Strategic Demarketing

Jeanine Miklós-Thal *, Juanjuan Zhang †

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Abstract

This paper shows that a seller can benefit from “strategic demarketing,” a practice that purposely suppresses marketing efforts to discourage demand even if such efforts are costless. By modestly marketing a product, the seller reduces sales \textit{ex ante} but improves its quality image \textit{ex post}, as buyers attribute any lackluster sales to insufficient marketing rather than low quality. The findings shed new light on classic marketing problems such as advertising scheduling and market selection.

\textit{Key words}: demarketing; observational learning; quality inferences.

*William E. Simon Graduate School of Business, University of Rochester, Rochester, NY.
†MIT Sloan School of Management, Cambridge, MA.
1 Introduction

As the release of a new movie approaches, one might envision the studio in a promotion extravaganza. However, Patrick Goldstein, film critic and columnist for the Los Angeles Times, noticed the opposite—studios relentlessly downplay their movies prior to release. Before the opening of “Star Trek,” Paramount modestly compared this new production to “Batman Begins” and “Superman Returns,” arguing that all three movies were “without big stars that were based on old franchises that had been in decline and needed a serious overhaul” (Goldstein 2009).

Not only do movie studios appear to be discouraging business. There are frequent observations of restaurants that choose hard-to-find locations, stores that set inconvenient service times, retailers that purposely plan stock outages, and manufacturers that introduce nuisance product attributes (Gerstner, Hess, and Chu 1993). Kotler and Levy (1971) devised the term “demarketing” to describe these intentional demand-reducing activities. The goal of this paper is to contribute a fresh perspective to understanding the benefit of demarketing.

To distinguish our hypothesis from other possible explanations, we make the following assumptions. First, to rule out the obvious cost saving benefit of demarketing, we deliberately assume that the costs of marketing are zero. For example, it would take trivial efforts for movie studios not to supply pessimistic box-office projections, or for manufacturers not to introduce additional nuisance attributes. Second, the seller faces no capacity constraint, and intends to keep serving the market. Third, demarketing to a group of consumers does reduce their expected demand; we do not model the potentially value enhancing role of scarcity. Last, the seller is the monopolist in the market with no need to differentiate. The question then is why a profit-maximizing seller should ever avoid free yet productive marketing efforts.

We propose that sellers can use demarketing to strategically manage buyers’ quality perceptions. Consider a seller of a new product with quality uncertain to buyers. Intensive marketing has its immediate appeal of boosting expected sales to early buyers. For instance, advertising a film as a blockbuster attracts the “young kids who drive opening weekend box-office business” (Goldstein 2009), distributing free samples raises product
awareness, and organizing trade shows familiarizes the market with new product features. However, this benefit comes at a hidden cost—intensive marketing also raises buyers’ expectation of early sales. Lukewarm buyer response despite heavy marketing casts doubt over product quality. The rest of the market will likely speculate that those who searched for more information about a new movie to decide whether to watch it, who tried free samples, and who attended trade shows were dissuaded by the product. Indeed, Goldstein warns studio marketers:

If your movie doesn’t match those opening weekend predictions come Monday morning, you’re faced with an onslaught of stories ... transforming what might have been a success story into a gloomy and often premature obituary (Goldstein 2009).

Conversely, had the seller chosen a more modest level of marketing, the public might have attributed slow sales to a lack of promotion, and considered sales that beat expectations as very strong indicators of quality. Indeed, Paramount’s demarketing of “Star Trek” turned out to be a savvy move:

Most box-office predictors had the movie opening to a $65-70 million number, so when it actually ended up grossing $75.2 million, the stories were all positive, with influential publications like the Wall Street Journal writing that the film “beat industry predictions” (Goldstein 2009).

We formalize the above intuition in a two-period model. A monopolist seller privately knows the quality of its product, which could be either high or low. A buyer’s willingness to pay depends on her quality belief, that is, her perceived probability that quality is high. In the first period, the seller determines the level of marketing efforts and an introductory price for first-period buyers, whom we call “early adopters.” The level of marketing efforts and the introductory price are publicly observed. Marketing efforts improve demand; for concreteness, we assume that marketing efforts increase the expected share of buyers who consider the product (thereafter referred to as “buyer interest”) in the sense of first-order stochastic dominance. Each interested early adopter then conducts a private inspection of the product which imperfectly detects low quality, and decides whether to buy. In the
second period, first-period sales volume further unfolds as a publicly observed statistic. The seller then sets the price for late adopters, and late adopters decide whether to buy based on their observation of first-period market efforts and sales, as well as their own inspection outcomes.

When marketing efforts and production are costless, a low-quality seller always wants to mimic its high-quality counterpart. Therefore, in equilibrium a high-quality seller maximizes its expected profits and a low-quality seller copies the high-quality seller’s actions.\(^1\) A high-quality seller would optimally charge an introductory price such that interested early adopters who receive a positive inspection outcome are just willing to buy. It follows that first-period sales reflect early adopters’ inspection results and are diagnostic of quality. Importantly, if an early adopter did not buy, late adopters face two interpretations—it could be that this early adopter simply did not consider the product due to insufficient marketing, or that she considered the product but detected a flaw during her inspection. A tradeoff therefore emerges in choosing the optimal level of marketing efforts. While intensive marketing helps raise buyer interest \textit{ex ante}, \textit{ex post} it aggravates late adopters’ doubt over quality if first-period sales fail to excel.

We derive conditions for demarketing to arise in equilibrium, whereby the seller does not choose the highest level of marketing efforts although they are costless. The purpose of demarketing is to build a strong quality image in the long run at the cost of current sales. Therefore, demarketing is optimal only when the relative mass of late adopters is sufficiently high. In addition, demarketing is worthwhile only if buyers are sufficiently uncertain about quality. Specifically, if buyers are very pessimistic, the seller should choose full marketing to maximize the chance of achieving stellar first-period sales to prove its high quality to late adopters. If buyers are very optimistic about quality, they will have high willingness to pay anyway. Consequently, there will be little room for improvement in quality perception and thus little return to demarketing. In this case, the seller should again choose full marketing and maximize expected sales volume.

New normative insights emerge as we reconsider familiar marketing problems from the demarketing perspective. For example, contrary to recommendations from established advertising scheduling models, firms may benefit from conservative advertising during

\(^1\)Our equilibrium refinement corresponds to the Undefeated Perfect Bayesian Equilibrium of Mailath, Okuno-Fujiwara, and Postlewaite (1993). We discuss the equilibrium concept in Section 3.2.
the early phase of the product life cycle. In case of slow product takeoff, consumers can blame insufficient advertising instead of inadequate product quality. Similarly, when a firm can choose between multiple markets to serve, selecting the market with the most match potential does not always help the firm, because any lack of interest despite great match potential can emanate a particularly detrimental message about product quality. This concern is especially relevant in selecting the test market for new products because consumers’ quality beliefs are important for national launch. It may be sensible to choose test markets where the product is less likely to prevail, so that any positive responses from these markets will be more convincing signs of high quality.

The rest of the paper is organized as follows. Section 2 surveys the related literature. Section 3 presents the general model and derives the conditions for demarketing to emerge as the optimal strategy. Section 4 demonstrates the existence of the demarketing equilibrium through an example, with further discussion of comparative statics. Section 5 revisits the classic marketing problems of advertising scheduling and market selection in light of demarketing. Section 6 discusses empirical observations related to demarketing in different industries. Section 7 concludes the paper. Proofs are relegated to the Appendix.

2 Related Research

The demarketing phenomenon caught the attention of academic researchers in the 1970’s. It is intriguing why marketers would intentionally reduce demand. Kotler and Levy (1971) outline several possible reasons. “General demarketing” discourages customers in response to excess demand; “selective demarketing” helps a seller quit undesirable market segments; “ostensible demarketing” creates a perception of limited supply to actually increase demand. Consistent with the notion of ostensible demarketing, Cialdini (1985) suggests a psychological tendency for humans to want things that are less available, Amaldoss and Jain (2005) show that limited availability satisfies consumers’ need for uniqueness, while Stock and Balachander (2005) demonstrate that scarcity can signal high quality.\(^2\) Gerstner, Hess, and Chu (1993) propose the notion of “differentiating demarketing,” whereby one firm introduces a nuisance attribute to differentiate from its

\(^2\)In a related study, Berger and Mens (2009) find that first-names which enjoy fast initial adoption are less likely to persist because people perceive fads negatively.
competitor and avoid profit-dissipating price wars.

We study a different market mechanism. First, in our story 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 an unprofitable market segment, but to build a high quality image in the segment of late adopters. In fact, we find that the faster this segment grows, the more likely that the seller will pursue demarketing. Third, unlike ostensible demarketing which actually attracts consumers, demarketing in our framework indeed discourages demand directly by lowering the expected degree of consumer interest. Last, we consider a monopolistic seller who is under no competitive pressure to differentiate. By making these assumptions, we isolate a new role of demarketing in managing buyers’ quality inferences.

The mechanism we focus on is related to the observational learning literature, which studies how observing others’ choices affects one’s own decision making. The seminal works of Banerjee (1992), and Bikhchandani, Hirshleifer, and Welch (1992) prove on the demand side that mere observations of peer decisions without knowledge of their private signals may lead to uniform choices within a society. A few studies extend the literature by looking at supply side pricing strategies given observational learning. For example, Caminal and Vives (1996) examine a duopoly market where buyers infer product quality from market shares. This inference process induces each of the sellers to secretly cut price in order to gain market share, thus intensifying competition. Taylor (1999) explores optimal real estate property pricing strategies when a house’s long time on the market raises doubts over its quality. Bose et al. (2006) study the long-run dynamic pricing decisions of a monopolistic seller who does not know the quality of its product.

In line with the observational learning literature, in our model buyers infer product quality from others’ purchase decisions. However, our paper extends this literature in several ways. We consider a monopolistic seller who has private information about its quality as in Taylor (1999), but we do not confine ourselves to products such as houses that only serve one buyer and thus only generate negative observational learning. Furthermore, our analysis goes beyond pricing and explores the role of a broadly defined set of marketing efforts. In our model, it is the intensity of marketing efforts that plays a key role in determining the direction and magnitude of the observational learning effect. Last, we
allow buyers to fully observe prices and marketing efforts, which distinguish our model from the signal jamming mechanism that underlies Caminal and Vives (1996). It is worth noting that in signal jamming models (see also Fudenberg and Tirole 1986; Iyer and Kuksov 2010; Kuksov and Xie 2010), the seller takes a hidden action to influence an observable outcome. In contrast, the seller’s actions (pricing and marketing effort choices) are conspicuous in our model.

Finally, if we consider advertising as a specific form of marketing efforts, this paper is related to the literature on how pricing and advertising signal product quality (see for example Milgrom and Roberts 1986; Simester 1995; Zhao 2000). While many advertising signalling theories treat advertising as purely dissipative (Milgrom and Roberts 1986), we take the opposite position: we assume marketing efforts such as advertising to be costless yet demand-enhancing. Zhao (2000) examines the role of awareness advertising, showing that a high-quality firm would spend less on advertising than a low-quality firm. However, the underlying market force is different from the one in our paper. Zhao (2000) focuses on a separating equilibrium in which a high-quality firm lowers awareness advertising and reduces market coverage to discourage mimicry from a low-cost-low-quality firm who prefers higher sales volumes. Our model, on the other hand, focuses on pooling equilibria, whereby a low-quality seller can and will pretend to be high quality. The key point is that, given the inevitable mimicry, a high-quality seller may still suppress demand-enhancing advertising to manage buyers’ quality inferences.

3 The Model

3.1 Model Setup

We consider a monopolistic seller. The seller privately observes its product’s quality \( q \), which can 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 (see Stock and Balachander 2005 for the same assumption and a detailed discussion).

\(^3\)Bagwell and Overgaard (2005) generalize the result of Zhao (2000).
Potential buyers fall into two segments: early adopters and late adopters. Segmentation is determined by exogenous factors such as the time a buyer arrives on the market. There is a continuum of early adopters whose measure is normalized to 1, and a continuum of late adopters of mass $\delta > 0$. Buyers have unit demands for the product, but cannot observe product quality. We assume that a buyer who believes that the product is good with probability $\mu \in [0, 1]$ is willing to pay $\mu$ for the product.

We analyze a two-period model. Figure 1 presents the timing of the game. At the start of the first period, the seller sets the level of marketing efforts $a \in [a, \bar{a}]$ and an introductory price $p_1$ that target early adopters. Both decisions are publicly observed. Marketing efforts encompass a variety of demand-enhancing activities a seller can engage in. For concreteness, we focus on marketing efforts that raise buyer interest and increase the expected number of buyers who consider buying the product. Consistent with this notion, 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; Villas-Boas 1993; Van den Bulte and Lilien 2004). Examples of marketing efforts that build consideration include devices to reduce buyers’ search costs, information campaigns to introduce product features, and advertising to spur interest among otherwise passive buyers.

Let $x \in [0, 1]$ denote the share of early adopters 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 density function $f(x|a)$ with support $[\underline{x}, \overline{x}]$, where $0 \leq \underline{x} < \overline{x} \leq 1$. Marketing efforts increase the expected level of buyer interest in the sense of first order stochastic dominance (FOSD). To identify the strategic forces—rather than mere cost concerns—that lead to demarketing, we deliberately assume that the cost of marketing efforts is zero (see Gerstner, Hess, and Chu 1992 for the same assumption).

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4For brevity we interpret $\delta$ as the relative mass of late adopters. However, $\delta$ 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.
Figure 1: Timing of the Game

- Seller sets marketing level $a$ and introductory price $p_1$ for early adopters. $a$ and $p_1$ are publicly observed.
- Each interested early adopter observes a private quality signal via inspection as well as $a$ and $p_1$, and decides whether to buy.
- Seller observes its sales volume among early adopters $m$ and sets price $p_2$ for late adopters.
- Each late adopter observes $a$, $p_1$, $m$, $p_2$ and a private quality signal via inspection, and decides whether to buy.

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<thead>
<tr>
<th>Period one</th>
<th>Period two</th>
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We can think of the product as a “search good” that consumers can inspect and evaluate prior to purchase (Nelson 1970). Once marketing efforts have spurred interest in the product, every consumer who considers the product inspects it before she decides whether to buy. Let the quality signal $s$ represent the outcome of a consumer’s inspection. 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:

\[
\begin{align*}
\Pr \{ s = G \mid q = H \} &= 1, \\
\Pr \{ s = G \mid q = L \} &= b \in (0, 1).
\end{align*}
\]

One interpretation of the above distribution is that consumers inspect a product for defects. While a high-quality product should be defect free, a low-quality product may still survive scrutiny with probability $b$. In this sense, inspection is imperfect—if inspection perfectly reveals quality ($b = 0$), then there is no need for late adopters to infer quality from first-period sales and marketing efforts. Each interested early adopter observes her own inspection outcome $s$, and all interested early adopters simultaneously decide whether to buy at price $p_1$.

In the second period, the seller observes the volume of sales it has achieved among early adopters $m$ and sets price $p_2$ for late adopters. Each late adopter observes $a$, $p_1$, $m$, $p_2$ and a private quality signal via inspection, and decides whether to buy.

\[\text{Period one} \quad \text{Period two}\]

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5In an earlier version of the paper, we show that the key results of the paper remain the same if we allow a high-quality product to generate a good signal with probability less than 1 but greater than $b$. The analysis is available upon request.

6 We make the conservative assumption that early adopters who do not purchase the product exit the market at the end of the first period. Alternatively, if these early adopters 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 adopters.
adopters, denoted by \( m \), and sets the price \( p_2 \) for late adopters. All late adopters observe \( a \), \( m \), \( p_1 \), and \( p_2 \). However, late adopters do not observe the precise number of early adopters 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 adopters do not directly access the inspection outcomes of early adopters.\(^7\) As a result, late adopters can have two interpretations why some early adopters did not buy—it could be that they simply did not consider the product due to insufficient marketing, or considered it but were discouraged by unfavorable inspection outcomes. As we shall see, this ambiguity in interpretation is the key reason why the seller may want to choose demarketing.

The seller should in principle also determine the level of marketing efforts in the second period. However, because there is no need to influence quality beliefs beyond late adopters in a two-period model, the seller would always want to maximize costless marketing efforts to target late adopters. We therefore assume that all late adopters consider the product.\(^8\) Correspondingly, unless otherwise indicated, by marketing efforts we specifically refer to those that target early adopters.

Before deciding whether to buy at price \( p_2 \), late adopters inspect the product whenever they are still uncertain about quality. (If first-period market outcome fully reveals quality, it is irrelevant whether late adopters inspect the product.) As a result of her inspection, each late adopter receives a private quality signal. These quality signals are identically and independently distributed across consumers conditional on true quality, following the same distribution specified in Equation (1). Again, if quality is low, an inspection only reveals this fact with probability \((1 - b)\). Table 1 summarizes the notations.

\(^7\)For parsimony, we focus on the case in which late adopters do not observe any first-period signals, although the main intuition of this paper does not change if we allow late adopters to observe a finite number of first-period signals.

\(^8\)Alternatively, a fraction \( E(x|\bar{a}) \) of late adopters will consider the product if their interest follows the same function as that of early adopters. Since this fraction \( E(x|\bar{a}) \) cannot be separately identified from the relative mass of late adopters \( \delta \), we assume the degree of consideration among late adopters to be 1 for notation simplicity.
Table 1: Summary of Notations

<table>
<thead>
<tr>
<th>Notation</th>
<th>Definition</th>
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<tbody>
<tr>
<td>$a$</td>
<td>The level of marketing efforts, $a \in [a, \bar{a}]$</td>
</tr>
<tr>
<td>$b$</td>
<td>The probability that a buyer receives a good signal when product quality is low</td>
</tr>
<tr>
<td>$\beta$</td>
<td>Consumers’ utility weight of quality beliefs in the market selection model</td>
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<tr>
<td>$\delta$</td>
<td>The relative mass of late adopters</td>
</tr>
<tr>
<td>$E\Pi(a)$</td>
<td>A high-quality seller’s expected profit by choosing marketing efforts $a$</td>
</tr>
<tr>
<td>$f(x</td>
<td>a)$</td>
</tr>
<tr>
<td>$K$</td>
<td>The fixed advertising budget in the advertising scheduling model</td>
</tr>
<tr>
<td>$m$</td>
<td>The share of early adopters who buy the product</td>
</tr>
<tr>
<td>$\mu$</td>
<td>Buyer’s belief that quality is good</td>
</tr>
<tr>
<td>$\mu_0$</td>
<td>Buyer’s prior belief that quality is good</td>
</tr>
<tr>
<td>$\mu_1(s)$</td>
<td>An early adopter’s belief that quality is good after receiving signal $s$</td>
</tr>
<tr>
<td>$\mu_2(a,m,s)$</td>
<td>A late adopter’s belief that quality is good after observing $a$, $m$ and $s$</td>
</tr>
<tr>
<td>$p_1$</td>
<td>The price charged to early adopters, i.e., the introductory price</td>
</tr>
<tr>
<td>$p_2$</td>
<td>The price charged to late adopters</td>
</tr>
<tr>
<td>$\phi$</td>
<td>The parameter that measures the prolonged effect of advertising, $\phi \in [0, 1]$</td>
</tr>
<tr>
<td>$q$</td>
<td>Product quality, which can be either high ($H$) or low ($L$)</td>
</tr>
<tr>
<td>$s$</td>
<td>The private quality signal a buyer receives, which can be either good ($G$) or bad ($B$); private signals are i.i.d. across consumers given quality</td>
</tr>
<tr>
<td>$\theta$</td>
<td>The conditional probability of achieving full buyer interest in the example of Section 4, $\theta \in {\theta, \bar{\theta}}$</td>
</tr>
<tr>
<td>$x$</td>
<td>The share of early adopters interested in the product</td>
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### 3.2 The Equilibrium Concept

We derive the Perfect Bayesian Equilibria (PBE) of this multi-period game of incomplete information. There are two important observations. First, a seller that is identified as being low quality ($\mu = 0$) earns zero profits. Second, marketing efforts and production are costless. Therefore, a low-quality seller always (weakly) prefers to mimic a high-quality seller 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 profits by charging a prohibitively high price or offering the product for free, so that the low-quality seller has no incentives for mimicry.

There exist 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 allows us to derive a unique pooling PBE outcome by solving the high-quality seller’s profit maximization problem. Since it is the low-quality seller who wishes 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. Note that the equilibrium outcome coincides with the unique Undefeated PBE outcome (see Mailath, Okuno-Fujiwara, and Postlewaite 1993 for concept development, and Taylor 1999 for an application).

A few remarks on our assumption about the cost of marketing efforts are in order. Our analysis deliberately assumes costless marketing. Pooling on the lowest marketing effort remains an equilibrium outcome if marketing efforts are costly. Moreover, as the cost of marketing efforts increases, we obtain a (weakly) larger range of parameters in which the pooling equilibrium where sellers choose the lowest level of marketing efforts is the most profitable of all pooling equilibria for the high-quality seller. These forces are in favor of demarketing emerging as an equilibrium outcome. However, for sufficiently high marketing costs, there may also exist separating equilibria in which marketing efforts signal high quality to buyers. This quality signaling role of marketing has been analyzed extensively elsewhere in the literature (Milgrom and Roberts 1986; Bagwell and Riordan 1991; also see Bagwell 2007 for a survey) and is therefore not the focus of this study.

One commonly applied refinement concept that often helps to reduce the multiplicity of equilibria is the “intuitive criterion” (Cho and Kreps 1987). This criterion rules out off-equilibrium beliefs that assign positive probabilities to a seller type who cannot profitably deviate even if such deviation indicates high quality with probability one. However, all pooling PBEs satisfy the intuitive criterion in our setting. To see this, suppose buyers believe that any seller who deviates is of high quality. It follows that high- and low-quality sellers earn the same profit upon deviating. Meanwhile, as we will see from subsequent analysis, in any pooling equilibrium the low-quality seller earns less than the high-quality seller. These two observations together imply that the low-quality seller always has weakly stronger incentives to deviate, and that the intuitive criterion does not preclude pessimistic off-equilibrium beliefs. As a result, all the pooling PBEs will survive the intuitive criterion.

The concept of undefeated equilibrium puts the following restriction on off-equilibrium beliefs: after a deviation, if there is an equilibrium in which the deviation decisions would have been on the equilibrium path, the belief should put positive probability only on the type that would have been better off in the latter equilibrium.

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3.3 Buyers’ Beliefs

Buyers’ beliefs about product quality evolve as new information arrives. At the start of the game, buyers share the common prior belief that quality is high with probability $\mu_0 \in (0, 1)$. The seller knows the value of $\mu_0$. Upon observing their private inspection outcomes, interested early adopter update their beliefs following Bayes’ rule:

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

(2)

Intuitively, since inspection is imperfect, although a defect reveals low quality, the failure to detect a flaw only lends partial confidence to quality, where the updated belief that quality is high lies between the prior $\mu_0$ and 1.

An interested early adopter’s willingness to pay can be either of two levels, $\mu_1(G)$ and $\mu_1(B) = 0$, depending on her inspection outcome. The most profitable price for a high-quality seller is therefore

$$
p_1^* = \mu_1(G) = \frac{\mu_0}{\mu_0 + b(1-\mu_0)}.
$$

(3)

The low-quality seller will charge this same price in equilibrium. In practice, the seller can set the price one cent below $\mu_1(G)$ to ensure purchase. At this introductory price, only interested early adopters who observe a favorable inspection outcome will buy. As a result, first-period sales contain useful information about product quality for late adopters.

Note that in a pooling equilibrium where high- and low-quality sellers always choose the same marketing efforts $a$, the exact effort level does not further affect early adopters’ quality beliefs. By observing an effort level $a$ only, an early adopter still thinks that the seller is high quality with prior probability $\mu_0$ and low quality with prior probability $1-\mu_0$. Therefore, although early adopters can observe market efforts $a$, the only way they can update their quality beliefs beyond the prior is through the private signals. In the second period, however, since late adopters can additionally observe the sales volume among early adopters, the seller’s marketing efforts become diagnostic of quality—intensive marketing yet weak first-period sales naturally raise doubt about quality. Below we will analyze how late adopters’ quality beliefs are shaped by marketing efforts and first-period sales.
as well as their own inspection outcomes.

Specifically, suppose a measure $x$ of early adopters become interested in the product as a result of marketing efforts. By the law of large numbers, the measure of early adopters who receive a good inspection outcome and purchase the product is either $x$ or $bx$, depending on product quality. Since $x$ itself varies stochastically between $x$ and $\bar{x}$, the highest possible level of first-period sales for a low-quality seller is $b\bar{x}$, while the lowest possible level of first-period sales for a high-quality seller is $x$. If first-period sales are “stellar” ($m > b\bar{x}$), then all late adopters can perfectly infer high quality; conversely, “poor” first-period sales ($m < x$) fully reveal low quality to late adopters. Altogether, if $b\bar{x} < x$, then any level of first-period sales perfectly indicates quality. For the rest of the paper, we focus on the more interesting case where

\[ x \leq b\bar{x}. \]

Under this assumption, there exists a range of “mediocre” first-period sales ($m \in [x, b\bar{x}]$) that leave late adopters uncertain about product quality. After observing mediocre first-period sales $m$, late adopters know that the realized interest level among early adopters must be $x = m$ if quality is high and $x = m/b$ if quality is low. However, late adopters do not directly observe the realized interest level, but understand that interest varies stochastically with marketing efforts. Specifically, they know that given marketing efforts $a$, the probability of observing first-period sales $m$ is $f(m|a)$ if quality is high and $f(m/b|a)$ if quality is low. In this way, marketing efforts influence late adopters’ quality beliefs.

A last factor that may affect a late adopter’s quality belief is her own inspection outcome $s$. If first-period sales already perfectly indicate quality, a late adopter gains no relevant additional information from inspection. In particular, a late adopter knows that quality is high for certain if first-period sales are stellar ($m > b\bar{x}$), and low for sure if first-period sales are poor ($m < x$). However, a late adopter remains uncertain about product quality if first-period sales are mediocre ($x \leq m \leq b\bar{x}$), in which case her own inspection adds incremental information on quality. A bad inspection outcome again reveals low quality. On the other hand, 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 $f(m|b|a)b$. The late adopter can then update her quality beliefs using Bayes’ rule.

In summary, after observing marketing efforts $a$, first-period sales $m$, and the outcome of her quality inspection $s$, a late adopter’s *ex post* quality belief is:

$$
\mu_2(a, m, s) = \begin{cases} 
1 & \text{if } m > b\bar{x}, \\
\frac{f(m|a)\mu_0}{f(m|a)\mu_0 + f(m|b|a)b(1-\mu_0)} & \text{if } \bar{x} \leq m \leq b\bar{x} \text{ and } s = G, \\
0 & \text{otherwise}.
\end{cases}
$$

(4)

One key observation is that the quality belief term $\frac{f(m|a)\mu_0}{f(m|a)\mu_0 + f(m|b|a)b(1-\mu_0)}$ decreases with marketing efforts $a$ if and only if the following condition holds:

$$
\frac{f(m|a)}{f(m|a)} > \frac{f(m|a')}{f(m|a')} \text{ for any } a > a'.
$$

(5)

Note that Condition (5) always holds if $f(x|a)$ satisfies the monotone likelihood ratio property (MLRP) in $a$, which stipulates that $\frac{f(x|a)}{f(x|a')}$ increases with $x$ for any $a > a'$ (Milgrom 1981). A frequently used assumption in mechanism design theories, the MLRP implies that marketing efforts increase buyer interest in the sense of FOSD (but not vice versa). Furthermore, the MLRP requires that, given any two interest levels, the relative chance of achieving the higher interest level increases with marketing efforts. This property parallels the core intuition underlying this paper: since marketing efforts raise interest, late adopters would expect high sales if they observe intensive marketing, and therefore are more likely to infer low quality when sales turn out mediocre. We summarize these results with the following proposition.

**Proposition 1.** If buyers’ interest in a product satisfies the monotone likelihood ratio property in marketing efforts, then late adopters’ quality beliefs (weakly) decrease with marketing efforts.

Proof: by construction.

The analysis thus far shows how a seller can influence late adopters’ quality beliefs...
by choosing its level of marketing efforts. The seller can adopt demarketing to serve as an excuse for any mediocre sales. However, late adopters’ quality beliefs as specified in Equation (4) are conditional on a realized first-period sales volume \( m \). It is unclear yet how marketing efforts affect seller profits \textit{ex ante} since 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.

### 3.4 Seller Profits and Equilibrium Strategies

In this section, we explore equilibrium (de)marketing strategies. In doing so, we focus on a high-quality seller’s profits associated with different marketing efforts. As discussed, the high-quality seller’s profit maximizing strategy forms the PBE. 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 seller to set the price \( p_2 \) equal to \( \mu_2(a, m, s) \) as described in Equation (4). This price extracts the full surplus of all late adopters who have a positive willingness to pay for the product. Since a high-quality product will never fail an inspection and will always achieve at least mediocre first-period sales \( (m \geq \underline{x}) \), its optimal second-period price is:

\[
p_2^*(a, m) = \mu_2(a, m, G) = \begin{cases} 
  \frac{1}{f(m|a)\mu_0 + F(b|x|a)b(1-\mu_0)} & \text{if } m > b\bar{x}, \\
  f(m|a)\mu_0 & \text{if } \underline{x} \leq m \leq b\bar{x}.
\end{cases}
\]  

The low-quality seller will imitate the high-quality seller’s second-period price as long as its first-period sales are mediocre \( (m \geq \underline{x}) \), but will not be able to sell anything at a positive price if its first-period sales are poor \( (m < \underline{x}) \).

Given these optimal pricing decisions, the high-quality seller’s expected profit ultimately depends on its marketing effort choice. At the marketing effort level \( a \), in expectation a mass of \( E(x|a) \) early adopters will be interested in the product. If the seller is of high quality, all interested consumers will observe a good inspection outcome, so that the same mass of \( m = x \) early adopters will buy at the introductory price \( p_1^* = \mu_1(G) \). With probability \( 1 - F(b\bar{x}|a) \), first-period sales are stellar, in which case late adopters unam-
biguously infer high quality. With probability $F(b\bar{x}|a)$, first-period sales are mediocre, so that late adopters remain uncertain about product quality. In either case, the seller will set $p_2$ equal to late adopters’ quality beliefs as given in Equation (6). Collecting terms, the high-quality seller’s expected profit is:

$$E\Pi (a) = E(x|a)\mu_1(G) + \delta [1 - F(b\bar{x}|a)] + \delta \int a^b x\mu_2(a,x,G)f(x|a)dx. \quad (7)$$

Equation (7) shows that marketing efforts affect a high-quality seller’s profit in several ways. The first term on the right-hand side, $E(x|a)\mu_1(G)$, reflects the demand-enhancing effect of marketing efforts among early adopters. The high-quality seller’s expected first-period sales $E(x|a)$ increase with $a$ by FOSD. The second term $\delta [1 - F(b\bar{x}|a)]$ represents the profit from selling to late adopters when stellar first-period sales unambiguously reveal high quality so that $p_2^* = 1$. This term increases with $a$ as well, given the assumption of FOSD. The last term is the profit derived from late adopters when first-period sales turn out mediocre. This term can decrease with $a$ if high marketing efforts adversely affect quality beliefs following mediocre sales, as under the MLRP assumption (Proposition 1). At the same time, marketing efforts also affect the probabilities for different levels of mediocre sales to arise, reflected by the probability weights $f(x|a)$ attached to different prices in the last term of Equation (7).

We are interested in whether “demarking” arises in equilibrium, where the seller does not choose the highest level of marketing $\bar{a}$ although it is costless. We first note a necessary condition for demarketing to be optimal, that the relative mass of late adopters $\delta$ should be sufficiently large. If $\delta$ is too close to 0, the seller will choose the highest marketing efforts to maximize expected interest and sales among early adopters. However, even when $\delta$ is sufficiently large, demarketing is worthwhile only if it improves second-period profits. We note two boundary conditions below.

If buyers’ prior quality beliefs are very pessimistic ($\mu_0$ being sufficiently 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 (2), where early adopters’ quality beliefs are close to 0 regardless of the private signal received; and Equation (4), where late adopters’ 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 either early or late adopters are close to zero. Hence, the high-quality seller’s imperative is to provide absolute proof of high quality to late adopters, that is, to maximize the probability of stellar sales in period one such that $\mu_2 = 1$. 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 ($\mu_0$ being sufficiently close to 1), demarketing will not be optimal either. As can be seen from Equation (2), if early adopters have firm faith in product quality, their quality belief will be close to 1 unless their inspection detects a flaw, which will not happen for the high-quality product anyway. Similarly, as Equation (4) shows, late adopters’ quality beliefs also remain close to 1 as long as first-period sales are at least mediocre ($m \geq \bar{x}$), a level that a high-quality seller will achieve for certain. Therefore, for sufficiently optimistic prior beliefs, consumers will have high willingness to pay regardlessly, and the high-quality seller’s imperative is to maximize expected first-period sales volume through full marketing efforts.

Altogether, the prior belief $\mu_0$ 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 our discussion of necessary conditions for a demarketing equilibrium. A formal proof is in the Appendix.

**Proposition 2.** An equilibrium with demarketing ($a < \bar{a}$) can only exist if

(i) the relative mass of late adopters $\delta$ is sufficiently large, and

(ii) the prior quality belief $\mu_0$ is neither too pessimistic (i.e., close to 0) nor too optimistic (i.e., close to 1).

Since beliefs following mediocre sales, as well as the probabilities by which different mediocre sales levels occur, depend on the entire curvature of the family of buyer interest distributions $\{f(x|a)\}$, it is difficult to further evaluate the net impact of demarketing on second-period profits without putting additional structure on this family of functions. To demonstrate the existence of demarketing equilibria and to gain further insights, we will therefore assume a specific functional form for $\{f(x|a)\}$ in the next section.
4 An Example

The goal of this section is to illustrate how demarketing may improve profits with a parsimonious model. Consider two levels of marketing efforts: “marketing” ($\bar{a}$), and “demarketing” ($a$). Marketing efforts can generate purchase interest among either all early adopters ($x = 1$) or a fraction of them ($x = b < 1$). The conditional distribution of interest given marketing efforts is

$$ f(x | a) = \begin{cases} \bar{\theta} & \text{if } x = 1, \\ 1 - \bar{\theta} & \text{if } x = b, \end{cases} $$

$$ f(x | \bar{a}) = \begin{cases} \theta & \text{if } x = 1, \\ 1 - \theta & \text{if } x = b, \end{cases} $$

with $0 < \theta < \bar{\theta} < 1$. It follows that the distribution $f(x | a)$ first order stochastically dominates $f(x | \bar{a})$, and that $f(x | a)$ satisfies the 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 adopters thus remain uncertain about quality after observing the mediocre sales level $b$, which makes the example interesting in spite of its simplicity.

After observing marketing efforts $a$, first-period sales $m$, and the outcome of her inspection $s$, a late adopter’s quality belief follows directly from Equation (4):

$$ \mu_2(a, m, s) = \begin{cases} 1 & \text{if } m = 1, \\ \frac{(1-\bar{\theta})\mu_0}{(1-\bar{\theta})\mu_0 + \theta b(1-\mu_0)} & \text{if } m = b, s = G, \text{ and } a = \bar{a}, \\ \frac{(1-\theta)\mu_0}{(1-\theta)\mu_0 + \theta b(1-\mu_0)} & \text{if } m = b, s = G, \text{ and } a = a, \\ 0 & \text{otherwise.} \end{cases} $$

Since $\bar{\theta} > \theta$, we immediately have:

$$ \mu_2(\bar{a}, b, G) < \mu_2(a, b, G). $$

The above result is consistent with Proposition 1. Demarketing to early adopters
leads to more favorable quality beliefs among late adopters when first-period sales are mediocre ($m = b$). Late adopters are uncertain whether the mediocre sales result from a marketing campaign by a low-quality seller that raised full interest, or from a marketing campaign by a high-quality seller that only generated partial interest. Since demarketing decreases the chance for a campaign to achieve full interest, it induces late adopters to believe that mediocre sales likely result from insufficient marketing and that the product may not necessarily be bad.

The equilibrium choices of marketing efforts and prices must maximize the expected profits of a high-quality seller. The optimal introductory price is $p_1^* = \mu_1 (G)$ as discussed before, and the optimal second-period price is given by Equation (6) as:

$$p_2^*(a, m) = \begin{cases} 
1 & \text{if } m = 1, \\
\mu_2 (a, b, G) & \text{if } m = b.
\end{cases}$$

Finally, the profits under different (de)marketing strategies follow from Equation (7):

$$E\Pi (\bar{a}) = \left[ \bar{\theta} + (1 - \bar{\theta}) b \right] \mu_1 (G) + \delta \left[ \bar{\theta} + (1 - \bar{\theta}) \mu_2 (\bar{a}, b, G) \right],$$

$$E\Pi (a) = \left[ \theta + (1 - \theta) b \right] \mu_1 (G) + \delta \left[ \theta + (1 - \theta) \mu_2 (a, b, G) \right].$$

Whether the seller should choose demarketing depends on the comparison between these two profits. We first compare expected second-period profits.

**Proposition 3.** Let buyer interest $x$ generated by marketing efforts $a$ follow the conditional distribution function $f (x | a)$ as defined in Equation (8), and let $\hat{\mu} = \frac{\mu_0 b}{1 - (1 - \theta)(1 + b)} \in (0, 1)$. Demarketing strictly maximizes the expected second-period profit of a high-quality seller if and only if buyers’ prior quality belief is sufficiently optimistic ($\mu_0 > \hat{\mu}$).

Proof: see the Appendix.

We are interested in whether demarketing can emerge in equilibrium. If the relative mass of late adopters is sufficiently high, the equilibrium marketing strategy will be the one that maximizes a high-quality seller’s second-period profits. A low-quality seller will duplicate this strategy. Proposition 3 therefore directly implies the following result.

**Corollary 1.** Let buyer interest $x$ generated by marketing efforts $a$ follow the conditional distribution function $f (x | a)$ as defined in Equation (8), and let $\hat{\mu} = \frac{\mu_0 b}{1 - (1 - \theta)(1 + b)} \in (0, 1)$.
Figure 2: The seller’s optimal marketing efforts as a function of buyers’ prior quality belief $\mu_0$ and the relative mass of late adopters $\delta$ (assuming $\bar{\theta} = 0.6$, $\underline{\theta} = 0.1$, and $b = \frac{2}{3}$).

For any sufficiently optimistic prior quality belief $\mu_0 > \hat{\mu}$, there exists a threshold value of the relative mass of late adopters $\hat{\delta}$, such that if $\delta > \hat{\delta}$ then the seller chooses demarketing in equilibrium.

Figure 2 shows the seller’s equilibrium (de)marketing decision as a function of buyers’ prior quality belief $\mu_0$ and the relative mass of late adopters $\delta$. For illustration we fix the remaining parameters as $\bar{\theta} = 0.6$, $\underline{\theta} = 0.1$, and $b = 2/3$. Demarketing arises as the equilibrium strategy for reasonable parameter values. In particular, there are three observations. First, if the relative mass of late adopters is small, then high marketing efforts are always optimal. Intuitively, if the first-period market is more important, it would be the seller’s priority to maximize sales among early adopters. Second, given any $\delta$, if the prior belief is very pessimistic ($\mu_0$ close to 0), high marketing efforts are optimal. This is because, as discussed in the previous section, the seller’s imperative now is to maximize the likelihood of stellar sales ($m = 1$) to convince pessimistic late adopters that
quality is high. Third, if the prior belief is very optimistic ($\mu_0$ close to 1), it is optimal for the seller to market heavily in the first period.\footnote{This result does not contradict Corollary 1. For any finite $\delta$, there exists a cutoff value of $\mu_0$ such that high marketing is optimal for prior beliefs above this cutoff value. At the same time, for any $\mu_0 > \hat{\mu}$, there exists a cutoff value of $\delta$ such that demarketing is optimal for $\delta$ above this cutoff (see Figure 2).} When buyers have firm confidence in product quality, the second-period price of a high-quality seller, certain to achieve at least mediocre first-period sales and to yield a positive inspection outcome, is always close to 1. Since marketing efforts have negligible impact on the profit margin, the high-quality seller should optimally maximize marketing efforts to expand sales volume among early adopters. These observations illustrate the predictions of Proposition 2 that demarketing can only arise as an optimal strategy when there are sufficient late adopters and when buyers face significant quality uncertainty.

5 Other Marketing Decisions

The analysis highlights two fundamental conditions that give rise to demarketing as an optimal seller strategy: (1) observable sales, and (2) conspicuous marketing efforts. If buyers could not access past sales as a quality cue, the seller would in each period choose the highest possible level of costless marketing efforts to raise buyer interest and maximize expected profits. If marketing efforts were unobservable, the seller would want to maximize marketing as well.\footnote{This is true except when the support of the buyer interest distribution varies with marketing efforts in highly contrived manners such that demarketing produces a buyer interest level which yields a unique sales volume that unambiguously indicates high quality.} The value of demarketing critically depends on its visibility to buyers; it must be able to serve as a conspicuous excuse of mediocre sales to influence beliefs. In general, buyers need not observe the exact level of past sales or marketing efforts. The rationale behind demarketing continues to hold as long as buyers observe informative signals of past sales and marketing efforts.

There is another technical condition, that 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. Clearly, a general condition for demarketing to arise is that late adopters cannot completely “parse out” the effect of marketing on sales so as 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.

We expect the intuition behind demarketing to apply to other marketing decisions when these conditions are satisfied. Below we specifically discuss the applications in two classic marketing problems: advertising scheduling and market selection.

5.1 Advertising Scheduling

Advertising scheduling has attracted significant attention both in practice and in academia (see for example Little and Lodish 1969; Horsky and Simon 1983; Mahajan and Muller 1986; Villas-Boas 1993). How should a company allocate its advertising budget over time? The literature has extensively studied how to best schedule advertising to maximize its effectiveness and to accelerate product adoption. For example, Horsky and Simon (1983) suggest that a firm advertise heavily in the initial periods of the product life cycle to inform all innovators of the existence of the product. However, the consumer quality inference perspective has not been emphasized in the literature. If sales and advertising intensity are observable, they may influence consumers’ quality beliefs (if quality is uncertain). In the same spirit of demarketing, relatively light advertising early on in the product life cycle may improve long-run profits, as late adopters attribute any slow takeoff of sales to conservative advertising rather than inferior product quality.

We illustrate this point by extending the main model of Section 3. Suppose the seller has a fixed advertising budget $K > 0$ that provides an upper bound on the sum of advertising expenditures $a_1 + a_2$ over the two periods. The level of interest among early adopters, denoted by $x_1$, follows a conditional p.d.f. $f_1(x_1 | a_1)$, whereas the level of interest among late adopters, $x_2$, follows a conditional p.d.f. $f_2(x_2 | a_2 + \phi a_1)$. The conditional distribution functions $f_1$ and $f_2$ need not be identical. However, we make a similar assumption as in the main model that $f_1$ satisfies the MLRP in advertising. The parameter $\phi$ captures the prolonged effect of advertising (e.g., Horsky and Simon 1983). The case of $\phi = 0$ marks the most advertising decay, whereby the impact of advertising is confined to its current period. The case of $\phi = 1$ represents the most advertising
carry-over, whereby buyer interest depends on the cumulative advertising stock to date.

In our two-period model, it is always optimal for the seller to fully exhaust the advertising budget in the second period; the seller will want to maximize interest among late adopters for any given level of first-period advertising. Therefore, \( a_2 = K - a_1 \). It follows that the expected fraction of interested buyers in the two periods are \( E(x_1 \mid a_1) \) and \( E(x_2 \mid K - a_1 + \phi a_1) \) respectively. Let \( \widetilde{\delta} \) denote the relative mass of late adopters (we will discuss how \( \widetilde{\delta} \) relates to \( \delta \) in the main model). The seller’s expected profit over the two periods is

\[
E(x_1 \mid a_1) p_1 + \widetilde{\delta} E(x_2 \mid K - a_1 + \phi a_1) p_2.
\]

(9)

We first consider the benchmark case in which late adopters do not engage in observational learning, a case often examined in traditional advertising scheduling models. Interested buyers in both periods make their purchase decisions based on their inspection outcomes. Therefore, the optimal prices to charge in both periods are \( p_1 = p_2 = \mu_1(G) \) as defined in Equation (3). The seller should then schedule its advertising to maximize \( E(x_1 \mid a_1) + \widetilde{\delta} E(x_2 \mid K - a_1 + \phi a_1) \). Other things being equal, the higher \( \phi \)—that is, the stronger the prolonged effect of advertising—the greater the seller’s incentive is to engage in heavy advertising at product launch. In particular, for \( \phi = 1 \), the seller would want to fully exhaust its advertising budget in period one. Intuitively, when the benefit of advertising fully carries over to future periods, the seller should “front-load” advertising to take the most advantage of its long-run market expansion effect.

With observational learning, however, less front-loaded advertising can increase the seller’s profit. The profit-maximizing prices are determined in the same way as in the main model (Equations (3) and (6)). A high-quality seller’s profit across the two periods becomes

\[
E(x_1 \mid a_1) \mu_1(G) + \widetilde{\delta} E(x_2 \mid K - a_1 + \phi a_1) \int_{\mathbb{X}} \mu_2(a_1, x, G) f_1(x_1 \mid a_1) dx_1.
\]

(10)

By Proposition 1, late adopters’ quality belief \( \mu_2(a_1, x, G) \) is weakly decreasing in \( a_1 \) since \( f_1(x_1 \mid a_1) \) satisfies the MLRP in \( a_1 \). For \( \phi = 1 \), the measure of interested late adopters is independent of \( a_1 \) and equal to \( \widetilde{\delta} E(x_2 \mid K) \). In this case, the analysis of the advertising scheduling model is equivalent to that of the main model where \( \delta \) is set equal
to $\tilde{\delta}E(x_2 | K)$ and where $f = f_1$. In particular, $a_1 < K$ can be the equilibrium first-period advertising level for intermediate values of prior quality belief $\mu_0$ if the measure of interested late adopters $\tilde{\delta}E(x_2 | K)$ is sufficiently large (Figure 2).

In summary, if late adopters can observe both early sales and early-stage advertising intensity, then the advertising scheduling problem satisfies the two fundamental conditions for demarketing to be relevant. Under these conditions, the seller faces a tradeoff: although front-loaded advertising helps expand the market, it may also damage the seller’s quality image if early sales are less than stellar. As a result, the seller may want to choose lighter advertising at product launch than in the case without observational learning. Interestingly, Horstmann and MacDonald (2003) find from the compact disc player market that advertising increases over time post product introduction, after controlling for product characteristics, firm heterogeneity, and aggregate growth effects. The authors conclude that the findings are inconsistent with traditional quality signaling models of dissipative advertising, and that organizing these findings calls for new models with persistent consumer uncertainty and learning. Our advertising scheduling results might suggest one way to explain this empirical puzzle.

### 5.2 Market Selection

Firms also frequently face a market selection problem. Conventional wisdom would recommend targeting the market segment where the product has good match potential. However, if sales and market match potential are both conspicuous, such targeting strategies also raise the public’s expectation of the resulting market response. If sales in the target market fail to excel, which could happen due to inevitable random factors, the firm may suffer more than if it had targeted markets of worse match. For instance, Daimler’s Smart mini-car is believed to perfectly match urban drivers as a new-age convenient city car (Landler 2006). Suppose consumers subsequently fail to see enough Smart cars in urban traffic. The car’s desirability might be more seriously questioned than if the company had, counter-intuitively, chosen to target rural drivers in the first place.

We formalize this intuition using a familiar empirical specification. In doing so, we see that demarketing can arise as a robust result under alternative formulation of the
problem. Suppose a firm can select one of multiple markets to serve. To suppress market size concerns, we assume these markets consist of the same measure of consumers. Each consumer derives the following consumption utility from the firm’s product:

\[ U = x + \beta \mu_1 + \epsilon. \]

This linear utility specification is often adopted in the literature (see for example Guadagni and Little 1983). The term \( x \) can be interpreted as the “match value” between the consumer and the brand which reflects, for example, how the product caters to a consumer’s personal tastes independent of the quality it offers. In the second term, \( \mu_1 \) is the consumer’s perceived probability that product quality is high, which corresponds to early adopters’ quality belief \( \mu_1 \) in the main model. The coefficient \( \beta > 0 \) denotes the utility weight the consumer attaches to quality beliefs. Consumption utility can also depend on other product attributes. However, the key intuition of the model continues to hold as long as these attributes are commonly observable. Therefore, we exclude these attributes from the utility function for notation simplicity. Finally, \( \epsilon \) denotes consumers’ idiosyncratic utility shocks.

The match value a product eventually delivers often depends on both the characteristics of the target market and random factors. To capture this idea, we let \( a \) denote the intrinsic “match potential” of the product in a given market, which relies on the characteristics of the target market. Meanwhile, let \( f(x|a) \) denote the conditional p.d.f. of delivering a specific match value \( x \) to consumers in a market that has match potential \( a \). We assume that \( f(x|a) \) satisfies the MLRP in \( a \), such that greater match potential increases the relative chance of eventually delivering higher match values. For instance, by selecting the urban market which exhibits greater match potential, Daimler’s Smart mini-car would supposedly improve the relative chance of fulfilling higher match values to consumers in this market. We also assume that the match potential of a market is commonly observable; it is commonly known that Smart cars have greater match potential in the urban market. Meanwhile, we assume that the general public cannot directly observe the product’s exact match value in the target market because it is susceptible to randomness. In this way, the relationship between match potential \( a \) and match value \( x \) parallels the relationship between marketing efforts \( a \) and buyer interest \( x \) in the main model. Demarketing in the market selection context thus corresponds to not targeting
the market with the highest match potential.

The Appendix presents the detailed analysis. The main findings are as follows. If the firm cares only about its target market, it should select the market with the greatest match potential to maximize expected sales, consistent with conventional wisdom governing market selection. However, the choice may change if the firm’s objective is to maintain the quality beliefs of the general public beyond the target market, which is plausible if the relative mass of the general public is sufficiently large. Indeed, we show that for any given sales in the target market, the choice of worse match potential improves the general public’s quality beliefs. Moreover, the greatest match potential does not always maximize the \textit{ex ante} expected quality belief of the general public. There even exist specifications of $f(x|a)$ such that the firm should select the least viable target market if it is sufficiently concerned about the quality beliefs of the general public.\footnote{This result does not contradict Proposition 2. It is straightforward to show that if the seller aims to maximize total profits rather than quality beliefs of the general public, it should only choose demarketing if the prior quality belief $\mu_0$ is neither too pessimistic nor too optimistic.} Generally, since quality and match both contribute to market share, quality is more likely to loom as the the main contributor when match potential is poor.

The result has direct implications for firms’ test market selection for new products. Besides gathering market information, test marketing itself may also influence sales at national launch if the general public draws quality inferences from the test outcome. In this case, demarketing will be a relevant strategy to consider due to the importance of national launch. It might benefit the firm to choose cities of worse match potential for test marketing. Consistent with this observation, Swatch conducted its pre-launch test marketing “without fanfare—no advertising or promotional support—in markets such as Dallas, Salt Lake City, and San Diego” (Moon 2004). Similarly, for test marketing of its Crystal Pepsi flavor in 1992, PepsiCo selected Denver, Dallas and Providence, as opposed to New York City or Los Angeles which were likely to receive this edgy soft drink concept more enthusiastically (\textit{The Washington Post}, April 14, 1992). Responses in the test markets were lackluster for Swatch but positive for Crystal Pepsi. However, both became an immediate hit at national launch. The interpretation from the demarketing perspective is as follows: Swatch’s failure in its test markets was less of a quality signal to the general public, who likely blamed the failure on taste mismatch; meanwhile, Crystal Pepsi’s success during test marketing could be a strong quality signal, because it was able
to pass the tougher tests of a more tradition-bound demographic.

To summarize, if product sales are publicly observable, they may affect consumers’ quality beliefs; if marketing efforts are conspicuous, they may further modify consumers’ quality inference process. As a result, demarketing can benefit a seller by inducing buyers to infer greater quality from the same level of sales. New normative insights may arise as we unify a set of marketing problems, including advertising scheduling and market selection, under the demarketing paradigm. Other applications abound. For example, how persuasive should advertising be? From a demarketing angle, persuasiveness can be a double-edged sword: it increases sales but makes each lost sale loom particular alarming to buyers. The next section discusses more applications of demarketing in an empirical context.

6 Empirical Observations and Discussion

While the main objective of this paper is to highlight the normative value of demarketing, it will be useful to note empirical instances where demarketing affects market outcomes. One important empirical question is whether consumers do update quality beliefs based on firms’ marketing efforts as predicted by the model. Observations from a number of categories—beyond the movie industry as previously discussed—are affirmative.

In one example, Tucker and Zhang (2011) look at clicks data from an internet portal site which lists wedding service vendors. They find that popular vendors, with popularity measured by the volume of previous clicks, tend to attract more subsequent visits. This result is consistent with the bandwagon effect of observational learning (Banerjee 1992; Bikhchandani, Hirshleifer and Welch 1992). Moreover, among equally popular vendors, subsequent consumers are more likely to visit those at inconvenient locations or offering a narrower scope of services. This finding is suitable for a demarketing explanation: inconvenient locations and narrow services tend to demarket a vendor by limiting its demand; from subsequent visitors’ perspective, this vendor therefore must provide great service quality to have overcome these limitations and become popular.

Zhang and Liu (2010) document similar observations in micro-loan markets, where
individuals borrow and lend money without the mediation of banks. Lenders are often uncertain about borrowers’ creditworthiness, and they partially resolve such uncertainty by observing other lenders’ choices. As a result, a larger amount of existing funding helps a borrower attract more lenders. Moreover, among borrowers who have received the same amount of funding, lenders favor those who exhibit unfavorable characteristics such as worse credit grades. This result can be interpreted using the demarketing argument as well: since bad credits demarket a borrower, from future lenders’ perspective this borrower must be sufficiently creditworthy otherwise to have attracted lenders in the past.

The rationale behind demarketing can also be understood in light of reference effects (e.g., Winer 1986; Lattin and Bucklin 1989). As demarketing lowers their expectations of sales, consumers should be content even with mediocre sales and should be less prone to challenge the product’s quality. In this sense, demarketing can be broadly related to the practice of expectations management in marketing. In particular, Kopalle and Lehmann (2006) note that “some companies deliberately underrepresent the quality of their products or services”—examples abound, including Boeing whose sales force tends to understate product benefits, Ben & Jerry’s who gained customer trust through modest advertisements, and Toyota who toned down quality claims when introducing Lexus. Kopalle and Lehmann (2006) have also conducted a survey with MBA students, asking them to choose the mileage to advertise for their company’s new line of tires. They find that subjects tend to understate mileage, especially when the objective is to maximize long-run sales rather than first-year sales. Although the authors’ explanations focus on expectations management to ensure repeat purchases of experience goods, these observations might also be rationalized from the demarketing perspective.

Last but not least, the notion of demarketing is related to the concept of “attribution” in social psychology (see, for example, Heider 1958). Attribution theories posit that individuals frequently attribute observed events to various causes, such as external versus internal factors. Analogously, consumers may attribute the market success of a product to external marketing efforts versus intrinsic quality, in which case aggressive marketing may overshadow quality. Indeed, Guadagni and Little (1983) find that a purchase on

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15 It is important to note that our story is fundamentally different from expectations management. Our model focuses on buyers’ quality inferences, whereas expectations management emphasizes the gap between expectations and actual consumption experiences which affects, for instance, consumer satisfaction (e.g., Ho and Zheng 2004; Kopalle and Lehmann 2006).
promotion contains a weaker signal about brand loyalty than a purchase off promotion. More generally, a Google search of the phrase “it is just marketing” yields more than 100,000 web pages, many of which attach a negative connotation to marketing, linking it to a lack of substance. Consistent with this sentiment, the recent comeback of the beer brand Pabst Blue Ribbon (P.B.R.) is believed to have benefited from its “no marketing” strategy (Walker 2003). P.B.R. declined an endorsement proposal from Kid Rock, refused to back major sports events, and suppressed any TV advertising of its brand visions, all in an effort to “appear to be doing as little as possible” (Walker 2003). Management of P.B.R. explains its no marketing strategy with the objective to “let the consumer lead the brand” (Walker 2003). To the extent that heavy marketing makes product sales and brand growth appear manufactured, demarketing can help maintain an “organic” and “genuine” quality image for the brand.

The overall implication for marketers is that even financially costless marketing resources may come with a hidden cost in terms of the quality signal sent to consumers. Intensive usage of marketing resources raises consumers’ expectation of market responses, and competes with product quality as an explanation of good sales. Demarketing, on the contrary, can help strengthen the positive quality signal of market success, and attenuate the negative quality implications of sluggish sales.

7 Concluding Remarks

This paper offers a reason why sellers should forgo costless yet productive marketing efforts and discourage demand, a practice called “demarketing.” By suppressing its marketing efforts on a new product, a seller lowers the expected level of sales among early adopters. However, demarketing can alleviate doubts over quality if sales among early adopters fail to excel, as late adopters attribute mediocre sales to low marketing rather than low quality. This mechanism highlights the future orientation of demarketing, whereby the seller sacrifices short-term sales to invest in long-term product quality image. This role of demarketing echoes Kotler and Levy (1971) who, when devising the term “demarketing,” emphasize that “rather than blindly engineering increases in sales, the marketer’s task is to shape demand to conform with long-run objective.”
There are several ways to extend the basic framework outlined in this paper. A direct extension is to model marketing efforts that change buyers’ preferences in addition to raising buyer interest. Another path of research is to explore optimal demarketing strategies in competitive marketplaces. Finally, our theory yields a set of counterintuitive yet testable empirical prediction: (1) controlling for the level of early sales, marketing efforts are negatively correlated with subsequent sales; (2) early stage marketing efforts can decrease with the growth rate of the market size; and (3) early stage marketing efforts can decrease with the transparency of early sales and marketing efforts, and thus with the amount of learning by late adopters. Empirical research could potentially compare the marketing intensity and advertising scheduling of products that exhibit different rates of learning, such as movies targeted at young versus old audiences.
References


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Appendix

A-1 Proof of Proposition 2

Part (i). As $\delta$ goes to zero, a high-quality seller’s expected profit approaches the following limit:

$$\lim_{\delta \to 0} E\Pi (a) = E(x|a)\mu_1 (G).$$

(A-1)

Since $E(x|a)$ is increasing in $a$, expected profits in the limit case are always maximized for $a = \bar{a}$. The continuity of $E\Pi (a)$ in $\delta$ then directly implies that $a < \bar{a}$ can only arise in equilibrium if $\delta$ is sufficiently different from 0.

Part (ii). Note first that, if $m \in [\underline{x}, \overline{x}]$, both $\mu_1 (G)$ and $\mu_2 (a, m, G)$ are continuous in $\mu_0$, and that expected profits are continuous in beliefs. As $\mu_0$ approaches 0, beliefs go to the following limits:

$$\lim_{\mu_0 \to 0} \mu_1 (G) = 0,$$

$$\lim_{\mu_0 \to 0} \mu_2 (a, m, s) = \begin{cases} 1 & \text{if } m > b\bar{x}, \\ 0 & \text{otherwise.} \end{cases}$$

A high-quality seller’s expected profit approaches the following limit:

$$\lim_{\mu_0 \to 0} E\Pi (a) = \delta \left[1 - F (b\bar{x}|a) \right].$$

(A-2)

By continuity, the above result implies that for $\mu_0$ sufficiently close to 0 profit maximization calls for $a = \bar{a}$ so as to maximize the likelihood of first-period sales $m$ being above $b\bar{x}$. Hence, demarketing can arise in equilibrium only if $\mu_0$ is sufficiently positive.

On the other hand, as $\mu_0$ goes to 1, beliefs approach the following limits:

$$\lim_{\mu_0 \to 1} \mu_1 (G) = 1,$$

$$\lim_{\mu_0 \to 1} \mu_2 (a, m, s) = \begin{cases} 0 & \text{if } m < \underline{x}, \text{ or if } m \in [\underline{x}, b\bar{x}] \text{ and } s = B, \\ 1 & \text{otherwise.} \end{cases}$$

Since a high-quality seller will achieve first-period sales of $m \geq \underline{x}$ and will generate a
positive inspection outcome \( s = G \) for certain, its expected profit approaches the following limits:

\[
\lim_{\mu_0 \to 1} E\Pi(a) = E(x|a) + \delta. \tag{A-3}
\]

The seller’s optimal strategy in the limit case is hence to set \( a = \bar{a} \) to maximize \( E(x|a) \). By continuity, the same is true for \( \mu_0 \) close to 1, and hence demarketing can only be optimal if \( \mu_0 \) lies sufficiently below 1. Q.E.D.

### A-2 Proof of Proposition 3

We compare the expected second-period profits of a high-quality seller after different choices of \( a \). Demarketing \( (a = \bar{a}) \) leads to higher second-period profits than marketing \( (a = a) \) if and only if

\[
(1 - \theta) \mu_2(a, b, G) - (1 - \bar{\theta}) \mu_2(\bar{a}, b, G) > \bar{\theta} - \theta,
\]

which is equivalent to

\[
\frac{\mu_0 (1 - \theta)^2}{\mu_0 (1 - \theta) + (1 - \mu_0) \theta b} - \frac{\mu_0 (1 - \bar{\theta})^2}{\mu_0 (1 - \bar{\theta}) + (1 - \mu_0) \bar{\theta} b} > \bar{\theta} - \theta.
\]

Straightforward calculation shows that this last condition can be rewritten as

\[
\mu_0 > \frac{\theta \bar{\theta} b}{1 - \theta - \bar{\theta} + (1 + b) \theta \bar{\theta}}. \tag{A-4}
\]

Since \( \theta, \bar{\theta} \in (0, 1) \), the right-hand side of this condition lies strictly between 0 and 1. Q.E.D.

### A-3 A Market Section Model

We abstract from specifying the micro-process (such as a private signal structure) by which true quality affects quality beliefs. Instead, we make a mild non-parametric assumption that all consumers in the target market hold a more favorable quality belief if
true quality is high ($\mu^H_1$) than if true quality is low ($\mu^L_1$):

$$\mu^H_1 > \mu^L_1.$$  \hfill (A-5)

To isolate the impact of match potential in market selection, we assume that quality beliefs are orthogonal to match values.

We normalize consumers’ no-purchase utility to be zero. Depending on the functional form of the utility shocks, we can then specify the product’s share of the target market.

We denote this market share as $m$, which echoes first-period sales $m$ in the main model. For concreteness, suppose utility shocks follow an i.i.d. double exponential distribution across markets. The firm’s market share follows the logit specification:

$$m = \frac{\exp(x + \beta \mu_1)}{1 + \exp(x + \beta \mu_1)}.

Market share depends on both quality beliefs and the match value, which ultimately depend on product quality and the match potential of the target market. It follows immediately that the firm should select the market with the greatest match potential $a$ to maximize its expected market share.

Now suppose the firm’s objective is to maintain the quality beliefs of the general public beyond the target market. Consider the general public’s posterior quality belief after observing the firm’s match potential choice $a$ and the resulting market share $m$: $\mu_2(a, m)$.

This term corresponds to late adopters’ quality beliefs in the main model. Given the logit specification, the general public knows that the match value $x$ must be $\log \frac{m}{1-m} - \beta \mu^H_1$ if quality is high, and $\log \frac{m}{1-m} - \beta \mu^L_1$ if quality is low. It follows that

$$\mu_2(a, m) = \frac{f(\log \frac{m}{1-m} - \beta \mu^H_1 | a) \mu_0}{f(\log \frac{m}{1-m} - \beta \mu^H_1 | a) \mu_0 + f(\log \frac{m}{1-m} - \beta \mu^L_1 | a)(1 - \mu_0)} = \frac{1}{1 + \frac{f(\log \frac{m}{1-m} - \beta \mu^H_1 | a)}{f(\log \frac{m}{1-m} - \beta \mu^L_1 | a)}} \frac{1 - \mu_0}{\mu_0}.

Since $\mu^H_1 > \mu^L_1$, $\beta > 0$ and $f(x|a)$ satisfies the MLRP in $a$, for any given market share $m$,

\footnote{The same conclusion holds qualitatively if the general public also receives quality signals.}
the choice of greater match potential hurts the general public’s quality beliefs:

$$\frac{\partial \mu_2(a, m)}{\partial a} < 0. \quad (A-6)$$

It remains to check whether the firm would ever prefer markets with worse match potential \textit{ex ante} given their lower probabilities of achieving high market shares.

To rule out purely cost-based considerations, we again assume that the firm incurs the same cost when serving the different markets regardless of product quality and match potential. Suppose firms are interested in improving the quality beliefs of the general public. It follows that the high-quality firm will choose the market with match potential \(a\) to maximize the expected quality belief of the general public \(E[\mu_2(a) | q = H]\) over all possible levels of market share \(m\). The low-quality firm will mimic its high-quality counterpart’s market selection in a PBE. Recall that for any match value \(x\), the high-quality firm’s market share is \(m = \exp(x + \beta \mu_1^H) /[1 + \exp(x + \beta \mu_1^H)]\). Therefore,

$$E[\mu_2(a) | q = H] = \int \mu_2(a, m) f(x|a) dx$$

$$= \int \frac{1}{1 + \frac{f(x + \beta \mu_1^H - \beta \mu_1^L | a) 1 - \mu_0}{\mu_0} f(x|a)} dx.$$

The greatest match potential does not always maximize the above term. For example, suppose \(f(x|a) = -a \exp(ax)\) where \(x \geq 0\) and \(a < 0\) such that \(f(x|a)\) satisfies the MLRP in \(a\). The above expression becomes

$$E[\mu_2(a) | q = H] = \int_0^\infty \frac{-a \exp(ax)}{1 + \exp[a \beta (\mu_1^H - \mu_1^L)] \frac{1 - \mu_0}{\mu_0}} dx$$

$$= \frac{1}{1 + \exp[a \beta (\mu_1^H - \mu_1^L)] \frac{1 - \mu_0}{\mu_0}}.$$ 

It follows that

$$\frac{\partial E[\mu_2(a) | q = H]}{\partial a} < 0. \quad (A-7)$$

That is, given the functional form assumptions, if a firm is sufficiently concerned about the quality beliefs of the general public, it should select the least viable target market.