (see also Veblen 1899). Becker and Murphy (2000, pp. 140–143) argued that the desire of leaders to distinguish themselves from followers could lead to the introduction of multiple products over time. Pesendorfer (1995) proposed a signaling model where people could signal their social status to potential dates by adopting the latest designs. In his model, as the latest design undermines the signaling value of the older and more common design, it leads to fashion cycles. It is useful to note that in the signaling literature, consumers could use their purchase decisions to signal a latent variable, such as wealth or status, which cannot be directly observed. In the behavioral literature, however, social position is observable. Here, a follower emulates a leader to *feel* like the leader. For example, consumers might buy what a famous movie star buys, not to signal that they are movie stars, but rather to feel like the movie star. Similarly, many amateur golfers purchase expensive Callaway clubs to feel like a pro (Silverstein et al. 2004). Consistent with this view, we incorporate social influences directly into the utility formulation

¹ When making an upward social comparison, people seem to engage in assessing the similarities between the standard and the self and this produces the assimilation effect. On the other hand, when making a downward social comparison, people focus on the dissimilarities between the standard and the self, and this often causes a contrast effect (Mussweiler et al. 2004).

as consumption externalities. In the signaling literature, however, consumer utility is increased only if a person successfully signals her wealth (or other latent variable). Thus our model formulation is very different from the signaling models.

Further, our work is related to the literature that deals with consumers' desire for scarcity. This literature suggests that consumers tend to prefer products that are available in smaller quantities (e.g., Worchel et al. 1975). One potential explanation for such a preference is that consumers believe that scarce products are of better quality (see Stock and Balachander 2005 for a signaling explanation for scarcity). The second explanation is based on consumer psychology and argues that consumers may have a need for uniqueness, and, consequently, prefer products that are less commonly available (see, for example, Ross et al. 1975, Jones 1984). Recently, using a one-period model, Amaldoss and Jain (2005a, b) examined how consumer desire for uniqueness and conformism affects firm profits and prices in a monopoly and duopoly setting. In their framework, consumers wish to be different from *all* other consumers or wish to be similar to *all* other consumers. Thus the desires for uniqueness and conformism that they study are not segment specific, but individual-level traits.² The key driving force in our model is different from these two explanations. In our model, as quality is known, there is no need to signal quality. However, leaders prefer a product more if it helps to distinguish them from followers, and followers prefer a product if it helps to assimilate with leaders. Consequently, our explanation is rooted in reference groups.³ Furthermore, our results are different from those obtained in these alternate frameworks.

Finally, our paper is related to the literature on durable goods (e.g., Coase 1972, Bulow 1982, Stokey 1981). As consumers rationally expect a durable goods monopolist to cut prices in future periods to satisfy the residual demand, they are willing to wait. On facing such patient consumers, the durable goods monopolist may sell its product at a price close to its

² Although the individual-level need for uniqueness (conformity) and the corresponding desire to contrast (assimilate) are related, the latter terminology is more frequently used in the social comparison literature. More specifically, we use the latter terminology to describe an *intergroup* phenomenon, where members of one group look up to and want to *assimilate* with the higher group, and members of the higher group, in turn, want to *contrast* themselves from the lower group.

³ Another stream of work that studies consumption externality is the research on network goods, where the externality is induced by technology rather than social factors (e.g., Besen and Farrell 1994, Katz and Shapiro 1994). Unlike this literature, we consider a different phenomenon in which both negative and positive externalities exist. Furthermore, the presence of both these externalities is crucial for our results.

marginal cost in the very first period or may limit total supply. Absent consumers' ability to wait, however, the Coase problem disappears. We model a different set of externalities that work in a different manner. In particular, in our framework, the second-period sales is positively affected by first-period sales. However, the first-period sales is negatively affected by the expected second-period sales. By using such a formulation, we show that a firm may increase or decrease its first-period price, depending on the strength of the reference group effects. Further, a firm may use limited edition even when consumers cannot wait and prices increase over time. Contrary to durable goods models, in our framework, offering a limited edition product leads to increased total sales rather than reduced sales. Besides, limited edition can reduce the first-period price rather than increase the price as evidenced in durable goods models. We also establish that reference group effects can motivate firms to add features, which provide limited or no functional benefits to their products to increase their marginal costs. Furthermore, reference group effects can induce buying frenzies. These results are not obtained in the durable goods framework.

The rest of the paper is organized as follows: Section 2 introduces the theoretical model and examines its equilibrium implications. Finally, §3 summarizes the findings and concludes by providing some directions for further research.

2. Model

We consider a two-period model in which a firm produces a product at a constant marginal cost c and sets the price in each period to maximize its total discounted profits. There are two groups of consumers: leaders and followers. We assume that both leaders and followers are aware of the product. Leaders enter the market in the first period and decide whether they want to adopt the product. Followers enter the market only in the second period to make their purchases. The assumption that followers enter later is consistent with the literature on diffusion of innovation (for a similar assumption, see Becker and Murphy 2000, p. 140; Stock and Balachander 2005).

Leaders. There is a unit mass of leaders. The leaders prefer to distinguish themselves from the followers. Consequently, the utility of the product declines if more followers adopt the product. More specifically, we assume that the expected (indirect) utility derived by a leader from purchasing the product at a price p_1 is given by

$$U_l(p) = v - g(y^e) - p_1, \quad (1)$$

where y^e is the number of followers expected to adopt the product in the second period, p_1 is the price of the product in the first period, and $g(\cdot)$ reflects the

extent to which leaders want to contrast from the followers.⁴ Note that, when the leaders are deciding to purchase the product, their expected utility depends on y^e , not y . This is because the leaders do not observe the actual sales to followers at the time of their decision, and hence must make their decisions on the basis of expected sales y^e .⁵ We assume that $g'(\cdot) > 0$ and $g(0) = 0$. The function $g(\cdot)$ captures Bourdieu's (1984) notion of "aesthetic distancing" and Bryson's (1996) concept of "symbolic exclusion," where people of a higher social group dislike choices that are popular in a lower social group. Consistent with past literature on reference groups, in our model, leaders distinguish themselves from followers based on product adoption (e.g., Bearden and Etzel 1982, Childers and Rao 1992).⁶ We also assume that the product's base utility v is distributed among leaders, according to a uniform distribution with range $(0, 1)$.

Followers. In the second period, followers of mass $\beta \geq 1/2$ enter the market. Thus the size of the follower segment can be different from the size of the leader segment (which is normalized to 1). The followers have an opportunity to observe the number of leaders who have adopted the product. Furthermore, the number of leaders, who have adopted the product, determines how much value the followers place on the product. Thus, followers are buying the product purely for its reference group effect. This simplifying assumption helps us to better delineate how a reference group impacts purchase behavior. The (indirect) utility derived by a follower from purchasing the product is given by

$$U_f(p) = h(x_1) - p_2, \quad (2)$$

where x_1 is the number of leaders who adopted the product and $h(\cdot)$ captures the desire of followers to assimilate with the leaders. We assume that $h' > 0$, $h'' \geq 0$, and $\beta h'' < 1$, so that the profit functions are concave.⁷ Note that in this formulation, followers are homogeneous. This is consistent with our

⁴ It is possible that some leaders value being the first to adopt a product and may actually like others emulating their purchase decision. In the context of our model, such a behavior can be captured by a decrease in the $g(\cdot)$ function. As long as the modified $g(\cdot) > 0$ and $g' > 0$, our results hold.

⁵ Of course, the actual utility that the leaders drive depends on the realized sales y . Note that under the rational expectations assumption $y^e = y$, and hence they turn out to be the same in equilibrium.

⁶ The adoption decisions could also be influenced by the number of people in the reference group that are concurrently using the product. We discuss the implications of such a formulation later.

⁷ The convexity of $h(\cdot)$ function is not necessary for most of our results; a substantially weaker (albeit complicated) assumption would be sufficient to derive all our results.

notion that the followers' utility is driven primarily by reference group effects and not by individual differences in product valuations. Alternatively, we could assume that there is an additional segment of followers who have intrinsic preferences for the product and that these preferences are heterogeneous. As we discuss later, the main results of our analysis would continue to hold even in this setting. Thus the assumption of homogeneous preferences is not critical, though it facilitates the exposition of the key results. As noted earlier, followers have no value for the product if none of the leaders buy the product, implying $h(0) = 0$. However, we do not assume that leaders always value the product more than followers. For example, if $h(\cdot)$ is sufficiently large, then it is possible that followers value the product more than leaders do.

To analyze the game, we assume that the leaders form rational expectations (e.g., Becker 1991, Rajiv et al. 2002, Amaldoss and Jain 2005a) and focus on the pure strategy solutions of the game.⁸ Consider first the decision of the followers. The followers will buy the product as long as $h(x_1) > p_2$, where x_1 is the number of leaders who have adopted the product (first-period sales), but will be indifferent between buying and not buying if $h(x_1) = p_2$. In the second period, the firm must charge a price that is at least equal to its marginal cost c . So, for any sales to take place in the second period, it is necessary that $h(x_1) > c$. That is,

$$x_1 \geq h^{-1}(c). \quad (3)$$

In other words, the first-period demand should be large enough to motivate the followers to pay more than the product's cost. Next, we characterize the complete demand function in the following lemma, relegating the proof to Appendix A, which can be found at <http://mktsci.pubs.informs.org>.

LEMMA 1. *The firm's first-period demand is given by*

$$x_1(p_1) = \begin{cases} 1 - p_1 - g(\beta) & \text{if } p_1 < \hat{p}_1 \\ 1 - p_1 - g(z(p_1)) & \text{if } p_1 \in (\hat{p}_1, \tilde{p}_1) \\ 1 - p_1 & \text{otherwise,} \end{cases} \quad (4)$$

where

$$z(p_1) = g^{-1}(1 - p_1 - h^{-1}(c)); \quad (5)$$

$$\hat{p}_1 = 1 - h^{-1}(c) - g(\beta) \quad \text{and} \quad \tilde{p}_1 = (1 - h^{-1}(c)).$$

⁸ The rational expectations assumption is a standard assumption in theoretical work (e.g., Stokey 1981, Narasimhan 1988). The process of forming rational expectations, however, is left unspecified in these models. There are multiple ways in which leaders can form expectations (see, for example, Guesenerie 1992).

The second-period demand for the first-period price p_1 is

$$y(p_1) = \begin{cases} \beta & \text{if } p_1 < \hat{p}_1 \\ z(p_1) & \text{if } p_1 \in (\hat{p}_1, \tilde{p}_1) \\ 0 & \text{otherwise.} \end{cases} \quad (6)$$

The lemma shows that first-period demand $x_1(p_1)$ is continuous and weakly decreasing in p_1 . Also, $y(p_1)$ is continuous and weakly increasing in p_1 . The firm chooses a price to maximize the following profit function:

$$\Pi_1 = x_1(p_1)(p_1 - c) + [h(x_1(p_1)) - c]y(p_1). \quad (7)$$

In the expression above, the first term is the first-period profit and the next term is the second-period profit, assuming the discount factor is 1.

Prices of Products. Define $g(\cdot) = \lambda_l \tilde{g}(\cdot)$ and $h(\cdot) = \lambda_f \tilde{h}(\cdot)$. Thus, as λ_l increases, the leaders' desire for contrast increases. Similarly, as λ_f grows in strength, the followers want to assimilate more with the leaders. On examining the impact of reference group effects on prices, we note that if c is not too large, then for low values of λ_l , the firm prefers to sell to the followers. In this case, as λ_l increases, the firm must decrease its price to the leaders, so that they condone the sales to the followers. However, when λ_l grows larger and reaches the threshold λ_l^* , the firm switches to the regime where it is unattractive for it to sell to the followers, and hence the prices are not affected by λ_l anymore. If c is so large that the firm never prefers to sell to the followers, then λ_l does not affect firm's prices. As discussed earlier, the firm's second-period price depends on the sales to the leaders. In general, if the firm is selling to the followers, as λ_l increases, the first-period sales decline even after the firm optimally adjusts p_1^* . Consequently, p_2^* is lower as λ_l increases.

Next, turning attention to the desire of followers to assimilate, we find that the firm's first-period price has an inverted-U relationship with λ_f . To understand this, note that the firm does not sell to the followers when λ_f is relatively low. In this case, an increase in λ_f forces the firm to increase p_1^* . This, in turn, reduces the sales to the leaders, thereby reducing the product's attractiveness to the followers. However, when the desire to assimilate reaches the level of λ_f^* , the firm switches to the regime where it is profitable to serve the follower segment. Now, the firm reduces the first-period price p_1^* , as λ_f further increases. The motivation for such penetration pricing in the first period is not to increase profits in the first period, but to make the product attractive to followers, so that it earns large profits in the second period. When the desire to assimilate increases, the product becomes

more attractive to followers, and, consequently, the second-period price p_2 increases with λ_f . These results are summarized in the following proposition.

PROPOSITION 1. (i) *As the leaders' desire for contrast increases, then the firm's prices are weakly decreasing.*

(ii) *As the followers' desire for assimilation increases, there exists a λ_f^* such that $\partial p_1^*/\partial \lambda_f > 0$ for $\lambda_f < \lambda_f^*$ and $\partial p_1^*/\partial \lambda_f < 0$ after that. Furthermore, as the followers' desire for assimilation increases, the firm's second-period price strictly increases.*

An important implication of the proposition is that for large values of λ_f , the firm's first-period price strictly decreases. Indeed, when the assimilation effects are strong enough, the firm can potentially benefit by making a loss in the first period and harvesting large profits in the second period by selling to the followers. We therefore have the following corollary.

COROLLARY 1. *The firm's first-period price is lower than c when the followers' desire for assimilation is sufficiently strong.*

In practice, firms that strive to bring class to the masses seed the market by selectively offering the product for free to some of the leaders. For example, Silverstein et al. (2004, p. 17) report that "influence marketing" and "seeding success through brand apostles" are common practices of successful luxury goods manufacturers. They argue that drinking is a social activity that is susceptible to social influences. Consistent with this view, prominent celebrities and leaders—including Robert Redford, Jack Smith, Bill Clinton, Barbra Streisand, Robert De Niro, and others—were sent a free bottle of Belvedere. Further, the initial marketing efforts were focused on selling the product at the finest restaurants in the country. The product later became a major success.⁹

Product Design. The design of a luxury good determines the number and level of its features and, in turn, its marginal cost c . Next, we explore whether the marginal cost of a product has any bearing on a firm's decision to bring class to the masses.

⁹Note that in our analysis, we have assumed that λ_f and λ_l are independent. This enabled us to highlight the independent effects of assimilation and contrast on prices. It is possible, however, that in markets where leaders have a strong desire for contrast, the followers may also have a strong desire for assimilation. In Appendix B (which can be found at <http://mktsci.pubs.informs.org>), we examine the theoretical implications of such a case. In general, we find that the first-period prices decrease as reference group effects become stronger and Corollary 1 holds. Further, when $g(\cdot)$ and $h(\cdot)$ functions are linear, we find that the second-period price increases as reference group effect increases.

PROPOSITION 2. *If $c < c^*(\lambda_l, \lambda_f)$, then the “class-to-mass” strategy is optimal. Furthermore, $\partial c^*/\partial \lambda_l < 0$ and $\partial c^*/\partial \lambda_f > 0$.¹⁰*

It is useful to note that the critical c depends on the reference group effects. An implication of the first part of the proposition is that, in general, for low-cost items, a firm finds it optimal to sell to both the leaders and followers. To better understand the second part of the proposition, note that, when leaders have a strong desire for contrast, they will not adopt the product if too many followers are expected to enter the market. Consequently, as λ_l increases, the range of c for which the firm sells primarily to the followers decreases. But this range increases when the followers’ desire to assimilate is high. This is because as the desire for assimilation increases, the firm finds it more profitable to sell mainly to the masses. Thus, this analysis clarifies when it might be profitable for a firm to bring class to the masses.

In general, a firm can control its marginal cost by appropriately designing its product. For example, when a firm increases the complexity of its product design by increasing the number and level of its features, it increases its marginal cost. But if the complex product design does not augment the functional benefits delivered by the product, we naturally expect the firm’s profits to decline because of the higher c . This is true in our model when social effects are weak. However, in the presence of strong reference group effects, we find that an increase in the marginal cost of a product can sometimes benefit the firm.

PROPOSITION 3. *If the need for contrast is sufficiently high, then the firm’s profits increase in c for all $c \in (c^*, c_1)$, where c_1 is uniquely defined by the implicit equation*

$$c_1 = \{c: (h^{-1}(c))'(1 - 2h^{-1}(c) - c) - h^{-1}(c) - c = 0\}. \quad (8)$$

For example, consider the case where $\beta = 1$, $h(x) = x$, and $g(y) = 0.9y^2$. In this situation, it can be shown that the firm’s profits increase as the marginal cost increases within the range (0.05, 0.25). The intuition for this result is that as c increases, the firm finds it easier to convince leaders to adopt the product because the product is less attractive to the followers. Consequently, demand in the first period increases and it helps firm profits. However, an increase in c hurts the margins. The overall effect is such that, if the firm prefers not to sell to the followers, for some range of c , the demand effect dominates and the firm would prefer to have a larger c .¹¹

This finding has important implications for the design of luxury goods. For example, luxury goods manufacturers can benefit by including unique and costly features, even when the additional features do not improve the functional benefit that the product provides. Thus the proposition offers a potential explanation about why LVMH’s Theda bag is ostrich rimmed and how such features that have little functional value might help improve the firm’s bottom line. This can happen even in circumstances when consumers find the product to be less attractive because of the additional features (see, for example, Simonson et al. 1994). The analysis also explains why many other products are gold plated, hand woven, etc., even in instances where these features do not improve the functional performance of the product. Next, we explore another mechanism that firms may use to motivate more leaders to purchase its products; namely, the strategy of extending product line.

Often firms introduce multiple products of different quality levels to exploit the commonly observed variation in consumer preference for quality. For example, designers such as Armani have multiple product lines. We now examine how reference groups may affect a firm’s incentive to extend its product line. To rule out heterogeneity in consumer preference for quality as the rationale for launching new products, assume that the quality level of the new products is identical to that of the original product. Further, assume that the firm incurs a fixed cost ϕ to introduce each new product. Clearly, absent reference group effects, it is not profitable for a firm to launch additional identical new products. However, in the presence of such social effects, we may observe product proliferation even when the products are identical and consumer tastes are relatively homogeneous. Product proliferation becomes profitable for the firm when it enables leaders to choose different products, and thereby reduce the attractiveness of any given product to the followers.¹² Hence we have the following result.

On the contrary, in our model, an increase in cost for $c \in (c^*, c_1)$ could lead to *lower* first-period price and *higher* sales. Furthermore, a durable goods monopolist may choose to invest less in cost-reducing technology. This is because a higher marginal cost implies the monopolist will charge a higher price in the second period, and, consequently, the firm will be able to charge a higher price in the very first period. However, this result does not imply that $\partial \Pi/\partial c > 0$ for some range of c if investing in cost-reducing technology were costless (see Bulow 1982, pp. 322–323). Proposition 3 clarifies that in the presence of reference group effects, sometimes firm profits can *increase* as marginal cost increases.

¹² In our current analysis, we assume that there are no cross-product externalities. As such, if a consumer buys a product by a firm, the reference group-based utility for the second product from the same firm is not affected. However, it is conceivable that the externalities of these two products may be related when they share a common family brand name. Even in such cases, as long as the reference

¹⁰ In Appendix B (which can be found at <http://mktsci.pubs.informs.org>), we also consider the case when λ_l and λ_f are not independent. If $g(\cdot) = \lambda x$ and $h(\cdot) = \lambda y$, c^* is increasing in λ .

¹¹ It is useful to note that in the traditional durable goods model, an increase in cost leads to a higher first-period price and lower sales.

PROPOSITION 4. *If $\beta > g^{-1}(1)$ and $h((1-c)/2) > c$, then for sufficiently small ϕ , the firm introduces a new product line and increases the market demand from leaders.*

It is useful to note that the condition on the $g(\cdot)$ function is sufficient but not necessary. Indeed, weaker conditions can suffice.¹³ Next, we discuss the implications of extending a product line by launching products of varying quality levels.

In the preceding analysis, we assumed that the new product was of the same quality. As noted earlier, when consumers vary in their preference for quality, a firm may introduce products with different quality levels to extract more consumer surplus. The presence of reference group effects may make it even more attractive for the firm to introduce new products, as additional products reduce the negative effects of followers on the leaders, thereby motivating more leaders to purchase the products. This could provide one potential explanation for product proliferation in luxury goods markets. Note, however, that another countervailing force is at play here. The presence of multiple products also reduces the attractiveness of each product to the followers because fewer leaders will adopt any one product. Thus, if the follower effect is large, it is possible that reference group effects may reduce the number of product variants that a firm offers.

Limited Edition. Now, consider the case where the firm decides to produce a limited edition of its product. In particular, the firm commits to not producing more than Q units of the good. We assume that Q is common knowledge. In this case, the leaders will adopt the product only if

$$v - p_1 - g(y^e) > 0. \quad (9)$$

However, unlike the earlier case, consumers' expectations about second-period sales are not only influenced by p_1 , but could also be influenced by Q . This is because if the second-period demand exceeds $(Q - x_1)$, then all consumers will not be served and the second-period sales will be only $(Q - x_1)$. If the leaders expect that the firm will sell up to Q , then the first-period demand is

$$x_1 = 1 - p_1 - g(Q - x_1^e), \quad (10)$$

where x_1^e is the first-period expected demand. Under rational expectations, we must have $x_1 = x_1^e$. We have

group effects within a product is stronger than that across products, the basic intuition holds.

¹³ For example, consider the case when $g(y) = 0.9y$, $\beta = 1$, $h(x) = x$, $c = 0.1$, $\phi = 0.1$. In this case, the firm makes a profit of 0.08 with a single product but a profit of 0.14 with two products. The firm sells to both the leaders and the followers in the case when it has two products.

the following result on the existence and uniqueness of a rational expectations equilibrium:

LEMMA 2. *If $g'(\cdot) < 1$, then there always exists a unique rational expectations equilibrium for any feasible Q and price p_1 .*

To consider situations with a unique rational expectations equilibrium, for the remainder of the paper, we assume that $g'(\cdot) < 1$. It is also interesting to note that, when the constraint is binding; namely, $Q \leq x_1 + y$, an increase in Q leads to lower first-period demand. Thus the firm can influence the first-period demand through its limited edition strategy. The general problem that the firm needs to solve for the limited edition case is as follows:

$$\max_{p_1, p_2, Q} [(p_1 - c)x_1(p_1, Q) + (Q - x_1)(p_2 - c)] \quad (11)$$

$$\text{s.t. } x_1(p, Q) \leq Q \leq \beta + x_1(p, Q); \quad p_1 \geq 0, \quad p_2 \geq 0. \quad (12)$$

It can be shown that the firm can achieve any profit level with the limited edition that it can achieve with the no-limited-edition case. Thus, if offering a limited edition is costless, then the firm weakly prefers to offer a limited edition. To gain more insights, we need to solve the problem detailed above. Note that (12) defines constraints that implicitly define the range of values that Q can take. As the first-period demand is defined by the rational expectations, Equation (10) and $p_2^* = h(x_1(p_1, Q))$, we can further simplify the problem. For general $g(\cdot)$ and $h(\cdot)$, however, the problem is highly nonlinear and intractable.

Denote the total quantity that the firm sells absent a limited edition strategy by Q_0 . We are interested in examining the conditions under which the limited edition strategy can be strictly profitable. Another interesting scenario is when the second-period demand exceeds supply; namely, when the constraint Q becomes binding. The next proposition addresses these two issues while still using general functional forms.

PROPOSITION 5. *If $h((1-c)/2) > (1+c)/2$ and $g(\beta)$ are sufficiently large, then the firm strictly benefits by limiting quantity to Q^* . Furthermore,*

(i) *On offering a limited edition, the firm increases its total sales. That is, $Q^* > Q_0$, implying that the firm commits to selling a higher quantity than it would sell absent a limited edition strategy.*

(ii) *There is a "buying frenzy" among followers, implying that $Q^* < x_1 + y$.*

(iii) *Firm's prices increase over time, implying that $p_2^* > p_1^*$.*

Note that the conditions specified in the proposition are sufficient but not necessary conditions for buying frenzies to occur. To illustrate the possibility of a

buying frenzy (under weaker conditions than those in the proposition), consider the case when $\beta = 1$, $g(y) = y^2/2$, $h(x) = 1.1x$, and $c = 0.3$. In this case, if the firm does not offer a limited edition, then it earns a profit of 0.116, charges a first-period price of 0.727, sells a quantity of 0.272 among the leaders and does not sell to the followers. The firm can increase its profits by more than 44% by offering to limit quantity to 1.19 units and charging a first-period price of 0.23. In this case, the firm sells 0.59 units to the leaders and the remaining quantity to the followers. All the followers wish to purchase the product, but only 60% are able to do so. It is interesting to note that the firm commits to a quantity that is *greater* than the amount it would sell absent limited edition. Further, more leaders buy the limited edition product.

The intuition for the proposition is as follows. Consider the case where $g(\cdot)$ is sufficiently convex, so that the leaders' desire for contrast is sufficiently high. In this situation, absent a limited edition, the firm is likely to confine its sales to the leaders by charging a high first-period price, so that only a few leaders can adopt the product. However, if the firm can commit to a limited edition strategy, it can increase its profits by increasing sales to the leaders (by reducing price) and selling to some followers at a higher price. This will happen if the followers' desire for assimilation is sufficiently high. In this situation, however, *all* followers desire to purchase the product, but only a *few* of them can buy because of the limited edition. This creates a buying frenzy. Thus we provide yet another explanation for firm-induced scarcity. DeGraba (1995) proposed a model of buying frenzy where uninformed consumers rush to buy the product without knowing its value because it will be sold out if they wait. Uncertainty about the true value of the product is critical for his model, but not for our model. Recently, Stock and Balachander (2005) have suggested that firms could use product scarcity as a strategy to signal quality to uninformed consumers. As they correctly note, the signaling explanation does not preclude the possibility that firms could induce scarcity to satisfy consumer desire for exclusivity. Our paper formally establishes the latter possibility.

The result again highlights some important differences between our work and the literature on durable goods. First, in our framework, prices increase over time, whereas in the durable goods literature, prices decrease over time. Second, quantity commitment in our model actually increases sales but it decreases total sales in durable goods models. Finally, we observe buying frenzies but there are no such frenzies in the durable goods literature. Thus the results of our paper are sufficiently different from those in the durable goods literature. Indeed, this is not surprising because the social phenomenon that we model

is quite different from the traditional durable goods problem.

Thus far we have explored three strategies that luxury goods manufacturers can consider to improve their profits: (1) increasing marginal costs, (2) offering multiple variants, and (3) offering limited editions. On comparing the profitability of these three strategies, we have the following result.

PROPOSITION 6. *The limited edition strategy dominates the strategy of adding costly features with limited functional value, as well as the strategy of offering multiple products of the same quality.*

The first part of the proposition shows that, when it is profitable for the firm to add costly product features that offer limited functional value, it is even more profitable to adopt the limited edition strategy. We find that offering a limited edition product increases profits by increasing first-period prices. Of course, using the limited edition strategy is constrained by the firm's ability to credibly convince consumers that it will not sell a higher quantity than Q^* (since it is ex post profitable to do so).

To understand the intuition for the second part of the proposition, first, consider the case where the firm sells its $k > 1$ product variants only to the leaders. In this case, offering a limited edition is a weakly dominant strategy. This is because, by using a limited edition strategy, the firm can confine the unit sales of a single product to just the number of leaders who may have purchased the k different product variants, if they were available in the market, and save on the cost of introducing additional products; namely, $k\phi$. Next, consider the case where the firm sells its multiple products to followers as well. In this situation, the leaders will expect β/k followers to purchase each product variant, and will therefore discount its value by $g(\beta/k)$. Now, consider an alternate strategy in which the firm sells a single limited edition product such that the second-period sales are β/k units. Such a strategy will not affect the first-period sales revenue, but changes the second-period revenue. Now, as all the leaders buy the same product, instead of dividing themselves among the k variants, the firm can sell its product at a high price to the followers. In this case, though the firm sells fewer total units (β/k instead of β), it sells them at a higher price to followers. As $h(\cdot)$ is weakly convex, the price effect is stronger, and hence the limited edition strategy may be profitable for the firm. Thus, Proposition 6 establishes that in the presence of reference group effects, a limited edition strategy, if credible, is a potentially powerful and cheap mechanism for improving firm profits even when the firm can pursue other product design strategies. A few caveats are in order now. Clearly, the firm can further improve its profits by

offering limited editions of multiple products. The multiple product line strategy will be even more profitable if the additional products are of different quality levels. Nevertheless, when consumer behavior is shaped by reference group effects, offering a limited edition improves firm profits.

Discussion. In sum, the analysis clarifies how reference groups might affect firm prices, product design, and target consumer selection. More specifically, it shows that, when the assimilation effect is sufficiently strong, the firm may seed the leader market and profit from its sales to the followers. The firm may choose to bring class to the masses, especially in contexts where the marginal cost of the good is low and followers' desire for assimilation is strong. We also find that reference group effects can motivate firms to add unique and costly features to a product even in the absence of competition and consumer desire for such features. Further, in such social contexts, firms may find it profitable to offer multiple product lines and limited edition products. We also show that adopting the limited edition strategy could create a buying frenzy.

In formulating our model, we assumed that the purchase decisions of followers were purely driven by the reference group effects. This assumption helped us to clearly show how reference groups influence firm behavior. However, the main insights of the paper are not contingent on this assumption. For example, consider the case where we allow for two segments of followers. The followers in one segment of size β have no base valuation for the product and their entire utility for the product is based on reference group effects, as in our original model. The followers in the other segment of size γ have some base valuation v for the product, which is distributed according to some continuous distribution. The followers in the second segment also derive additional utility from the product, depending on the numbers of leaders who adopt the product; that is, $h(x_1)$. The qualitative insights drawn from our original model continue to hold in this alternative setting, where we allow for multiple segments of followers and heterogeneous valuations for the product.¹⁴

Following prior marketing literature, we assumed that product adoption formed the means by which individuals assimilated or distinguished themselves from their reference group. However, it is possible

that in some social situations, concurrent usage of a product could further increase the reference group effects. In the context of our theoretical framework, this implies that the attractiveness of a product to followers depends not only on the first-period demand (x_1), but also on the usage of the product by leaders in the second period; namely, x_2 . The leaders may also care about whether followers concurrently use the product. Now, let α fraction of the lifetime value of a product be enjoyed by leaders in the first period. The size of α will be small if followers enter very quickly or the product has a long life. Note that, for small values of α , whether consumers care only about adoption or whether they also care about concurrent usage has no significant impact on firm behavior. However, when α is large, the desire of firms to use penetration pricing may depend on the extent to which leaders and followers use product adoption and concurrent product usage to distinguish themselves and assimilate with their reference group. For example, in the extreme case where leaders care only about concurrent usage and followers care only about adoption, firms are more likely to give discounts to the leaders to seed the market. On the other extreme, if followers care only about concurrent usage and leaders care only about adoption, then the firm will find penetration pricing to be less profitable. In both cases, however, offering a limited edition can still be profitable.

In an attempt to sharply focus our analysis on reference group effects, we assumed that leaders do not care about how many other leaders adopt the product. It is possible that some leaders may find the product less attractive if other leaders adopt the product because they want to be different from other leaders as well. Even on allowing for such a possibility, the main results of the paper hold.

3. Conclusion

Marketing researchers have investigated the effect of reference groups on product evaluation and consumer choice (Bearden and Etzel 1982, Childers and Rao 1992). In this paper, we examined the implications of reference groups for firm behavior. Our theoretical analysis offers some useful insights on the marketing of luxury goods.

(1) *How do reference groups impact prices?* Our analysis shows that if a firm sells exclusively to leaders, then the firm's price may increase as the desire of followers to assimilate increases. However, if the firm sells to both leaders and followers and the assimilation effect is sufficiently strong, the firm could even give the product to leaders for free. The consequent adoption of the product by leaders, however, can help the firm to sell the product at a higher price to followers and earn more profits. This finding is helpful

¹⁴ For example, consider the case where $h(x) = x$, $g(y) = y^2/5$, $\beta = 2$, $\gamma = 1$, and the base value of the product to followers v is distributed according to a uniform distribution with range $(0, 1)$. In this case, the firm's profits increase as cost increases for $c \in (0, 0.16)$. Furthermore, if $c = 0.1$, the firm can increase its profits by more than 50% (from 0.43 to 0.65) by offering a limited edition. We will also observe a buying frenzy in such a situation.

in understanding, from the perspective of reference group theory, why successful luxury goods marketers make an effort to appropriately seed the market. Consistent with our finding, Millenium Imports offered its product for free to prominent personalities and initially marketed its product only in the finest outlets. The seeding strategy apparently helped the firm to command a premium in the retail market and become a major success (Silverstein et al. 2004).

(2) *When is it profitable for a firm to bring class to the masses?* Our analysis suggests that, when the marginal cost of production is low and followers' desire to assimilate with leaders is sufficiently high, it would be profitable for the firm to focus on selling its product to the masses. Thus our analysis offers a reference group-based explanation for why designers like Vera Wang may choose to sell their goods through mass merchandisers.

(3) *Why do luxury goods manufacturers add costly features to their products, even if those features offer no functional benefit?* In theory, sometimes it is profitable for manufacturers to add features with limited functional value, so that the cost of the product increases. The increased cost helps the firm to sell only to a few leaders, and, in turn, makes the product less attractive to followers. This finding may, in part, explain why it might be prudent for LVMH to offer a \$4,000 gold, ostrich-trimmed Theda handbag.

(4) *Why do luxury goods manufacturers introduce multiple products in their product line?* A traditional argument for introducing multiple products is heterogeneity in consumer preference for quality. We provide an alternate explanation for product proliferation in the luxury goods market. We show that when leaders' have a strong desire to distinguish themselves from followers, it is profitable for the firm to offer multiple products in its product line, even when these products are functionally identical and product introduction is costly.

(5) *Why do firms offer limited edition products?* Our analysis shows that, when reference group effects are sufficiently high, offering a limited edition product increases sales to leaders and improves profits. By offering a limited edition, the firm can control the availability of the product to followers, and thereby reduce the extent to which followers can blur the distinction the product offers leaders. Subsequently, the firm can harvest the value followers derive from assimilating with the leaders. Absent a limited edition, the leaders might not even buy a product when reference group effects are strong. Our analysis is consistent with the conventional wisdom that marketers of luxury goods need to "preserve brand equity by controlling unit sales" (Silverstein et al. 2004, p. 208).

(6) *Why do we observe buying frenzies?* If followers have a strong desire to assimilate and the firm offers

a limited edition, then only a few of the followers can buy the product, though all of them want to buy the product. This causes a firm-induced buying frenzy. In part, this might explain why we see a two-year waiting list for the \$6,000 Birkin bag from Hermès. Note that, in our model, a buying frenzy is not a consequence of uninformed customers rushing to buy the product or firms inducing product scarcity to signal quality, but it is a direct consequence of reference groups.

Limitations and Directions for Future Research.

In our theoretical analysis, we considered a two-period model. Future research could consider a dynamic model to investigate how reference group effects impact consumer and firm behavior over time. In such a formulation, it would be useful to understand how new products can be used to manage reference group effects. For example, the firm could strategically introduce products over time to satisfy leaders' desire for contrast. In formulating our model, we focused on two marketing mix variables; namely, price and product design. However, marketing mix variables such as advertising and promotion play a very important role in the marketing of luxury goods. Future research might extend the model to accommodate these additional marketing mix variables. Another important avenue of research is to test the predictions of the theoretical model.

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