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Conspicuous Consumption and Dynamic Pricing

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How do firms develop marketing strategy when consumers seek to satisfy both quality and status-related considerations? We develop an analytical model to study this issue, examining both pricing and product management decisions in markets for conspicuous durable goods. Our analysis yields many interesting and nontrivial insights. First, we demonstrate that high intrinsic quality indirectly generates exclusivity via pricing effects; in turn, this exclusivity generates considerable social payoffs where consumers value status. This insight reverses the direction of causality in the existing literature, wherein only status considerations matter and mere price increases may enhance consumer utility. Second, our dynamic model indicates that where consumers prioritize status benefits, producers incur substantial price depreciation in equilibrium. Third, we examine the product management strategies used by firms to preserve early adopter exclusivity. Finally, we discuss the boundary conditions of our results as well as our results' implications for managerial and policy issues.

Key words: conspicuous consumption; status; durable goods; game theory; dynamic pricing
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I don't want to belong to any club that will accept me as a member. Groucho Marx

The difference between style and fashion is quality. Giorgio Armani

1. Introduction

Since time immemorial, the visibility of consumption has affected social interaction across cultures. Those with wealth have invariably indulged in ostentatious displays of their riches, be it the golden thrones of Egyptian pharaohs or the gold-embroidered coats of French nobility (Chaussinand-Nogaret 1985, Sundie et al. 2011). This type of display, referred to as *conspicuous consumption*, has not occurred outside the highest echelons of society for much of history; however, in today's industrialized societies, prominent middle classes possess the means to engage in slighter forms of such pageantry (Page 1992, Perry 2011). Accordingly, the scope of conspicuous consumption now extends to many commonplace products, providing social benefits in addition to any intrinsic consumption value.

This social benefit, referred to as *status utility* in the present article, arises from the pleasure of surpassing others in wealth or social rank. By engaging in conspicuous consumption, an individual compels others to acknowledge her wealth, as made salient by her purchase. For that reason, status utility will influence consumption decisions wherever people may observe others' product selections and will vary in intensity across product categories. A consumer may evaluate thread count to infer the comfort of cotton bed sheets; she, however, cannot use thread count to flaunt social status because she is not a pharaoh receiving merchants at her throne. She must instead consume a relatively public product, such as a pair of denim jeans, to parade her wealth. By opting for a premium brand such as True Religion, she can flaunt her social status in the same manner as a French nobleman bearing gold embroidery (Hyland 2009).

Such concerns of status often influence choice in nondurable categories such as wine and fine dining. For a durable good, however, the consumer displays her choice for a much longer time horizon. Consequently, the interaction of intrinsic and status benefits particularly affects adoption of newly available durables. An early adopter often pays the steepest price when purchasing. In exchange, she does not merely enjoy product benefits before others; rather, she also enjoys exclusivity, in the sense that poorer individuals cannot afford the initial price. This phenomenon reveals itself with every iPhone release—droves of customers endure long lines, sometimes to the point of retail stockouts on opening day (Elmer-DeWitt 2010). Each release introduces incremental improvements in intrinsic consumption value, allowing early adopters to update their iPhone and maintain their sense of exclusivity. Some firms, however, employ more obvious measures to address this preference of early adopters. In the luxury fashion industry, for instance, high-end brands often remove product tags before sending to discount retailers at season's end (Rosenbloom 2010).

In the present study, we examine purchase behavior and firm strategy in durable product categories affected by status utility. We construct a model wherein heterogeneous consumers decide whether to buy a durable good and, if applicable, when to purchase. This purchase timing decision relies on the product's quality, the producer's pricing sequence, and the status utility accompanying the item throughout its lifespan. Within our dynamic model, we endogenously derive both consumers' purchase decisions and a firm's optimal pricing scheme; in doing so, we help explain marketing practices when social status concerns markedly shape purchase decisions. We demonstrate that when status motivations heavily drive purchase decisions, products suffer sharper price drops over time. Furthermore, we offer a nuanced rationale as to why high-status products typically provide superior intrinsic quality.

Our paper contains obvious managerial implications. First, we help explain how status utility influences consumer choice, an insight relevant to industries such as fashion, automobiles, and consumer electronics. Second, we illustrate how consumer status needs often require firms to maintain early adopter prestige, whether through pricing or product line management strategies. Beyond managerial implications, these firm strategies possess public policy implications for issues such as luxury taxes (Corneo and Jeanne 1997) and status-related expenditures among poorer households (Charles et al. 2009), as we briefly discuss in our concluding remarks.

The remainder of this paper is organized as follows: In §2, we review the related literature, underlining gaps in the extant knowledge on conspicuous consumption. In §§3 and 4, we outline our baseline model and present key findings, respectively. We analyze product management strategies in §5 and present extensions in §6. We conclude in §7, discussing both the contributions and limitations of our work.

2. Literature Review

In an extensive literature in sociology, psychology, economics, and, most recently, marketing, researchers have examined consumer behavior with respect to conspicuous consumption. One of the earliest scholars to acknowledge the phenomenon, Adam Smith, stated in his 1776 seminal work *The Wealth of Nations* that

> [w]ith the greater of rich people, the chief enjoyment of riches consists in the parade of riches, which in their eye is never so complete as when they appear to possess those decisive marks of opulence which nobody can possess but themselves. In their eyes the merit of an object which is in any degree either useful or beautiful, is greatly enhanced by its scarcity, or by the great labour which it requires to collect any considerable quantity of it, a labour which nobody can afford to pay but themselves. (Smith 1776/1976, Book I, Chapter XI, Part II, p. 192)

Likewise, Rae (1834, p. 265) contended that consumption of an item by the "vulgar" class diminishes the "pleasure" otherwise provided; he attributed this aversion to vanity, "the mere desire of superiority over others, without any reference to the merit of that superiority." Veblen (1899/1912, Chapter IV, pp. 74–75) popularized the term "conspicuous consumption" in his seminal work *The Theory of the Leisure Class*, in which he indicated that "conspicuous consumption of valuable goods is a means of reputability to the gentleman of leisure." Specifically, he reasoned that because "consumption of … more excellent goods is an evidence of wealth, it becomes honorific," whereas a deficiency of such consumption connotes "inferiority and demerit." Constructing a similar argument, Simmel (1957, p. 541) scrutinized the existence of fashion in stratified societies, reasoning that fashion "unites those of a social class and segregates them from others." These early treatises recognize that certain products, such as clothes and houses, do not merely provide warmth and shelter; rather, such items indicate the owner's status, in that society likens the owner to those with highly similar consumption choices.

Accepting that social considerations affect consumer preferences, the economics literature has formulated nonfunctional demand, the portion of demand not attributable to inherent quality. Leibenstein (1950) formalized *bandwagon*, *snob*, and *Veblen* effects, the last of which implies that consumers will pay a premium for products that convey higher status. Bagwell and Bernheim (1996) derived consumer utility conditions consistent with the occurrence of Veblen effects. Becker (1991) argued that bandwagon effects can explain pricing in restaurants, plays, and other social events. Corneo and Jeanne (1997) studied the implications of snob and bandwagon effects on luxury goods taxation, and Pesendorfer (1995) examined the emergence of fashion cycles. Although their contexts differ, these articles share the idea that status seeking can induce a price premium for a product, regardless of the item's quality; furthermore, these articles rationalize upward-sloping demand curves under certain conditions.

Whereas relevant economics papers congregate around the above theme, the consumer behavior literature in marketing has studied a diverse set of issues. Wertenbroch and Dhar (2000) investigated the psychological drivers affecting choice between hedonic and utilitarian goods. Bourne (1957) and Bearden and Etzel (1982) studied the effect of reference groups in conspicuous product purchases. More recently, Berger and Health (2007, 2008) examined how consumers succumb to social influences, abandoning intrinsic preferences in identity-relevant product domains. Wilcox et al. (2009) showed that consumers are more likely to buy luxury counterfeits when brand attitudes serve a social-adjustive function. Han et al. (2010) illustrated that preference for brand logo prominence corresponds to status-signaling motivations.

The formal modeling literature in marketing, on the other hand, is somewhat limited in the area of conspicuous consumption. Miller et al. (1993) developed a generalizable model that reconciles previous fashion-related theories, including diffusion, trickle-down theory, and bandwagon/snob models. Kuksov (2007) assembled a matching model in which agents convey personal attributes through brand choice, and Kuksov and Xie (2012) utilized a similar framework in which individuals signal social status via product selection. In a series of important papers, Amaldoss and Jain (2005a, b; 2008) analyzed the effect of conspicuous consumption on consumer demand as well as its implications for firm pricing and product line decisions. Amaldoss and Jain (2005a, b) demonstrated the conditions under which uniqueness-seeking consumers, existing alongside conformist peers, exhibit an upward-sloping demand curve. Examining a horizontally differentiated duopoly, Amaldoss and Jain (2005b) also determined equilibrium prices and market shares with respect to each product's quality and each consumer type's valuation of quality. Most relevant to our work, Amaldoss and Jain (2008) considered the dynamic pricing policy of a firm selling conspicuous durables to "leaders" and "followers," groups that vary only in their consumption-timing preferences.[1] We, however, endogenously derive consumption timing: in determining her time of purchase, each consumer surveys the social status of each product user and nonuser.

In addition to these contributions, we consider the role of intrinsic quality, a key component absent from Amaldoss and Jain (2008). The conspicuous consumption literature as a whole does not recognize quality's effect on consumer preferences and focuses solely on social benefits (Pesendorfer 1995). This view seemingly conflicts with the prevalence of high-quality items in conspicuously consumed product categories. For instance, Hermès crafts its iconic Birkin handbag using gold-plated hardware and saltwater crocodile skin, handsewn and polished by French artisans (Tonello 2009). Accordingly, we jointly consider intrinsic quality and status utility to produce a more complete characterization of conspicuous consumption.[2] We establish product quality as an effective advertisement of social status. Furthermore, we study product management strategies that preserve this effectiveness, another point of salient departure from the extant literature.

To summarize, we contribute the following to the existing literature on conspicuous consumption: (1) The literature has principally focused on social-related benefits, neglecting the effect of intrinsic quality. We jointly consider these effects, demonstrating that status utility may arise as a consequence of product quality. (2) To capture the status utility associated with an item, we incorporate each individual's social rank and consumption decision. (3) Through empirically testable propositions, we relate product-level attributes to market-level outcomes such as price depreciation. (4) Our paper enriches the extant durable goods literature (Levinthal and Purohit 1989, Desai and Purohit 1998), which traditionally has not considered the relationship between status utility and market-level outcomes. (5) Finally, we analyze product management strategies to preserve early adopter exclusivity.

3. Model

We first introduce model preliminaries, explaining the rationale behind our assumptions as needed. Table 1 lists all variables appearing in our model.

Market. A monopolist sells a durable good of intrinsic quality $Q \in \mathbb{R}_+$ over each period $t \in \{1, 2\}$. The seller markets its product to a fixed unit interval of consumers, where $\nu^i \sim \mathrm{U}[0, \nu_0 = 1]$ captures consumer i's wealth. In our baseline model, we assume individual i's wealth to perfectly correspond to her social status, although we later relax this assumption.

Intrinsic Consumption Utility. Each consumer's willingness to pay (WTP) directly reflects her wealth level ν^i; that is, upon product acquisition, consumer type ν^i receives lifetime utility amounting to $\nu^i Q$. If consumer i purchases in period t, she incurs a price of P_t, implying a net intrinsic benefit of $\nu^i Q - P_t$.

Status Utility for Buyers. In addition to providing intrinsic utility, the durable good cues the owner's social status, producing a benefit that we refer to as status utility. This form of utility depends on two factors: (1) the consumption choices of all $\nu^i \in [0, 1]$ and (2) each consumer's sensitivity to others' consumption choices, as represented by $\lambda \in \mathbb{R}_+$.

[1] Specifically, in Amaldoss and Jain (2008), a leader's preference for a product drops with the number of followers expected to buy, whereas a follower's preference rises with the number of leaders that have already purchased.

[2] A recent article on luxury khaki pants that retail at $550 illustrates this: "Mr. Sternberg's khakis are tailored like dress pants, and the details are largely sewn by hand, including buttonholes and split waistbands, which can be altered easily. The fabric, which costs $24 a yard, plus $3 a yard to import, is a cotton gabardine fine enough to withstand basting stitches. About two yards, counting for boo-boos and such, is used to make a pair of pants, so the fabric cost is $54" (Wilson 2010).

Table 1 Notation

Variable	Description
ν^i	Consumer *i*'s WTP for quality in baseline model
ν_t	Period *t* marginal consumer
Q	Intrinsic quality of durable good
λ	Consumer sensitivity to status utility
k	Marginal cost parameter
δ	Discount factor
$\{P_1^*, P_2^*(P_1^*)\}$	Optimal pricing sequence in baseline model
γ	Firm investment cost for product dating and updating (see §5)
$\{P_1^\circ, P_2^\circ(P_1^\circ)\}$	Optimal pricing sequence for product dating model
Q_n	Intrinsic quality of updated version (see §5.3)
$\{P_{1Q}^\triangle, P_{2Q}^\triangle(\cdot), P_{2Q_n}^\triangle(\cdot)\}$	Optimal pricing sequence for product updating model
z^i	Second dimension of consumer *i*'s social status (see §6)
w^i	Consumer *i*'s WTP for social status (see §6)

To illustrate the effect of others' consumption choices, suppose that a continuum $[\underline{\nu}, \bar{\nu}]$ purchase the product. Where some $\nu^i \in [\underline{\nu}, \bar{\nu}]$ enjoy the item in the company of others, consumption forcefully reminds each $\nu^j \in [0, \underline{\nu})$ of her lesser wealth. Thus, the consumption of any type $\nu^j < \underline{\nu}$ deprives each $\nu^i \in [\underline{\nu}, \bar{\nu}]$ of an opportunity to assert her socioeconomic superiority; consequently, we expect the purchase of any $\nu^j < \underline{\nu}$ to decrease the status utility of all $\nu^i \in [\underline{\nu}, \bar{\nu}]$. An added individual of type $\nu^j > \bar{\nu}$, however, improves the item's status utility for all $\nu^i \in [\underline{\nu}, \bar{\nu}]$ because the higher status individual is no longer segregated from the original set of consumers. Note the difference between *status* and *status utility*: the former is an individual trait, proxied by wealth level ν^i, whereas the latter is a consequence of both the consumption context and the adoption decisions of all $\nu^i \in [0, 1]$.

Because others' consumption decisions affect each individual's status utility, we must also consider the severity of this effect, as captured by λ in our model. In certain contexts, consumers will be more sensitive to social effects; i.e., others' decisions will more heavily influence purchase timing.[3] Handbags and backpacks, for example, serve similar consumption needs, but society views only the former as a status marker. Sensitivity to status utility is thus higher for a handbag purchase, implying a higher λ in our model. As a general matter, we expect higher λ in product categories where others observe and notice consumption choices. We also note that status sensitivity will only exist when others view product use (Chao and Schor 1998).

To integrate these two elements into our formulation of status utility, suppose again that a continuum $[\underline{\nu}, \bar{\nu}]$ consume a product. Ignoring intertemporal considerations, status utility amounts to $\lambda(\int_{\underline{\nu}}^{\bar{\nu}} \nu^i \, d\nu^i / \int_{\underline{\nu}}^{\bar{\nu}} d\nu^i) = \lambda((\bar{\nu} + \underline{\nu})/2)$. The addition of a type $\nu^j > \bar{\nu}$ ($\nu^j < \underline{\nu}$) thus improves (worsens) overall status utility, and this effect becomes more pronounces as λ increases.[4]

To map the range of consuming types into status utility, we endogenously derive the price skimming sequence of a monopolist firm (Besanko and Winston 1990). For a product sold over time, higher types will consume earlier; we can thus state, without loss of generality, that some portion $\nu^i \in (\nu_t, 1]$ of consumers utilize the item in period $t \in \{1, 2\}$. As a broader range of types adopt, existing consumers lose a source of segregation between themselves and those that have newly adopted. Product use no longer reminds these parties of the existing socioeconomic disparity, which decreases the sense of exclusivity enjoyed by the wealthier consumers. As indication of this effect, an individual contemplating purchase in $t = 2$ obtains a lifetime benefit of $\lambda(\int_{\nu_2}^{1} \nu^i \, d\nu^i / \int_{\nu_2}^{1} d\nu^i) = \lambda((1 + \nu_2)/2)$ if she adopts. A first-period buyer, on the other hand, receives a discounted lifetime benefit of $(1 - \delta)\lambda \cdot ((1 + \nu_1)/2) + \delta\lambda((1 + \nu_2)/2)$ at the time of purchase, where $\delta \in (0, 1)$ denotes the discount rate. Here, the first term captures utility attributable to the initial period of consumption, where a higher ν_1 denotes fewer early adopters and suggests a more exclusive subset of consumers. The latter term captures the effect of later sales on lifetime status utility; a lower ν_2 indicates that more low types purchase at clearance, deteriorating the exclusivity previously enjoyed by early adopters.

Status Utility for Nonbuyers. Since consumption conveys status, non-consumption underscores a deficiency of social cachet, particularly where most individuals use the product (Kuksov 2007, Kuksov and Xie 2012). An individual that forgoes adoption in $t = 2$ integrates herself into the subset of types $[0, \nu_2)$ that do not purchase. Hence, non-consumption carries a greater stigma when the marginal type ν_2 is lower. Again allowing each individual equal weight, product rejection in $t = 2$ yields a lifetime status benefit of $\lambda(\int_0^{\nu_2} \nu^i \, d\nu^i / \int_0^{\nu_2} d\nu^i) = \lambda(\nu_2/2)$.[5] Similarly, we can show that from the perspective of an individual at $t = 1$, the status benefits of rejection and delayed purchase are $(1-\delta)\lambda(\nu_1/2) + \delta\lambda(\nu_2/2)$ and $(1-\delta)\lambda(\nu_1/2) + \delta\lambda((1 + \nu_2)/2)$, respectively.

For both buyers and nonbuyers, status utility may be interpreted as an internal utility arising from

[3] We use the terms "sensitivity to social effects," "sensitivity to status utility," and "status sensitivity" interchangeably to describe λ. We initially assume λ as constant across consumers but later relax this assumption.

[4] For these results to hold, social status must positively correlate with WTP for quality. We demonstrate this later in the paper.

[5] Although product rejection yields positive status utility, adoption carries a greater gross benefit—if available for free, everyone adopts the item. Relative to rejection, this benefit of adoption increases with λ.

in-group membership (Berger and Heath 2007, 2008). A higher average type denotes membership to a more selective group, where members inherently enjoy exclusivity. A rational justification of this internal utility, an individual may seek to gesture her status to others, ultimately yielding payoffs from social contacts (Pesendorfer 1995, Bagwell and Bernheim 1996).[6]

Accounting for both status and consumption (i.e., intrinsic) benefits, type ν^i acquires total lifetime utility $U(\nu^i, t)$ at the time of purchase. For each period $t \in \{1, 2\}$, $U(\nu^i, t)$ equals

$$U(\nu^i, 1) = \nu^i Q + (1-\delta)\lambda\frac{1+\nu_1}{2} + \delta\lambda\frac{1+\nu_2}{2} - P_1, \quad \text{(1a)}$$

$$U(\nu^i, 2) = \nu^i Q + \lambda\frac{1+\nu_2}{2} - P_2. \quad \text{(1b)}$$

Each consumer is rational and forward looking, timing her purchase to maximize intertemporal utility. Assuming a fully rational consumer population, a consumer purchases in $t = 1$ if early adoption yields utility exceeding both non-consumption and delayed purchase. To determine the optimal period of purchase, consumer ν^i must account for the {buy, no buy} choices of consumers $\nu^j \neq \nu^i$ as well as the pricing decision of the manufacturer. Given that all consumers maximize intertemporal utility, equilibrium behavior in both periods influences the timing decision of each consumer ν^i. With two periods in which to purchase, each consumer faces the following optimization problem:

$$\max_{x_1^i, x_2^i} \left\{ x_1^i[U(\nu^i, 1)] + x_2^i\left[(1-\delta)\lambda\frac{\nu_1}{2} + \delta U(\nu^i, 2)\right] + (1 - x_1^i - x_2^i)\left[(1-\delta)\lambda\frac{\nu_1}{2} + \delta\lambda\frac{\nu_2}{2}\right]\right\} \quad \text{(2a)}$$

$$\text{s.t.} \quad x_1^i + x_2^i \leq 1, \quad \text{(2b)}$$

where x_t^i is an indicator variable that equals 1 if consumer i purchases at time t. Once individual ν^i acquires an item, she does not repurchase at a later date. As before, an individual's status utility depends on the range of consumers that share her choice for each period of time. A person waiting for a lower price initially receives the status utility associated with product rejection; upon purchase, however, she receives a greater benefit in that she assimilates with higher-status early adopters. Given that the distribution of {buy, no buy} decisions affects the benefit to consumption, a nonbuyer experiences relatively higher status utility during the initial period of sales; once additional sales occur, product rejection renders a stronger indictment of being a low type.

4. Analysis

We apply standard techniques to derive consumer and firm strategies using a subgame-perfect Nash equilibrium (SPNE). We first write out consumers' individual rationality (IR) and incentive compatibility (IC) constraints, allowing us to characterize each consumer's purchase decision as follows:[7]

$x_1^i = 1$ if

$$U(\nu^i, 1) \geq (1-\delta)\lambda\frac{\nu_1}{2} + \delta U(\nu^i, 2), \quad \text{(3a)}$$

$$U(\nu^i, 1) \geq (1-\delta)\lambda\frac{\nu_1}{2} + \delta\lambda\frac{\nu_2}{2}; \quad \text{(3b)}$$

$x_2^i = 1$ if

$$x_1^i = 0, \quad \text{(3c)}$$

$$U(\nu^i, 2) \geq \lambda\frac{\nu_2}{2}. \quad \text{(3d)}$$

Each individual's purchase timing decision depends on the product's pricing scheme as well as her WTP. The producer, however, cannot directly observe each consumer's WTP, rendering first-degree price discrimination an infeasible strategy (Besanko and Winston 1990). To exploit heterogeneity in product valuation, the producer instead applies an optimal price skimming sequence $\{P_1^*, P_2^*(P_1^*)\}$ to maximize total profits.

Given the consumer response to the price sequence $\{P_1^*, P_2^*(P_1^*)\}$, we can aggregate purchase decisions across all ν^i to derive demand X_t^D in period t:

$$\text{for } t = 1, \quad X_1^D = \int_0^1 x_1^i \, d\nu^i = 1 - \nu_1; \quad \text{(4a)}$$

$$\text{for } t = 2, \quad X_2^D = \int_0^1 x_2^i \, d\nu^i = \nu_1 - \nu_2. \quad \text{(4b)}$$

Because a price skimming sequence implies that prices decline over time, demand in period $t \in \{1, 2\}$ equals a fraction $\nu_{t-1} - \nu_t$ of total consumers. Thus, we may formalize the producer's profit maximization problem as follows:

$$\max_{P_1} \left\{ \left(P_1 - \frac{k}{2}Q^2\right)(1-\nu_1) + \delta\left[\left(P_2^*(P_1) - \frac{k}{2}Q^2\right)(\nu_1 - \nu_2)\right]\right\} \quad \text{(5a)}$$

[6] Consumers cannot observe others' exact types in this interpretation. To overcome this, each may reveal some information through product consumption. This signaling ability is greatly valued for visible products that confer higher status, given that a larger audience is likely to observe the revealed information. We do not explicitly consider this interpretation henceforth—we abstract away from uncertainty and do not build an explicit signaling model in the spirit of a "dating game."

[7] Derivation of marginal type is contained in Appendix B.

$$\text{s.t. } P_2^*(P_1) = \arg\max_{P_2} \left\{ \left(P_2(P_1) - \frac{k}{2}Q^2 \right)(\nu_1 - \nu_2) \right\}; \quad (5b)$$

$$\forall \nu^i \in [\nu_1, 1], \quad \nu^i \text{ satisfies (3a) and (3b)}; \quad (5c)$$

$$\forall \nu^i \in [\nu_2, \nu_1), \quad \nu^i \text{ satisfies (3c) and (3d)}; \quad (5d)$$

and where $(k/2)Q^2$ denotes the marginal cost to produce an item of quality Q.[8]

Where the price sequence $\{P_1^*, P_2^*(P_1^*)\}$ yields $\pi(P_1^*, P_2^*(P_1^*), \cdot)$, the producer coordinates period t supply X_t^S as the following:

$$X_t^S = \begin{cases} X_t^D & \text{if } \pi(P_1^*, P_2^*(P_1^*), \cdot) \geq 0, \\ 0 & \text{if } \pi(P_1^*, P_2^*(P_1^*), \cdot) < 0. \end{cases} \quad (6a)$$

Unless otherwise noted, we shall assume a priori that $\pi(P_1^*, P_2^*(P_1^*), \cdot) \geq 0$ in subsequent analyses.

We derive the optimal pricing sequence $\{P_1^*, P_2^*(P_1^*)\}$ in an SPNE. First, however, we require a technical result demonstrating that constraint (3b) does not bind in equilibrium.[9] Intuitively, rational consumers expect a decreasing price sequence to transpire over time (Besanko and Winston 1990). Considering that consumers anticipate declining prices, a producer must allow sufficiently positive surplus for all consumers buying in $t = 1$; consumers otherwise postpone purchase until $t = 2$.

Utilizing the result above, we solve for the producer's pricing strategy and establish the range of δ for which two-period sales occur. To determine this range of discount rates, we first note that a standard durable goods model requires that P_1^* exceeds $P_2^*(P_1^*)$. Second-period sales do not happen if this criterion is unmet because forward-looking consumers require some benefit to consumption postponement. Similarly, positive $t = 1$ demand requires a markedly cheaper P_1 than if the monopolist only sells in $t = 2$; the firm, after all, affords consumers a substitute good by selling across two periods. The producer consequently obtains a smaller profit margin under a two-period skimming strategy, relative to exclusively selling in the later period. If δ is close enough to 1, this diminished profit margin does not justify the benefit of immediate sales. Thus, when $\delta > \delta^*$, the producer sets P_1^* so that all consumers forgo purchase until $t = 2$. We note, however, that we restrict our analysis to pure-strategy equilibria; when $\delta > \delta^*$, sales could occur in both periods under a mixed-strategy equilibrium.[10]

For $\delta < \delta^*$, the consumer faces a trade-off in her purchase timing decision. If she buys now, she accrues immediate consumption benefits; if she delays purchase, she enjoys a cheaper retail price to compensate for consumption deferment. Consumers with high WTP, valuing consumption benefits to a greater degree, typically reject price discounts in lieu of immediate consumption.

Impact of Product's Social Benefits on Prices. When δ is relatively low, the producer sells across both time periods with a decreasing price sequence. This pricing strategy segments the market, in that wealthier individuals pay a premium for immediate consumption. They exclusively use the product for a period of time, attaching a degree of prestige to consumption during this time frame. This exclusivity increases in importance with status sensitivity; thus, more affluent types hold more incentive to purchase early, separating themselves from later adopters and non-consumers.

This separation, however, is fleeting; upon a clearance sale, some lower types ultimately utilize the same status symbol. Consumption at this juncture allows the late adopter to segregate herself from non-consumers, reminding these poorest types of their low status. This status benefit, again, rises in importance with λ. Where status considerations more deeply affect purchase timing, consumption provides a greater benefit relative to non-consumption. The clearance buyer receives more incentive to differentiate herself from those unable to purchase, implying that the producer commands a $P_2^*(P_1^*)$ that rises with λ. However, P_1^* increases with λ at an even greater rate than $P_2^*(P_1^*)$ because the early adopter also seeks to initially distinguish herself from those that delay product acquisition. Status sensitivity having a bigger impact on $t = 1$ than on $t = 2$, the ratio of $P_2^*(P_1^*)$ to P_1^* declines as λ grows in magnitude (see Figure 1). Stated differently, when sensitivity to social benefits is higher, the product experiences sharper declines in price. This is formally presented in Proposition 1.

Proposition 1. *Higher status sensitivity yields sharper price depreciation under a two-period skimming sequence.*

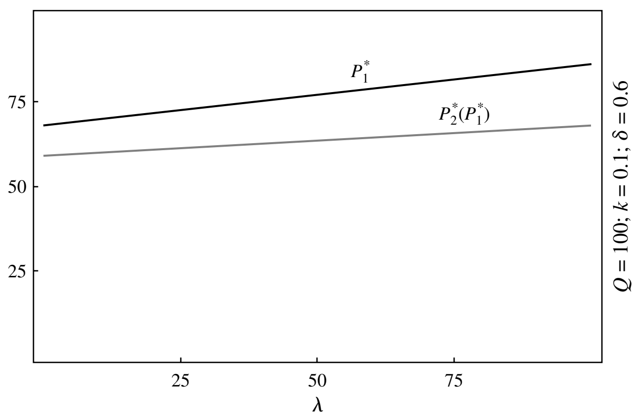
Price depreciation pervasively affects durable goods markets. As identified by Coase (1972), a firm prefers an ex ante price commitment when selling its durable product over time. Consumers, however, will not view any such commitment as credible because the firm has incentive to deviate ex post. Our first finding suggests that the *incidence* of price depreciation occurs for all durables; in the context of conspicuous consumption, however, the *severity* of this depreciation depends on the level of sensitivity to

[8] We shall assume that the producer never obtains full market coverage; $k \in (\max\{(0, (\lambda(3-2\delta) - 2Q(1-\delta))/Q^2(3-2\delta)\}, (2Q+\lambda)/Q^2)$ is a sufficient condition for such an interior solution. Our results are also consistent with other convex cost formulations.

[9] All proofs are contained in the Appendices A and B. This first result appears as Lemma T1 in Appendix B.

[10] Because our substantive insights center around pricing over time, we relegate this technical result as Lemma T2 in Appendix B.

Figure 1 Prices and Status Sensitivity



status utility. Where social effects greatly influence consumption decisions, firms critically need commitment devices that maintain early adopter exclusivity. We later explore product management strategies that achieve this objective in §5.

We note that the a firm may not always require a commitment device in a setting of high status sensitivity. Although our depreciation result holds under different formulations of status utility (see §6), an opposite outcome may occur if, for example, consumers are uncertain about their own preferences. Here, a monopolist may instead use penetration pricing (e.g., see Bergemann and Välimäki 2006) to induce trial and discourage competitive entry.

Role of Quality in Determining Status Utility. Irrespective of any external benefit, an improvement in quality directly boosts intrinsic utility. Ceteris paribus, higher quality increases demand since an expanded range of consumers prefers to purchase. A change in quality does not uniformly affect consumers, however, because wealthier types experience a more substantial shift in intrinsic utility. To exploit the WTP of this subset, the monopolist assesses a more-than-commensurate price increase. The producer effectively forfeits sales to low status individuals, allowing the firm to extract additional surplus from those most willing to acquire.

Higher quality, via equilibrium pricing, indirectly causes a more exclusive segment to purchase the product. Consuming types enjoy this greater exclusivity because product use becomes a marker of substantial wealth. Thus, in the context of conspicuous consumption, an increase in quality yields greater status utility. Furthermore, any quality improvement renders greater influence on status utility when status sensitivity is high. Consumers, in this instance, hold more incentive to separate themselves from those with lower status. This, in effect, produces greater demand and allows the producer extra flexibility in pricing a high-quality product. To sufficiently exploit WTP among high types, the producer may sacrifice a larger share of demand than possible for a product with lower λ. Proposition 2 formally captures this intuition.

Proposition 2. *In equilibrium, product quality increases the status utility of adoption. Furthermore, product quality exerts a greater influence at higher levels of status sensitivity. That is,* $\forall\, t \in \{1, 2\}$, $(\partial/\partial Q)[\lambda((1+\nu_t^*)/2)] > 0$ *and* $(\partial^2/\partial Q \partial\lambda)[\lambda((1+\nu_t^*)/2)] > 0$.

At this stage, it is useful to discuss this result in relation to Proposition 1. An increase in λ diminishes differences in total WTP since all consumers receive the same social benefit. Where consumers are more homogeneous in their overall product evaluation, the producer can pursue a pricing policy that expands demand. The opposite, however, occurs for an increase in quality, where differences in WTP become more pronounced. In this scenario, the producer targets those willing to incur a substantial premium for the item. Through this effect on the distribution of users, higher quality enhances the status associated with the item.[11]

Proposition 2 conveys one of this paper's key messages. Intrinsic quality is seemingly unrelated to status utility since quality does not carry social benefits per se. Higher quality commands higher prices, however, and pricier items entail greater exclusivity; thus, superior quality *indirectly* generates greater status utility. Our rationale provides nuance to the past literature, where elevated prices entirely drive any notion of high status. Furthermore, our logic explains the prevalence of higher intrinsic quality among high-end fashion goods (Dubois et al. 2005, Hines and Bruce 2007). This result also bears relation to the literature on luxury counterfeits (Higgins and Rubin 1986). Luxury brands subtly cue their product's quality, allowing consumers to more easily differentiate authentic luxury products from counterfeit knockoffs (Berger and Ward 2010). To the extent that consumers can identify counterfeit users, luxury brands help maintain the exclusivity associated with their products.[12]

This link between status and product quality depends on two underlying assumptions. First, quality must affect intrinsic consumption utility; second,

[11] Note that for positive levels of λ, this result is quite general and applies for all well-studied cost formulations, including any linear cost formulation. We thank an anonymous reviewer for help in refining this argument.

[12] The findings of Pesendorfer (1995) imply that use of branding and logos primarily determine purchase behavior in conspicuous consumption markets. This, however, is hard to reconcile with the fact that a good Louis Vuitton counterfeit costs about $80, whereas an authentic bag sells for $1,200 at Barney's (Gosline 2010).

the producer must induce exclusivity through its pricing scheme. In the first instance, consumers may sacrifice quality for other product characteristics. Individuals that buy Eileen Fisher's "rugged" fair trade sweaters, for instance, pay a premium for uncomfortable fabrics because they are handwoven in Peruvian communities and do not contain any environmentally harmful chemicals (Lockwood 2012). In the second instance, people may purchase these rugged fair trade sweaters because they derive status from a prosocial reputation (Griskevicius et al. 2010). We address this latter concern by allowing status to be multidimensional in §6. We finally note that Proposition 2 requires an intuitive assumption that marginal production costs increase with quality. Were marginal costs completely independent of product quality, our result might not apply in these scenarios.

5. Product Management Strategies

In the model outlined so far, lower status individuals appropriate the status item in $t = 2$, to the chagrin of those that purchase beforehand. These initial consumers prefer to sustain the social partition provided by an early purchase, as this allows a strong association between status and product use. Accordingly, they will accept higher first-period prices to retain the integrity of their status symbol.

Many firms employ commitment devices to help preserve the prestige associated with early adoption. As an extreme example, high-end label Comme des Garçons allegedly burns or shreds its overstock, thereby preventing its availability at T.J. Maxx and other discount retailers (Seabrook 2012). We, however, shall concentrate on two more common strategies. In the first scenario, the producer may utilize some form of product dating; essentially, the manufacturer markets a single product but facilitates immediate identification of a consumer's time of purchase. Examples include the introduction of "limited editions" (e.g., commemorative stamps and coins), "special editions" (e.g., Subaru Forester 2007 L.L. Bean Edition), "collector's editions" (e.g., collector editions of DVDs, first editions of major novels), and "deluxe editions." As an alternative strategy, the producer may release a new version, presumably of higher quality. Selling this item simultaneously with its price-reduced predecessor, the producer entices early adopters to update their product. Producers execute this strategy for publicly consumed electronic gadgets in particular (e.g., iPhone 5, Sony VAIO Z Series laptop).

In the discussion that follows, we first motivate each strategy before presenting a more formal analysis.

5.1. Product Dating

In this strategy, the seller creates two distinct classes of products through the use of labeling. This strategy enables a consumer to identify each individual's time of purchase, despite the fact that product quality does not vary significantly across users. Higher types that purchase a deluxe edition can maintain a sense of separation even as the producer sells a functionally equivalent item at clearance. In that the firm does not alter its product's quality, this labeling strategy solely upholds early adopter status utility.

Under this labeling strategy, a firm typically sells its deluxe, or special, edition before marketing a regular version at a lower price. The special edition features distinctive attributes not available in the regular version, allowing consumers to differentiate the two different items. In many product categories, the manufacturer produces the special edition in a limited, precommitted quantity. Firms also announce this scarcity, via advertisements and promotions, so that consumers will pay a significant premium. For example, Toyota Motor Corporation produced only 1,500 units of its limited edition Scion 2012 xB Release Series (RS) 9.0; these vehicles came in Hot Lava, a bold color not available through the xB regular edition (Scion.com 2013). Later RS editions came in equally bold, unique colors. Yamaha recently introduced its Elton John Signature Series Red Piano, a 50-unit line of vibrant red pianos that featured the singer's autograph (Balachander and Stock 2009).

Aside from these limited editions, fashion brands have recently marketed "diffusion lines." This strategy, similar in nature to product dating, capitalizes on the strength of the parent brand's high-end image. To harness the parent brand's prestige, the firm offers products similar in construction; the diffusion products, however, differ in labeling and sell at discount (Schiro 1998, Feitelberg 2007). These subbrands, typically sold toward the end of the season, may also differ in color scheme; nonetheless, they employ the same fabric, feel, and overall look as the parent (Passariello 2006). Recent examples of diffusion lines include Armani Exchange by Armani, Marc by Marc Jacobs, Versus by Versace, Miu Miu by Prada, D&G by Dolce & Gabbana, and DKNY by Donna Karan (Schiro 1992, Casciato 2009, Walker 2011, Zargani 2011). These fashion brands additionally utilize so-called exclusives, style modifications unique to a particular retailer. With minor changes (e.g., hemline adjustments), consumers may differentiate versions available to various department stores and fashion boutiques (Holmes 2011).

Regardless of particular dating strategy, the firm must incur up-front costs associated with exclusive logos and ad campaigns. Suppose that for a fixed cost γ, the producer may invest in a technology permitting product dating. Each consumer can thus freely identify any other consumer's purchase date, implying the below optimization problem:

$$\max_{x_1^i, x_2^i} \left\{ x_1^i[U(\nu^i,1)] + x_2^i\left[(1-\delta)\lambda\frac{\nu_1}{2} + \delta U(\nu^i,2)\right] + (1-x_1^i-x_2^i)\left[(1-\delta)\lambda\frac{\nu_1}{2} + \delta\lambda\frac{\nu_2}{2}\right]\right\} \tag{7a}$$

$$\text{s.t.}\quad x_1^i + x_2^i \le 1, \tag{7b}$$

where

$$U(\nu^i,1) = \nu^i Q + \lambda\frac{1+\nu_1}{2} - P_1, \tag{8a}$$

$$U(\nu^i,2) = \nu^i Q + \lambda\frac{\nu_1+\nu_2}{2} - P_2. \tag{8b}$$

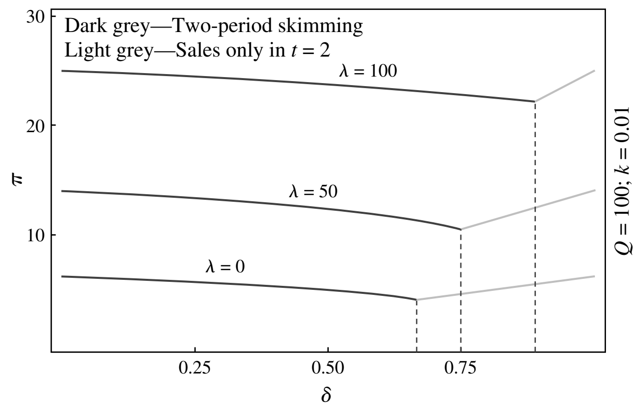
Here, an individual's status utility depends only on the types in her purchase cohort, whereas all product buyers influence the social benefit in the baseline model. Aware that the time of purchase can be determined, consumer i buys in the first period if and only if it is preferable to either delaying or forgoing acquisition. If she does not purchase in the initial period, i acquires the product in $t=2$ iff acquisition yields greater utility than non-consumption. We expound these consumer rationality constraints, as well as the producer optimization problem, in Appendix B.

5.1.1. Analysis. Solving for an SPNE, we require the following two technical results: (1) that the IR constraint does not bind in equilibrium and (2) that the discount factor affects the number of sales periods.[13] Because these results are analogous to their baseline counterparts, we relegate them to Appendix B as Lemma T3a and Lemma T3b, respectively. Unlike the baseline setup, however, this model's primitives influence δ°, the threshold separating single-period sales from two-period skimming. Specifically, early adopters prefer product dating to the baseline scenario, and this preference grows as consumers care more about social effects. Because the producer will partially extract this surplus improvement, λ increases skimming profits at a greater rate than that occurring in the baseline model. Single-period profits do not change, however, since product dating requires multiple periods to be effective. Hence, as λ rises, the producer adheres to a two-period skimming strategy for a larger range of δ (see Figure 2). This result is formalized in Lemma T4 (see Appendix B). It allows us to derive the optimal pricing sequence $\{P_1^\circ, P_2^\circ(P_1^\circ)\}$ and thus determine the range of fixed costs at which a producer invests in product dating.

Effect of Status Sensitivity and Product Quality on Product Dating. With distinctive styling, the limited

[13] Again, we emphasize that we focus on pure-strategy equilibria.

Figure 2 Pricing Schemes and Delta Under Product Dating



edition is clearly differentiated from its cheaper, more widely available counterpart. Each individual can identify those that acquired the limited edition from those that later purchased the regular product. With the former's target segment composed of wealthier types, consumers with a limited edition enjoy a lasting sense of exclusivity and prestige. Product dating bestows a benefit to those with the highest WTP, allowing the seller to extract a substantial premium. Conversely, product dating decreases the WTP of individuals buying in $t=2$ because they no longer attain the status symbol of those buying beforehand. This drop in WTP is relatively small, however, because all product users still prefer to segregate themselves from non-consumers. Under sufficiently low fixed costs, the seller thus attains a net benefit through the use of product dating. This benefit grows particularly large as consumers become more sensitive to others' purchase decisions; in other words, status sensitivity increases the payoff of product dating.

Although sensitivity to status utility strengthens the value of product dating, higher product quality impedes the use of this labeling strategy. An improvement in Q directly enhances intrinsic consumption utility and indirectly boosts status utility, as demonstrated in Proposition 2. However, in that a more exclusive subset consumes a superior item, the marginal benefit to product dating becomes less valuable. That is, a dating technology supplies lower marginal returns as product quality improves. An intrinsic quality improvement, in other words, serves as a *substitute* to product dating for the purpose of providing status utility.

These two effects are formally presented in the following proposition.

Proposition 3. (a) *As status sensitivity increases, a manufacturer is willing to incur greater investment cost toward product dating, and* (b) *as product quality increases, a manufacturer is less willing to incur an investment cost toward product dating.*

This result emerges as a consequence of two model features: (1) the distribution of vertically differentiated consumers and (2) a social benefit dependent on each consumer's vertical type. If consumers only sought to conform, status utility would not depend on the types of those consuming; instead, utility would rise with the number of users ("bandwagon effect"), motivating the producer to forgo product dating in more scenarios. The producer may also decline the use of dating under certain consumer distributions, even where social utility hinges on who consumes. For consumer distributions heavily skewed toward lower types, product dating may reduce the WTP of too many consumers, thereby decreasing overall profits.

5.2. Product Updating

As described before, firms regularly introduce product versions of higher quality than their predecessors. A product upgrade certainly provides higher intrinsic benefits; however, the newer version also allows the consumer to distinguish herself from those using the prior generation. An upgrade thus offers considerable status utility, even in products with substantial intrinsic benefits. For example, consumers often queue up to purchase the newest version of an electronic durable, be it an iPad, iPhone, or Nintendo Wii. Such a product update may entail the use of newer technologies, ingredients, or both.

In the context of fashion apparel, for example, many denim brands have updated their products with the incorporation of Lycra®, popularly known as spandex.[14] This synthetic fiber provides a better stretch to the garment, enhancing overall comfort. Although largely invisible, consumers may indirectly detect its presence through the distinctive shape of the garment. Brands have capitalized on both the intrinsic value and status value of Lycra via cobranding promotions with the spandex manufacturer Invista, as well as prominently displaying its use in product descriptions (Kotler and Pfoertsch 2010).

In the following analysis, we assume that the producer introduces an upgraded version, contingent upon a fixed cost investment in its manufacturing processes. The firm sells this upgrade concurrently with its predecessor in the second period (Levinthal and Purohit 1989). Because these two versions constitute separate products, an individual may determine the specific generation possessed by any given consumer. With two generations ultimately available, five consumption patterns may transpire: (1) buy the first generation in period 1 and update in period 2, (2) purchase the first version in period 1 and do not update, (3) buy the newer generation in period 2, (4) buy the first release in period 2, or (5) do not purchase.[15] Each consumer, under such a scenario, faces the optimization problem:

$$\begin{aligned}\max_{x^i_{1Q},x^i_{2Q},x^i_{2Q_n}} \quad & \Bigg\{x^i_{1Q}x^i_{2Q_n}\bigg[U(\nu^i,1Q)-\delta\bigg(\nu^iQ+\lambda\frac{1+\nu_{1Q}}{2}\bigg) \\ &\qquad +\delta U(\nu^i,2Q_n)\bigg] \\ &+(1-x^i_{1Q})x^i_{2Q_n}\bigg[(1-\delta)\lambda\frac{\nu_{1Q}}{2}+\delta U(\nu^i,2Q_n)\bigg] \\ &+x^i_{2Q}\bigg[(1-\delta)\lambda\frac{\nu_{1Q}}{2}+\delta U(\nu^i,2Q)\bigg] \\ &+(1-x^i_{2Q}-x^i_{2Q_n}) \\ &\cdot\bigg[(1-\delta)\lambda\frac{\nu_{1Q}}{2}+\delta\lambda\frac{\nu_{2Q}}{2}\bigg]\Bigg\} \qquad (9a)\end{aligned}$$

$$\text{s.t.}\quad x^i_{1Q}+x^i_{2Q}\le 1, \qquad (9b)$$

$$\text{s.t.}\quad x^i_{2Q}+x^i_{2Q_n}\le 1, \qquad (9c)$$

where

$$U(\nu^i,1Q)=\nu^iQ+\lambda\frac{1+\nu_{1Q}}{2}-P_{1Q}, \qquad (10a)$$

$$U(\nu^i,2Q)=\nu^iQ+\lambda\frac{\nu_{2Q_n}+\nu_{2Q}}{2}-P_{2Q}, \qquad (10b)$$

$$U(\nu^i,2Q_n)=\nu^iQ_n+\lambda\frac{1+\nu_{2Q_n}}{2}-P_{2Q_n}. \qquad (10c)$$

Here, Q denotes the quality level of the original version, and Q_n represents that of the updated product; and x^i_{tQ} indicates consumer ν^i's decision to purchase product version Q in period t. At most, each individual buys a particular version once; furthermore, no consumer simultaneously purchases both versions of the item.

The purchase decision space differs from that of product dating, in that consumers account for the improvement in intrinsic quality. However, status utility depends only on the types consuming the same version, as occurred in the prior dating scenario. Considering these facts together, we can determine each individual's purchase decision; we formally characterize this in Appendix B.

The producer accounts for this consumer behavior in developing its product update. To upgrade its

[14] Clothing brands have also improved product quality through the use of Supima® cotton, allowing greater comfort. The use of this fabric is noticeably advertised by high-end retailers such as Brooks Brothers and Nordstrom.

[15] Analysis becomes quickly complicated because many parameter regions allow for a variety of consumption patterns. To focus on the issues at hand, we consider an interior solution that guarantees consumption patterns 1, 3, 4, and 5. Numerical analyses of other solutions are available from the authors upon request.

manufacturing process, the firm incurs a fixed cost γ; this investment, in turn, yields a product of quality $Q_n > Q$ at variable production cost $(k/2)Q^2$.[16] Here, the monopolist charges an optimal price skimming sequence $\{P_{1Q}^{\triangle}, P_{2Q}^{\triangle}(P_{1Q}^{\triangle}, P_{2Q_n}^{\triangle}), P_{2Q_n}^{\triangle}(P_{1Q}^{\triangle}, P_{2Q}^{\triangle})\}$ to solve the revised maximization problem:

$$\max_{P_{1Q}} \left\{\left(P_{1Q}-\frac{k}{2}Q^2\right)(1-\nu_{1Q}) + \delta\left[\left(P_{2Q_n}^{\triangle}(P_{1Q}, P_{2Q}^{\triangle})-\frac{k}{2}Q^2\right)(1-\nu_{2Q_n})\right] + \delta\left[\left(P_{2Q}^{\triangle}(P_{1Q}, P_{2Q_n}^{\triangle})-\frac{k}{2}Q^2\right) \cdot (\nu_{2Q_n}-\nu_{2Q})\right]-\gamma\right\} \tag{11a}$$

$$\text{s.t. } \{P_{2Q}^{\triangle}(\cdot), P_{2Q_n}^{\triangle}(\cdot)\} = \underset{P_{2Q}, P_{2Q_n}}{\arg\max}\left\{\left(P_{2Q_n}(\cdot)-\frac{k}{2}Q^2\right)\cdot(1-\nu_{2Q_n}) + \left(P_{2Q}(\cdot)-\frac{k}{2}Q^2\right)(\nu_{2Q_n}-\nu_{2Q})\right\} \tag{11b}$$

$$\forall \nu^i \in [\nu_{1Q}, 1], \quad \nu^i \text{ satisfies (B5a), (B5b), and (B5c);} \tag{11c}$$

$$\forall \nu^i \in [\nu_{2Q_n}, \nu_{1Q}), \quad \nu^i \text{ satisfies (B5d), (B5e), and (B5f);} \tag{11d}$$

$$\forall \nu^i \in [\nu_{2Q}, \nu_{2Q_n}), \quad \nu^i \text{ satisfies (B5g), (B5h), and (B5i).} \tag{11e}$$

Where the price sequence $\{P_{1Q}^{\triangle}, P_{2Q}^{\triangle}(P_{1Q}^{\triangle}, P_{2Q_n}^{\triangle}), P_{2Q_n}^{\triangle}(P_{1Q}^{\triangle}, P_{2Q}^{\triangle})\}$ yields $\pi(P_{1Q}^{\triangle}, P_{2Q}^{\triangle}(\cdot), P_{2Q_n}^{\triangle}(\cdot), \cdot)$, the producer coordinates period t supply X_t^S as follows:

$$X_t^S = X_t^D \quad \text{if } \pi(P_{1Q}^{\triangle}, P_{2Q}^{\triangle}(\cdot), P_{2Q_n}^{\triangle}(\cdot), \cdot) - \gamma \geq \pi(P_1^*, P_2^*(P_1^*), \cdot). \tag{12a}$$

5.2.1. Analysis. Solving for an SPNE, we determine the range of fixed costs at which the firm invests in product updating. We present this optimization solution in Appendix B.

Effect of New Product Quality and Status Sensitivity on Product Updating. Per Proposition 3(b), product dating yields a smaller marginal benefit for superior quality products. The marginal payoff of a product update, however, depends on the intrinsic value of both product generations. When offering a more substantial quality improvement, the producer may attain better market segmentation. After all, a greater quality improvement exacerbates differences in WTP, where the highest types experience the largest increases in WTP. The monopolist can target the update to these highest types, thereby extracting a substantial premium for the newer version. This premium, however, does not decrease total market demand since the firm concurrently offers the older product at a lower price. Accordingly, the profitability of an updating strategy increases as the newer version's quality improves.

Where a firm creates an upgrade of higher quality, early adopters more easily separate themselves from lower types. Creating a sense of exclusivity around the upgrade, an increase in product quality also indirectly boosts WTP via status utility. The indirect impact on status utility, however, is subject to the level of status sensitivity. Where social effects exert greater influence, a consumer possesses more incentive to associate with early adopters. In equilibrium, a wider range of consumer types purchase when status sensitivity is greater; hence, higher λ diminishes the extent to which a quality improvement creates exclusivity. The marginal return on quality improvement thus declines as consumers' sensitivity to social effects increases.

These intuitions are formally captured in the following proposition.

Proposition 4. (a) *A manufacturer is willing to incur greater investment cost for a more substantial quality improvement*, *and* (b) *the marginal benefit of quality improvement decreases with status sensitivity.*

Part (a) of Proposition 4 may seem somewhat obvious, but this result may not apply in certain contexts outside the scope of our paper. A substantial quality improvement will yield marginal returns if consumers minimally value intrinsic quality. Furthermore, for a consumer population that is both sufficiently homogeneous and patient, potential early buyers may simply delay purchase until a newer version is available. If these consumers do not upgrade but rather "leapfrog" to the new version, a substantial investment in quality improvement may not generate adequate profit. Finally, for a quality upgrade to affect status utility, consumers must be able to differentiate the new and prior versions; otherwise, a quality upgrade only affects intrinsic utility and may provide modest returns.[17]

[16] We obtain similar results by modeling quality improvement as a consequence of a marginal cost increase. However, our fixed cost approach is more faithful to Moore's law; furthermore, new product generations require plant and machinery upgrades, particularly in consumer electronics industries. Finally, this formulation provides a ready comparison to our product dating analysis.

[17] Producers do take cognizance of the status-enhancing role of upgrades: for example, newer versions of smartphones do not just carry faster processors, better cameras, or sharper displays but also come in distinctive shapes that allow these to be distinguished from the previous versions.

6. Extensions

Our above work contains two key assumptions. First, we construct an individual's social status as entirely derived by her wealth, ν^i. Second, we allow consumers to differ only in their quality preference, assuming that all similarly value the social benefits associated with product use. We present two extensions in this section, relaxing the first restriction in §6.1 and the latter in §6.2.

6.1. WTP Imperfectly Correlated with Status

Many groups and subcultures wield influence through characteristics besides wealth (Fox 1987). Where these other characteristics determine social status, a producer is less able to induce exclusivity through product consumption. As an extreme example, consider the explosion of grunge music into mainstream America in the early 1990s. Based in the Pacific Northwest, grunge bands typically sported flannel and wool button-downs as a means of "utilitarian necessity" (Steele 2010, p. 380). This look, in turn, suffered appropriation at the whims of fashion designers, culminating in a much-ridiculed Vogue spread of "high-end" grunge looks (Rubin 1995, Gray 1999). This anecdote aside, unorthodox and counterculture tastes have largely blended with the conventional, as evidenced by the emergence of the "bourgeois bohemian" (Brooks 2000, p. 11). Integrating the "artistic rebelliousness of the bohemian beatnik" with the "worldly ambitions" of her "bourgeois corporate forefathers," the bourgeois bohemian seeks upward social mobility without, as Toby Miller, a professor of popular culture at New York University, says, "too obviously looking down on those below" (Wittstock 2000). She furnishes her home with "distressed Third World antiques," particularly those that help "distant cultures" through her consumerism (Wittstock 2000). Her social status depends on attributes such as political awareness; however, she chooses pricier creations to convey these other attributes, implying the coinciding importance of wealth. As a similar example, note the image of Harley-Davidson—an owner requires high WTP to afford an expensive bike but also seeks an association with an "anti-yuppie" attitude (Schouten and McAlexander 1993).

Most commonly, social status depends on WTP in conjunction with other, possibly independent, attributes. Accordingly, we allow status to imperfectly correlate with WTP so as to establish the robustness of our findings. Let $\nu^i \sim \mathrm{U}[0,1]$ denote a vertical differentiation measure that scales quality preference; as a reflection of income, ν^i correlates with individuals i's social status. However, unlike the baseline scenario, status also depends on a second dimension independent of ν^i. We formally denote $z^i \sim \mathrm{U}[0,1]$ such that $z^i \mid \nu^i \sim \mathrm{U}[0,1]\ \forall i$. It is plausible that an individual may exert social influence despite moderate or lower wealth. For instance, a person's expertise in a domain may render her opinions persuasive, or her linguistic cues may convey status (Fiske 2010).

Accounting for this second dimension z^i, let the social status of person i equal $y^i = \alpha\nu^i + (1-\alpha)z^i$; here, $\alpha \in [0,1]$ indicates the correlation of social status and quality preference. Where each individual i must consider $y^j\ \forall j \neq i$, the following set of individuals consume in any $t \in \{1,2\}$:

$$z^i \in \begin{cases} [0,1] & \text{if } \nu^i \in [\nu_t, 1], \\ \varnothing & \text{if } \nu^i \in [0, \nu_t). \end{cases} \tag{13a}$$

Consequently, a late adopter yields lifetime status utility $\lambda\big(\int_{\nu_2}^1\int_0^1(\alpha\nu^i + (1-\alpha)z^i)\,dz^i\,d\nu^i / \int_{\nu_2}^1\int_0^1 dz^i\,d\nu^i\big) = \lambda((1+\alpha\nu_2)/2)$ at the time of purchase. The status benefit for early adopters and nonusers can be similarly derived. We formally determine social utility in Appendix B but discuss key insights below.

As before, the producer develops a decreasing price sequence for segmentation purposes. The efficacy of this strategic tool, however, is lessened as α decreases because the producer cannot employ pricing to segment on dimensions such as consumer expertise. Where the producer is less able to create exclusivity via pricing effects, product consumption weakly correlates with high social status. The consumer does not enjoy a sense of exclusivity in this instance, implying lower status utility. Accordingly, status sensitivity has a smaller marginal effect as α decreases. When $\alpha = 0$, wealth is entirely irrelevant to status, implying that product consumption provides no useful suggestion of social capital. In this scenario, status sensitivity does not factor into a person's purchase decision since individuals attain no social payoff through product use.

Status sensitivity only affects price depreciation to the extent that consumption separates individuals according to social status. That is, as α decreases, status sensitivity produces a smaller effect on price depreciation; when $\alpha = 0$, it has no impact on price depreciation. This insight is formalized below.

Proposition 5. *When WTP weakly influences social status, sensitivity to social effects* (λ) *exerts a weaker effect on price depreciation; when WTP does not influence status,* λ *does not affect depreciation. That is,* $(\partial^2/\partial\lambda\partial a)(P_2^*(P_1^*)/P_1^*) < 0$ *and* $(\partial/\partial\lambda)(P_2^*(P_1^*)/P_1^*)|_{a=0} = 0$.

Propositions 5 provides a robustness check to our results but also highlights that these results require a positive correlation between WTP and status.

6.2. Heterogeneity in WTP for Status Utility

Although the baseline model acknowledges heterogeneity in quality preference, it assumes that every consumer assigns the same value to social benefits. In many contexts, however, we may expect that individuals vary in this regard, implying that some will pay more for status utility. Indeed, this type of heterogeneity manifests through benefit segmentation in conspicuous product categories. The Samsung Galaxy S3 may lack Apple's highly identifiable branding, but its lighter weight and faster network speed have earned Samsung significant market share (Jaroslovsky 2012). Apple retains a devoted consumer base, nevertheless, in part because of its designs of attractive, recognizable items (Saba 2012). Although Apple provides relatively high-quality products, we also note starker examples in which some consumers prioritize social benefits. For instance, "purse parties" allow women to examine and purchase cheap counterfeits of luxury brands such as Prada and Gucci (Gosline 2010).

To reflect that consumers do not equally regard status, we present an extension where status sensitivity is allowed to vary across individuals. This creates a joint distribution between status sensitivity and WTP for quality, allowing us to generalize our model. We introduce w^i, a scaling factor that determines i's WTP for a product's social benefit. A second-period buyer derives lifetime status utility $w^i\,\lambda(\int_0^1\int_0^1(x_1^i+x_2^i)\,dw^i\,d\nu^i/\int_0^1\int_0^1 dw^i\,d\nu^i)$ at the time of purchase, where $x_t^i=1$ if i buys in period t. The status benefit for early buyers and nonusers can be similarly derived, and both are formally presented in Appendix B.

Individual i still optimizes her intertemporal utility according to the timing decisions of all other consumers. Every individual's choice, however, is now contingent on her value of w^i, implying that the relationship between ν^i and w^i affects demand. This relationship can materialize as one of many possible joint distributions. For computational ease, however, we assume that $w^i=\frac{1}{2}+\beta(\nu^i-\frac{1}{2})$, where $\beta\in[-1,1]$; ν^i is still uniformly distributed across a unit interval, $w^i\sim \mathrm{U}[\frac{1}{2}-\frac{1}{2}|\beta|,\frac{1}{2}+\frac{1}{2}|\beta|]$.

We note that under this assumption, $\mathrm{Corr}(\nu^i,w^i)=\int_0^1\beta(\nu^i-\frac{1}{2})^2\,d\nu^i/\big(\sqrt{\int_0^1(\nu^i-\frac{1}{2})^2\,d\nu^i}\sqrt{\int_0^1\beta^2(\nu^i-\frac{1}{2})^2\,d\nu^i}\big)=\beta/\sqrt{\beta^2}$. Thus, when β is strictly greater (less) than 0, a perfect positive (inverse) relationship exists between ν^i and w^i. The set of buyers each period hence remains one-dimensional, allowing a tractable formulation of status utility. That said, $\mathrm{Cov}(\nu^i,w^i)=\int_0^1\beta(\nu^i-\frac{1}{2})^2\,d\nu^i=\beta/12$, indicating that β affects the degree to which ν^i and w^i differ in absolute terms. This implies that a change in β affects the degree to which WTP varies across the population, meaning that β determines which individuals buy each period and whether Proposition 1 holds.

To illustrate how β affects the relationship between ν^i and w^i, consider two extreme examples. First, $w^i\to\nu^i$ as $\beta\to 1$, meaning that those with higher social rank (i.e., high ν^i) care more about social considerations (i.e., high w^i). Although fairly plausible, this scenario exacerbates differences in WTP across consumers. We thus expect that price depreciation increases with status sensitivity when $\beta\to 1$, much like our baseline model. At the opposite extreme, $w^i\to 1-\nu^i$ when $\beta\to -1$. This might occur if a high type (i.e., high ν^i) weakly desires to flaunt said social position, whereas an individual with poorer status (i.e., low ν^i) feels pressured to acquire status items. A negative β provides us with a conservative test of our result since it lessens (increases) the total WTP of individuals with high (low) values of ν^i.

Whenever $2Q>\lambda>0$, $(\partial/\partial\lambda)(P_2^*(P_1^*)/P_1^*)<0$ $\forall\,\beta\in(-1,1]$ and $(\partial/\partial\lambda)(P_2^*(P_1^*)/P_1^*)|_{\beta=-1}=0$ (see Appendix B for formal exposition). Although Proposition 1 does not hold when $\beta=-1$, this is the most conservative test where both $\nu^i\sim\mathrm{U}[0,1]$ and $w^i\sim\mathrm{U}[0,1]$. The ratio $(P_2^*(P_1^*))/P_1^*$ should decrease with λ anytime that $\mathrm{Corr}(\nu^i,w^i)\in(-1,1)$, since early adopters will skew more toward higher types than when $\beta=\mathrm{Corr}(\nu^i,w^i)=-1$. For sufficiently negative β and $\lambda>2Q$, however, a higher ν^i may not always imply an earlier purchase date. Our result may become invalid under such circumstances.[18]

7. Concluding Remarks

In this paper, we explore marketplace outcomes in conspicuous product categories, employing a consumer preference model that acknowledges the extant literature. Conspicuousness requires a degree of exclusivity in that the product user desires consumption unattainable for those with less status. To recognize this role of product exclusivity, we allow each individual's purchase timing preferences to depend on the product adoption decisions of all other consumers. The consuming item provides exclusivity to the extent that only high status individuals acquire. This benefit of exclusivity increases in importance where individuals particularly care about social payoffs; accordingly, we permit consumers' status sensitivity to figure into a prospective buyer's decision-making process.

[18] Analysis quickly becomes intractable whenever the set of buyers becomes two-dimensional, even if ν^i and w^i are independent. In an online appendix, available at http://dx.doi.org/10.1287/mksc.2013.0797, we examine a scenario in which $\{\nu^i,w^i\}\in\{\{\underline{\nu},\bar{\nu}\}\times\{\underline{w},\bar{w}\}\}$, leading to four distinct consumer segments. Cumbersome analyses yield a picture in which different parameter combinations produce different results. In particular, there could exist some cases in which the severity of price depreciation is lessened by an increase in visibility. This suggests that certain consumer distributions may generate different insights. We, however, leave this for future research because our study provides a first step in this area.

Allowing exclusivity to emerge as a consequence of both product quality and status sensitivity, we achieve an endogenous determination of early adopters and market followers. In essence, our model captures in-group formation, in that each consumer's purchase timing decision hinges on the choices of all other individuals. This allows us to show that high intrinsic quality indirectly causes exclusivity by way of pricing effects. This indirect effect becomes important when consumers highly value social effects, particularly in that it causes rapid price depreciation.

In addition, we considered two product management strategies that allow early adopters to maintain exclusivity and its associated status benefits. The first method, product dating, sustains separation of types through minor style modifications, such as those employed through the use of fashion diffusion lines. Product updating, on the other hand, entails a functional improvement in product quality, indirectly affecting social benefits. Because these two strategies differ in nature, they encompass distinctive costs and yield unequal returns in revenue. Hence, we expect each to be more appropriate under certain conditions. Although an explicit analysis is beyond the scope of our paper, Propositions 3 and 4 help explicate this issue. We predict product dating to generate superior returns wherever consumption is more social and/or intrinsic quality is relatively unimportant. Conversely, when intrinsic benefits more heavily influence purchase timing, we anticipate product updating to be optimal. This pattern may help explain (1) the emphasis on designers, label, and logos in the apparel industry and (2) the greater focus on engineering, technology, and product development in automobiles and electronic gadgets.

From a public policy perspective, our model allows us to calculate both consumer welfare and the effect of product management strategies on welfare. Such analyses can help clarify public policy concerns surrounding conspicuous consumption (Charles et al. 2009). Our calculations determine that greater status sensitivity typically implies higher overall welfare but that product management strategies may potentially harm consumers.[19]

In the present article, we have considered a monopoly to illustrate the combined effect of consumption utility and status utility; however, conspicuous product markets are, in many cases, characterized by differentiated competition. Future research may accordingly consider multiple sellers, determining how competition has an impact on status utility and, ultimately, market pricing outcomes. A future model can also account for marketing variables beyond price and product quality; for instance, where branding influences status sensitivity, our model may help compare the return on investment of branding to that of product development. Finally, future studies may consider alternative formulations of status utility and empirically test each formulation. For example, an alternative specification can allow positive (negative) social utility when above (below)-average individuals consume a product. Such a formulation can also incorporate different sensitivity parameters, depending on whether the product induces a gain or loss relative to expectations.[20]

Supplemental Material

Supplemental material to this paper is available at http://dx.doi.org/10.1287/mksc.2013.0797.

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Appendix A

Proof of Proposition 1. For $\{P_1^* = (2(1-\delta)(2Q+\lambda) + (2-\delta)kQ^2)/(2(4-3\delta)),\ P_2^*(P_1) = (2P_1 + kQ^2)/4\}$, the partial derivative $(\partial/\partial\lambda)(P_2^*(P_1^*)/P_1^*)$ demonstrates this result: $(\partial/\partial\lambda)(P_2^*(P_1^*)/P_1^*) < 0\ \forall Q > 0,\ \lambda > 0,\ \delta \in (0, \delta^*),\ k \in (\max\{0, (\lambda(3-2\delta) - 2Q(1-\delta))/(Q^2(3-2\delta))\}, (2Q+\lambda)/Q^2)$.

Proof of Proposition 2. To determine that $(\partial/\partial Q) \cdot [\lambda((1+\nu_t^*)/2)] > 0$, we utilize the envelope theorem.

First consider the scenario of a clearance buyer at $t = 2$:

$$\frac{\partial}{\partial Q}\left[\lambda\frac{1+\nu_2^*}{2}\right] = \frac{\lambda}{2}\frac{\partial}{\partial Q}[\nu_2^*] = \frac{\lambda}{2}\left[\frac{\partial \nu_2}{\partial Q}\bigg|_{P_2 = P_2^*(P_1^*)} + \frac{\partial \nu_2}{\partial P_2}\frac{\partial P_2^*(P_1^*)}{\partial Q}\right].$$

Here,

$$\frac{\partial \nu_2}{\partial P_2} > 0, \quad \frac{\partial P_2^*(P_1^*)}{\partial Q} > 0, \quad \text{and}$$

$$\left|\frac{\partial \nu_2}{\partial P_2}\frac{\partial P_2^*(P_1^*)}{\partial Q}\right| > \left|\frac{\partial \nu_2}{\partial Q}\bigg|_{P_2 = P_2^*(P_1^*)}\right| \quad \forall Q > 0,\ \lambda > 0,\ \delta \in (0, \delta^*),$$

$$k \in \left(\max\left\{0, \frac{\lambda(3-2\delta) - 2Q(1-\delta)}{Q^2(3-2\delta)}\right\}, \frac{2Q+\lambda}{Q^2}\right).$$

The status utility of an early buyer may be verified in the same manner. To demonstrate that $(\partial^2/\partial Q\partial\lambda)[\lambda((1+\nu_t^*)/2)] > 0$, application of the envelope theorem reveals

[19] These results are not central to our paper and thus do not appear in a formal analysis; however, the results are available from the authors upon request.

[20] We thank an anonymous reviewer for this suggestion. Note that in our context of vertically differentiated markets, this formulation does not affect our results.

that $(\partial^2/\partial Q\partial\lambda)[(1+\nu_t^*)/2] = (\partial^2/\partial Q\partial\lambda)[\nu_t^*] > 0\ \forall Q > 0$, $\lambda > 0$, $\delta \in (0,\delta^*)$, $k \in (\max\{0, (\lambda(3-2\delta)-2Q(1-\delta))/(Q^2(3-2\delta))\}, (2Q+\lambda)/Q^2)$. By the chain rule, it follows that $(\partial^2/\partial Q\partial\lambda)[\lambda((1+\nu_t^*)/2)] > 0$.

Proof of Proposition 3(a). $(\partial/\partial\lambda)[\pi(P_1^\circ, P_2^\circ(P_1^\circ),\cdot) - \pi(P_1^*, P_2^*(P_1^*),\cdot)] \geq 0\ \forall Q>0$, $\lambda \in (0,2Q)$, $\delta \in (0,\delta^*)$, $k \in (\max\{0, ((\lambda(3-2\delta)-2Q(1-\delta))/(Q^2(3-2\delta)))\}, (2Q+\lambda)/Q^2)$ by application of the envelope theorem and chain rule.

Here,

$$\left\{P_1^\circ = \frac{Q^2(8(1-\delta)(2Q+\lambda) - \delta k\lambda(4Q-\lambda) + 4(2-\delta)kQ^2)}{8(4-3\delta)Q^2 - 2\delta\lambda(4Q-\lambda)},\right.$$

$$\left. P_2^\circ(P_1) = \frac{(2P_1-\lambda)(2Q+\lambda)+2kQ^3}{8Q}\right\},$$

and $Q>0$, $\lambda \in (0,2Q)$, $\delta \in (0,\delta^*)$, $k \in (\max\{0, ((\lambda(3-2\delta) - 2Q(1-\delta))/Q^2(3-2\delta))\}, (2Q+\lambda)/Q^2)$ comprise the set of parameters in which the producer sells for two periods under both the baseline model and product dating.

Proof of Proposition 3(b). Same as Proposition 3(a).

Proof of Proposition 4(a). Where

$$\delta^\triangle = \begin{cases} \dfrac{2}{3} \quad \text{if } Q_n > Q > 0, \lambda \in \left(0, \dfrac{8}{5}Q\right], \\[2ex] \dfrac{3(4Q+\lambda) - \sqrt{16Q^2+8Q\lambda+9\lambda^2}}{4(2Q+\lambda)} \\[2ex] \qquad \text{if } Q_n > Q > 0, \lambda \in \left(\dfrac{8}{5}Q, 2Q\right), \end{cases}$$

then $(\partial/\partial Q_n)[\pi(P_{1Q}^\triangle, P_{2Q}^\triangle(P_{1Q}^\triangle, P_{2Q_n}^\triangle), P_{2Q_n}^\triangle(P_{1Q}^\triangle, P_{2Q}^\triangle),\cdot) - \pi(P_1^*, P_2^*(P_1^*),\cdot)] \geq 0\ \forall Q_n > Q > 0$, $\lambda \in (0,2Q)$, $\delta \in (0,\delta^\triangle)$, $k \in (\max\{(\lambda(1-\delta))/Q^2, (\lambda(3-2\delta)-2Q(1-\delta))/Q^2(3-2\delta)\}, \min\{\lambda/Q^2, ((2Q+\lambda)(1-\delta))/Q^2\})$ by application of the envelope theorem and chain rule.

Here, $\{P_{1Q}^\triangle = ((1-\delta)(2Q+\lambda)+kQ^2)/4, P_{2Q}^\triangle(\cdot) = (2Q+kQ^2)/4, P_{2Q_n}^\triangle(\cdot) = (2Q(2Q_n+\lambda)+\lambda^2+(2Q-\lambda)\cdot kQ^2)/(8Q)\}$, and $Q_n > Q > 0$, $\lambda \in (0,2Q)$, $\delta \in (0,\delta^\triangle)$, $k \in (\max\{(\lambda(1-\delta))/Q^2, (\lambda(3-2\delta)-2Q(1-\delta))/(Q^2(3-2\delta))\}, \min\{\lambda/Q^2, ((2Q+\lambda)(1-\delta))/Q^2\})$ comprise the set of parameters for which two periods sales transpire under both the baseline model and product updating.

Proof of Proposition 4(b). Same as Proposition 4(a).

Proof of Proposition 5. Proof follows the same procedure as in Proposition 1.

Appendix B

Calculation of Marginal Types

The maximum of ν_1' and ν_1'' is the lowest

$$\nu^i \text{ s.t. } \nu^i Q + (1-\delta)\lambda\frac{1+\nu_1}{2} + \delta\lambda\frac{1+\nu_2}{2} - P_1 \geq (1-\delta)\lambda\frac{\nu_1}{2} + \delta\left(\nu^i Q + \lambda\frac{1+\nu_2}{2} - P_2\right) \quad \text{and}$$

$$\nu^i \text{ s.t. } \nu^i Q + \lambda\frac{1+\nu_1}{2} - P_1 \geq \lambda\frac{\nu_1}{2}.$$

However, this value of ν^i can mathematically exceed 1 for certain pricing sequences $\{P_1, P_2\}$; in this scenario, no one buys in the first period, indicating that $\nu_1 = 1$.

The marginal consumer in period 1 is thus determined as follows:

$$\nu_1:\quad \exists!\nu_1' \text{ s.t. } \nu_1'Q + (1-\delta)\lambda\frac{1+\nu_1'}{2} - P_1 = (1-\delta)\lambda\frac{\nu_1'}{2} + \delta(\nu_1'Q - P_2) \quad \text{and}$$

$$\exists!\nu_1'' \text{ s.t. } \nu_1''Q + \lambda\frac{1+\nu_1''}{2} - P_1 = \lambda\frac{\nu_1''}{2},$$

$$\nu_1 = \min\{1, \max\{\nu_1', \nu_1''\}\}.$$

If the pricing sequence $\{P_1, P_2\}$ is s.t. $\nu_1'' > \nu_1'$, then constraint (3b) binds. When this occurs, any purchase in period 2 returns insufficient utility $\forall \nu^i < \nu_1$; consequently, no purchases occur in period 2, implying that $\nu_2 = \nu_1$.

The marginal consumer in period 2 is similarly calculated:

$$\nu_2:\quad \exists!\nu_2' \text{ s.t. } \nu_2'Q + \lambda\frac{1+\nu_2'}{2} - P_2 = \lambda\frac{\nu_2'}{2} \quad \text{and}$$

$$\nu_2 = \min\{\nu_1, \nu_2'\}.$$

Lemma T1. *In an SPNE, constraint* (3*b*) *cannot bind in determining* P_1^*.

Proof. Suppose not. Algebraic manipulation demonstrates that $\nu_1' = (2(P_1 - \delta P_2) - \lambda(1-\delta))/(2Q(1-\delta))$ and $\nu_1'' = (2P_1-\lambda)/(2Q)$. Hence, an assumption that (3b) binds requires $1 \geq \nu_1 = \nu_1'' = (2P_1-\lambda)/(2Q) \geq (2(P_1-\delta P_2) - \lambda(1-\delta))/(2Q(1-\delta))$; the second inequality implies that $P_2 \geq P_1$.

For $t=2$, similar deduction simplifies to $\nu_2 = \min\{\nu_1, (2P_2-\lambda)/(2Q)\} = \nu_1$ since $P_2 \geq P_1$; if P_2 exceeds or equals P_1, no purchases occur in the second period.

Thus, if consumers expect the monopolist to commit to a pricing sequence where $P_2 \geq P_1$, consumers $\nu^i \in [(2P_1-\lambda)/(2Q), 1]$ buy in the first period and $\nu^i \in [0, (2P_1-\lambda)/(2Q))$ do not intend to purchase. The monopolist, however, may profitably deviate if $\exists P_2$ s.t. $(P_2 - (k/2)Q^2)((2P_1-\lambda)/(2Q) - \nu_2) \geq 0$. Second-period sales require that $\nu_2 = \min\{\nu_1, \nu_2'\} < \nu_1$, or, rather, $\nu_2' = (2P_2-\lambda)/(2Q) < \nu_1$; the final inequality reduces to $P_2 < P_1$. Hence, $\forall P_2 \in ((k/2)Q^2, P_1)$, the monopolist earns positive profits in the terminal period.

Contradiction: The durable goods monopolist cannot credibly commit to a pricing sequence $\{P_1, P_2\}$ s.t. $P_2 \geq P_1$; at $t=2$, the monopolist will always decrease P_2 so that positive profits are generated in the terminal period.

Lemma T2. *If δ is sufficiently close to 1, P_1^* sits prohibitively high relative to $P_2^*(P_1^*)$. Under such a pricing scheme, purchases occur only in $t=2$; otherwise, sales occur across both periods via a two-period skimming strategy. Furthermore, there exists a unique δ^* that delineates the optimality of both pricing strategies.*

Proof. Given that (3a) binds in equilibrium, we need not consider price sequences $\{P_1, P_2\}$ such that the monopolist earns zero profits at $t=2$. In determining the SPNE pricing strategy, we shall only examine the two remaining pricing policies.

Case 1. Positive profits in both $t=1$ and $t=2$.

Here, P_1^1 and P_2^1 denote the most profitable $t=1$ and $t=2$ prices in a two-period skimming strategy. In $t=1$, consumers enjoy the option of delaying purchase, mitigating the monopolist's pricing power. However, in $t=2$, consumers no longer benefit from any alternative purchase occasion; accordingly, the producer sets $P_2^1(P_1)=(2P_1+kQ^2)/4$ to maximize profits among all remaining consumers. Furthermore, for a two-period skimming strategy, the producer maximizes overall profits when $P_1^1=(2(1-\delta)(2Q+\lambda)+(2-\delta)kQ^2)/(2(4-3\delta))$.

Case 2. Positive profits only in $t=2$.

P_1^2 and P_2^2 signify the most profitable $t=1$ and $t=2$ prices under Case 2. Given that sales only occur in $t=2$, the producer charges $P_2^2(P_1^2)=(2Q+\lambda+kQ^2)/4$, the single-period profit maximizing price. So that $\nu_1=1$, P_1^2 must remain sufficiently high; specifically, $P_1^2\geq((2-\delta)(2Q+\lambda)+\delta kQ^2)/4$.

Abbreviating $\pi(P_1^S,P_2^S(P_1^S),\cdot)$ as π^S, we note that $\lim_{\delta\to0^+}[\pi^1-\pi^2]>0$ and $\lim_{\delta\to1^-}[\pi^1-\pi^2]<0$. Via the envelope theorem and chain rule,

$$\begin{aligned}\frac{\partial}{\partial\delta}[\pi^1-\pi^2]&=\frac{\partial P_1^1}{\partial\delta}X_1^{D_1}+\Big(P_1^1-\frac{k}{2}Q^2\Big)\frac{\partial X_1^{D_1}}{\partial\delta}+\frac{\partial P_2^1(P_1^1)}{\partial\delta}X_2^{D_1}\\&\quad+\Big(P_2^1(P_1^1)-\frac{k}{2}Q^2\Big)\frac{\partial X_2^{D_1}}{\partial\delta}-\frac{\partial P_2^2(P_1^2)}{\partial\delta}X_2^{D_2}\\&\quad-\Big(P_2^2(P_1^2)-\frac{k}{2}Q^2\Big)\frac{\partial X_2^{D_2}}{\partial\delta}.\end{aligned}$$

Here, $X_1^{D_S}$ and $X_2^{D_S}$ indicate period $t=1$ and $t=2$ demand corresponding to P_1^S and $P_2^S(P_1^S)$.

We show that $\forall\,\delta\in(0,1)$, $[\pi^1-\pi^2]$ only changes direction once. Specifically, $(\partial/\partial\delta)[\pi^1-\pi^2]>0\ \forall\,\delta\in(0,\delta')$ and $(\partial/\partial\delta)[\pi^1-\pi^2]<0\ \forall\,\delta\in(\delta',1)$. Considering that $[\pi^1-\pi^2]\,|_{\delta=\delta'}>0$, we utilize the intermediate value theorem to show $\exists!\delta^*\in(\delta',1)$ s.t. $\pi(P_1^1,P_2^1(P_1^1),\cdot)=\pi(P_1^2,P_2^2(P_1^2),\cdot)$. Here, $\delta^*=\frac{2}{3}$. Thus, $\forall\,\delta\in(0,\delta^*)$, $\{P_1^*=P_1^1,P_2^*(P_1)=P_2^1(P_1)\}$, and $\forall\,\delta\in(\delta^*,1)$, $\{P_1^*=P_1^2,P_2^*(P_1)=P_2^2(P_1)\}$.

Product Dating: Consumer Purchase Timing and Producer Optimization

Each consumer's purchase decision is characterized as follows:

$x_1^i=1$ if

$$U(\nu^i,1)\geq(1-\delta)\lambda\frac{\nu_1}{2}+\delta U(\nu^i,2),\tag{B1a}$$

$$U(\nu^i,1)\geq(1-\delta)\lambda\frac{\nu_1}{2}+\delta\lambda\frac{\nu_2}{2};\tag{B1b}$$

$x_2^i=1$ if

$$x_1^i=0,\tag{B1c}$$

$$U(\nu^i,2)\geq\lambda\frac{\nu_2}{2};\tag{B1d}$$

where

$$U(\nu^i,1)=\nu^iQ+\lambda\frac{1+\nu_1}{2}-P_1,\tag{B2a}$$

$$U(\nu^i,2)=\nu^iQ+\lambda\frac{\nu_1+\nu_2}{2}-P_2.\tag{B2b}$$

The producer charges an optimal price skimming sequence $\{P_1^\circ,P_2^\circ(P_1^\circ)\}$ to solve the revised maximization problem:

$$\max_{P_1}\ \Big\{\Big(P_1-\frac{k}{2}Q^2\Big)(1-\nu_1)+\delta\Big[\Big(P_2^*(P_1)-\frac{k}{2}Q^2\Big)(\nu_1-\nu_2)\Big]-\gamma\Big\}\tag{B3a}$$

$$\text{s.t.}\quad P_2^*(P_1)=\arg\max_{P_2}\Big\{\Big(P_2(P_1)-\frac{k}{2}Q^2\Big)(\nu_1-\nu_2)\Big\}\tag{B3b}$$

$$\forall\,\nu^i\in[\nu_1,1],\quad \nu^i\text{ satisfies (B1a) and (B1b);}\tag{B3c}$$

$$\forall\,\nu^i\in[\nu_2,\nu_1),\quad \nu^i\text{ satisfies (B1c) and (B1d).}\tag{B3d}$$

Where the price sequence $\{P_1^\circ,P_2^\circ(P_1^\circ)\}$ yields $\pi(P_1^\circ,P_2^\circ(P_1^\circ),\cdot)$, the producer coordinates period t supply X_t^S as the following:

$$X_t^S=X_t^D\quad\text{if } \pi(P_1^\circ,P_2^\circ(P_1^\circ),\cdot)-\gamma\geq\pi(P_1^*,P_2^*(P_1^*),\cdot).\tag{B4a}$$

Lemma T3a. *In an SPNE, constraint* (B1*b*) *cannot bind in determining* P_1°.

Proof. Same as Lemma T1. Let $\nu_1'=(2(P_1-\delta P_2)-\lambda(1-\delta\nu_2))/(2Q(1-\delta))$, $\nu_1''=(2P_1-\lambda)/2Q$, and $\nu_2'=(2P_2-\lambda\nu_1)/2Q$.

Lemma T3b. *If* δ *is sufficiently close to* 1, P_1° *sits prohibitively high relative to* $P_2^\circ(P_1^\circ)$. *Under such a pricing scheme, purchases occur only in* $t=2$; *otherwise, sales occur across both periods via a two-period skimming strategy. Furthermore, there exists a unique* δ° *that delineates the optimality of both pricing strategies; specifically,*

$$\delta^\circ=\begin{cases}\dfrac{8Q^2(8Q^2-\lambda^2)-16\sqrt{4Q^8-4Q^7\lambda+Q^5\lambda^3}}{(2Q+\lambda)^2(12Q^2-8Q\lambda+\lambda^2)} & \text{if } Q>0,\ \lambda\in(0,Q],\\[2ex] \dfrac{8Q^2}{8Q^2+2Q\lambda-\lambda^2} & \text{if } Q>0,\ \lambda\in(Q,2Q).\end{cases}$$

Proof. Same as Lemma T2. Let $P_1^1=(Q^2(8(1-\delta)(2Q+\lambda)-\delta k\lambda(4Q-\lambda)+4(2-\delta)kQ^2))/(8(4-3\delta)Q^2-2\delta\lambda(4Q-\lambda))$, $P_2^1(P_1)=((2P_1-\lambda)(2Q+\lambda)+2kQ^3)/8Q$, $P_1^2\geq((2-\delta)(2Q+\lambda)+\delta kQ^2)/4$, and $P_2^2(P_1^2)=(2Q+\lambda+kQ^2)/4$.

Lemma T4. *When retailing a more status-sensitive item under product dating, the producer implements a two-period skimming strategy for a wider range of consumer patience levels; that is,* $\partial\delta^\circ/\partial\lambda>0$.

Proof. The derivative of δ°, as contained in Lemma T3b, yields this result. Further note that $\delta^\circ=\delta^*$ for $\lambda=0$, and $\delta^\circ>\delta^*\ \forall\,Q>0$, $\lambda\in(0,2Q)$, $k\in(\max\{0,(\lambda(3-2\delta)-2Q(1-\delta))/(Q^2(3-2\delta))\},(2Q+\lambda)/Q^2)$.

Product Updating: Consumer Purchase Timing

We may characterize each individual's purchase decision as follows:

$\{x_{1Q}^i=1,x_{2Q_n}^i=1\}$ if

$$U(\nu^i,1Q)-\delta\Big(\nu^iQ+\lambda\frac{1+\nu_{1Q}}{2}\Big)\geq(1-\delta)\lambda\frac{\nu_{1Q}}{2},\tag{B5a}$$

$$U(\nu^i, 1Q) - \delta\left(\nu^i Q + \lambda \frac{1+\nu_{1Q}}{2}\right) + \delta U(\nu^i, 2Q_n) \geq (1-\delta)\lambda\frac{\nu_{1Q}}{2} + \delta U(\nu^i, 2Q), \quad \text{(B5b)}$$

$$U(\nu^i, 1Q) - \delta\left(\nu^i Q + \lambda \frac{1+\nu_{1Q}}{2}\right) + \delta U(\nu^i, 2Q_n) \geq (1-\delta)\lambda\frac{\nu_{1Q}}{2} + \delta\lambda\frac{\nu_{2Q}}{2}; \quad \text{(B5c)}$$

$\{x^i_{1Q} = 0, x^i_{2Q_n} = 1\}$ if

$$U(\nu^i, 1Q) - \delta\left(\nu^i Q + \lambda \frac{1+\nu_{1Q}}{2}\right) < (1-\delta)\lambda\frac{\nu_{1Q}}{2}, \quad \text{(B5d)}$$

$$U(\nu^i, 2Q_n) \geq U(\nu^i, 2Q), \quad \text{(B5e)}$$

$$U(\nu^i, 2Q_n) \geq \delta\lambda\frac{\nu_{2Q}}{2}; \quad \text{(B5f)}$$

$\{x^i_{1Q} = 0, x^i_{2Q} = 1\}$ if

$$U(\nu^i, 1Q) - \delta\left(\nu^i Q + \lambda \frac{1+\nu_{1Q}}{2}\right) < (1-\delta)\lambda\frac{\nu_{1Q}}{2}, \quad \text{(B5g)}$$

$$x^i_{2Q_n} = 0, \quad \text{(B5h)}$$

$$U(\nu^i, 2Q) \geq \delta\lambda\frac{\nu_{2Q}}{2}, \quad \text{(B5i)}$$

where

$$U(\nu^i, 1Q) = \nu^i Q + \lambda\frac{1+\nu_{1Q}}{2} - P_{1Q}, \quad \text{(B6a)}$$

$$U(\nu^i, 2Q) = \nu^i Q + \lambda\frac{\nu_{2Q_n} + \nu_{2Q}}{2} - P_{2Q}, \quad \text{(B6b)}$$

$$U(\nu^i, 2Q_n) = \nu^i Q_n + \lambda\frac{1+\nu_{2Q_n}}{2} - P_{2Q_n}. \quad \text{(B6c)}$$

Calculation of Status Utility (§6.1)

Suppose an individual's social status equals $y^i = \alpha\nu^i + (1-\alpha)z^i$, where $\nu^i Q$ is the intrinsic utility obtained by consuming an item of quality Q and z^i is independent of individual i's quality preference; i.e., $z^i \sim \mathrm{U}[0,1]$ and $z^i \mid \nu^i \sim \mathrm{U}[0,1]\ \forall i$.

As in the baseline model, each individual equally determines the status utility enjoyed by her consumption cohort. Thus, without loss of generality, we can express status utility as follows:

For those consuming in period 2,

$$\lambda\frac{\int_0^1\int_{f_2(\nu^i)}^1 (\alpha\nu^i + (1-\alpha)z^i)\,dz^i\,d\nu^i}{\int_0^1\int_{f_2(\nu^i)}^1 dz^i\,d\nu^i};$$

For those not consuming in period 2,

$$\lambda\frac{\int_0^1\int_0^{f_2(\nu^i)} (\alpha\nu^i + (1-\alpha)z^i)\,dz^i\,d\nu^i}{\int_0^1\int_0^{f_2(\nu^i)} dz^i\,d\nu^i};$$

where f_2: $[0,1] \to [0,1]$.

Suppose there exists an interval of consumer types $(\underline{\nu}, \bar{\nu})$ s.t. $f_2(\nu^i) \in (0,1)\ \forall \nu^i \in (\underline{\nu}, \bar{\nu})$. This implies that for a given $\nu^i \in (\underline{\nu}, \bar{\nu})$, $z^i \geq f_2(\nu^i)$ consume in period 2 and $z^i < f_2(\nu^i)$ do not utilize the item. Since an individual characterized by $\{\nu^i, z^i < f_2(\nu^i)\}$ receives the same intrinsic utility as $\{\nu^i, z^i \geq f_2(\nu^i)\}$, product rejection implies that the item does not provide $\{\nu^i, z^i < f_2(\nu^i)\}$ sufficient status utility.

However, we note that a single individual's decision to consume does not affect status utility because both ν^i and z^i have zero measure. Given that $\{\nu^i, z^i \geq f_2(\nu^i)\}$ and $\{\nu^i, z^i < f_2(\nu^i)\}$ cannot affect status utility by deviating, all individuals characterized by ν^i face the same preference constraints. Consequently, $f_2(\nu^i) \notin (0,1)\ \forall \nu^i$.

Thus, for period 2, $\exists\, \nu_2$ s.t. $f_2(\nu^i) = 0\ \forall \nu^i \geq \nu_2$ and $f_2(\nu^i) = 1\ \forall \nu^i < \nu_2$. That is, status utility from consumption equals

$$\lambda\frac{\int_{\nu_2}^1\int_0^1 (\alpha\nu^i + (1-\alpha)z^i)\,dz^i\,d\nu^i}{\int_{\nu_2}^1\int_0^1 dz^i\,d\nu^i} = \lambda\frac{1+\alpha\nu_2}{2},$$

and for nonusers,

$$\lambda\frac{\int_0^{\nu_2}\int_0^1 (\alpha\nu^i + (1-\alpha)z^i)\,dz^i\,d\nu^i}{\int_0^{\nu_2}\int_0^1 dz^i\,d\nu^i} = \lambda\frac{1-\alpha+\alpha\nu_2}{2}.$$

Where

$$U(\nu^i, 1) = \nu^i Q + (1-\delta)\lambda\frac{1+\alpha\nu_1}{2} + \delta\lambda\frac{1+\alpha\nu_2}{2} - P_1, \quad \text{(B7a)}$$

$$U(\nu^i, 2) = \nu^i Q + \lambda\frac{1+\alpha\nu_2}{2} - P_2, \quad \text{(B7b)}$$

$x^i_1 = 1$ if

$$U(\nu^i, 1) \geq (1-\delta)\lambda\frac{1-\alpha+\alpha\nu_1}{2} + \delta U(\nu^i, 2), \quad \text{(B8a)}$$

$$U(\nu^i, 1) \geq (1-\delta)\lambda\frac{1-\alpha+\alpha\nu_1}{2} + \delta\lambda\frac{1-\alpha+\alpha\nu_2}{2}; \quad \text{(B8b)}$$

$x^i_2 = 1$ if

$$x^i_1 = 0, \quad \text{(B8c)}$$

$$U(\nu^i, 2) \geq \lambda\frac{1-\alpha+\alpha\nu_2}{2}. \quad \text{(B8d)}$$

Note that when $\alpha = 0$, social status is independent of quality preference. In this scenario, consumption and nonconsumption provide the same status utility, implying a standard durable goods problem:

$x^i_1 = 1$ if

$$\nu^i Q - P_1 \geq \delta(\nu^i Q - P_2), \quad \text{(B9a)}$$

$$\nu^i Q - P_1 \geq 0; \quad \text{(B9b)}$$

$x^i_2 = 1$ if

$$x^i_1 = 0, \quad \text{(B9c)}$$

$$\nu^i Q - P_2 \geq 0. \quad \text{(B9d)}$$

Calculation of §6.2 Status Utility

For each period $t \in \{1, 2\}$, $U(\nu^i, w^i, t)$ equals

$$U(\nu^i, w^i, 1) = \nu^i Q + (1-\delta)w^i\lambda\frac{\int_0^1\int_0^1 x^i_1\,dw^i\,d\nu^i}{\int_0^1\int_0^1 dw^i\,d\nu^i} + \delta w^i\lambda\frac{\int_0^1\int_0^1 (x^i_1 + x^i_2)\,dw^i\,d\nu^i}{\int_0^1\int_0^1 dw^i\,d\nu^i} - P_1, \quad \text{(B10a)}$$

$$U(\nu^i, w^i, 2) = \nu^i Q + w^i\lambda\frac{\int_0^1\int_0^1 (x^i_1 + x^i_2)\,dw^i\,d\nu^i}{\int_0^1\int_0^1 dw^i\,d\nu^i} - P_2. \quad \text{(B10b)}$$

Each purchase decision arises as follows:
$x_1^i = 1$ if

$$U(\nu^i, w^i, 1) \geq (1-\delta w^i)\frac{\int_0^1\int_0^1(1-x_1^i)\,dw^i\,d\nu^i}{\int_0^1\int_0^1 dw^i\,d\nu^i} + \delta U(\nu^i, w^i, 2), \tag{B11a}$$

$$U(\nu^i, w^i, 2) \geq (1-\delta w^i)\frac{\int_0^1\int_0^1(1-x_1^i)\,dw^i\,d\nu^i}{\int_0^1\int_0^1 dw^i\,d\nu^i} + \delta w^i\frac{\int_0^1\int_0^1(1-x_1^i-x_2^i)\,dw^i\,d\nu^i}{\int_0^1\int_0^1 dw^i\,d\nu^i}; \tag{B11b}$$

$x_2^i = 1$ if

$$x_1^i = 0, \tag{B11c}$$

$$U(\nu^i, w^i, 2) \geq w^i\frac{\int_0^1\int_0^1(1-x_1^i-x_2^i)\,dw^i\,d\nu^i}{\int_0^1\int_0^1 dw^i\,d\nu^i}. \tag{B11d}$$

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