JEANINE MIKLÓS-THAL and JUANJUAN ZHANG*

Savvy consumers attribute a product's market performance to its intrinsic quality as well as the seller's marketing push. The authors study how sellers should optimize their marketing decisions in response. They find that a seller can benefit from "demarketing" its product, meaning visibly toning down its marketing efforts. Demarketing lowers expected sales *ex ante* but improves product quality image *ex post*, as consumers attribute good sales to superior quality and lackluster sales to insufficient marketing. The authors derive conditions under which demarketing can be a recommendable business strategy. A series of experiments confirm these predictions.

Keywords: demarketing, observational learning, quality inference, new product adoption, analytical modeling

(De)marketing to Manage Consumer Quality Inferences

Good marketing contributes to product success. However, the very effectiveness of marketing can be a concern to companies if consumers attribute product success to marketing rather than to product quality. It is common to hear comments such as "the restaurant is popular because of its convenient location" and "the product sold well because it was heavily promoted." A Google search of the phrase "it's just marketing" yields more than one million hits, many of which associate the efficacy of marketing with a product's lack of substance.

Consumers' ability to draw savvy attributions has been documented in academic research. For example, Tucker and Zhang (2011) find that consumers are more likely to visit popular vendors, especially those at inconvenient locations. This happens as consumers attribute vendor popularity to location versus quality; in their perception, a popular yet faraway vendor's quality must be excellent to overcome its locational inconvenience. Zhang and Liu (2012) show evidence of attribution in microloan markets, in which people borrow and lend money on an open platform. Lenders prefer borrowers who are already well funded, especially those with obvious shortcomings such as poor credit grades. This is because lenders attribute the unexpected funding success of disadvantaged borrowers to their creditworthiness that is privately observed by other lenders.

How, then, should the supply side respond to consumer attribution? Should vendors settle for inconvenient locations? Should lenders work to lower their credit grades? Counterintuitive as it sounds, there are observations of decision makers who voluntarily choose adverse conditions to manage how they are perceived by others. For example, Katok and Siemsen (2011) find that agents in laboratory experiments choose more difficult tasks so that they appear capable. The psychology literature also documents widespread "self-handicapping" behaviors, such as abusing alcohol and setting unrealistic goals, which allow people to take

*Jeanine Miklós-Thal is Assistant Professor of Economics and Marketing, Simon Graduate School of Business, University of Rochester (e-mail: jeanine.miklos-thal@simon.rochester.edu). Juanjuan Zhang is Associate Professor of Marketing, MIT Sloan School of Management, Massachusetts Institute of Technology (e-mail: jjzhang@mit.edu). The authors thank the three anonymous *JMR* reviewers for their excellent suggestions. The authors also gratefully acknowledge helpful comments from Joshua Ackerman, Anne Coughlan, Laurence Debo, Renée Gosline, Liang Guo, Ernan Haruvy, Teck Ho, Dan Horsky, Dongling Huang, Ganesh Iyer, Dmitri Kuksov, Nanda Kumar, John Little, Ting Liu, Sanjog Misra, Marco Ottaviani, Michael Raith, Greg Shaffer, Duncan Simester, K. Sudhir, Nader Tavassoli, Glen Urban, J. Miguel Villas-Boas, Weng Xi, Jinhong Xie, and Kaifu Zhang; from seminar participants at California Institute of Technology, Dartmouth College, Massachusetts Institute of Technology, Stanford University, University of British Columbia, University of California Berkeley, University of California San Diego, University of Florida, University of Michigan, University of Pennsylvania, University of Toronto, University of Wisconsin–Madison, Washington University in St. Louis, and Yale University; and from attendees of the 2010 BBCRST Marketing Conference, 2010 International Industrial Organization Conference, 2010 Marketing Science Conference, 2010 MIT Applied Economic Theory Summer Camp, 2010 UTD-Frontiers of Research in Marketing Conference, 2011 Marking Science Institute Young Scholars Program, 2011 MIT Micro @ Sloan Conference, 2011 Summer Institute in Competitive Strategy, and 2012 Workshop on the Economics of Advertising and Marketing. Ron Shachar served as associate editor for this article.

ISSN: 0022-2437 (print), 1547-7193 (electronic)

Journal of Marketing Research
Vol. L (February 2013), 55–69

credit for success and find excuses for failure (e.g., Jones and Berglas 1978; Kolditz and Arkin 1982; Smith, Snyder, and Perkins 1983). However, it is theoretically unclear whether it is an *ex ante* optimal strategy to seek adversity. In the language of Harbaugh (2011, p. 16), "self-handicapping makes losing more frequent even as it makes losing less painful, so it is unclear why people should prefer to self-handicap."

The objective of this article is to formally analyze how companies should optimize their marketing efforts when consumers actively attribute a product's performance in the marketplace to product quality as well as marketing. We are particularly interested in whether, and under which conditions, a company finds it optimal *ex ante* to adopt a "demarketing" strategy. We define demarketing as pursuing a marketing activity even though another marketing activity that could have improved the product's market performance is available to the company. Demarketing is thus relative; it does not require companies to actively turn away customers. Demarketing can take many forms, such as choosing inconvenient locations, omitting useful product features, offering limited services, understocking inventory, reducing advertising intensity, and launching a product during the off-season.

We analyze the effect of demarketing in the context of new product introduction using a two-period model. A monopolist seller privately knows the quality of its product, which can be either high or low. A buyer's willingness to pay depends on his or her perception of the product's quality. For concreteness, suppose the seller can choose between two levels of marketing efforts, marketing and demarketing, whereby higher marketing efforts increase the expected share of buyers who consider the product. To rule out a simple cost explanation of demarketing, we assume that higher marketing efforts do not impose additional costs.

In the first period, the seller publicly sets the level of marketing efforts and an introductory price. Each first-period consumer (referred to as "early consumer" hereinafter) who considers the product conducts a private inspection, which imperfectly reveals product quality, and then decides whether to buy. In the second period, first-period sales volume becomes publicly observed. The seller then sets the price for a new generation of "late consumers," who decide whether to buy on the basis of their observation of first-period marketing efforts, first-period sales, and their own inspection outcomes. Late consumers do not observe whether an early consumer considered the product because product consideration, unlike product purchase, is typically a private process (Van den Bulte and Lilien 2004).

Demarketing improves quality image *ex post* in the following way. Suppose that an early consumer chose not to buy the product. Late consumers can have two interpretations. It could be that this early consumer simply did not consider the product due to insufficient marketing or that he or she considered the product but detected a flaw during inspection. The second interpretation hurts the seller's quality image, and demarketing works to shift attention away from it. The downside of demarketing, as we discussed previously, is that it reduces expected sales in the first period.

We find that demarketing can emerge as the *ex ante* optimal strategy under the following conditions. First, the relative mass of late consumers is sufficiently large. Intuitively, demarketing builds a long-term quality image at the cost of current sales and is thus worthwhile only when the future market is sufficiently important. Second, buyers' prior quality perception is neither too pessimistic nor too optimistic. If buyers are very pessimistic, the seller in period 1 should try to achieve stellar sales—sales volumes unattainable by a low-quality seller—to prove its high quality to late consumers. If buyers are very optimistic, there is little room for improvement in quality perception and thus little return to demarketing. The seller's imperative, then, is to serve as many buyers as possible. In both cases, the seller should market intensively in period 1.

A series of human subject experiments confirm the main predictions of the model. Buyers' quality beliefs decrease with marketing efforts for a given sales volume. Sellers are more likely to choose demarketing when consumers are uncertain about product quality and when the market is fast growing. In addition, sellers are less likely to choose demarketing when consumers cannot observe either past sales or past marketing efforts. Finally, enhancing the salience of buyer quality inference increases the choice incidence of demarketing, which suggests that consumers do consider demarketing with quality image management in mind.

We extend the model to explore how sellers should adjust their (de)marketing decisions in a rich set of market situations. We find that the demarketing incentive decreases if marketing improves buyers' prior quality beliefs, can be nonmonotonic over time if there are more than two periods, and is invariant to heterogeneous buyer willingness to pay for quality. Counterintuitively, sellers may be more likely to choose demarketing if marketing accelerates buyer arrival or if consumers are able to directly communicate with their predecessors. Moreover, when sellers are uncertain about their own quality, we uncover a separating equilibrium in which a seller with greater confidence in its quality chooses demarketing to establish a strong quality image, whereas an unconfident seller pursues marketing to grow short-term demand.

New normative insights emerge as we reconsider familiar marketing problems from the demarketing perspective. For example, contrary to recommendations from the advertising scheduling literature, a firm may benefit from conservative advertising during the early phase of its product life cycle. In case of slow takeoff, consumers can attribute it to insufficient advertising instead of inadequate product quality. Similarly, targeting the market with the best taste match does not always help a firm, because lukewarm response in a supposedly friendly market is a particularly worrisome sign of product quality.

In the following sections, we review the literature, introduce the setup of the main model, present the analysis and results, and report empirical validation of the model's key predictions. We then extend the main model to accommodate a set of market features and conclude with a discussion of suggestions for further research. Proofs and other technical details are relegated to the Web Appendix (www.marketingpower.com/jmr_webappendix).

RELATION TO PREVIOUS RESEARCH

Demarketing

The demarketing phenomenon first attracted the attention of academic researchers in the 1970s. Kotler and Levy (1971) outline several possible reasons that firms would

demarket their products. "General demarketing" aims to shed excess demand, "selective demarketing" helps a seller drop undesirable market segments, and "ostensible demarketing" creates a perception of limited supply to actually attract customers. Consistent with the notion of ostensible demarketing, Cialdini (1985) suggests that humans have a psychological tendency to desire things that are less available, Amaldoss and Jain (2005) show that limited availability satisfies consumers' need for uniqueness, and Stock and Balachander (2005) demonstrate that scarcity can signal high quality.[1] Gerstner, Hess, and Chu (1993) propose the concept of "differentiating demarketing," whereby a firm introduces a nuisance attribute to differentiate from competition if consumers have heterogeneous tolerance for this nuisance attribute.

We study a different market force. First, in our model, the seller suppresses marketing today to grow demand tomorrow, rather than to lower demand generally in response to capacity constraints. Second, the purpose of demarketing is not to abandon any unprofitable market segment but rather to build a high-quality image in the late consumer segment. Indeed, we find that the larger this segment, the more likely the seller will pursue demarketing. Third, unlike ostensible demarketing, which actually attracts consumers, demarketing in our framework discourages demand (in the short run) by lowering the expected number of consumers who consider the product. Last, we consider a monopolistic seller that is under no competitive pressure to differentiate. By making these assumptions, we focus on the role of demarketing in managing buyers' attribution process.

In another related study, Zhao (2000) shows that a high-quality, high-cost firm spends less on awareness advertising than a low-quality, low-cost firm (for a generalized model, see also Bagwell and Overgaard 2005). By lowering awareness and reducing market coverage, the high-type firm discourages mimicry from its low-quality, low-cost counterpart who prefers to stay in the volume business. In our model, by contrast, the key intuition behind demarketing is present even in pooling equilibria. Anticipating the mimicry from its low-quality counterpart, a high-quality seller may still choose demarketing to improve its expected profit.

Finally, expectations management may be another reason that firms want to tone down their marketing efforts (e.g., Ho and Zheng 2004; Joshi and Musalem 2011; Kopalle and Lehmann 2006). For example, Kopalle and Lehmann (2006) show that companies deliberately understate quality because customers derive satisfaction from being pleasantly surprised, which in turn drives repeat purchase. In general, expectations management emphasizes buyers' comparison between expectations and experience, highlights the intrapersonal aspect of consumer decision making, and is more relevant for experience goods, for which satisfied customers take further actions such as buying again or referring the product to others. In comparison, our theory focuses on buyers' attribution of sales outcome to various causes, emphasizes the interpersonal aspect of decision making, and is relevant even in a search goods category and even if buyers exit the market right after purchase without making product recommendations (for a discussion of experience goods versus search goods, see Nelson 1970).

Observational Learning

The way buyers infer product quality from product sales is related to the observational learning literature. "Observational learning" means learning the fundamental value of an object (e.g., quality) by observing other decision makers' actions (e.g., purchase decisions), which reflect their private information about the object. Banerjee (1992) and Bikhchandani, Hirshleifer, and Welch (1992) prove that the mere observation of peer decisions may lead to uniform choices within a society. A few studies expand this literature by exploring supply-side pricing strategies given buyer observational learning. For example, Caminal and Vives (1996) examine a duopoly market in which buyers infer product quality from market share and sellers secretly cut price to compete for market share. Taylor (1999) derives optimal real estate pricing strategies when a house's long time on the market raises doubts over its quality. Bose et al. (2006) study the long-term dynamic pricing decisions of a monopolistic seller that does not know the quality of its product.[2]

Our article extends the observational learning literature in the following ways. We consider a monopolistic seller that privately knows its quality as in Taylor (1999), but we do not confine ourselves to products that only serve one buyer and thus can only generate negative observational learning (e.g., houses). Furthermore, our analysis goes beyond pricing and explores a broadly defined set of marketing efforts.[3] Last, we allow buyers to fully observe prices and marketing efforts, which distinguishes our model from the signal-jamming mechanism that underlies Caminal and Vives (1996). In signal-jamming models (see also Fudenberg and Tirole 1986; Holmström 1999; Iyer and Kuksov 2010; Kuksov and Xie 2010), the seller takes a hidden action to influence an observable outcome. In our model, the seller takes conspicuous actions (pricing and marketing effort choices) to influence how buyers interpret an observed outcome.

MODEL SETUP

Market Environment

We consider a monopolistic seller of a product. The seller privately observes its product quality q, which could be either high (H) or low (L). The marginal cost of production is the same for both seller types, which is realistic when quality-related investments are sunk, and can be normalized to zero (for the same assumption and a detailed discussion, see Stock and Balachander 2005).

Buyers fall into two segments: early consumers and late consumers. Segmentation is determined by exogenous factors such as the time a buyer arrives on the market. (We examine endogenous segmentation in the "Extensions" sec-

[1] In a related study, Berger and Le Mens (2009) find that first names that enjoy fast initial adoption are less likely to persist because people perceive fads negatively.

[2] Empirical evidence of observational learning has been documented in a variety of contexts, such as restaurant ordering (Cai, Chen, and Fang 2009), transplant kidney adoption (Zhang 2010), product purchase on the Internet (Chen, Wang, and Xie 2011), and lending in microloan markets (Zhang and Liu 2012).

[3] In a related study, Gill and Sgroi (2012) show that choosing a tough prelaunch product reviewer can be optimal for a seller of a new product of unknown quality.

tion.) There is a continuum of early consumers whose measure is normalized to 1 and a continuum of late consumers of mass $\delta > 0$.[4] Buyers have unit demands for the product but cannot observe product quality. We make the normalization assumption that a buyer who believes that the product is good with probability $\mu \in [0, 1]$ is willing to pay μ for the product. Buyers share the common prior belief that product quality is high with probability $\mu_0 \in (0, 1)$. The seller knows the value of μ_0.[5]

We analyze the market dynamics with a two-period model. Figure 1 presents the timing of the game. At the beginning of the first period, the seller sets the level of marketing efforts a and an introductory price p_1 that target early consumers. Both decisions are publicly observed. For concreteness, we consider two levels of marketing efforts, $\overline{a} > \underline{a}$, where $\underline{a}$ corresponds to demarketing. To identify the strategic forces—rather than mere cost concerns—that lead to demarketing, we deliberately assume that the cost of marketing is the same for both marketing levels, and we normalize it to zero (for another study that shares the same assumption, see Gerstner, Hess, and Chu 1993).[6]

Research on new product adoption often distinguishes two stages that lead to final product choice: the consideration stage and the evaluation stage, with marketing efforts typically affecting consideration (Hauser and Wernerfelt 1990; Urban, Hauser, and Roberts 1990; Van den Bulte and Lilien 2004; Villas-Boas 1993). For concreteness, we focus on marketing efforts that raise buyer interest and increase the expected number of consumers who consider the product. Examples of marketing efforts that build consideration include convenient locations that reduce buyers' transportation costs, devices that lower buyers' search costs, information campaigns that introduce product features, and advertising that spurs interest among otherwise passive buyers. Nevertheless, the key intuition behind demarketing applies to other types of demand-enhancing marketing efforts (see the Web Appendix at www.marketingpower.com/jmr_webappendix).

Let x denote the share of early consumers who consider buying the product, also referred to as "buyer interest." The actual level of interest that marketing efforts generate is often influenced by random factors (Mahajan, Muller, and Kerin 1984; Urban, Hauser, and Roberts 1990). To capture this randomness, we assume that given any level of marketing efforts a, buyer interest x follows a conditional probability distribution function $f(x|a)$, where $x \in [\underline{x}, \overline{x}]$ and $0 \le \underline{x} < \overline{x} \le 1$. We further assume that $f(x|a)$ satisfies the strict monotone likelihood ratio property (MLRP) in a (Milgrom 1981). Strict MLRP requires that for any two buyer interest levels, the relative chance of achieving the higher interest level strictly increases with marketing efforts. Formally, for any $x > x'$, where $x, x' \in [\underline{x}, \overline{x}]$, and any $a > a'$,

$$\frac{f(x \mid a)}{f(x' \mid a)} > \frac{f(x \mid a')}{f(x' \mid a')}. \tag{1}$$

A frequently used assumption in mechanism design theories, the MLRP implies that marketing efforts increase expected buyer interest in the sense of first-order stochastic dominance.

We can consider the product a search good that consumers can inspect and evaluate before purchase. After marketing efforts have spurred interest in the product, every consumer who considers the product conducts a private inspection. Let the quality signal s represent the inspection outcome. The value of the quality signal can be either good (G) or bad (B). We assume that quality signals are identically and independently distributed across consumers conditional on the true quality level:

$$\begin{aligned} &\Pr(s = G \mid q = H) = 1, \\ &\Pr(s = G \mid q = L) = b \in (0, 1). \end{aligned} \tag{2}$$

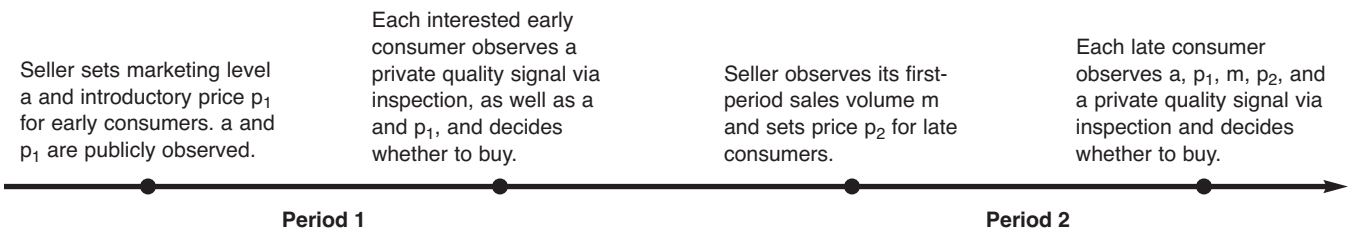
One interpretation of the preceding distribution is that consumers inspect a product for defects. While a truly high-

[4]For brevity, we interpret δ as the relative mass of late consumers. However, δ also captures the seller's degree of patience for future payoffs. Adding a temporal discounting parameter increases the notational burden in this context without bringing new insights.

[5]We assume a common prior belief to identify how consumers' private information and observations of market outcomes endogenously lead to heterogeneous posterior beliefs. For example, this assumption could hold in new product markets in which buyers share a similar lack of preexisting knowledge about the product. Prior beliefs may be category specific. For example, in a category dominated by technological inventions from established brands, consumers are likely to hold optimistic prior beliefs.

[6]There are situations in which this assumption holds. For example, a marketing manager can have a predetermined advertising budget whereby any unspent resources do not carry over; a merchant can choose whether to list its phone number on its website, an action that is readily implementable; and a movie studio can decide whether to make an optimistic or pessimistic box office forecast, neither of which is obviously more costly than the other (Goldstein 2009). In a broader context, a company can choose between two marketing plans that are close in budget yet different in efficacy—the cost-effectiveness of marketing campaigns does vary in reality.

Figure 1
TIMING OF THE GAME



quality product should be defect free, a low-quality product may still survive scrutiny with probability b.[7] In this sense, inspection is imperfect: If inspection perfectly reveals quality (b = 0), there is no need for late consumers to engage in observational learning. Each interested early consumer observes his or her own inspection outcome s, and all interested early consumers simultaneously decide whether to buy at price p_1.[8]

In the second period, the seller observes the volume of sales it has achieved among early consumers, denoted by m, and sets the price p_2 for late consumers. All late consumers observe a, m, p_1, and p_2. However, late consumers do not observe x, the precise number of early consumers who considered the product. This is because product consideration is not an overt buyer behavior, unlike product adoption, which tends to leave a paper trail (Van den Bulte and Lilien 2004). Similarly, late consumers do not directly access the inspection outcomes of early consumers. As a result, late consumers can have two interpretations of why some early consumers did not buy: It could be that early consumers did not consider the product due to insufficient marketing or considered it but were discouraged by unfavorable inspection outcomes. As we demonstrate subsequently, this ambiguity in interpretation allows marketing efforts to affect late consumers' attribution process.

In principle, the seller should also determine the level of marketing efforts in the second period. However, because there is no need to influence quality beliefs beyond late consumers in a two-period model, the seller would always want to maximize costless marketing efforts in period 2. To simplify presentation, we therefore assume that all late consumers consider the product. Correspondingly, unless otherwise indicated, by "marketing efforts" we specifically refer to those that target early consumers.[9]

Finally, late consumers also inspect the product before deciding whether to buy at price p_2. (If first-period market outcome fully reveals quality, it is irrelevant whether late consumers inspect the product, because inspection does not provide additional information about quality.) A late consumer's inspection outcome again follows the distribution specified in Equation 2. Table 1 summarizes the key notations.

Equilibrium Concept

We derive the perfect Bayesian equilibria (PBE) of this multiperiod game of incomplete information. There are two important observations. First, a seller that is identified as being low quality ($\mu = 0$) earns zero profit. Second, marketing efforts and production are costless. Therefore, a low-quality seller always weakly prefers to mimic a high-quality seller (but not vice versa) by choosing the same marketing efforts and charging the same price. The only separating PBEs in this setting are degenerate equilibria in which a high-quality seller earns zero profit by charging a prohibitively high price or offering the product for free, so that the low-quality seller has no incentives for mimicry.

There are multiple pooling PBEs, in which high- and low-quality sellers make the same decisions. In particular, any decisions can be sustained as a pooling equilibrium if buyers attribute any deviation from the equilibrium decisions to a low-quality seller. We approach the equilibrium selection issue by focusing on the equilibria in which the high-quality seller chooses optimal decisions. This enables us to derive a unique pooling PBE outcome by solving the high-quality seller's profit maximization problem. Because the low-quality seller wants to mimic the high-quality seller but not the reverse, this equilibrium refinement, which allows the high-quality seller to follow its sequentially optimal course of action, is intuitively appealing. This equilib-

[7]In an earlier version of this article, we allow a high-quality product to generate a good signal with probability less than 1 but greater than b. This specification complicates exposition but leads to the same key results. The analysis is available upon request.

[8]We make the conservative assumption that early consumers who do not consider the product exit the market at the end of the first period. Alternatively, if these early consumers remain in the market as potential buyers in the second period, the high-quality seller could have even stronger incentives to pursue demarketing because demarketing improves the quality beliefs of a larger segment of late consumers. In the "Extensions" section, we formally model the endogenous segmentation of buyers across the two periods.

[9]The implicit assumption is that marketing efforts are adjustable over time. Some marketing decisions (e.g., store location choices) might be more difficult to change in a timely fashion. We analyze this issue in the Web Appendix (www.marketingpower.com/jmr_webappendix). The key intuition of demarketing continues to hold, although the parameter range for demarketing to be optimal is smaller when the level of marketing is fixed than when it is adjustable.

Table 1
SUMMARY OF KEY NOTATIONS

Notation	*Definition*
a	Level of marketing efforts, $a \in \{\underline{a}, \overline{a}\}$
b	Probability that inspection generates a good signal when product quality is low
δ	Relative mass of late consumers
f(x|a)	Probability distribution function of buyer interest x conditional on marketing efforts a
m	Share of early consumers who buy the product
μ_t	Buyer's belief (i.e., perceived probability) in period t that quality is good, where $t \in \{0, 1, 2\}$ and μ_0 is the prior belief
p_t	Price in period t, $t \in \{1, 2\}$
q	Product quality, which can be either high (H) or low (L)
r	Precision of seller's private quality signal, $r \in (1/2, 1)$
s	Private quality signal a consumers receives through inspection, which can be either good (G) or bad (B); private signals are i.i.d. across consumers given quality
θ	Conditional probability of achieving full buyer interest in the example of Equation 11
x	Share of early consumers interested in the product, $x \in [\underline{x}, \overline{x}]$

rium outcome coincides with the unique strongly undefeated PBE outcome (for a development of this equilibrium concept, which is a variant of the undefeated PBE of Mailath, Okuno-Fujiwara, and Postlewaite 1993, see Mezzetti and Tsoulouhas 2000; for an application, see Gill and Sgroi 2012).

A few remarks on our assumption about the cost of marketing efforts are in order. We deliberately assume that (incremental) marketing is costless. Whenever pooling on demarketing is an equilibrium outcome for costless marketing, it remains an equilibrium outcome if marketing is costly. Moreover, as the cost of marketing increases, we obtain a (weakly) larger range of parameters in which the demarketing pooling equilibrium is the most profitable of all pooling equilibria for the high-quality seller. These forces are in favor of demarketing emerging in equilibrium. However, for sufficiently high marketing costs, there may also exist separating equilibria in which marketing effort signals high quality to buyers. While undoubtedly important, this quality signaling role of marketing has been analyzed extensively elsewhere in the literature and is therefore not the focus of this study.[10] We focus instead on the following question: How can a high-quality seller choose the right level of marketing to communicate its quality to consumers when this choice itself can be freely mimicked by a low-quality seller? To answer this question, we turn to the analysis of the model in the next section.

ANALYSIS

Evolution of Buyer Beliefs

Buyers' beliefs about product quality evolve as new information arrives. An interested early consumer's information set includes the observation of seller strategies (marketing efforts and prices) and his or her private inspection outcome. However, in a pooling equilibrium in which high-quality and low-quality sellers choose the same strategies, the exact strategy does not affect early consumers' quality beliefs. Therefore, an early consumer can only update his or her quality belief through inspection. This consumer's posterior quality belief follows from Bayes' rule:

$$\mu_1(s) = \begin{cases} \dfrac{\mu_0}{\mu_0 + b(1-\mu_0)} & \text{if } s = G, \\ 0 & \text{if } s = B. \end{cases} \tag{3}$$

Because inspection is imperfect, although a defect reveals low quality, the failure to detect a flaw only partially indicates high quality, so that $\mu_0 < \mu_1(G) < 1$.

An interested early consumer's willingness to pay can be either $\mu_1(G)$ or $\mu_1(B) = 0$, depending on his or her inspection outcome. Therefore, the most profitable introductory price for a high-quality seller is as follows:

$$p_1^* = \mu_1(G). \tag{4}$$

The low-quality seller will charge this same price in equilibrium. In practice, the seller can set the price one cent below p_1^* to ensure purchase. At this introductory price, only interested early consumers who observe a favorable inspection outcome will buy. As a result, first-period sales contain useful information about product quality for late consumers.

Specifically, recall that a fraction x of early consumers are interested in the product. By the law of large numbers, the measure of early consumers who receive a good inspection outcome and purchase the product is x if quality is high, and bx if quality is low. Because x itself varies stochastically between $\underline{x}$ and $\overline{x}$, the highest possible level of first-period sales for a low-quality product is $b\overline{x}$, and the lowest possible level of first-period sales for a high-quality product is $\underline{x}$. If $b\overline{x} < \underline{x}$, any level of first-period sales perfectly indicates quality. For the remainder of the article, we focus on the more interesting case in which

$$\underline{x} \le b\overline{x}. \tag{5}$$

Under this assumption, there are three ranges of first-period sales: "stellar" sales ($m > b\overline{x}$) perfectly reveal high quality to late consumers, "poor" sales ($m < \underline{x}$) unambiguously indicate low quality, and "mediocre" sales ($m \in [\underline{x}, b\overline{x}]$) leave late consumers uncertain. After observing mediocre first-period sales m, late consumers know that the interest level among early consumers must have been x = m if quality is high and x = m/b if quality is low. However, late consumers do not directly observe the realized interest level but understand that interest varies stochastically with marketing efforts. To be concrete, suppose f(x|a) is continuous. (The intuition behind demarketing remains valid if f(x|a) is discrete, as we show with an example subsequently.) Given marketing effort a, late consumers know that the probability density function of first-period sales m is f(m|a) if quality is high and f(m/b|a)(1/b) if quality is low, following the Jacobian transformation (Casella and Berger 1990). In this way, marketing efforts influence late consumers' quality beliefs although they do not directly convey quality in a pooling equilibrium.

A last factor that further updates a late consumer's quality belief, if first-period sales are mediocre, is his or her own inspection outcome. A bad inspection outcome again reveals low quality, whereas a good inspection outcome updates quality beliefs in the following way: If quality is high, the probability of observing mediocre first-period sales m and a good inspection outcome should be f(m|a); if quality is low, this probability becomes f(m/b|a)(1/b)b = f(m/b|a). The late consumer can then form his or her posterior quality beliefs using Bayes' rule.

In summary, after observing marketing efforts a, first-period sales m, and inspection outcome s, a late consumer's posterior quality belief is as follows:

$$\mu_2(a, m, s) = \begin{cases} 1 & \text{if } m > b\overline{x}, \\ \dfrac{f(m|a)\mu_0}{f(m|a)\mu_0 + f\left(\dfrac{m}{b}\middle| a\right)(1-\mu_0)} & \text{if } \underline{x} \le m \le b\overline{x} \text{ and } s = G, \\ 0 & \text{otherwise.} \end{cases} \tag{6}$$

A key observation is that, keeping m constant, the quality belief term $f(m|a)\mu_0/[f(m|a)\mu_0 + f(m/b|a)(1 - \mu_0)]$ decreases

[10] See, for example, Milgrom and Roberts (1986); Wernerfelt (1988); Bagwell and Riordan (1991); Desai and Srinivasan (1995); Moorthy and Srinivasan (1995); Simester (1995); and Erdem, Keane, and Sun (2008). For a survey, see also Bagwell (2007).

with marketing effort a if and only if the following condition holds:

$$\frac{f\left(\frac{m}{b}\middle|\bar{a}\right)}{f(m|\bar{a})} > \frac{f\left(\frac{m}{b}\middle|\underline{a}\right)}{f(m|\underline{a})}. \tag{7}$$

Because $b < 1$, Condition 7 always holds if $f(x|a)$ satisfies the strict MLRP in a as defined in Condition 1. Intuitively, because marketing efforts raise expected product consideration by the MLRP, intensive marketing competes with product quality in explaining good sales and exacerbates buyers' concerns over quality when sales are lackluster. We summarize these results in the following proposition. The proof holds by construction.

P_1: If buyers' interest in a product satisfies the strict MLRP in marketing efforts, late consumers' quality beliefs (weakly) decrease with marketing efforts for any level of first-period sales.

The analysis thus far shows how demarketing can improve buyers' quality beliefs *ex post*. However, late consumers' quality beliefs as specified in Equation 6 are conditional on a realized first-period sales volume m. It is yet unclear how marketing efforts affect seller profits *ex ante*, because demarketing also lowers first-period sales in expectation. We next analyze seller profits and derive the conditions for demarketing to emerge as the equilibrium strategy.

Seller Profits and Equilibrium (De)marketing Strategies

In this section, we explore sellers' equilibrium choice between marketing ($\bar{a}$) and demarketing ($\underline{a}$). As discussed previously, we focus on a high-quality seller's profits associated with different marketing efforts. A low-quality seller will always mimic the high-quality seller in the pooling equilibrium; any deviation would reveal its bad quality and reduce its profit to zero.

Note that in the second period, it is optimal for the high-quality seller to set the price p_2 equal to $\mu_2(a, m, s)$, as specified in Equation 6. This price extracts the full surplus of all late consumers who have a positive willingness to pay for the product. Because a high-quality product will always pass an inspection and will always achieve at least mediocre first-period sales ($m \geq \underline{x}$), its optimal second-period price is as follows:

$$p_2^*(a,m) = \begin{cases} 1 & \text{if } m > b\bar{x}, \\ \dfrac{f(m|a)\mu_0}{f(m|a)\mu_0 + f\left(\frac{m}{b}\middle|a\right)(1-\mu_0)} & \text{if } \underline{x} \leq m \leq b\bar{x}. \end{cases} \tag{8}$$

The low-quality seller will imitate the high-quality seller's second-period price unless its first-period sales are poor ($m < \underline{x}$), in which case it will not be able to sell anything at a positive price.

For subsequent analysis, it is useful to formulate late consumers' expected quality belief about a high-quality seller, integrated over all possible levels of first-period sales. A high-quality seller's first-period sales are stellar with probability $1 - F(b\bar{x}|a)$ and mediocre otherwise. Its expected quality belief among late consumers is therefore as follows:

$$E[\mu_2(a,m,s)|H] = E[\mu_2(a,x,G)] = [1 - F(b\bar{x}|a)] + \int_{\underline{x}}^{b\bar{x}} \mu_2(a,x,G) f(x|a)\,dx. \tag{9}$$

It follows that a high-quality seller's expected profit ultimately depends on its marketing effort choice:

$$EII(a|H) = E(x|a)\mu_1(G) + \delta[1 - F(b\bar{x}|a)] + \delta\int_{\underline{x}}^{b\bar{x}} \mu_2(a,x,G) f(x|a)\,dx. \tag{10}$$

Equation 10 shows that marketing efforts affect a high-quality seller's expected profit in several ways. The first term on the right-hand side, $E(x|a)\mu_1(G)$, is the high-quality seller's expected profit in period 1. This term reflects the demand-enhancing effect of marketing efforts, as expected consideration among early consumers $E(x|a)$ increases with a by the MLRP. The second term $\delta[1 - F(b\bar{x}|a)]$ represents the profit from selling to late consumers when first-period sales are stellar so that $p_2^* = 1$. This term increases with a as well by definition of the MLRP. The last term is the profit derived from late consumers when first-period sales are mediocre. We have shown that $\mu_2(a, x, G)$ decreases with a by the MLRP. However, a also affects the probabilities for different levels of mediocre sales to arise, as captured by the distribution function $f(x|a)$ in the last term of Equation 10.

We are interested in whether demarketing arises in equilibrium. We first note a necessary condition for demarketing to be optimal: that the relative mass of late consumers δ should be sufficiently large. If δ is too close to 0, the seller will maximize marketing efforts to serve as many early consumers as possible. However, even when δ is sufficiently large, demarketing is worthwhile only if it improves second-period profits. We note two boundary conditions next.

On the one hand, if buyers' prior quality beliefs are very pessimistic (μ_0 being close to 0), demarketing will never be optimal. For very pessimistic prior beliefs, buyers continue to hold minimal confidence in quality whenever in doubt. This can be seen from Equation 3, in which early consumers' quality beliefs are close to 0 regardless of the private signal received, and Equation 6, in which late consumers' quality beliefs are also close to 0 unless first-period sales are stellar ($m > b\bar{x}$). As a result, unless first-period sales are stellar, the profits that can be earned from consumers in either period are close to zero. Thus, the high-quality seller's imperative is to maximize the probability of stellar sales in period 1 to provide absolute proof of high quality to late consumers. To achieve this goal, the seller should maximize its marketing efforts in the first period.

On the other hand, if buyers' prior quality beliefs are very optimistic (μ_0 being close to 1), demarketing will not be optimal either. As Equation 3 shows, if early consumers have firm faith in product quality to begin with, their quality belief will be close to 1 unless their inspection detects a flaw, which will never happen for the high-quality product. Similarly, as Equation 6 shows, late consumers' quality beliefs also remain close to 1 as long as first-period sales are at least mediocre ($m \geq \underline{x}$), a level that a high-quality seller will achieve for certain. Therefore, for a high-quality seller, consumers will have high willingness to pay already, and so

the imperative is to maximize expected sales volume through full marketing efforts.

Taken together, the prior belief μ_0 must fall in an intermediate range for demarketing to arise in equilibrium. Intuitively, the purpose of demarketing lies in belief manipulation, which is effective only if buyers face significant quality uncertainty. The following proposition summarizes the necessary conditions for a demarketing equilibrium (for proof, see the Web Appendix at www.marketingpower.com/jmr_webappendix):

P_2: A pooling equilibrium with demarketing ($a = \underline{a}$) being the optimal strategy can exist only if (i) the relative mass of late consumers δ is sufficiently large and (ii) the prior quality belief μ_0 is neither too pessimistic (i.e., close to 0) nor too optimistic (i.e., close to 1).

Because beliefs following mediocre sales, as well as the probabilities by which different mediocre sales levels occur, depend on the buyer interest distribution function f(x|a), it is difficult to derive sufficient conditions for a demarketing equilibrium without putting additional structure on this function. To demonstrate the existence of a demarketing equilibrium, we turn to an example that assumes a specific functional form for f(x|a).

An Example

Suppose that marketing efforts generate purchase interest among either all early consumers ($x = 1$) or a fraction of them ($x = b < 1$). The conditional distribution of interest given marketing efforts is

$$(11)\qquad f(x \mid \overline{a}) = \begin{cases} \overline{\theta} & \text{if } x = 1, \\ 1 - \overline{\theta} & \text{if } x = b, \end{cases}$$
$$f(x \mid \underline{a}) = \begin{cases} \underline{\theta} & \text{if } x = 1, \\ 1 - \underline{\theta} & \text{if } x = b, \end{cases}$$

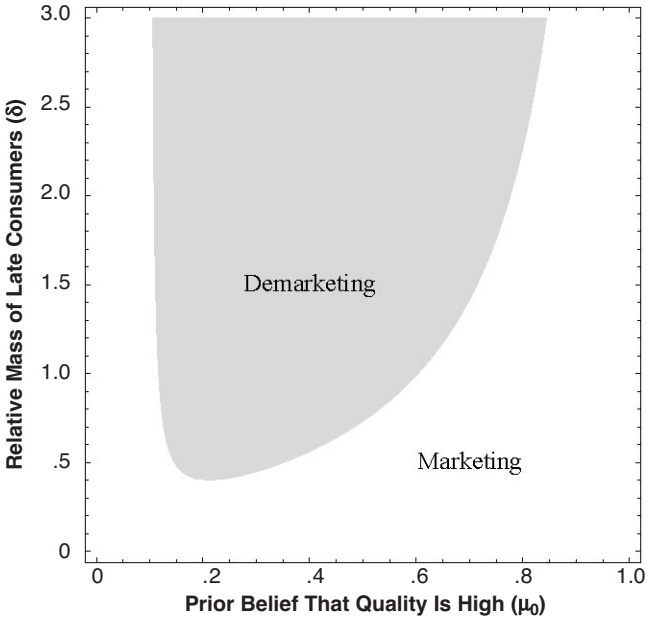
with $0 < \underline{\theta} < \overline{\theta} < 1$. It follows that f(x|a) satisfies the strict MLRP in a.

When the seller charges the optimal first-period price $p_1^* = \mu_1(G)$, first-period sales are either 1 or b if quality is high and either b or b^2 if quality is low. Late consumers thus remain uncertain about quality after observing the mediocre sales level b, which makes the example interesting despite its simplicity. Indeed, there exists an equilibrium in which demarketing emerges as the optimal strategy (for proof, see the Web Appendix at www.marketingpower.com/jmr_webappendix):

P_3: Let buyer interest (x) generated by marketing effort (a) follow the conditional distribution function f(x|a) as defined in Equation 11. There exists a pooling equilibrium in which demarketing is the optimal strategy when the relative mass of late consumers δ is sufficiently large and the prior quality belief μ_0 is nether too pessimistic nor too optimistic.

Figure 2 shows the sellers' equilibrium (de)marketing choice as a function of buyers' prior quality belief μ_0 and the relative mass of late consumers δ. For illustration, we fix the remaining parameters as $\overline{\theta} = .6$, $\underline{\theta} = .1$, and $b = 2/3$. Demarketing arises as the equilibrium strategy for reasonable parameter values. Consistent with P_2 and P_3, demarketing is optimal when the relative mass of late consumers is sufficiently large and when buyers face significant prior uncertainty about quality.

Figure 2
EQUILIBRIUM MARKETING LEVEL



Notes: This figure is based on the functional form specification of Equation 11, where $\overline{\theta} = .6$, $\underline{\theta} = .1$, and $b = 2/3$.

Discussion

Pooling in actions, separating in payoffs. A further reflection on the pooling equilibrium analyzed thus far is in order. It is worth noting that although the two types of sellers pool in actions, they diverge in payoffs. A low-quality seller only passes inspections with probability b in either period. Therefore, the expected quality belief a low-quality seller can achieve among early consumers is $b\mu_1(G)$; in expectation, a fraction b of early consumers hold belief $\mu_1(G)$, whereas the remaining fraction $1 - b$ hold belief 0. Moreover, a low-quality seller cannot achieve stellar sales in period 1 but faces the risk of poor sales. Therefore, the low-quality seller's expected quality belief among late consumers is as follows:

$$(12)\qquad E\left[\mu_2(a, m, s) \mid L\right] = bE\left[\mu_2(a, bx, G)\right]$$
$$= b\int_{\frac{\underline{x}}{b}}^{\overline{x}} \mu_2(a, bx, G) f(x \mid a)\, dx,$$

which is different from a high-quality seller's expected quality belief among late consumers as specified in Equation 9. It can be shown that buyers' expected quality beliefs for a high-quality seller are more optimistic than their expected quality beliefs for a low-quality seller in both periods (for proof, see the Web Appendix at www.marketingpower.com/jmr_webappendix).

In other words, although product quality is not immediately revealed through seller actions, it is partially revealed

through market data (inspection outcomes, first-period sales). Divergent quality beliefs generate divergent profits. Indeed, because a seller's expected profit equals its expected quality belief in each period, in a pooling equilibrium, a high-quality seller earns a higher expected profit than a low-quality seller in both periods.

Finally, it will be interesting to see how the level of marketing efforts further affects the payoff divergence between the two seller types. Early consumers' quality beliefs depend on the prior belief and inspection outcomes. However, late consumers' quality beliefs are influenced by marketing efforts in the following way:

P_4: Demarketing improves late consumers' expected quality belief about a high-quality seller if and only if it worsens late consumers' expected quality belief about a low-quality seller.

The proof is as follows: By the law of iterated expectations, we obtain

$$\mu_0 = \mu_0 E\left[\mu_2(a, m, s)|H\right] + (1-\mu_0) E\left[\mu_2(a, m, s)|L\right], \quad (13)$$

and thus,

$$E\left[\mu_2(\underline{a}, m, s)|H\right] > E\left[\mu_2(\overline{a}, m, s)|H\right]$$
$$\Leftrightarrow E\left[\mu_2(\underline{a}, m, s)|L\right] < E\left[\mu_2(\overline{a}, m, s)|L\right]. \quad \square$$

The law of iterated expectations implies that buyers' expected posterior quality beliefs for the two seller types must straddle their prior belief. Intuitively, because buyers rationally use available data (inspection outcomes, first-period sales) to update their beliefs, learning brings their perception closer to truth in expectation. In this sense, if demarketing (relative to marketing) helps a high-type seller better unveil its high quality, it also forces a low-type seller that mimics the same demarketing choice to further reveal its low quality, though the low-type seller still prefers mimicry to deviation. Therefore, demarketing may not only improve a high-quality seller's profit but also provide better information to the marketplace by helping late consumers better discern quality from available data. Indeed, when the relative mass of late consumers is sufficiently large, demarketing maximizes a high-quality seller's expected profit if and only if it maximizes the expected amount of information in the marketplace and if and only if it minimizes a low-quality seller's expected profit from mimicry.

What do buyers need to observe for demarketing to work? The analysis thus far highlights two fundamental requirements on buyers' information set that allow demarketing to work as an optimal seller strategy. Buyers must (1) at least partially observe past product sales and (2) at least partially observe the level of marketing efforts. We discuss these requirements next.

First, if buyers have no information on past sales, they cannot infer product quality by observing previous buyers' purchase decisions. The seller, in turn, has no incentive to manipulate buyer observational learning through demarketing. In our model, the seller would maximize costless marketing efforts to maximize expected buyer interest. In reality, however, buyers can often obtain informative signals of a product's market performance. For example, they can observe the length of the line waiting outside a store, track how many units of the iPad have been sold since launch, and, more generally, form an impression of whether a new product is a hit or a flop.

Second, the credibility of demarketing in influencing buyers' quality perception depends on its visibility to buyers. If the level of marketing is unobservable, the seller in our model will lose its incentive to demarket: Buyers will dismiss any demarketing claims by the seller as untrustworthy cheap talk, and so the seller might as well exhaust its free marketing resources. Consistent with this visibility requirement of demarketing, the psychology literature finds that people exhibit self-handicapping more often when others can observe their handicap. For example, Kolditz and Arkin (1982) show that experiment participants are far more likely to take a debilitating drug in an IQ test if the drug choice is public than if it is private. The implications are twofold. Normatively, demarketing, if it is to be used, should be used conspicuously. Positively, we expect more adoption of demarketing when it is observable—for example, when passersby can (trivially) observe business locations, when stores can publicize inconvenient service terms, and when consumers can witness how often a company advertises.

In addition, there is a technical condition for demarketing to work: The precise level of buyer interest (or other direct outputs of marketing efforts) should be unobservable to subsequent buyers, who would otherwise be able to fully infer quality from the conversion rate between buyer interest and sales. A general condition for demarketing to arise is that late consumers cannot completely "parse out" the effect of marketing on sales to perfectly infer quality. If demarketing loses its influence on beliefs, the seller will again maximize marketing efforts. This technical condition should hold in many circumstances due to the personal and often idiosyncratic nature of buyer interest.

EMPIRICAL VALIDATION

The analysis thus far identifies a set of conditions for demarketing to be an optimal seller strategy. First, the *ex post* effect of demarketing, as described by P_1, relies on the (implicit) assumption that consumers are able to draw savvy inferences about product quality taking marketing efforts into account. Second, P_2 specifies the necessary market conditions for demarketing to be optimal. Third, we have discussed what buyers must observe for demarketing to achieve its purpose.

We conduct a series of human subject experiments to validate these conditions. These experiments test whether people, when taking the role of buyers or sellers, behave consistently with the model's implications. We proceed with five studies. Study 1 tests whether buyers' quality beliefs decrease with marketing efforts for a given level of past sales (P_1). Study 2 tests the main prediction of the model, namely, that demarketing is relevant when buyers are uncertain about product quality and the market is fast growing (P_2). Study 3 replicates Study 2 using business students as subjects. Study 4 evaluates the condition that demarketing is recommendable only if buyers can observe past sales and past marketing effort. Study 5 further investigates whether it is quality image management that motivates sellers to choose demarketing.

Study 1

We begin with a 1 × 2 design to test whether buyers' quality beliefs decrease with marketing efforts *ex post*. Condition 1 presents information about past sales, describes marketing efforts as "intensive," and elicits buyers' quality perception. We asked participants the following question:

> An e-book reader was introduced into the market a year ago. The company that produces and sells the e-book reader put in intensive marketing efforts. The e-book reader sold 5 million units globally within 12 months.
>
> Based on the information, how good do you think the quality of the e-book reader is? Please indicate your answer on a 1-to-5 scale, with 1 being the poorest quality and 5 being the best quality.

We chose e-book readers because this is a category of new products in which quality uncertainty is likely to be high. We set the sales volume of 5 million units in line with the 2011 sales of the Apple iPad (60 million), Kindle (19 million), and Nook (12 million) to evoke a perception of mediocre sales. Condition 2 asks the same question except that the seller is described as putting in "moderate marketing efforts." We adopt the verbiage "intensive" and "moderate" marketing because, as defined previously, the concept of demarketing is relative. We hypothesize that perceived quality is greater in Condition 2 than in Condition 1.

We recruited human subjects from Amazon Mechanical Turk (MTurk), a leading Internet-based labor market that has been widely adopted for behavioral experimental research (e.g., Paolacci, Chandler, and Ipeirotis 2010).[11] We randomly assigned 50 participants to Condition 1 and 50 participants to Condition 2. Each participant had up to 15 minutes to complete the experiment and earned an effective hourly rate of approximately $6.

[11]As a quality screening measure, we required that a participant receive a task approval rate greater than 95% and have more than 500 tasks approved.

The top panel of Table 2 reports the experiment results. The mean perceived quality is 3.68 in Condition 1, which is significantly lower than its counterpart of 4.12 in Condition 2 ($p = .008$).[12] This finding supports the hypothesis of savvy consumer attribution: For a given sales volume, lower marketing intensity increases buyers' perceived quality.

Study 2

Having validated the *ex post* effect of demarketing on buyer quality inference, we proceed to Study 2 to test the main prediction of the model—that higher prior quality uncertainty and a higher market growth rate increase the relevance of demarketing. We asked participants to choose whether to market a new e-book reader "intensively" or "moderately" during its first year of launch. The decision task aims to capture the key elements of the theory: Marketing builds buyer consideration, yet the purchase decision also depends on evaluation; second-year consumers observe first-year marketing intensity and sales volume; the cost of marketing is not a concern, and the goal is to maximize profit over a two-year span (for the actual question wording, see the Web Appendix at www.marketingpower.com/jmr_webappendix).

We adopted a 1 × 3 design.[13] Condition 3 evokes a high-uncertainty, high-growth environment by stating that "consumers are fairly uncertain about the quality of your e-book reader at the time of launch" and that "it is forecast that the potential customer base for e-book readers will significantly grow over the two years." Condition 4 asks the same question as Condition 3 except that consumers are described as being "fairly certain" about the quality of the e-book reader at launch. Condition 5 differs from Condition 3 by stating

[12]Throughout this section, we report *p*-values based on one-tailed tests because the hypotheses of interest are unidirectional.

[13]We did not pursue a 2 × 2 design, because our theory makes no prediction about the interaction effect of prior quality uncertainty and market growth rate.

Table 2
EXPERIMENT RESULTS

		Perceived Quality		*Demarketing (Dummy)*	
Condition	*Number of Participants*	*M*	*SD*	*M*	*SD*
Study 1					
1. Quality inference observing marketing	50	3.680	.819	—	—
2. Quality inference observing demarketing	50	4.120	.961	—	—
Study 2					
3. High uncertainty, high growth	49	—	—	.327	.474
4. Low uncertainty, high growth	50	—	—	.160	.370
5. High uncertainty, low growth	50	—	—	.140	.351
Study 3					
6. High uncertainty, high growth; business students	34	—	—	.382	.493
7. Low uncertainty, high growth; business students	31	—	—	.194	.402
8. High uncertainty, low growth; business students	34	—	—	.176	.387
Study 4					
9. High uncertainty, high growth; unobservable sales	50	—	—	.140	.351
10. High uncertainty, high growth; unobservable marketing	50	—	—	.180	.388
Study 5					
11. Quality inference observing marketing + high uncertainty, high growth	50	3.886	.876	.480	.505
12. Quality inference observing demarketing + high uncertainty, high growth	49	4.265	.569	.510	.505

Notes: The dummy variable "demarketing" equals 1 if the subject chooses moderate marketing and 0 if the subject chooses intensive marketing.

that the potential customer base will "stay stable" over the two-year span. We randomly assigned 50 MTurk participants into each of the three conditions.[14]

The second panel of Table 2 reports the results. The share of participants who chose moderate marketing over intensive marketing is 32.7% in Condition 3 (high uncertainty, high growth), which is higher than 16% in Condition 4 (low uncertainty, high growth) with a p-value of .03. This percentage is also higher than 14% in Condition 5 (high uncertainty, low growth) at the $p = .01$ level. These results support our central hypothesis that demarketing is more relevant when buyers' prior quality uncertainty is high and when the market grows fast.

Study 3

Although MTurk participants have been found to perform comparably to laboratory participants (e.g., Paolacci, Chandler, and Ipeirotis 2010), we wanted to evaluate explicitly whether our key results are robust with respect to alternative subject types. It is common to use students to test theories of firm strategies (Holt 1995). Indeed, several studies that compare students and managers document little difference in their decisions (Ball and Cech 1996; Plott 1987). Therefore, in Study 3, we replicated Study 2 using students as participants. A total of 99 business students at a major university in the United States participated in the experiment. The three conditions in Study 2, which we relabeled as Conditions 6, 7, and 8 for Study 3, had 34, 31, and 34 participants, respectively. Participation was voluntary and unpaid.

The third panel of Table 2 displays the results. The percentage of participants who chose moderate marketing is 38.2% in Condition 6 (high uncertainty, high growth), which is higher than 19.4% in Condition 7 (low uncertainty, high growth) at the $p = .05$ level and higher than 17.6% in Condition 8 (high uncertainty, low growth) at the $p = .03$ level. These patterns are consistent with those of Study 2, though student participants seem more prone to choose demarketing.

Study 4

In Study 4, we extended our analysis to evaluate the observability requirements of demarketing—that demarketing is recommendable only if buyers can observe past sales and past marketing intensity. To do so, we created two new conditions. Condition 9 is identical to Condition 3 except that it states, "In your second year of launch, consumers cannot observe how many units your company actually sold during the first year." Condition 10 is identical to Condition 3 except that it states, "Consumers cannot observe how intensively you have marketed your product during the first year." We randomly assigned 50 MTurk participants to each condition. We ran Conditions 9 and 10 (as well as Conditions 11 and 12 of Study 5) simultaneously with the benchmark Condition 3 to minimize confounding time effects and maximize comparability.

The fourth panel of Table 2 reports the results. The percentage of participants who chose moderate marketing declines to 14% in Condition 9 (unobservable sales) and 18% in Condition 10 (unobservable marketing), both of which are significantly lower than their counterpart in Condition 3 ($p = .01$ and .05 respectively). These results confirm the observability requirements of demarketing.

Study 5

Finally, we wanted to investigate whether participants chose demarketing with buyer quality inference as a consideration. To do so, in Study 5, we exogenously varied the salience of buyer quality inference by asking a participant to infer product quality from a buyer perspective before choosing marketing intensity as a seller. Specifically, we created two new conditions. In Condition 11, each participant first answered the question of Condition 1 (inferring product quality observing intensive marketing) and then answered the question of Condition 3. In Condition 12, each participant answered the question of Condition 2 (inferring product quality observing moderate marketing) and then the question of Condition 3. We randomly assigned 50 MTurk participants to each condition.

The fifth panel of Table 2 highlights three results. First, mean perceived quality is 3.89 in Condition 11, which is lower than 4.27 in Condition 12 at the $p = .006$ level, replicating the finding of Study 1. Second, the percentages of participants choosing moderate marketing are 48% and 51% in Conditions 11 and 12, respectively, both significantly higher than the level in Condition 3 (p-values of .06 and .03, respectively). In other words, when participants are primed to consciously think about quality inference from the buyer perspective, they are indeed more prone to choose demarketing. Last, the percentage of participants choosing moderate marketing does not significantly differ between Conditions 11 and 12 ($p = .38$). This result rules out the possibility that the mention of moderate marketing per se in Condition 12 predisposes participants to choose demarketing.

In summary, the lab experiments provide reassuring evidence that real-world decision makers can intuit the key ideas of the model: Buyers are able to make savvy inferences about product quality on the basis of marketing efforts, and sellers are able to understand these inferences and adjust their marketing efforts in response. In the following section, we build on the main model to explore how firms should adjust their (de)marketing strategies in response to a rich set of market conditions.

EXTENSIONS

This section explores a set of real-world situations that may affect sellers' (de)marketing incentives. We focus on presenting the results and discussing the intuition. We present all technical details, including derivations and proofs, in the Web Appendix (www.marketingpower.com/jmr_webappendix).

Marketing That Improves Prior Quality Beliefs

The main analysis focuses on the role of marketing in raising buyer interest. In addition, marketing can also directly improve buyers' prior quality beliefs. For example, persuasive advertising can boost buyers' confidence in quality. To capture this effect, we allow buyers' prior beliefs to be $\mu_0(a)$, where $\mu_0'(a) \geq 0$. It follows that marketing improves early consumers' quality belief unless their inspection outcome is unfavorable. The effect of marketing on late consumers' quality beliefs, however, is ambiguous: Although

[14]One participant in Condition 3, as well as one participant in Condition 12 of Study 5, did not submit an answer.

intensive marketing hurts quality perceptions *ex post*, as shown in the main analysis, it also "anchors" late consumers with more optimistic prior quality beliefs. We find that sellers have less incentive to demarket if marketing is more effective at improving buyers' prior quality beliefs. Naturally, demarketing should be used with greater caution if buyers' prior perception of product quality is susceptible to marketing efforts.

Marketing That Accelerates Buyer Arrival

Marketing activities such as awareness advertising campaigns may also help accelerate the arrival of buyers. We model this effect of marketing by allowing the mass of early consumers to be $\lambda(a)$ and the mass of late consumers to be $\delta + 1 - \lambda(a)$, where $0 \le \lambda(\underline{a}) \le \lambda(\bar{a}) \le 1 + \delta$. Notably, we find that greater effectiveness of marketing efforts in accelerating buyer arrival may increase the parameter range for demarketing to be optimal. The intuition is as follows. With endogenous buyer arrival, marketing has two effects on seller profits (in addition to raising interest among early consumers): It shifts the distribution of buyers across time, and it influences the expected equilibrium price in period 2 by affecting late consumers' quality beliefs. With this latter effect, the seller does not always want to accelerate buyer arrival and expedite sales. Indeed, if the expected equilibrium price in period 2 exceeds the equilibrium price in period 1 as market data reveal product quality over time, the high-quality seller has the incentive to shift greater sales volume to period 2. Demarketing helps serve this purpose.[15]

More Than Two Time Periods

Sellers have no incentive to choose demarketing, a future-oriented strategy, in the final period of the game. The two-period structure of the main model thus implies that marketing levels weakly increase over time. Would this monotonicity property always hold when there are more than two periods? The answer is no. As a counterexample, we consider a three-period model. There exist pooling equilibria in which sellers choose high marketing in the first and third periods and demarketing in the second period if and only if first-period sales are mediocre.

This result reflects a high-quality seller's tradeoff in setting its first-period marketing level. On the one hand, demarketing protects the seller's quality image in the case of mediocre sales. Because there are more future periods to benefit from a good quality image, there is, ceteris paribus, greater return to demarketing early on. On the other hand, there is also better reason to market intensively in the first period. If the seller can achieve stellar sales in period 1, all future periods benefit from this flawless quality image. If early sales are mediocre, the seller ends period 1 with a worse quality image than if it had chosen demarketing, but it has another chance to improve quality beliefs in period 2, possibly through demarketing. This second effect may break the monotonicity of marketing effort dynamics. Managerially, it suggests that the timing of demarketing requires careful analysis when the seller has a planning horizon longer than two periods.

Heterogeneous Willingness to Pay

The main model assumes that consumers hold homogeneous willingness to pay for quality. We can relax this assumption by allowing a consumer's willingness to pay to equal his or her quality belief multiplied by his or her intrinsic valuation for quality, which follows a generic, commonly known distribution across consumers. This modification generates a downward-sloping demand curve even if consumers hold the same quality belief.

We find that accommodating heterogeneous willingness to pay does not affect sellers' (de)marketing incentives. The key reason is that the introductory price does not change late consumers' quality beliefs. For example, although a low introductory price boosts first-period sales, a late consumer is aware of this. The seller in turn must achieve a greater sales volume to prove its high quality. Indeed, we find that a high-quality seller would choose a price in each period to maximize its static profit of that period. A low-quality seller mimics this choice. Furthermore, we show that the high-quality seller's expected profit given these prices are identical to its expected profit in the main model up to a scaling factor, which comes from optimal pricing on a downward-sloping demand curve. Therefore, the parameter range for (de)marketing to be optimal stays the same as in the main model.

A reason that the introductory price does not affect subsequent beliefs is that the demand curve is deterministic and is known by consumers. In line with our previous discussion, this consumer knowledge rules out introductory price as a form of demarketing because late consumers can fully parse out the effect of price on sales. However, if we built randomness into the demand curve, in much the same way we incorporate randomness in the buyer interest function, sellers could demarket through pricing. For example, if we allowed demand to satisfy the MLRP in the negative of price, sellers could demarket by charging an introductory price that is higher than its static optimal level. Intuitively, this excessively high price would help alleviate quality concerns if sales were lackluster and highlight good quality if sales were satisfactory (see also Taylor 1999).[16]

Word-of-Mouth Communication

In addition to observational learning, word-of-mouth communication could also facilitate social learning among consumers (e.g., Chen, Wang, and Xie 2011; Godes and Mayzlin 2004; Kuksov and Shachar 2010). In our model, in addition to observing past sales, late consumers could

[15]This finding raises another question: What happens if consumers can strategically postpone their purchases to gain more information about product quality? Strategic waiting does not occur in our model for the following reason. Consumers who receive a bad inspection outcome will not buy and will earn their outside utility of zero. Consumers who receive a good inspection outcome will receive zero net utility as well, because the equilibrium prices in both periods equal buyers' quality beliefs unless first-period sales are poor, in which case the consumer will again receive an outside utility of zero. Therefore, even though buyers can choose when to buy, they have no incentive to wait.

[16]This result complements the literature on quality signaling through high price. The standard rationale focuses on separating equilibria, in which high-quality sellers raise price to deter mimicry of low-quality sellers. The demarketing account of pricing could generate the same high-price outcome in a pooling equilibrium: High-quality sellers raise price not to separate from their low-quality counterparts but to manage buyers' quality inference, considering mimicry as given. We thank a referee for pointing out this connection.

update their quality beliefs by communicating with past consumers. To investigate how this additional channel of social learning affects sellers' (de)marketing decisions, we extend the main model in the following way: We allow each late consumer to communicate with one randomly selected consumer from the first period. The message transmitted through this communication could be a good or bad signal this predecessor obtained through private inspection or could reveal that this predecessor did not consider the product (referred to as a "null" signal hereinafter).

Notably, we find that a null word-of-mouth message is more diagnostic of high quality than a good word-of-mouth message. The reason is as follows: Regardless of actual product quality, all early consumers with a good signal would purchase the product in equilibrium. For a given period 1 sales level m, the fraction of early consumers with a good, bad, or null signal is m, 0, and 1 – m, respectively, if quality is high, and m, m(1 – b)/b, and 1 – m/b, respectively, if quality is low. In other words, because late consumers already observe past sales, knowing the reason behind purchase (good word-of-mouth message) does not bring additional information about quality. It is the reason behind the no-purchase decisions that provides new information. The reason would be the lack of consideration if quality is high, and it would be the lack of consideration or a bad signal if quality is low. Therefore, knowing that a predecessor did not consider the product suggests high quality disproportionately, which serves to increase a late consumer's quality belief.

This result affects a high-quality seller's (de)marketing incentives in two ways. First, demarketing lowers expected consideration *ex ante*, which makes it more likely that a late consumer receives a null message through word of mouth. Second, demarketing could also dilute the quality implication of a null signal *ex post*. At one extreme, if no one considered the product in the first period, a late consumer will receive a null signal regardless of product quality, which makes the null signal uninformative. At the other extreme, if first-period sales equal b, the highest level of mediocre sales, a null signal is perfectly indicative of high quality because a low-quality seller would have required 100% consideration to achieve this sales level. The second effect dominates if buyers' prior quality belief μ_0 is sufficiently high. When late consumers are already optimistic, a null signal does not improve their quality belief much beyond a good signal. Instead, the high-quality seller has more to gain from increasing first-period sales and making a null signal an almost-sure sign of high quality.

When buyers' prior quality belief is not too optimistic, word-of-mouth communication can actually increase the parameter range for demarketing to be the optimal seller strategy (see, e.g., Figure W6 of the Web Appendix at www.marketingpower.com/jmr_webappendix). This result might appear surprising because word of mouth enriches the amount of information available to late consumers, which might weaken the need for a high-quality seller to prove its quality through demarketing. Indeed, allowing word of mouth increases a high-quality seller's expected profit. However, unless buyers' prior beliefs are too optimistic, a high-quality seller could convey its quality through null signals, and demarketing makes null signals more prevalent in the marketplace. We summarize these results with the following proposition (for proof, see the Web Appendix):

P_5: When buyers' prior quality belief μ_0 is not too optimistic, word-of-mouth communication can increase the range of (other) parameters for demarketing to be the optimal seller strategy.

Seller Uncertainty About Quality

Finally, sellers might not know their own quality with absolute certainty (Bose et al. 2006). When sellers are uncertain about their quality, separating equilibria may emerge because a seller that is revealed to hold low confidence in quality can still earn a positive margin. In contrast, in the main model a low-quality seller would always want to mimic its high-quality counterpart because a seller that is identified as low quality earns zero profits.

To investigate whether seller uncertainty about quality leads to separating equilibria,[17] we assume that a seller only observes a private signal $v \in \{H, L\}$ about its quality. The precision of the signal is r, as defined by

$$\Pr(v = q) = r, \tag{14}$$

where $r \in (1/2, 1)$ such that the signal is informative but imperfect. A seller that receives an H signal has greater confidence in its quality than a seller that receives an L signal.

In a pure-strategy separating equilibrium of interest, a seller's marketing decision affects consumer beliefs in two ways. First, by signaling higher (lower) confidence in quality, the seller anchors consumers with more optimistic (pessimistic) prior quality beliefs than in a pooling equilibrium. Second, when first-period sales are mediocre, demarketing improves late consumers' quality beliefs *ex post*, for the same intuition behind the pooling equilibrium analyzed previously. As Figure W7 of the Web Appendix (www.marketingpower.com/jmr_webappendix) shows, there exists a separating equilibrium in which demarketing signals a seller's greater confidence in quality. The following proposition formally states necessary conditions for such an equilibrium to exist (for proof, see the Web Appendix):

P_6: A separating equilibrium in which demarketing signals a seller's higher confidence in quality can only exist if (i) the relative mass of late consumers δ is sufficiently large, (ii) the prior quality belief μ_0 is not too optimistic, (iii) the seller's private information is neither too precise (i.e., r close to 1) nor too noisy (i.e., r close to 1/2), and (iv) demarketing hurts short-term profits even if it anchors early consumers with a more optimistic prior quality belief.

To understand Condition i, suppose δ is small enough that the seller only cares about its first-period profits. However, both types of sellers face the same trade-off in period 1: Demarketing signals greater confidence in quality, whereas marketing raises buyer interest, regardless of the seller's actual level of confidence. In other words, first-period incentives alone cannot achieve separation between the two seller types; the ability for demarketing to signal seller confidence relies on its long-term impact on quality image.

[17]A demarketing pooling equilibrium can continue to exist when the seller only observes a noisy signal of its quality. Detailed results are available on request.

To understand Condition ii, suppose the prior belief μ_0 is close to 1. It follows that buyers' willingness to pay approaches the highest level, unless they witness sure signs of low quality (bad inspection outcomes or poor first-period sales). However, with a very optimistic prior belief, both types of sellers are confident that they will not generate these signs of low quality and will therefore both maximize marketing to grow sales volume, for the same intuition behind the high-marketing pooling equilibrium discussed previously.[18]

Condition iii can be interpreted as follows: If the seller's private information about its quality is very precise, the situation is similar to the main model, whereby revealing seller type amounts to revealing product quality. A low-type seller will thus prefer to mimic its high-type counterpart. If the seller's private information about its quality is too noisy, intuitively, the two types of sellers have almost aligned incentives, thus nullifying the need for separation.

Condition iv states that for demarketing to signal seller confidence, it must truly hurt profits in the short run; the demand reduction effect of demarketing must dominate its belief anchoring effect among early consumers. Separation is then achieved, in that a confident seller enjoys a better quality image while an unconfident seller focuses on immediate profitability. The result reinforces the message from the pooling equilibrium analysis—that the credibility of demarketing comes from its costly nature (in terms of sacrificed short-term sales).

Finally, there is an important observation: No separating equilibrium exists in which demarketing signals lower seller confidence. Otherwise, a low-type seller would want to deviate to marketing; doing so improves both the sales volume and price in period 1 and anchors consumers with a more optimistic prior belief in period 2. The total benefit of marketing more than offsets any *ex post* decrease in quality beliefs. The following proposition formally states this result (for proof, see the Web Appendix at www.marketingpower.com/jmr_webappendix):

P_7: A separating equilibrium in which demarketing signals the seller's lower confidence in quality does not exist.

CONCLUDING REMARKS

Savvy consumers attribute a product's performance in the marketplace to product quality versus marketing efforts. This research finds that a seller's best response might be to demarket its product. Demarketing hurts demand directly; however, exactly because of this, demarketing highlights high quality when sales are satisfactory and mitigates quality concerns when sales are disappointing. We confirm the main predictions of the demarketing theory through a series of experiments and extend the model to accommodate a rich set of market conditions.

We present a theory in which marketing serves to increase buyer consideration. The same intuition behind demarketing could be extended to other marketing decisions. One important decision is intertemporal advertising scheduling (e.g., Horsky and Simon 1983; Little and Lodish 1969; Mahajan and Muller 1986), for which a classic recommendation is to front-load advertising. Another frequent decision is market selection, for which the conventional wisdom is to target the market that most closely matches the product. From the demarketing perspective, however, modest initial advertising and less precise targeting might benefit companies in the long run, if consumers are able to draw savvy inference of product quality from marketing decisions and their market achievements (for models that demonstrate this result, see the Web Appendix at www.marketingpower.com/jmr_webappendix). It will be worthwhile for researchers in the future to study the implications of demarketing in various business contexts.

[18]When the prior belief μ_0 approaches 0, both types of sellers expect no business unless they can prove their high quality by achieving stellar sales in period 1. This again parallels the result of the pooling equilibrium. However, a seller with a very pessimistic prior belief expects no chance at achieving stellar sales. Therefore, the expected profits of both types of sellers approach zero. The separating equilibrium passively exists because neither type can profitably deviate by mimicking the other type.

REFERENCES

Amaldoss, Wilfred, and Sanjay Jain (2005), "Conspicuous Consumption and Sophisticated Thinking," *Management Science*, 51 (10), 1449–66.

Bagwell, Kyle (2007), "The Economic Analysis of Advertising," in *Handbook of Industrial Organization*, Vol. 3, Mark Armstrong and Rob Porter, eds. Amsterdam: North-Holland, 1701–1844.

——— and Per Baltzer Overgaard (2005), "Look How Little I'm Advertising!" working paper, Department of Economics, Columbia University.

——— and Michael H. Riordan (1991), "High and Declining Prices Signal Product Quality," *American Economic Review*, 81 (1), 224–39.

Ball, Sheryl B. and Paula-Ann Cech (1996), "Subject Pool Choice and Treatment Effects in Economic Laboratory Research," in *Research in Experimental Economics*, Vol. 6, R. Mark Isaac, ed. Greenwich, CT: JAI Press, 239–92.

Banerjee, Abhijit V. (1992), "A Simple Model of Herd Behavior," *Quarterly Journal of Economics*, 107 (3), 797–817.

Berger, Jonah and Gael Le Mens (2009), "How Adoption Speed Affects the Abandonment of Cultural Tastes," *Proceedings of the National Academy of Sciences*, 106 (20), 8146–50.

Bikhchandani, Sushil, David Hirshleifer, and Ivo Welch (1992), "A Theory of Fads, Fashion, Custom, and Cultural Changes as Information Cascades," *Journal of Political Economy*, 100 (5), 992–1026.

Bose, Subir, Gerhard Orosel, Marco Ottaviani, and Lise Vesterlund (2006), "Dynamic Monopoly Pricing and Herding," *RAND Journal of Economics*, 37 (4), 910–928.

Cai, Hongbin, Yuyu Chen, and Hanming Fang (2009), "Observational Learning: Evidence from a Randomized Natural Field Experiment," *American Economic Review*, 99 (3), 864–82.

Caminal, Ramon and Xavier Vives (1996), "Why Market Shares Matter: An Information-Based Theory," *RAND Journal of Economics*, 27 (2), 221–39.

Casella, George and Roger L. Berger (1990), *Statistical Inference*. Belmont, CA: Duxbury Press.

Chen, Yubo, Qi Wang, and Jinhong Xie (2011), "Online Social Interactions: A Natural Experiment on Word of Mouth Versus Observational Learning," *Journal of Marketing Research*, 48 (April), 238–54.

Cialdini, Robert B. (1985), *Influence: Science and Practice*. Glenview, IL: Scott Foresman.

Desai, Preyas and Kannan Srinivasan (1995), "Demand Signalling Under Unobservable Effort in Franchising: Linear and Non-Linear Contracts," *Management Science*, 41 (10), 1608–1623.

Erdem, Tülin, Michael Keane, and Baohong Sun (2008), "A Dynamic Model of Brand Choice When Price and Advertising Signal Product Quality," *Marketing Science*, 27(6), 1111–25.

Fudenberg, Drew and Jean Tirole (1986), "A 'Signal-Jamming' Theory of Predation," *RAND Journal of Economics*, 17 (3), 366–76.

Gerstner, Eitan, James Hess, and Wujin Chu (1993), "Demarketing as A Differentiation Strategy," *Marketing Letters*, 4 (1), 49–57.

Gill, David and Daniel Sgroi (2012), "The Optimal Choice of Pre-Launch Reviewer," *Journal of Economic Theory*, 147 (3), 1247–60.

Godes, David and Dina Mayzlin (2004), "Using On-Line Conversations to Study Word-of-Mouth Communication," *Marketing Science*, 23 (4), 545–60.

Goldstein, Patrick (2009), "'Star Trek' and the Real Art of Movie Marketing: Managing Expectations," *Los Angeles Times*, (May 12).

Harbaugh, Rick (2011), "Prospect Theory or Skill Signaling?" working paper, Kelley School of Business, Indiana University.

Hauser, John R. and Birger Wernerfelt (1990), "An Evaluation Cost Model of Consideration Sets," *Journal of Consumer Research*, 16 (4), 393–408.

Ho, Teck H. and Yu-Sheng Zheng (2004), "Setting Customer Expectation in Service Delivery: An Integrated Marketing-Operations Perspective," *Management Science*, 50 (4), 479–88.

Holmström, Bengt (1999), "Managerial Incentive Problems: A Dynamic Perspective," *Review of Economic Studies*, 66 (1), 169–82.

Holt, Charles A. (1995), "Industrial Organization: A Survey of Laboratory Research," in *Handbook of Experimental Economics*, J.H. Kagel and A.E. Roth, eds. Princeton, NJ: Princeton University Press, 349–443.

Horsky, Dan and Leonard S. Simon (1983), "Advertising and the Diffusion of New Products," *Marketing Science*, 2 (1), 1–17.

Iyer, Ganesh and Dmitri Kuksov (2010), "Consumer Feelings and Equilibrium Product Quality," *Journal of Economics and Management Strategy*, 19 (1), 137–68.

Jones, Edward E. and Steven Berglas (1978), "Control of Attributions About the Self Through Self-Handicapping Strategies: The Appeal of Alcohol and the Role of Underachievement," *Personality and Social Psychology Bulletin*, 4 (2), 200–206.

Joshi, Yogesh V. and Andrés Musalem (2011), "Underpromising and Overdelivering: Strategic Implications of Word of Mouth," working paper, Department of Marketing, University of Maryland.

Katok, Elena, and Enno Siemsen (2011), "Why Genius Leads to Adversity: Experimental Evidence on the Reputational Effects of Task Difficulty Choices," *Management Science*, 57 (6), 1042–54.

Kolditz, Thomas A. and Robert M. Arkin (1982), "An Impression Management Interpretation of the Self-Handicapping Strategy," *Journal of Personality and Social Psychology*, 43 (3), 492–502.

Kopalle, Praveen K. and Donald R. Lehmann (2006), "Setting Quality Expectations When Entering a Market: What Should the Promise Be?" *Marketing Science*, 25 (1), 8–24.

Kotler, Philip and Sidney J. Levy (1971), "Demarketing, Yes, Demarketing," *Harvard Business Review*, (November/December), 74–80.

Kuksov, Dmitri and Ron Shachar (2010), "User Generated Content and Image Advertising," working paper, John M. Olin School of Business, Washington University in St. Louis.

——— and Ying Xie (2010), "Pricing, Frills, and Customer Ratings," *Marketing Science*, 29 (5), 925–43.

Little, John D.C. and Leonard M. Lodish (1969), "A Media Planning Calculus," *Operations Research*, 17 (1), 1–35.

Mahajan, Vijay and Eitan Muller (1986), "Advertising Pulsing Policies for Generating Awareness for New Products," *Marketing Science*, 5 (2), 89–106.

———, ———, and Roger A. Kerin (1984), "Introduction Strategy for New Products with Positive and Negative Word-of-Mouth," *Management Science*, 30 (12), 1389–1404.

Mailath, George J., Masahiro Okuno-Fujiwara, and Andrew Postlewaite (1993), "Belief-Based Refinements in Signalling Games," *Journal of Economic Theory*, 60 (2), 241–76.

Mezzetti, Claudio and Theofanis Tsoulouhas (2000), "Gathering Information Before Signing a Contract with a Privately Informed Principal," *International Journal of Industrial Organization*, 18 (4), 667–89.

Milgrom, Paul R. (1981), "Good News and Bad News: Representation Theorems and Applications," *Bell Journal of Economics*, 12 (2), 380–91.

——— and John Roberts (1986), "Price and Advertising as Signals of Product Quality," *Journal of Political Economy*, 94 (4), 796–821.

Moorthy, Sridhar and Kannan Srinivasan (1995), "Signaling Quality with a Money-Back Guarantee: The Role of Transaction Costs," *Marketing Science*, 14 (4), 442–66.

Nelson, Phillip (1970), "Information and Consumer Behavior," *Journal of Political Economy*, 78 (2), 311–29.

Paolacci, Gabriele, Jesse Chandler, and Panagiotis G. Ipeirotis (2010), "Running Experiments on Amazon Mechanical Turk," *Judgment and Decision Making*, 5 (5), 411–19.

Plott, Charles R. (1987), "Dimensions of Parallelism: Some Policy Applications of Experimental Methods," in *Laboratory Experimentation in Economics: Six Points of View*, A.E. Roth, ed. New York: Cambridge University Press.

Simester, Duncan (1995), "Signaling Price Image Using Advertised Prices," *Marketing Science*, 14 (2), 166–88.

Smith, Timothy W., C.R. Snyder, and Suzanne C. Perkins (1983), "The Self-Serving Function of Hypochondriacal Complaints: Physical Symptoms as Self-Handicapping Strategies," *Journal of Personality and Social Psychology*, 44 (4), 787–97.

Stock, Axel and Subramanian Balachander (2005), "The Making of a Hot Product: A Signaling Explanation of Marketers' Scarcity Strategy," *Management Science*, 51 (8), 1181–92.

Taylor, Curtis R. (1999), "Time-on-the-Market as a Sign of Quality," *Review of Economic Studies*, 66 (3), 555–78.

Tucker, Catherine and Juanjuan Zhang (2011), "How Does Popularity Information Affect Choices? A Field Experiment," *Management Science*, 57 (5), 828–42.

Urban, Glen L., John R. Hauser, and John H. Roberts (1990), "Prelaunch Forecasting of New Automobiles," *Management Science*, 36 (4), 401–421.

Van den Bulte, Christophe and Gary L. Lilien (2004), "Two-Stage Partial Observability Models of Innovation Adoption," working paper, The Wharton School, University of Pennsylvania.

Villas-Boas, J. Miguel (1993), "Predicting Advertising Pulsing Policies in an Oligopoly: A Model and Empirical Test," *Marketing Science*, 12 (1), 88–102.

Wernerfelt, Birger (1988), "Umbrella Branding as a Signal of New Product Quality: An Example of Signalling by Posting a Bond," *RAND Journal of Economics*, 19 (3),458–66.

Zhang, Juanjuan (2010), "The Sound of Silence: Observational Learning in the U.S. Kidney Market," *Marketing Science*, 29 (2), 315–35.

——— and Peng Liu (2012), "Rational Herding in Microloan Markets," *Management Science*, 58 (5), 892–912.

Zhao, Hao (2000), "Raising Awareness and Signaling Quality to Uninformed Consumers: A Price-Advertising Model," *Marketing Science*, 19 (4), 390–96.