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# Profit-Increasing Consumer Exit

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This paper examines the phenomenon of profit-increasing consumer exit and the related phenomenon of profit-decreasing consumer entry. We demonstrate that firms can be better off in shrinking markets and worse off in growing markets, even in the absence of competitive entry or exit. Specifically, firms may benefit if a segment of consumers who are relatively indifferent about consuming any product in the category leave the market. Profits can increase for all firms even if the exiting consumers have strong preferences for only one of the products in the market. In shrinking markets, it is reasonable to assume that the people who are likely to exit the market first are people who are "least committed" to the category. In particular, people who are the least satisfied with the existing offers are the most likely to change their behavior by finding an alternative or adopting a new technology. Similarly, in growing markets, consumers who enter the market late are generally the least committed to the category. Such exiting can relax the competitive pressure between firms and lead to increased profitability. Our findings provide an explanation for profit growth that has been observed in product industries exhibiting slow and predictable declines over time, including vacuum tubes, cigarettes, and soft drinks.

*Key words*: competitive analysis; analytic models; game theory; market evolution
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## 1. Introduction

Would a manager rather compete in a growing market or a shrinking market? Conventional wisdom suggests that growing markets are more attractive (Kotler and Keller 2012). This is underlined by managerial tools such as the Boston Consulting Grid, which uses market growth as a proxy for market attractiveness when considering investments (Lilien et al. 1992). This conventional wisdom has been challenged by researchers who say that firms could be worse off in growing markets if such growth is associated with large levels of entry that lead to intense competition. For example, the costs of research and development, distribution systems, and awareness systems limit the profitability of new entrants in growing markets (Gatignon and Soberman 2002).

What happens, however, when there is no entry or exit by rival firms? Can firms be more profitable in a shrinking market and less profitable in a growing one? We show that these events are quite possible with two uncontroversial assumptions: In growing markets, consumers who enter the market late are the people who are "least committed" to the category. Similarly, in shrinking markets, consumers who are most likely to exit the market first are people who are least committed to the category.

Consider the cigarette market in the United States. Since 1982, when the cigarette market peaked at 640 billion pieces, it has declined significantly. Today, the market is estimated to be less than 400 billion pieces, a decrease of more than 35% in terms of volume (Womach 2003). Explanations for this decline abound. Studies have demonstrated that tobacco exhibits characteristics similar to other categories of consumer goods; important factors that have had a significant effect on overall consumption are (a) average pricing and (b) per-capita income (Wilcox and Vacker 1992). In addition, the health effects of smoking have undoubtedly contributed to reduced smoking in the United States. Despite a gradual and predictable decline in cigarette sales beginning in 1982, the profits of domestic cigarette manufacturers exhibited significant growth through 1990 (Bauder 1984, Gordon 1985, Wiggins 1985, Ticer 1986, Yankeelov 1986).[1]

[1] It is important to note that the important lawsuits undertaken by various state governments and class actions did not start until the

A key question is, why did the profits of cigarette manufacturers hold up so well in a context of declining sales and reduced popularity of smoking?[2] To answer this question, we first consider the type of people who stopped buying and consuming cigarettes over the course of the decline. We abstract away from the natural evolution of tobacco consumers, where people start buying cigarettes in their teens and stop buying later in life, and focus our attention on the fraction of consumers who stopped smoking early or quit smoking. In general, these were people who wanted to reduce their tar and nicotine intake. Many ex-smokers smoked low-tar cigarettes before they quit. They may have enjoyed smoking, but they were perhaps unwilling to accept the level of risk associated with tobacco consumption.

The reality is that tobacco companies were unable to (or chose not to) develop tar-free cigarettes. The existence of a segment that seeks the satisfaction of smoking without the inherent risk is underlined by the recent development of electronic cigarettes, which do not deliver tar (Zezima 2009, Keeley 2012). These observations are further supported by research and surveys that show that people who were (and are) most likely to quit are smokers of low-tar and nicotine cigarettes (Kozlowski et al. 1999, Kelbsch et al. 2005).

In our model, we show that these are precisely the conditions associated with increased profits in a shrinking market. It is also important to note that the U.S. tobacco market was dominated by six major cigarette manufacturers in 1982: this market structure remained stable until 1994, when Brown & Williamson merged with American Tobacco.[3] Thus, it is difficult to explain increased profitability by changes in market structure or concentration. In a nutshell, tobacco consumers who were leaving the market were less committed to the category. Their relative preference for the products on the market were small (none of the products offered what these consumers wanted: a product that delivered flavor and satisfaction without the perceived risk). It is straightforward to see how such consumers might exacerbate competition between firms.

Other examples of market decline coupled with profit growth come from the carbonated beverage market and vacuum tubes industries. The per-capita consumption of soda declined 16% between 1998 and 2011, reflecting increased concerns about obesity: sugary soft drinks account for a large fraction of the calories consumed in the average American's diet (Strom 2012). This has led to a decline in overall volume of approximately 3.1% over the 13-year period.[4] Nevertheless, beverage companies have been making more money on carbonated soft drinks by raising prices and forcing die-hard drinkers to pay more to feed their sugar habit. In fact, revenue from carbonated soft drinks reached a record high of $75.2 billion in 2011 (Strom 2012).[5]

The production of vacuum tubes in the United States stopped sometime in the 1980s after decades of market decline.[6] As noted in Harrigan and Porter (1983), the discovery of the transistor in the late 1940s meant that vacuum tubes were a technological anachronism; pundits predicted that vacuum tubes would disappear by the 1970s. Despite these predictions, the decline stage for vacuum tubes lasted more than 20 years. Throughout the 1960s, manufacturers maintained impressive profitability by reducing volume and focusing on price-insensitive demand associated with replacement tubes and military applications.

In these three examples, there are three commonalities worth highlighting. First, the decline of the category was both gradual and predictable. Second, the decline was driven by the departure of noncommitted category participants who stopped using the product (as in the case of cigarettes), switched to an alternative without "negative baggage" (in the soda case, switching to diet soft drinks, water, or fruit juices), or adopted an alternative technology (in the vacuum tubes case, adopting transistors and solid state electronics). Third, and finally, the firms responded by raising prices for customers who remained in the market.

Our objective is to show how these conditions can lead to profit-increasing consumer exit. Moreover, we demonstrate that this phenomenon is the expected outcome in a model where the firms compete vigorously with each other. That is, the prediction that

early 1990s. Although these lawsuits no doubt reduced the profits of the tobacco companies, we restrict our attention to the "prelitigation" period. There were private lawsuits launched against tobacco companies prior to 1990, but generally, these were successfully defended or had a negligible impact on tobacco company profits.

[2] The penetration of smoking reached a peak in the 1950s at well over 40% of the adult population. Penetration has declined to currently less than 25% of the adult population (see http://www.infoplease.com/ipa/A0762370.html, accessed July 25, 2013).

[3] Although Big Tobacco was often referred to as the Big Seven (Philip Morris, R.J. Reynolds, Brown & Williamson, Lorillard, Liggett & Myers, American Tobacco, and United States Tobacco), United States Tobacco was primarily a manufacturer of smokeless tobacco.

[4] The overall decline in volume is obtained by multiplying the per-capita decline in volume by the percentage increase in the U.S. population over the same 13-year period (12.7%) according to U.S. Census data.

[5] We thank the associate editor for suggesting this example.

[6] As of 2005, there were still manufacturers of vacuum tubes in China and Russia.

incumbents can realize profit growth in declining markets does not rely on any form of collusion or coordination between the firms.

Understanding the possibility and causes of profit-increasing consumer exit has several important implications for managers. For example, knowing that exits by customers who do not easily switch between products can increase profits. This provides a new context for managers to better forecast how their sales, prices, and profits will evolve over time. Furthermore, our results run counter to the conventional wisdom that managers should restrict their investments to growing industries. Rather, in the examples we provided, the profit-increasing decline takes a long time to play out. Thus, in some conditions, firms in declining industries may want to reinvest in their factories or sign long-term leases if such leases provide better terms. Our results also have implications for advertising and consumer relationship management (CRM): managers in shrinking industries may be tempted to advertise and create loyalty programs aimed at retaining customers who are leaving the market. Our results suggest this strategy may be ill-advised—profits can increase when less committed customers leave the market as long as strong relationships are maintained with core consumers in the category.

It is also useful to underline the flip side of profit-increasing consumer exit: profit-decreasing consumer entry. This phenomenon can occur when the growth of a market is both gradual and driven by "doubters" who finally enter the category. A prototypical example of this phenomenon comes from the market for flat-screen televisions. From 2008 to 2009, unit sales in the U.S. television market rose by 2%. Despite this increase in volume, revenues dropped by 7%, driven primarily by an approximately 8% decline in prices.[7] Although there are several factors that could account for lower average prices, a key finding was that televisions were increasingly being sold to less affluent and more price-sensitive customers. In 2009, Sony's management concluded that the decreased revenues—and profits[8]—in their electronics division occurred as a result of intensified price competition, among other factors, despite higher unit sales.[9] Gregg Richard, president of the prominent retailer P.C. Richard & Son, noted that they were "selling more TVs, more units, at lower retail prices," as reported in the *New York Times* (Martin 2011). The contrast is even more stark for flat-screen TV sales in China: sales grew 70% comparing the first quarters of 2008 and 2009, but revenues increased by only 3% in the same period, leading to profit declines for manufacturers of up to 90% (Xing 2009). We posit that similar effects occur in technological industries when early movers are less price-sensitive than late adopters (such as Rogers' early and late majority). In many of these industries, prices fall and total profits are lower despite higher sales. However, these same industries experience a learning curve where marginal costs fall as well, making it hard to tease out how much of the price cut is due to better technology and how much is due to intensified competition.[10] In the following section, we briefly review the related literature.

## 2. Literature Review

The literature related to profit-increasing consumer exit is sparse because the majority of work that examines decision making in shrinking markets is focused on how to minimize damage and not on how profits can increase (Harrigan and Porter 1983, Hague 1985). However, there are three papers that relate directly to the ideas we investigate.

In Desai (2001), two firms compete for two segments of consumers with product lines targeted by segment. One segment (the "high" segment) has a high preference for quality and is sensitive to the difference between products, and the other is less so (the "low" segment). The author finds that the competing firms often reduce the quality of the products designed for the low segment so as to minimize cannibalization. The creation of low-quality line extensions reduces the incentive that firms have to reduce the price on high-quality products by siphoning the low segment to a lower-priced, lower-quality alternative. This work points to the value that can be created by eliminating price-sensitive consumers from the basket of potential demand for a product. However, it is important to note that the value of the strategy highlighted by Desai also entails firms earning significant profit on the products being sold to the low segment.

Using a similar model, Coughlan and Soberman (2005) find that competing firms can increase profits by removing price-sensitive switchers from a primary market with outlet malls. Price-insensitive shoppers (who remain in the primary market) are assumed to place high value on in-store service, whereas price-sensitive shoppers (who are attracted to the outlet mall) place no value on in-store service. Similar to the model of Desai (2001), this model points to the value that firms can capture by removing "bad consumers" from a market. The key mechanism that allows segmentation to work in this model is the difference

[7] See NPD DisplaySearch (2010). Kono (2011) provides a similar description in the Japanese market for later years.

[8] Thus, the price decreases reflected thinner margins, not just lower costs from learning by doing.

[9] See p. 3 of Sony (2009a). Unit sales are taken from Sony (2009b).

[10] Liu (2010) demonstrates that firms set early prices in ways to subsidize the learning that they anticipate will occur, thus also loosening the link between prices and the learning curve.

between segments in terms of their appreciation of in-store service; without this difference, self-selection by the segments would not be possible.

Finally, Ishibashi and Matsushima (2009) propose a model that is similar in spirit to the two models discussed above: there are two segments, one with high preference for quality and high sensitivity to product differences and the other with low preference for quality and less sensitivity to product differences. A low-quality entrant draws all the price-sensitive consumers away from two incumbents, and the authors find conditions where the incumbents earn higher profits by serving only the price-insensitive consumers that remain.

Although none of this work deals explicitly with the topic of consumer exit (or market shrinkage), it is straightforward to see how it relates to our topic. The contribution of our analysis is threefold. First, we show that two dimensions of heterogeneity are not needed for consumer exit to be profit enhancing.[11] We demonstrate the phenomenon in a model where the *only* dimension of heterogeneity is horizontal differentiation. Second, we demonstrate that profits can increase for both firms even when the customers that exit from the market consider only consuming from one of the firms (versus choosing the outside option). For example, a firm's profits can increase even if the only consumers that exit are those that are essentially loyal to its product. This contrasts with the above-mentioned models, where the market segment that is removed is one that is hotly contested by both firms.

We now move to our model and consider a market where there is but one dimension of heterogeneity: horizontal differentiation. Our focus is on understanding how consumer exit affects profitability. As noted earlier, our model is based on exits by consumers who are the most likely to exit once a market starts declining.

## 3. Exit by Consumers at the Edge of the Market

Our base model is a Hotelling market with two firms that are exogenously located at internal points on the linear market. The objective to explain how the departure of less committed consumers (i.e., consumers who realize less surplus from consumption than consumers who are central) can lead to higher profits for competing firms. First, we analyze a situation where the departure of consumers who are less committed to the market occurs symmetrically. We then present an asymmetrical version of the model that more closely reflects the dynamics of the tobacco and carbonated soft drink markets discussed in §1.

Consumers are uniformly distributed along the line with a density of 1. We assume that consumer $i$'s utility from buying and consuming the product from firm $j$ can be represented as

$$U_{ij} = V - p_j - d_{ij}, \tag{1}$$

where $p_j$ is the price charged by firm $j$ and $d_{ij}$ is the distance between consumer $i$ and the location of firm $j$.[12] Consumers can decide not to buy from either firm, in which case they consume only an outside good and earn a normalized utility of zero.

We assume that firms compete in prices and have constant and equal marginal costs, so profits for each firm are equal to $(p_j - c)q_j$, where $q_j$ is the quantity sold. Without loss of generality, we set $c = 0$, with the implication that $p$ represents the absolute markup on the product (i.e., the difference between the price and marginal cost).

Finally, we assume that the firms are located internally, away from the edge of the market, and that $V$ is small enough such that the market is uncovered for some locations (i.e., there are consumers in the market who find that consuming the outside good is preferable to buying either of the existing products). In particular, if the distance between the firms is $2D$, we focus our attention on a market where $\frac{7}{3}D \le V \le \frac{1}{3}(7 + 5\sqrt{10})D$. We further assume that the firms are located at least a distance of $\frac{3}{5}V - \frac{2}{5}D$ from the edges of the market (before consumer exit). The basis for these conditions is explained in §A.2 in the appendix.

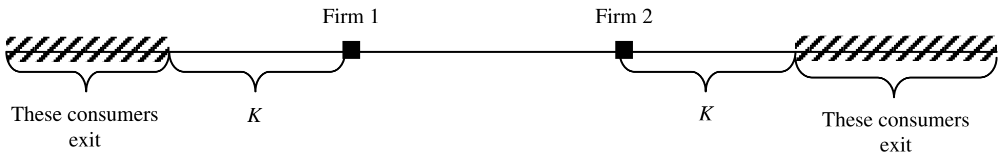
One limitation of our analysis is that we treat the locations of firms as being set exogenously. Although the locations do not reflect the equilibrium outcome of a location-then-price game, there are many reasons why firms might locate internally. For example, the firms could have been initially located at optimal locations when the market was new, and then the market might have grown around them (and moving costs might have prevented the firms from changing their location).[13] Consistent with the lifecycle events noted in §1, our model is designed to represent markets that have just started contracting. Alternatively, firms are sometimes limited by technology. Thus, they may want to locate closer to the edges of the market but would be unable to produce products at that location.

[11] Desai (2001), Coughlan and Soberman (2005), and Ishibashi and Matsushima (2009) all assume two dimensions of heterogeneity: transportation costs and a willingness to pay for quality (or service).

[12] Note that Equation (1) is equivalent to $U = v - \beta P - \alpha d$ under the normalization $V = v/\alpha$ and $p = \alpha P/\beta$.

[13] We prove that there exist conditions under which the locations of the firms in Theorem 1 below could be chosen if the market were smaller and the firms did not anticipate growth that leads to the ex ante scenario presented in Theorem 1. Details are available from the authors upon request.

**Figure 1** Removing Consumers Near the Edge ($K$ and Farther) from Firms






For example, cigarette companies sought to produce tar-free cigarettes, but they were unable to do so. Finally, it is possible that firms do not fully know the state of demand when they enter a market; a lot of ongoing marketing research today is devoted to measuring consumer preferences.

Under these assumptions, the solution to the first-order pricing conditions (before consumer exit) implies an equilibrium where the firms choose prices equal to $\frac{2}{5}(V+D)$ and earn profits of $\frac{6}{25}(V+D)^2$. Note that consumers at the edges of the market do not consume either product because they obtain a negative surplus from buying. Instead, they purchase the outside good and obtain a utility of zero.

We now consider whether profits can increase if consumers who are near the edge of the market leave (or exit) the category. Specifically, we consider what happens to firm profits if consumers located a distance $K$ and farther from the firms (toward the outer edges of the market) leave. Figure 1 illustrates this situation. We make two comparisons: (1) the range of $K$ where profits after consumers exit the market are higher than the profits before they exit and (2) the range of $K$ where incrementally more exiting (i.e., an incrementally smaller $K$) leads to greater profit. The first is a before-and-after comparison; the second looks at the derivative of profit with respect to $K$.

Theorem 1 (Exit from Both Ends of the Market). *Profits increase for both firms if all consumers located at a distance greater than $K$ toward the edge (from each of the firms) leave the market for any $K \in (\max\{(2V-3D)/5, V-4D\}, (3V-2D)/5)$. Furthermore, $d\pi/dK < 0$ after exit (that is, profits increase as more consumers exit the market) for $K \in ((V-D)/2, (3V-2D)/5)$.*

The proofs to the theorems are in §A.1 of the appendix. The intuition behind Theorem 1 is that consumer exit acts as a commitment device for the firms to charge high prices. In the first period, firms compete relatively intensively on price, since cuts in prices attract customers near the edge of the market who would otherwise consume the outside good as well as customers from the center of the market who would otherwise consume from the competing firm. The optimal price represents the point where the gain that an increase in price has on profit margins exactly balances the loss of consumers from both the edge and the center of the market. After consumers leave, the benefit of higher margins from increased prices is realized from all remaining customers, but the fraction of consumers the firm loses when it increases prices is less because now the firm does not lose any customers toward the edge of the market. This means that at first-period prices, the benefit of higher prices on margins outweighs the loss from serving fewer customers. Ultimately, the firms raise prices after the consumer exit to $V-K$ such that the most distant consumers remaining in the market obtain exactly zero utility from the closest firm.[14] At this point, any further increase in prices would lead to losing customers both in the center of the market and at the edge of the market, so there is a kink point in the demand curve at $V-K$.

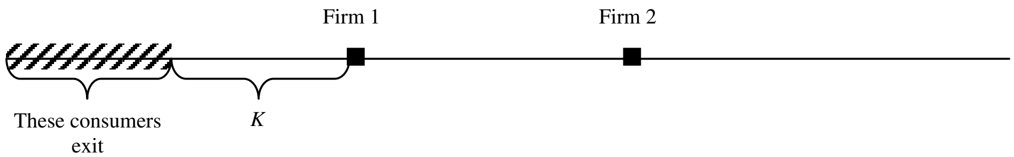
Of course, increasing prices does not automatically imply increasing profits. Profits only increase as a result of higher prices when the price increase more than offsets the decrease in sales. To see that an increase in price alone is not enough to guarantee that profits increase, consider a monopolist facing a market with exiting consumers at its edges. The monopolist would raise its prices. However, the monopolist's profits must decrease with consumer exit since it always had the option of charging a higher price prior to market decline and serving fewer customers. Under competition, things are different. If a firm raises its price, its competitor's best response would be to raise its price as well, resulting in higher profits for both. The problem is that the focal firm cannot commit to this high price because the consumers at the edge are still there, and once the competitor raises its price, it has an incentive to increase its profit by reducing its price to capture these consumers' business. Thus, the mechanism behind profit-increasing customer exit is that the consumer exit decreases a firm's incentive to undercut its rival, and the rival, recognizing this, will in turn increase its price since the best response to a higher price is an even higher price.

The upper bound for $K$ in Theorem 1, $(3V-2D)/5$, reflects the marginal consumer for each firm prior to consumers leaving the market.[15] Thus, profits increase

[14] Note that a marginal decrease in $K$ would increase prices even more, as the price needed to provide consumers at the new edge of the market zero surplus would be higher.

[15] Consumers more distant from the firms than $(3V)/5-(2D)/5$ can leave the market but have no effect on firms' profits because

**Figure 2** **Removing Consumers from Only One Side of the Market**






as a small number of the consumers "served" farthest from the firm exit the market.[16] The lower bound on $K$ reflects that there is a limit on how many consumers can exit such that firm profits increase. It makes intuitive sense that at some point, the increased margin that can be made on existing die-hard consumers cannot offset the loss caused by high levels of market shrinkage. Note that prices continue to rise with consumer exit even if $K < (V - D)/2$, reinforcing the idea that increases in equilibrium prices with consumer exit are not "sufficient" for profits to increase.

Theorem 1 refers to a situation where consumers exit from both edges of the market. We now move to Theorem 2, which addresses a situation where consumers exit from just one edge of the market. The scenario associated with Theorem 2 is illustrated in Figure 2.

If one thinks of the Hotelling continuum as representing tar and nicotine levels (in the case of tobacco) or calories or sugar content (in the case of carbonated soft drinks), Theorem 2 is a closer depiction of the dynamics described in §1. This is because in the tobacco market, consumers who wanted less tar and nicotine were the most likely to exit the category. Similarly, in the carbonated soft drink market, the consumers who are most likely to exit the category are those who are looking for significantly less sugar and calories.

Theorem 2 (Exit from Only One Side of the Market). *Profits increase for both firms if all consumers located at a distance greater than K toward the edge of the market from one of the firms exit the market for any* $K \in ((49V - 36D)/85, (3V - 2D)/5)$.

As in Theorem 1, Firm 1 increases its price from $\frac{2}{5}(V + D)$ to $V - K$, the price at which the consumer at a distance $K$ from Firm 1 toward the edge of the market receives zero utility. Firm 1 will commit to this price for a wide range of prices from Firm 2 since this price forms a kink point in Firm 1's demand curve. If Firm 1 charges a higher price, it would lose consumers both toward the edge of the market and in between the two firms, whereas if Firm 1 charges a lower price, it does not gain additional consumers toward the edge of the market. Firm 2 knows that Firm 1 will charge a higher price, and because prices are strategic complements, it also increases its price (even though its direct incentives have not changed). Ultimately, Firm 2 benefits because Firm 1 charges a higher price. Firm 1 is also better off—despite it being the only firm to lose customers—because Firm 2's higher prices allow Firm 1 to increase its price enough to offset the lost volume. Thus, Firm 1's profits increase from the consumer exit because the exit acts as a commitment device for Firm 1 to keep prices high, softening the competition it faces.

It is possible that Theorem 2 better represents the cigarette market because there are two components that quitters are trying to avoid: tar and nicotine. However, the measured tar and nicotine deliveries of cigarettes tend to be highly correlated. In any event, as long as one accepts that less committed consumers (those whose preferences are relatively distant from the products offered) are the ones exiting the market, the model provides a cogent explanation for why profits might increase in a context of a gradual market decline (at least in the first few years after the decline starts).[17]

Note that consumers who leave the market are the consumers who have the lowest willingness to pay for the products in the market. This explains why firm profits increase even though market volume drops. Since consumer entry is the opposite of consumer exit, it is straightforward to show the inverse result: profits can decrease in a market where there is consumer entry if the entry occurs primarily among consumers who have a low willingness to pay for the products. Thus, Theorems 1 and 2 are also informative of sufficient conditions for market expansion to decrease profits. If the markets initially extend only a distance $K$ from the firms, and then consumers enter to fill in the market up to a distance more than $(3V)/5 - (2D)/5$ from the firm, profits will subsequently decrease with entry.

consumers at such locations purchase the outside good prior to consumer exit.

[16] In this model, profits increase with the exit of a small number of relatively uncommitted consumers, but other models may require that a minimum number of consumers exit before such exiting leads to profit increases. We discuss such a model, where consumers have heterogeneous sensitivities to product differentiation, in §A.2 in the appendix.

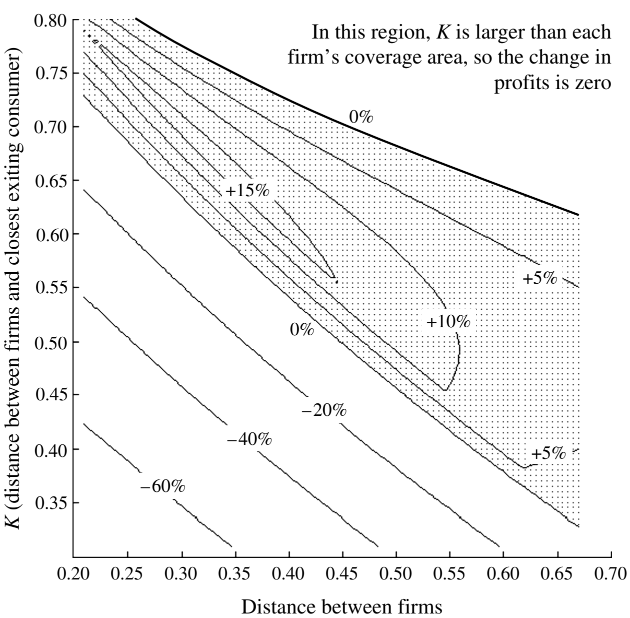
[17] As an example supporting this assumption, a 1976 advertisement for True cigarettes (a low-tar brand) declared, "Considering all I'd heard, I decided to either quit or smoke True. I smoke True" (see Pollay and Dewhirst 2002 for more examples).

The results of the above theorems do not depend on the linear form of the travel costs. To see this, suppose consumer utility were quadratic, as shown below:

$$U_{ij} = V - p_j - d_{ij}^2. \tag{2}$$

If firms are located in the interior of a linear market such that consumers at the edge choose not to purchase in equilibrium, then there are conditions where exiting by consumers at the edge of the market leads to increased profits. Unfortunately, the complexity of the expressions with quadratic travel costs makes it impossible to derive explicit conditions that define when consumer exit leads to profit increases for the competing firms. However, a simple numerical example can be used to demonstrate the existence of such situations. We do this by setting $V = 1$, and we then calculate the changes in profits for a range of distances between firms and a range of $K$, as defined in Figure 1. We limit the distance between firms to be less than 0.67, since at greater distances there are multiple pricing equilibria after market contraction for some levels of market shrinkage. We calculate the percentage change in profits before and after the consumers exit the market, and we map the results in the form of a contour map, shown in Figure 3. There is a significant range where profits increase with consumer exit, and the magnitude of the increase can be substantial: consumer exit leads to an increase in profits of more than 15% in some cases. Furthermore, profits can increase with consumer exit even in situations where a substantial fraction of consumers exit. For example, when the firms are located at a distance of 0.67 units apart, profits can increase even if almost 30% of each firm's consumers leave the market.

**Figure 3** Fractional Increase in Profits Under Symmetric Exit and Quadratic Travel Costs




## 4. Exit by Consumers at the Center of the Market

Further support for the robustness of consumer exit leading to profit growth for competing firms is obtained by considering a version of the model where instead of external consumers exiting the market, internal consumers (between the two firms) leave. This situation might relate to a context where diehard consumers are strongly committed to one of the two competing brands (e.g., PlayStation and Xbox in the videogame console market) and new consumers are relatively indifferent between the two brands. In many cases, this assumption seems reasonable as novice consumers often have preferences that are poorly defined. They may even have a poor understanding of how the products are different.[18]

In this section, we consider the same model with the same firm locations as in §3. However, instead of considering the case where consumers exit from the edge of the market, we consider what happens when consumers exit from the center of the market. Specifically, we examine consumer exit for a fraction $f$ of consumers in a line segment of length $2G$, centered at the midpoint between the two firms, that leave the market (see Figure 4).

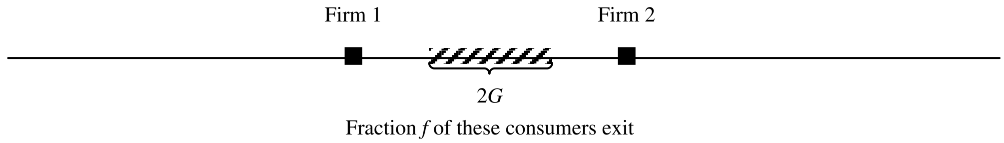
Theorem 3 (Exit from the Middle of the Market). *Profits increase for both firms if a fraction $f$ of the consumers located in an interval of $2G$ centered between the two firms exits the market whenever $((25\sqrt{174} - 81)/1{,}481)V < D < \frac{3}{7}V$, $f < \frac{11}{12}$, and*

$$\frac{(V+D)[(30-11f+2f^2)-2(5-f)\sqrt{3(3-f)}]}{85f-32f^2+4f^3} < G < \frac{V+D}{f} - \frac{(5-f)(V+D)\sqrt{3}}{5f\sqrt{3-f}}.$$

Theorem 3 provides a set of sufficient conditions for profits to increase with such consumer exiting. We limit ourselves to sufficient conditions in order to simplify the exposition. The upper bound on $f$ and lower bound on $G$ ensure the existence of a pure-strategy pricing equilibrium. The upper bound on $G$ is binding for profits to increase, showing that if too many consumers exit the market, then profits will decrease. Ultimately, we see that exiting by consumers

[18] There is evidence in the behavioral literature that demonstrates how differently novices and experts perceive and categorize choices within a category (Mitchell and Dacin 1996, Cowley and Mitchell 2003). Quite simply, novices are more likely to be indifferent between the available choices and sensitive to price. In fact, first-time buyers are known to be heaviest users of sales staff in the retail environment because they have so little understanding (or preference) for the differences between the Xbox, PlayStation, and Nintendo Wii. These consumers are thus more willing to switch between products than the typical consumer.

**Figure 4** **Removing Some Consumers from the Middle of the Market**






who are relatively indifferent between two products in the market can lead to increasing rather than decreasing profits.[19] It seems reasonable to assume that consumers who have a strong preference for an existing product (i.e., that are located adjacent to one of the products) are the least likely to leave the market, although we believe that the scenarios examined in Theorems 1 and 2 are more common.

## 5. Conclusion

The models we propose provide a simple explanation of how firm profits can increase in shrinking markets or decrease in growing markets even without changes in the number of competing firms or in the products offered. Are these findings idiosyncratic because they rely on restrictive assumptions about which consumers exit the market? We think not. As explained in our discussion of the cigarette market, when a market starts to decline (and we have yet to identify a category that does not pass through the stages of the product life cycle), the consumers who are most likely to exit the market are those who are the most frustrated with the current offerings (i.e., the consumers that realize the least amount of utility from consumption). Our model shows how their departure can help firms by reducing the competitive pressure between them. Of course, there is a limit to this dynamic. Although the profits of the tobacco companies held up surprisingly well through the 1980s and into the 1990s, at some point, an industry's decline hits a point Where the higher prices charged to the consumers who remain active do not make up for the lost volume.[20]

Another aspect of our analysis relates to recent prescriptions from the CRM literature (Reinartz and Kumar 2002). A constant refrain from this literature is that some consumers are so costly to serve that a firm may be better off refusing to serve them. This appears to echo our findings of how departing consumers can lead to higher profits for incumbent firms (even when the number of firms and their product attributes are kept constant). However, the finding from the CRM literature is based on firms carefully measuring the revenues and costs of serving individual customers in their CRM system and making sure that revenues exceed the costs.[21] In contrast, the findings from our analysis emanate from the strategic interaction of competing firms: the consumers who leave the market in our models *are worth serving*.

Our analysis also raises a number of implications that ought to figure in the management of declining markets. First, as noted in §1, a fundamental tenet of the Boston Consulting Grid is that declining markets are unattractive. Our analysis, however, shows that when a market decline is driven by the departure of consumers who are not fully satisfied with the market's offerings, a declining market might be every bit as attractive as a growing market. Why? Because the likelihood of new competitors is low, and consumers who remain in the market generally have a higher willingness to pay. This suggests that there are often conditions where the conventional wisdom related to where firms should invest is incorrect: sometimes it pays to invest, rather than divest, in a shrinking industry.[22]

Second, the natural reaction of many managers to declining sales is to reduce price to maintain volume. Our analysis underlines the importance of not having reflexive reactions such as this. In many cases, a decline in sales might be a signal to raise and not lower price.

Third, it is extremely important for managers to fully understand the segments of consumers who are driving a decline when it is encountered. When the decline is driven by consumers who appear to be core consumers, this is a markedly different situation than one where the decline is driven by casual (or less committed) category participants.

Finally, our results have implications for the segments of consumers firms should target in declining markets. At first, it might appear reasonable for a firm in a declining market to target customers who

[19] This result is qualitatively robust to other ways of modeling indifference between products. First, one obtains a similar result if the firms are located at the endpoints of a Hotelling market rather than at internal points. Second, in a separate analysis in §A.2 in the appendix, we show that in a model where consumers have heterogeneous sensitivities to product differentiation (i.e., heterogeneous travel costs), profits can increase if the consumers who are least sensitive to product differentiation exit the market.

[21] In particular, the importance of accounting for indirect costs such as advertising, service, organizational costs, and direct product costs is emphasized in this literature (Reinartz and Kumar 2002).

[22] In a similar vein, if a person had invested in tobacco companies that did not pursue diversifications strategies in the 1982–1990 time period (e.g., American Brands, Liggett & Myers), his or her returns would have been significantly higher than average market returns.

have only a marginal interest in the firm's product and are at risk to stop consuming. Our model shows that firms may be better off to let those customers leave the market and instead focus on extracting more profit and sales from the customers who remain.

## Appendix

### A.1. Proofs

Proof of Theorem 1. For the first part of the theorem, before considering what happens when consumers exit the market, we first note the equilibrium that occurs with no exit: $p = \frac{2}{5}(V+D)$; $\pi = \frac{6}{25}(V+D)^2$. Each firm sells to $D$ consumers in between the two outlets and to $\frac{3}{5}V - \frac{2}{5}D$ consumers on the other side. Thus, if $K \geq \frac{3}{5}V - \frac{2}{5}D$, then there is no impact from consumers exiting the market. Now consider what happens when some consumers exit the market, such that $K < \frac{3}{5}V - \frac{2}{5}D$. Firm $i$'s profits are then $p_i(K+D+(p_{-i}-p_i)/2)$, which gives first-order conditions of $p_i = K + D + p_i/2$. Symmetry ensures that $p = 2(K+D)$. However, this solution assumes that $p = 2(K+D) < V-K$. If $2(K+D) > V-K$, then firm $i$'s profits are $p_i(V-p_i+D+(p_{-i}-p_i)/2)$, which are maximized at a price of $p = \frac{2}{5}(V+D)$. However, at this price, $V - p_i > K$. Thus, firms price at the lower of $p = 2(K+D)$ or the kink point where $p = V-K$. This can be summarized as follows:

$$p = \begin{cases} V-K & \text{if } K \geq \dfrac{V-2D}{3}, \\ 2(K+D) & \text{if } K < \dfrac{V-2D}{3}. \end{cases}$$

Note that $(V-2D)/3 < (2V-3D)/5 < (V-D)/2$, so the conditions where profits increase involve $p = V-K$. Equilibrium profits are

$$\pi = (V-K)(K+D) = VD + K(V-D) - K^2. \tag{3}$$

Profits will be higher after the consumer exit when $VD + K(V-D) - K^2 > \frac{6}{25}(V+D)^2 \rightarrow K > (2V-3D)/5$.

We must make sure that the firms do not undercut. To undercut its rival, a firm must charge $p = V-K-2D$, and demand will be $2K+2D$. One can confirm that undercutting will not be profitable as long as $K > V-4D$.

For the second part of the theorem, taking the derivative of (3) reveals that $d\pi/dK = V-D-2K < 0 \Leftrightarrow K > (V-D)/2$. Note that $(V-D)/2 > V-4D$ when $V \leq [(7+5\sqrt{10})/3]D$.

Proof of Theorem 2. The calculations for the before-exit case are presented above.

Suppose that all consumers located at a distance greater than $K$ from the closest outlet toward one end of the line exit, where $K \in ((49V-36D)/85, (3V-2D)/5)$. Without loss of generality, call the firm that is located near the exiting consumers firm $A$, and the other firm is firm $B$. Then the following prices form an equilibrium:

$$p_A = V-K; \quad p_B = \frac{V+D}{3} + \frac{p_A}{6} = \frac{V}{2} + \frac{D}{3} - \frac{K}{6}. \tag{4}$$

To see this, note that if $A$ responded to $B$'s price with a price above $V-K$, it faces the same first-order condition it faced before entry. Its best response would thus be to price such that $p_{\text{Dev}} = (V+D)/3 + p_B/6 = (5V)/12 + (7D)/18 - K/36$. However, it is easy to check that $(5V)/12 + (7D)/18 - K/36 < V-K$ whenever $K < (3V-2D)/5$, so $A$ would never charge a higher price. Similarly, firm $A$'s first-order condition associated with prices below $V-K$ is $p_A = V-K+p_B/2$. Because $p_B > 0$, the best response in this range is to raise prices back up to the limit of $V-K$.

The remaining issue is to ensure that profits rise for the two firms. Profits for $A$ are given by

$$(V-K)\left(K+D+\frac{V/2+D/3-K/6-(V-K)}{2}\right) = \frac{(V-K)(14D+17K-3V)}{12},$$

whereas profits for firm B are given by $(3V+2D-K)^2/24$. Profits for $A$ are greater than $\frac{6}{25}(V+D)^2$ whenever $K \in ((49V-36D)/85, (3V-2D)/5)$, whereas profits for $B$ are greater than $\frac{6}{25}(V+D)^2$ whenever $K < (3V-2D)/5$.

Proof of Theorem 3. The profits before the customer exit are solved in the proof of Theorem 1 above. After the exit, the marginal consumer in equilibrium is located within the gap (as is the case with any symmetric equilibrium). This implies that the profits for each firm after exit can be represented by $p_j[V - p_j + D - f \cdot G + (1-f)((p_{-j}-p_j)/2)]$. Equilibrium prices and profits are then $p_1 = p_2 = 2(V+D-fG)/(5-f)$ and $\Pi_1 = \Pi_2 = ((6-2f)(V+D-fG)^2)/(5-f)^2$, respectively. Given the constraints on $D$, these profits are always higher than the profits with no exit (equivalently, when $f=0$) whenever $G < (V+D)/f - ((5-f)(V+D)\sqrt{3})/(5f\sqrt{3-f})$. However, there are three nonlocal deviations that must be considered for this equilibrium to hold. First, one of the firms may deviate to a lower price such that the marginal consumer is located on the far side of the "exit gap" from the firm. In such a case, the profit of the deviating firm would be $(6D - Df + 6V - 11fG + 2f^2G - Vf)^2/(6(5-f)^2)$. The deviation profits are greater than the equilibrium profits whenever $f < \frac{11}{12}$ and $(V+D)[(30-11f+2f^2) - 2(5-f)\sqrt{3(3-f)}]/(85f - 32f^2 + 4f^3) < G$. This deviation assumes that the price is low enough that the marginal consumer is located more than a distance $G$ from the center of the line, which occurs given the constraint on $D$ (which keeps the conditions simpler). Second, the firms in principle could deviate nonlocally by raising their prices to a level where the marginal consumer is located on the close side of the exit gap to them; however, such a deviation is not profitable in the above conditions. Third and finally, we must ensure that neither firm could profit from undercutting the other if an equilibrium price is charged. This constraint is not binding.

### A.2. Example: Consumer Exit in a Market Where Consumers Have Heterogeneous Sensitivities to Product Differentiation

In this model, we obtain a similar result to the model in §4. However, in some conditions, a substantial amount of consumer exit is required before it leads to increased profits. We assume that there are two firms, Firm 1 and Firm 2, located at the opposite ends of two Hotelling markets of length 1 (i.e., Firm 1 is located at 0, and Firm 2 is located at 1). Each firm offers a single product to both markets at the same price. Each Hotelling line represents a segment; one segment (with mass $\lambda$) has high travel costs, and the other segment (with mass $1-\lambda$) has low travel costs. Consumers in both segments are uniformly distributed along the line, and consumer utility is given by $U_{ij} = V_S - p_j - \alpha_S d_{ij}$, where $S \in \{H, L\}$.[23] We assume that $\alpha_H > \alpha_L$. Many spatial models that employ this structure (e.g., Iyer 1998, Desai 2001, Ishibashi and Matsushima 2009) also assume a quality component such that consumers in the first segment are sensitive to both product quality and product attributes whereas consumers in the second segment are less sensitive to both. We assume that the competing products are of equal quality. Higher sensitivity to both quality and horizontal attributes can be represented by allowing $V_H > V_L$. Such an assumption has no effect on the analysis as along as $V_H$ and $V_L$ are high enough such that no consumer considers purchasing the outside good.

The indifferent consumer is found at the point where the utilities offered by the competing products are identical, located at $x_S = (p_2 - p_1 + \alpha_S)/(2\alpha_S)$, where $x_S$ denotes the marginal consumer in segment $S$. Profits for each firm are then $\Pi_1 = p_1[\lambda x_H + (1-\lambda)x_L]$ and $\Pi_2 = p_2[\lambda(1-x_H) + (1-\lambda)(1-x_L)]$, respectively. Substituting the marginal consumers into the profit equation and differentiating with respect to price yields $p_1^* = p_2^* = \alpha_H\alpha_L/((1-\lambda)\alpha_H + \lambda\alpha_L)$. Thus, the equilibrium prices are the harmonic means of the travel costs for the two segments. Because the market is covered and the equilibrium is symmetric, the equilibrium profits are

$$\Pi_1^* = \Pi_2^* = \frac{1}{2}\frac{\alpha_H\alpha_L}{(1-\lambda)\alpha_H + \lambda\alpha_L}. \tag{5}$$

Suppose that a fraction $(1-\omega)$ of the consumers in the low segment exit. Analogous calculations to those above generate the following the equilibrium profits:

$$\Pi_1^* = \Pi_2^* = \frac{1}{2}\frac{[\lambda + \omega(1-\lambda)]^2\alpha_H\alpha_L}{\omega(1-\lambda)\alpha_H + \lambda\alpha_L}. \tag{6}$$

Comparing Equation (5) with (6), it is apparent that profits increase with consumer exit whenever $\alpha_L \le \alpha_H/2$ and either

- $\alpha_H/(2(\alpha_H - \alpha_L)) \le \lambda$, or
- $\alpha_L/(\alpha_H - \alpha_L) \le \lambda \le \alpha_H/(2(\alpha_H - \alpha_L))$ and $\omega \le (\lambda^2(\alpha_H - \alpha_L) - \lambda\alpha_L)/(\alpha_H + \lambda\alpha_L - 2\lambda\alpha_H + \lambda^2(\alpha_H - \alpha_L))$.

Note that the finding that $\omega$ must be small enough if $\alpha_L/(\alpha_H - \alpha_L) \le \lambda \le \alpha_H/(2(\alpha_H - \alpha_L))$ means that profits do not increase when only a few low consumers exit the market. Rather, consumer exit is profitable *only if* enough customers leave the market for this range of $\lambda$. This may seem counterintuitive—after all, if too many consumers exit the market, then profits must decrease because there are few consumers remaining to whom firms can sell. This intuition is offset by the fact that the price increases from consumer exit are convex with respect to the rate of exit from the market, and the rate at which consumers leave the market is directly proportional to the fraction of low types that leave (i.e., $1-\omega$). If only a few consumers exit, the increase in prices is negligible. However, if enough customers exit, equilibrium prices increase substantially because the firms have less incentive to fight over the reduced mass of consumers in the low segment. When $\lambda = \alpha_L/(\alpha_H - \alpha_L)$, profits only increase when *all* consumers in the low segment exit.

[23] The results are identical if consumers have quadratic travel costs.

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