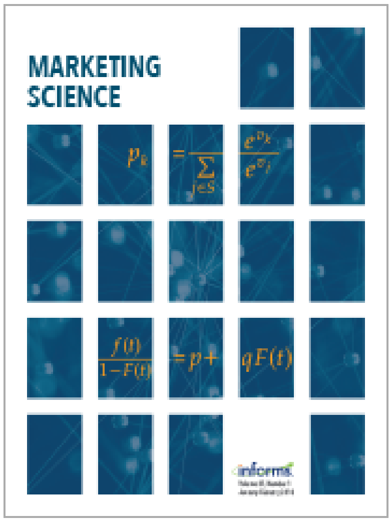


Individual Marketing with Imperfect Targetability

Yuxin Chen, Chakravarthi Narasimhan, Z. John Zhang,

Individual Marketing with Imperfect Targetability

Yuxin Chen • Chakravarthi Narasimhan • Z. John Zhang
The Leonard N. Stern School of Business, New York University, New York, New York
John M. Olin School of Business, Washington University, St. Louis, Missouri
Graduate School of Business, Columbia University, New York, New York,
zz25@columbia.edu

Abstract

Our research investigates the competitive ramifications of individual marketing and information management in today's information-intensive marketing environments. The specific managerial issues we address are as follows. First, what kinds of incentive environments do competing firms face when they can only target individual customers imperfectly? Second, does the improvement in an industry's targetability intensify price competition in the industry such that all competing firms become worse off? Third, should a firm share its customer knowledge so as to improve its rival's targetability? Fourth, how should an information vendor sell its information that can improve a firm's targetability? Finally, do competing firms have the same incentives to invest in their own targetability?

To answer those questions, we develop a simple model à la Narasimhan (1988), in which each of the two competing firms have their own loyal customers and compete for common switchers. We assume that each firm can classify its own loyal customers and switchers correctly only with a less-than-perfect probability. This means that each firm's perceived customer segmentation differs from the actual customer segmentation. Based on their perceived reality, these two competing firms engage in price competition. As an extension, we also allow the competing firms to make their investment decisions to acquire targetability.

We show that when individual marketing is feasible, *but* imperfect, improvements in targetability by either or both competing firms can lead to win-win competition for both even if both players behave noncooperatively and the market does not expand. Win-win competition results from the fact that as a firm becomes better at distinguishing its price-insensitive loyal customers from the switchers, it is motivated to charge a higher price to the former. However, due to imperfect targetability, each firm mistakenly perceives some price-sensitive switchers as price-insensitive loyal customers and charges them all a higher price. These misperceptions thus allow its competitors to acquire those mistargeted customers without lowering their prices and, hence, reduce the rival firm's incentive to cut prices. This effect softens price competition in the market and qualitatively changes the incentive environment for competing firms engaged in individual marketing. A "prisoner's dilemma" occurs only when targetability in a market reaches a sufficiently high level.

This win-win perspective on individual marketing has many managerial implications. First, we show that superior knowledge of individual customers can be a competitive advantage. However, this does not mean that a firm should always protect its customer information from its competitors. To the contrary, we find that competing firms can all benefit from exchanging individual customer information with each other at the nascent stage of individual marketing, when firms' targetability is low. Indeed, under certain circumstances, a firm may even find it profitable to give away this information unilaterally. However, as individual marketing matures (as firms' targetability becomes sufficiently high), further improvements in targetability will intensify price competition and lead to prisoner's dilemma. Therefore, it is not only prudent politics but also a business imperative for an industry to seize the initiative on the issue of protecting customer privacy so as to ensure win-win competition in the industry.

Second, we show that the firm with a larger number of loyal customers tends to invest more in targetability when the cost of acquiring targetability is high. However, the firm with a smaller loyal base can, through information investment, acquire a higher level of targetability than the firm with a larger loyal base as long as the cost of acquiring targetability is not too high. As the cost further decreases, competing firms will all have more incentives to increase their investments in targetability until they achieve the highest feasible level.

Third, an information vendor should make its information available nonexclusively (exclusively) when its information is associated with a low (high) level of targetability. When the vendor does sell its information exclusively, it should target a firm with a small loyal following if it can impart a high level of targetability to that firm.

Finally, our analysis shows that an information-intensive environment does not doom small firms. In fact, individual marketing may provide a good opportunity for a small firm to leapfrog a large firm. The key to leapfrogging is a high level of targetability or customer knowledge.

(*One-to-One Marketing; Information Strategy; Price Discrimination*)

0732-2399/01/2001/0023/$05.00
1526-548X electronic ISSN

1. Introduction

With the onset of the information revolution and the emergence of the Internet as a one-to-one medium, firms no longer need to rely on customer self-selection to segment a heterogenous market. Individual marketing, the marketing approach that seeks to target individual customers with tailored offers (Kotler 1997, p. 252), is becoming increasingly popular.[1] AT&T, for instance, routinely lures competitors' customers by mailing them rebate checks with varying values determined by the demographic characteristics and calling history of each customer (Young 1997). This approach is also widely used in many other industries such as catalog retailing, financial services, and airlines (Petrison et al. 1997). In this paper, we investigate the competitive implications of individual marketing.

In practice, because of insufficient data or inaccurate statistical inferences, a firm's *targetability,* the ability to predict the preferences and purchase behaviors of individual consumers for the purpose of customizing its price or product offers, is imperfect. For example, AT&T once mailed three rebate checks to a marketing executive of MCI, while its own CEO was also targeted by MCI to switch phone service (Young 1997).[2] This state of imperfect targetability raises a managerially relevant question concerning the competitive implications of individual marketing: How does targetability affect price competition in an industry?

The experience of individual marketers offers no clear answer to that question. On the one hand, competition seems to intensify in some industries as individual marketing becomes more sophisticated. In the long distance telephone service industry, for instance, individual marketing by AT&T and MCI has caused millions of customers to churn every year at a great cost to both companies (Rockwell 1997). On the other hand, the need for more accurate individual marketing seems to facilitate cooperation among competing firms in some other industries. For instance, more than 600 catalog marketers routinely exchange the purchase information of individual customers with their competitors (*Direct Marketing* 1996). This practice of exchanging proprietary customer information baffles industry analysts. Yet, insiders laud the practice, insisting that it ''really works'' for all the participants (*Direct Marketing* 1996).

Also baffling is the position that many industries take on the issue of protecting consumer privacy, which can effectively limit firms' targetability. If improvements in targetability simply intensify price competition in an industry, then it would make sense for the industry to avail itself of any help in curbing such improvements. In practice, however, many industries choose simply to institute their own rules to restrict, rather than prohibit, information exchange among competing firms, vehemently opposing any harsh government regulation on consumer privacy. For instance, the Direct Marketing Association only requires its members (some 2,600 Internet companies, catalog retailers, banks, etc.) to disclose to customers when information about them might be shared with other marketers and to give customers the option to not have their information shared (*The Wall Street Journal* 1999).

In this paper, we provide the first rigorous analysis of individual marketing with imperfect targetability to shed some light on price competition with imperfect targetability as well as on these puzzling phenomena. Our analysis generates many insights of interest to marketing academics and practitioners alike.

First, we highlight the strategic nature of *targetability* and distinguish it from *addressability,* the ability to contact customers individually (Blattberg and Deighton 1991). We show that only when firms have both addressability and targetability is it optimal for them to conduct individual marketing.[3] Thus, individual marketing is different from direct marketing, which requires addressability but not necessarily targetability (Balasubramanian 1998).

[1]In practice, this approach is alternatively referred to as database marketing or one-to-one marketing.

[2]As another example, credit card issuers occasionally send targeting offers to the deceased, to children, and even to family pets (*Credit Card Management* 1997).

[3]Many empirical studies, such as Rossi and Allenby (1993), Bult and Wansbeek (1995), Rossi et al. (1996), and Montgomery (1997), are devoted to refining statistical models to improve a firm's targetability.

Second, complementing the research on the issue of how customers' information about firms may affect the firms' competitive strategies, e.g., Zettelmeyer (1996), Bakos (1997), and Lal and Sarvary (1999), our analysis examines how firms' knowledge of individual customers affects the nature of their strategic interactions. We show that the *mistargeting effect,* in addition to other effects previously identified by Shaffer and Zhang (1996), can be a dominant force driving these interactions. This effect results from a firm mistakenly perceiving some price-sensitive customers as price-insensitive and charging them high prices. These misperceptions allow its competitors to acquire those mistargeted customers without lowering their prices and, hence, reduce the rival firms' incentive to cut prices. This effect softens price competition in the market and qualitatively changes the incentive environment for competing firms engaged in individual marketing. We show that competitive improvements in targetability can, surprisingly, lead to win-win competition for all, even when all players behave noncooperatively and the market does not expand.

Third, our analysis offers many new strategic insights for the management of information assets and adds to the stream of literature, such as Vives (1984, 1990), Gal-Or (1985), and Villas-Boas (1994), that investigates the incentives of information sharing in different market settings. We show that superior knowledge of individual customers can be a competitive advantage. However, this does not mean that a firm should always protect its customer information from its competitors. To the contrary, we find that competing firms can all benefit from exchanging individual customer information with each other at the nascent stage of individual marketing, when firms' targetability is low. Indeed, under certain circumstances, a firm may even find it profitable to give away this information unilaterally. In those circumstances, the so-called *co-opetition* strategies (Brandenburger and Nalebuff 1996) should prevail. However, as individual marketing matures (as firms' targetability becomes sufficiently high), further improvements in targetability will intensify price competition and lead to "prisoner's dilemma." Therefore, an industry-wide self-regulation both protects consumer privacy and helps to ensure a win-win competition for the industry.

Finally, we show that because of the possibility of downstream win-win competition, an information vendor may optimally choose to sell its information nonexclusively to all competing firms when its information provides a low level of targetability to a firm. Otherwise, it should make the information available exclusively, targeting a large or small firm, depending on the level of targetability. Thus, our study complements Sarvary and Parker (1997) in that we focus on a vendor's incentive to sell exclusively or otherwise, whereas they examine information buyers' incentives to buy exclusively or otherwise from competing information providers.

All these conclusions allow us to develop a win-win managerial perspective on individual marketing. This perspective is in stark contrast to the view put forth by the studies of competitive first-degree price discrimination in the economics and marketing literature. Lederer and Hurter (1986) first suggest that the practice of location-specific prices will force down the price at any point of a geographic market to the marginal production cost of the second most efficient firm. Thisse and Vives (1988) and Shaffer and Zhang (1995) further point out that the flexibility allowed by individual specific prices will simply intensify price competition and lead to a prisoner's dilemma in which all competing firms become worse off. Our perspective differs because the first-degree price discrimination presumes perfect knowledge about each individual consumer. Thus, each consumer constitutes an independent submarket, and a firm can decide on its pricing strategy in one submarket without any reference to its strategy in another. However, this is no longer true in the case of individual marketing with imperfect targetability, because the same individual may be grouped differently by different firms, such that the market segments as perceived by each firm overlap.

The rest of this paper is organized as follows. Section 2 develops the basic model used in our analysis. Section 3 examines firms' pricing strategies and payoffs when individual marketing is feasible. Section 4 explores the managerial insights of our model. Finally, §5 discusses extensions of our basic model and concludes with suggestions for future research.

2. The Basic Model

Consider a market consisting of two risk-neutral firms. Each firm produces at a constant marginal cost. In the basic model, we assume that the marginal costs of production, normalized to zero without loss of generality, are the same for both firms. This assumption can be relaxed without altering our basic conclusions.

On the demand side, we assume that the total number of customers in the market is constant and normalized to one. Each customer buys at most one unit of the product and has an identical reservation price, R. As a scaling factor, R can be normalized to one without loss of generality. We assume that consumers are heterogeneous in that some are loyal to Firm 1 and some to Firm 2. These are the price-insensitive consumers in the market à la Varian (1980) and Narasimhan (1988). The rest are switchers who always buy from the firm with the lowest price. When both firms offer the same price, we assume that a switcher will buy from either firm with probability .50. We will denote these three segments as L_1, L_2, and S, respectively, and their respective sizes as γ_1, γ_2, and χ with $\gamma_1 + \gamma_2 + \chi = 1$. All of these assumptions are commonly made in the marketing and economics literature.[4] As discussed in the concluding section, most of these assumptions can be relaxed without altering our conclusions.

2.1. Targeting Accuracy

The sizes of the three customer segments are known to both firms. This market-level information is typically available from sources such as industry reports, survey results, aggregated sales data, and census data (Kotler 1997). Besides the market-level information, each firm can obtain individual customer information. This type of information can be acquired from internal sources such as firms' transaction databases that record individual customers' purchase histories or from external sources such as credit reports. We assume for now that each firm has information on its own loyal customers and switchers but not on customers loyal to its competitor. This assumption can be justified because in many individual-marketing situations, information about individual customers is obtained from the records of their previous purchases (Deighton et al. 1994). After a sufficiently long period of time, a firm's loyal customers and switchers will all have records in the firm's database, but customers loyal to the other firm will not have any purchase record in the database.[5] Nevertheless, we will show later in the paper that this assumption can be relaxed without changing our conclusions.

We assume that each firm's customers, including its own loyal customers and switchers, are all addressable in the sense that the firms can sell to them directly through mailing addresses, phone numbers, e-mail accounts, etc. The mailing cost to reach each customer is assumed to be identical and is normalized to zero without loss of generality.

Through the lens of its own information technology, each firm can use its individual customer information and can classify its customers into two segments: the perceived loyal customers of its own and the perceived switchers, which we denote as l_i and s_i ($i = 1, 2$), respectively. This is the perceived market for a firm. Each firm can then offer a price, p_{iL_i}, to its perceived loyal customers and a price, p_{iS}, to its perceived switchers. If Firm i conducts mass marketing, then p_{iL_i} and p_{iS} are the same. If Firm i conducts individual marketing, then p_{iL_i} and p_{iS} can be different. We require that a firm's perception about the market be unbiased. This means that the sizes of a firm's perceived loyal and switching segments ought to be equal to the corresponding sizes of the actual market.

However, because of imperfect customer information or imperfect information processing technology, a firm does not always classify individual customers correctly. For example, a firm can easily misclassify a

[4]See, for example, Lal et al. (1996), McGahan and Ghemawat (1994), Narasimhan (1988), and Varian (1980).

[5]Narasimhan (1988) shows that there is a positive probability for a switcher to shop at either firm. As shown later, this result also holds in the model used here. Thus, all switchers will have records in both firms' databases after a sufficiently long period.

loyal customer (a switcher) as a switcher (a loyal customer) when the customer happens to purchase frequently from the firm but only when the firm offers promotions (Colombo and Morrison 1989). To allow this possibility, let $Pr_i(k|j)$ ($j = L_i, S$; $k = l_i, s_i$) denote the probability that Firm i classifies a customer from segment j into a perceived segment k. The unbiasness condition implies

$$\gamma_i Pr_i(l_i|L_i) + \chi Pr_i(l_i|S) = \gamma_i, \quad (1)$$

$$\gamma_i Pr_i(s_i|L_i) + \chi Pr_i(s_i|S) = \chi. \quad (2)$$

As a measure of probability, $Pr_i(k|j)$ should also satisfy the following regularity conditions,

$$Pr_i(l_i|L_i) + Pr_i(s_i|L_i) = 1, \quad (3)$$

$$Pr_i(l_i|S) + Pr_i(s_i|S) = 1. \quad (4)$$

Firm i's targeting accuracy, T_i, can then be defined as the expected proportion of its customers who are correctly classified, i.e.,

$$T_i = \frac{\gamma_i Pr_i(l_i|L_i) + \chi Pr_i(s_i|S)}{\gamma_i + \chi}. \quad (5)$$

When Firm i can correctly classify all customers, we must have $Pr_i(l_i|L_i) = 1$ and $Pr_i(s_i|S) = 1$, and, hence, $T_i^{\max} = 1$. When Firm i can only classify customers randomly based on the segment sizes, we must have

$$Pr_i(l_i|L_i) = \frac{\gamma_i}{\gamma_i + \chi} \quad \text{and} \quad Pr_i(s_i|S) = \frac{\chi}{\gamma_i + \chi}$$

and, hence,

$$T_i^{\min} = \frac{\gamma_i^2 + \chi^2}{(\gamma_i + \chi)^2}.$$

Of course, a firm's targetability ultimately depends on the firm's capability of gathering and processing individual customer information. To measure this capability, we define Firm i's targetability, I_i, by rescaling T_i upon [0, 1] with the following identity,

$$I_i \equiv \frac{T_i - T_{i\min}}{T_{i\max} - T_{i\min}}. \quad (6)$$

Then, I_i is an index measure for Firm i's ability to classify individual consumers correctly. When $I_i = 0$, Firm i does not have individual customer information at all, so that $T_i = T_i^{\min}$. When $I_i = 1$, Firm i can distinguish individual customers perfectly so that $T_i = T_i^{\max} = 1$.

Table 1 Main Assumptions for the Basic Model

Cost	Zero marginal cost for both firms
Demand	Unit demand for all consumers with reservation price normalized to 1
Consumer heterogeneity	γ_1 fraction loyal to Firm 1 (L_1), γ_2 fraction loyal to Firm 2 (L_2), χ fraction switchers (S), and $\gamma_1 + \gamma_2 + \chi = 1$
Information	Own loyal customers and switchers imperfectly distinguished
Game	Noncooperative, simultaneous pricing decisions

Thus, from (1)–(6), we can express, in terms of targetability I_i, a firm's probabilities of classifying a consumer from a given segment into the two perceived segments as

$$Pr_i(l_i|L_i) = I_i + (1 - I_i)\frac{\gamma_i}{\gamma_i + \chi},$$

$$Pr_i(s_i|L_i) = (1 - I_i)\frac{\chi}{\gamma_i + \chi}, \quad (7)$$

$$Pr_i(l_i|S) = (1 - I_i)\frac{\gamma_i}{\gamma_i + \chi},$$

$$Pr_i(s_i|S) = I_i + (1 - I_i)\frac{\chi}{\gamma_i + \chi}. \quad (8)$$

2.2. The Game

Firms are assumed to play a noncooperative game. Both firms classify their customers and make their pricing decisions simultaneously for any given size of customer segments in the market and for each firm's targetability. However, as we will show in the conclusion, both segment sizes and targetability can be endogenized without changing our conclusions. Table 1 summarizes the main assumptions of our basic model.

Under the above assumptions, a $\gamma_i Pr_i(l_i|L_i)$ proportion of customers will be correctly classified by Firm i as its own loyal customers. These customers will purchase from Firm i and pay p_{iL_i}. A $\gamma_i Pr_i(s_i|L_i)$ proportion of customers will be misclassified as switchers by Firm i. These customers will purchase from Firm i but will pay p_{iS}. A $\chi Pr_1(s_1|S)Pr_2(s_2|S)$ proportion of customers will be correctly classified as switchers by both firms. The prices they face are p_{1S} and p_{2S}. They will purchase from the firm with the lower price. A $\chi Pr_1(l_1|S)Pr_2(l_2|S)$ proportion of customers will be misclassified as own loyal customers by both firms. These customers face prices p_{1L_1} and p_{2L_2}. They will also purchase from the firm with the lower price. A $\chi Pr_1(l_1|S)Pr_2(s_2|S)$ and a $\chi Pr_2(l_2|S)$ $Pr_1(s_1|S)$ proportions of customers, respectively, will be correctly classified by one firm as switchers but misclassified by the other firm as its loyal customers. These customers face prices p_{iL_i} and p_{3-iS}. Again, they will purchase from the firm with the lowest price.

Thus, because of imperfect targetability, not all customers in the market will face the intended price or prices, and target pricing has ''leakage.''[6] Specifically, customers loyal to a firm may face, as a group, two different prices from that firm at any given time, whereas switchers may face four different prices, two from each firm. This leakage creates a market structure that is very different from that under mass marketing, in which each firm offers a single price to all customers. It is also different from that under perfect addressability and targetability, in which each customer type faces only the intended price from a firm.

3. Targetability and Competitive Pricing Strategies

Under individual marketing, a firm's optimal pricing strategy needs to reconcile two conflicting objectives: (*i*) charging its loyal customers their maximum willingness to pay so that no money is left on table and (*ii*) attracting switchers by undercutting the competitor's price and consequently foregoing some profits from the loyal customers. In addition, the pricing strategy needs also to incorporate the firm's knowledge of individual customers while minimizing any side effect from segment leakage. What pricing strategy would allow a firm to strike the optimal balance among the conflicting incentives in a competitive context?

We can gain an intuitive understanding of such a strategy by examining two extreme cases. Narasimhan (1988) shows that when neither firm can use target pricing, a firm will randomize its prices. The randomization is commonly interpreted as temporary sales (Varian 1980, Narasimhan 1988). However, when firms have perfect addressability and targetability, firms should use target pricing, each charging its loyal customers their reservation prices, which is one in our basic model, and also charging its switchers its marginal production cost, which is zero. Thus, if firms' targetability is imperfect, we would expect a firm to use both a mixed pricing strategy and target pricing. Target pricing allows a firm to charge a higher price to its perceived loyal customers than to its perceived switchers, whereas randomization in price within each perceived segment corrects for imperfect classification. Our formal analysis of the basic model confirms such a pricing strategy. We characterize this strategy in the following proposition and leave details of proofs to the appendix.

Proposition 1. *A firm does not use target pricing unless it has positive targetability* ($I_i > 0$). *With positive targetability, a firm charges a higher price to its perceived loyal customers than to its perceived switchers, although the price to each perceived segment is randomized. Furthermore, the average price charged to its perceived loyal customers increases with its own targetability.*

Proposition 1 disentangles the effects of addressability and targetability on market competition. When a firm's targetability is zero, the firm will conduct mass marketing, even though it has the addressability to deal with customers individually. Therefore, direct marketing in the absence of targetability ''is nothing more than mass marketing with a response device'' (*Progressive Grocer* 1995).

For a firm with nonzero targetability, target pricing is implemented by setting the lower bound of the prices it charges to its perceived loyal customers equal to the upper bound of the prices it charges to its perceived switchers. Therefore, the firm *always*

[6] The issue of leakage has been previonsly studied by Gerstner and Holthausen (1986) in the context of a monopolist instituting price discrimination between two segments of consumers. Note, however, that leakage in our competitive model results from firms' imperfect targetability rather than from consumer self-selection.

charges a higher price to its perceived price-insensitive customers than to its perceived price-sensitive customers, despite not being able to classify its customers perfectly. Intuitively, for any $I_i > 0$, the proportion of truly loyal customers in Firm i's perceived loyal segment is always larger than that in its perceived segment of switchers and, hence, it pays to use target pricing. Indeed, as a firm's targetability improves, this proportion becomes larger, and the firm has even more incentives to charge its price-insensitive customers higher prices. Thus, as a managerial insight, Proposition 1 suggests that a firm can safely extract more surplus from perceived loyal customers as its targetability improves. Indeed, identifying loyal customers and extracting more profit from them is the primary motivation behind most individual-marketing programs (McCorkell 1997, *Progressive Grocer* 1995).

4. Targetability and Profitability of Individual Marketing

One basic question in individual marketing is: How does a firm benefit from the improvement of its information technology? The answer to this question will shed light on the likely winners and losers in the age of competitive individual marketing. It will also help to address the important managerial questions of whether a firm should invest in targetability and how it should manage strategically a firm's customer information in a competitive context. In this section, we will discuss the impact of targetability on the profitability of competing firms in a variety of market environments. In the next section, we will explore what the incentive structure implies for the management of customer information.

To facilitate our discussions on the profitability of individual marketing, let $\phi_i = \gamma_i Pr_i(l_i|L_i)$, $\varphi = \chi Pr_1(s_1|S) Pr_2(s_2|S)$, and $\psi = \chi Pr_1(l_1|S)Pr_2(l_2|S)$. By definition, ϕ_i is the number of Firm i's loyal customers correctly classified by the firm, φ the number of switchers correctly classified by both firms, and ψ the number of switchers misclassified by both firms, all of which, of course, depend on the targetability of respective firms, as we can see from Equations (7) and (8). Furthermore, let $\hat{\pi}_i(I_1, I_2)$ and $\hat{s}_i(I_1, I_2)$ denote the equilibrium profit and market share for Firm i. Lemma 1 states both firms' equilibrium profits and market shares (detailed derivations are in the appendix).

Lemma 1. *For all* $0 \le I_1 \le 1$ *and* $0 \le I_2 \le 1$ *and if* $\phi_i \ge \phi_j$, *where* $i = 1, 2$, $j = 3 - i$, *the equilibrium profits are given by*

$$\hat{\pi}_i(I_1, I_2) = \frac{\phi_i}{\phi_i + \psi}(\phi_i + \psi + \chi - \varphi) \quad \text{and}$$

$$\hat{\pi}_j(I_1, I_2) = \frac{\phi_i}{\phi_i + \psi}(\phi_j + \psi + \chi - \varphi).$$

The respective market shares are given by

$$\hat{s}_i(I_1, I_2) = \frac{1}{2} + \frac{1}{2}\frac{\phi_i}{\phi_i + \psi}(\phi_i - \phi_j) \quad \text{and}$$

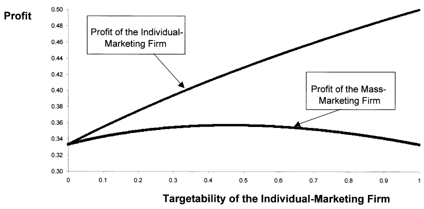
$$\hat{s}_j(I_1, I_2) = 1 - \hat{s}_i(I_1, I_2).$$

Lemma 1 completely characterizes, once proper substitutions are made using Equations (7) and (8), a firm's equilibrium profit and market share for any given level of targetability for both competing firms (I_1, I_2) and for any size distribution of loyal customers (γ_1, γ_2). Thus, we can use the general profit expressions in this lemma to explore the impact of targetability on a firm's bottom line in a variety of competitive scenarios.

4.1. Individual-Marketing Firm Competes with Mass Marketer

First, consider the simple case where one firm, say Firm 1, has access to individual customer information and conducts individual marketing, whereas the competing firm, Firm 2, has no such access so that it can only conduct mass marketing (i.e., $I_1 > 0$ and $I_2 = 0$). To build our intuition in the simplest possible context, we assume for now that both firms have the same number of loyal customers ($\gamma_1 = \gamma_2$). Such a competitive scenario can come about when one of the competing firms secures the exclusive right to the available customer database and it also approximates the markets in which catalog marketers or Internet marketers compete with conventional retailers. What

Figure 1 Individual-Marketing Firm Competes with Mass-Marketing Firm



are the competitive implications of Firm 1's targetability? Specifically, is it always the case that Firm 1 is better off and Firm 2 is worse off as Firm 1's targetability improves? Surprisingly, the answer is "no," as the following proposition makes clear.

PROPOSITION 2. *When an individual marketing firm competes with a mass marketer having the same number of loyal customers, the profit of the individual-marketing firm (Firm 1) increases with its own targetability. The profit of the mass-marketing firm (Firm 2) also increases with its rival's targetability when the rival's targetability is not too large* ($I_1 < I^* = [(1 - \chi)(1 + 3\chi)/4\chi^2][\{(1 + \chi)/\sqrt{(1 - \chi)(1 + 3\chi)}\} - 1]$) *but decreases otherwise.*

Proofs for Proposition 2 are provided in the appendix. Figure 1 illustrates this proposition for the case where $\gamma_1 = \gamma_2 = \chi = 1/3$.[7] Intuitively, as its targetability increases, Firm 1 can classify its loyal customers more accurately, so that it can safely charge a higher price to its perceived loyal customers. This *segmentation effect* always increases Firm 1's profit and decreases the consumer surplus of Firm 1's loyal customers.[8] Firm 1 also gains a larger market share because of its enhanced ability to identify and attract switchers. This *market share* and *price competition effects* have a tendency to lower not only Firm 1's price to switchers but also Firm 2's price and profit.

However, the effect of an increase in Firm 1's targetability is not summarily deleterious for the mass-marketing firm. This is because Firm 1 cannot help but mistarget some switchers as its loyal customers because of its imperfect targetability. With an increase in its targetability, Firm 1 can better distinguish between its loyal customers and its switchers and is thus motivated to charge a higher price to its perceived loyal customers, including those mistargeted switchers. This price increase is a boon to Firm 2 because of the *mistargeting effect*: Firm 2 can set a higher price and still attract the mistargeted switchers. A higher price for Firm 2 will, in turn, provide a strategic incentive for Firm 1 to increase its price to switchers. This effect is stronger when there are more loyal consumers in the market, as each firm has more incentives to raise its price to its own loyal customers. This effect is also stronger at a low level of Firm 1's targetability, as any improvement in Firm 1's targetability will lead to a higher price increase for both Firm 1 and Firm 2 when there are a larger number of misidentified switchers.

The magnitude of this mistargeting effect, along with the market share and price competition effects, will determine whether or not Firm 2's profit increases with Firm 1's targetability. It will also determine whether or not Firm 1's price to switchers and Firm 2's price will rise with Firm 1's targetability. Because market share and price competition effects dominate when the targetability is high or the number of switchers in the market is large, it is not surprising that Firm 2's profit first increases and then decreases with Firm 1's targetability. Similarly, as Firm 1's targetability increases, Firm 1's price to switchers and Firm 2's price will either monotonically increase when the number of loyal customers is large and, hence, the mistargeting effect always dominates, or they first increase and then decrease when the number of loyal customers is small. This implies that the change in consumer surplus for switchers[9] and Firm 2's loyal customers is not monotonic as Firm 1's targetability increases. The surplus can first decrease and then increase.

This mistargeting effect, absent from the previous literature, clearly plays a pivotal role in the incentive structure of individual marketing and gives rise to the phenomenon that Firm 2's profit has an inverted-U relationship with Firm 1's targetability. The impor-

[7]In this case, we have $\hat{\pi}_1(I_1, 0) = (1 + I_1)/(3 + I_1)$ and $\hat{\pi}_2(I_1, 0) = [(3 - I_1)(1 + I_1)]/[3(3 + I_1)]$.

[8]The consumer surplus for Firm i's loyal customers can be computed as $cs_{L_i} = \gamma_i - \gamma_i Pr_i(l_i|L_i)p_{iL_i} - \gamma_i Pr_i(s_i|L_i)p_{iS}$.

[9]The consumer surplus for switchers can be computed as $cs_S = 1 - cs_{L_1} - cs_{L_2} - \hat{\pi}_1(I_1, I_2) - \hat{\pi}_2(I_1, I_2)$.

Figure 2 Competition Between Two Symmetric Individual-Marketing Firms*

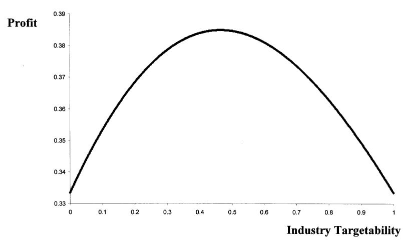
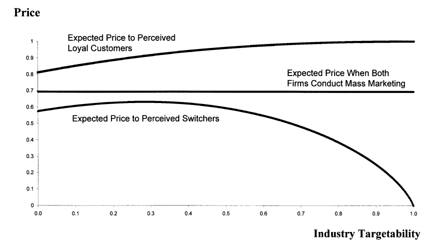


Figure 3 Expected Equilibrium Prices for Symmetric Firms*



tance of this effect begs the question: Is it inherent to individual marketing or is it an anomaly born of the assumption that the rival firm has no access to individual customer information? We take up this issue next.

4.2. Competitive Individual Marketing with Symmetric Firms

The past literature has shown that when firms are symmetric and engage in competitive individual marketing, the prisoner's dilemma always ensues (Thisse and Vives 1988, Shaffer and Zhang 1996). We now show that the mistargeting effect is intrinsic to individual marketing with imperfect targetability, and win-win competition can occur in the situation where we least expect it—competitive individual marketing with symmetric firms.

Consider the case in which two firms compete with the same level of targetability ($I_1 = I_2 = I$) and the same size of loyal segments ($\gamma_1 = \gamma_2 = \gamma$). As we show in the appendix, we can obtain the following proposition by applying Lemma 1.

Proposition 3. *When two firms with equal targetability compete, an improvement in industry targetability will increase the profit of each firm if the targetability is not too high* ($I < I^* = [(1-\chi)(1+3\chi)]/4\chi^2[\{(1+\chi)/\sqrt{(1-\chi)(1+3\chi)}\} - 1]$). *Otherwise, each firm's profit decreases with their targetability.*

Figure 2 illustrates the relationship between a firm's profit and the targetability. There we see that as competing firms improve their targetability, they are first better off and then worse off, suggesting that the win-win competition can occur even with competitive individual marketing and that it occurs only when targetability is imperfect. To see why this is the case, let us dissect in some detail a firm's profit function, given below,

$$\hat{\pi}_i(I, I) = \gamma_i Pr_i(l_i | L_i)\left[1 + \frac{\chi - \chi Pr_i(s_i|S)Pr_j(s_j|S)}{\gamma_i - \chi Pr_i(s_i|S)Pr_j(l_j|S)}\right], \quad (i = 1, 2, j = 3 - i). \tag{9}$$

The *segmentation effect* in this case is captured by $\gamma_i Pr_i(l_i|L_i)$, which increases with I. This effect motivates a firm to increase its price to perceived loyal customers and has a positive impact on the firm's profit. The *price competition effect* is captured by $\chi Pr_i(s_i|S)Pr_j(s_j|S)$, which also increases with I. This effect intensifies price competition for switchers and has a negative impact on each firm's profit. The mistargeting effect is captured by $\chi Pr_i(s_i|S)Pr_j(l_j|S)$, which has an inverted-U relationship with I. This effect, caused by the correct identification of switchers by one firm but the misidentification by the other, softens price competition and has a positive effect on each firm's profit. The joint impact of these three effects causes a firm's expected price for loyal customers to rise with I, as illustrated in Figure 3, such that all loyal customers in the market are unambiguously worse off. A firm's expected price for switchers has an inverted-U relationship with I, as does the firm's profit, such that switchers become worse off (better off) as the targetability in the industry improves when the level of targetability is low (high). This is because only at a low level of targetability does the mistargeting effect dominate.

Thus, all these effects are rooted in imperfect targetability and will manifest themselves unless competing firms have either perfect targetability or zero targetability, which are the two extreme cases the literature has studied extensively. By examining the intermediate cases, which are perhaps more relevant to practice, we show that an increase in industry-wide targetability can make all firms better off.

4.3. Competitive Individual Marketing with Asymmetric Firms

More generally, when competing firms are not symmetric and they have differential access to individual customer information, all three effects we have identified will still be present. However, whether or not win-win competition can occur will depend not only on the level of targetability in an industry but also on who makes the improvement in targetability. The following proposition can be proven analytically in the case of asymmetric firms. (Proofs are provided in the appendix.)

PROPOSITION 4. *When the two firms' loyal segments are not too different in size, the profits of both firms can increase when the firm with the larger loyal segment, or both firms, improve their targetability starting from a low level of targetability.*

Propositions 2–4 thus affirm that a firm's pursuit of individual marketing can result in a win-win situation that benefits all competing firms (correspondingly, consumers as a whole become worse off). Such a win-win situation is more likely to occur when the targetability in an industry is low, in markets in which firms are similar to each other in terms of the loyal customers they command, and when either a firm with a larger market share improves its targetability or all firms do so together.

5. Management of Information Asset

Our analysis in the previous section provides a perspective on individual marketing that is in stark contrast to that provided by the previous literature. We show that individual marketing need not be a game in which one firm gains only at the expense of the other, regardless of whether a single firm or both can use target pricing. The mistargeting effect can turn a prisoner's dilemma game into a positive-sum game in which competing firms gain from improvements in targetability. This conclusion provides a new perspective and offers some fresh insights for understanding an information-intensive marketing environment.

For instance, because an increase in the targetability of incumbent firms can benefit potential competitors and does not constitute an entry barrier in an industry, we would expect that as the targetability in that industry improves, firms without customer information may be encouraged, rather than discouraged, to enter that industry. Evidence from the long-distance phone service industry seems to be consistent with this insight. Although leading firms in this industry are accumulating their customer information and individual marketing plays an increasingly important role in competition, hundreds of smaller and less information-intensive firms have entered and stripped off switching customers from incumbents, such that the concentration rate in the industry is actually decreasing (*Los Angeles Times* 1997).

For another instance, our analysis suggests that win-win competition occurs at a low level of targetability, whereas the prisoner's dilemma occurs at a high level of targetability. This means that protecting customer privacy and, hence, limiting the availability of customer information to all competing firms through industry-wide self-regulation, as opposed to sweeping government regulations, assume the added significance of ensuring the win-win outcomes in the industry. From this vantage point, it is perhaps not surprising that many information-intensive industries are zealous about industry-wide self-regulation at an early stage to protect customer privacy (*The Wall Street Journal* 1997)[10] and are eager to ''shoulder responsibility on privacy'' (Lohr 1999). Also from this vantage point, we can see that the requirement by the Direct Marketing Association that its members disclose and ask for customer consent for information sharing is not only a good public relations gesture but also a calculated move that enables the industry to benefit from win-win competitions.

[10]As a matter of fact, ''Self-Regulation Wins'' was named as the most important news for the direct marketing industry in 1997 (*DM News* 1998).

This new perspective also calls for new management imperatives for competing firms in an information-rich industry. In this section, we develop these imperatives.

5.1. Targetability as Competitive Advantage

Porter (1985) points out that a firm can gain competitive advantages through either product differentiation or cost leadership. Our analysis of individual marketing uncovers knowledge about individual customers as a potential source of competitive advantages. From Lemma 1, we can immediately obtain the following proposition.

PROPOSITION 5. *Under competitive individual marketing where firms have the same production cost, a firm has an advantage over its competitor in terms of profit and market share if and only if it has a larger number of accurately targeted loyal customers than its competitor, i.e.,* $\gamma_1 Pr_1(l_1 | L_1) \geq \gamma_2 Pr_2(l_2 | L_2) \Leftrightarrow \hat{\pi}_1(I_1, I_2) \geq \hat{\pi}_2(I_1, I_2)$ *and* $\hat{s}_1(I_1, I_2) \geq \hat{s}_2(I_1, I_2)$.

This proposition shows that a firm with a smaller loyal following can outperform the firm with a larger loyal following, provided that the former has a sufficient advantage in customer information. This information advantage is a competitive advantage, especially in an information-intensive marketing environment. This is because even if the two firms with identical costs were product-differentiated symmetrically, leading to $\gamma_1 = \gamma_2$, there could still be a difference in profits based on targetability.[11]

5.2. Competitive Pursuit of Targetability

When superior targetability constitutes a competitive advantage, one would expect that all competing firms will pursue it. Then, could such a competitive advantage survive this competitive pursuit of targetability, especially when there is no appreciable interfirm difference in the cost of acquiring targetability? More importantly, could all competing firms still be better off with individual marketing than without it?

We can address these questions by allowing both firms to make their decisions simultaneously on how much targetability to acquire in a prior stage. Each firm's payoff function in this prior stage is given by

$$\Pi_i = \hat{\pi}_i(I_1, I_2) - c_i(I_i), \qquad i = 1, 2, \tag{10}$$

where $\hat{\pi}_i(I_1, I_2)$ is the expected profit given by Lemma 1, and $c_i(I_i)$ is Firm i's cost of acquiring targetability I_i. Specifically, we assume that the cost of acquiring targetability I_i as $c_i(I_i) = cI_i^2$ for $I_i < \bar{I}$ and $c_i(I_i) = \infty$ otherwise, where $\bar{I} < 1$ is the maximum achievable targetability in an industry.[12] From the analysis of this investment game,[13] we have the following proposition.

PROPOSITION 6. *A pure strategy equilibrium for this investment game exists when* $0 < I_1^* < 1$ *and* $0 < I_2^* < 1$. *Both* I_1^* *and* I_2^* *decrease with the cost of acquiring targetability c. When the cost is sufficiently large, the firm with a larger loyal segment will acquire a higher level of targetability. When the cost is sufficiently small, both firms will acquire the maximum targetability. For the intermediary values of c, there exist two equilibria in which either the firm with a larger loyal franchise acquires a higher level of targetability than the firm with a smaller loyal following, or vice versa.*

The firm with a larger number of loyal customers tends to invest more in targetability when the cost is high, because the firm gains more from the segmentation effect. This conclusion is consistent with the observation that the first-movers in individual marketing are typically the leading firms in an industry (Petrison et al. 1997). However, it is possible for a firm with a smaller loyal base to leapfrog the first-mover on information investment as long as the cost of acquiring targetability is not too high. As the cost decreases, competing firms will all have more incentives to increase their investments in targetability until they achieve the highest feasible level.

[11]Indeed, corporations are paying increasing attention to intangible assets such as brands, information, and expertise as contributing to their success in the Internet Age. See *The Economist* (1999).

[12]As we show in the appendix, the condition for the existence of a pure strategy equilibrium is far more general. All we require is for $c_i(I_i)$ to be continuous, nondecreasing, and convex with respect to I_i. In addition, an interior solution exists when we further assume $c_i(0) = 0$, $c_i'(0) = 0$ and $c_i(1) = \infty$.

[13]Because there is no closed-form solution for this two-stage game, a numerical procedure is used to find the equilibrium. For details, see Appendix B in Chen (1999).

Furthermore, in this equilibrium, when neither firm excessively dominates in customer loyalty, both firms are better off under competitive individual marketing than under competitive mass marketing (see Endogenizing Targetability in the appendix). Thus, the transition from mass marketing to individual marketing, which is characterized by firms' competitive pursuit of individual-level customer information, is a process of win-win competition as long as competing firms are not too different in terms of their customer loyalty.

5.3. Sharing Customer Information

When targetability can give a firm a competitive advantage, does that mean that the firm should always guard its customer information and never share it with its competitor in their competitive pursuit of targetability? We show here that information sharing can be an optimal way to manage customer information.

There are three possible ways for a firm to share individual-level customer information. A firm can exchange customer information with its competitor. It can also sell customer information to its competitor. Finally, it can simply give away customer information to its competitor. All these mechanisms of information sharing improve incrementally the targetability of the information recipient. Here we are not interested in the choice of information-sharing mechanisms, which will, of course, depend on institutional details in a specific market. We are interested in a more fundamental question: the feasibility of information sharing. We will first state the conditions under which each of these mechanisms is feasible, i.e., the conditions under which the competing firms are motivated by self-interest to share information via a particular mechanism. We then show that those conditions can be satisfied in the equilibrium of our pricing game with imperfect targetability.

Because exchanging customer information increases both firms' targetability on the margin, both have incentives to participate in an information exchange if and only if, after the exchange, each participant's profit increases as a result, or algebraically

$$\frac{\partial\hat{\pi}_i(I_1, I_2)}{\partial I_i} + \frac{\partial\hat{\pi}_i(I_1, I_2)}{\partial I_{3-i}} > 0 \quad \text{for } i = 1, 2. \qquad (11)$$

Otherwise, information sharing cannot occur without compensation. A firm, say Firm i, will sell information to its competitor, which, in turn, will agree to buy if and only if such a transaction is a Pareto improvement: One of the firms can be made better off, whereas the other is at least as well off after the transaction. For example, for Firm i to sell information to Firm j, which will help the latter's targetability, we must have

$$\frac{\partial\hat{\pi}_i}{\partial I_j} + \frac{\partial\hat{\pi}_j}{\partial I_j} > 0, \qquad (12)$$

where $\partial\hat{\pi}_i/\partial I_j$ is the marginal change in Firm i's profit from an increase in Firm j's targetability, and $\partial\hat{\pi}_j/\partial I_j$ is the marginal increase of Firm j's profit through obtaining targeting information from Firm i. This latter term is also the price Firm i will charge for the marginal transferring of information to Firm j when it is allowed to make a take-it-or-leave-it offer. Finally, Firm i may even voluntarily give away customer information to its competitor when doing so is in its self-interest or when the following condition is satisfied:

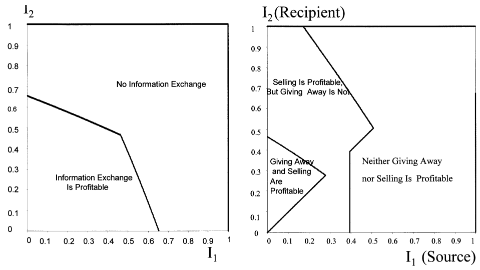
$$\frac{\partial\hat{\pi}_i}{\partial I_{3-i}} > 0. \qquad (13)$$

As competitive individual marketing with imperfect targetability can lead to win-win competition, information sharing can be an optimal strategy for competing firms. The following proposition states this result, and all proofs are provided in the appendix.

Proposition 7. *Two competing firms will optimally choose to share (exchange, sell to the competitor, or give away to the competitor) their customer information when at least one firm's targetability is sufficiently low and when the size of two firms' loyal franchise is not too different. Furthermore, although either firm always has incentives to be an information buyer, the seller can only be the firm with a low level of targetability.*

Figure 4 illustrates this proposition for the case in which $\gamma_1 = \gamma_2 = \chi = 1/3$. Competing firms have incen-

Figure 4 Information Sharing by Competing Firms*



tives to share information fundamentally, because an increase in one or both firms' targetability leads to a win-win situation when their targetability is low and when the size of their loyal customers is not too different, as we have concluded in Propositions 2–4. When a one-way sale takes place, the firm with a low level of targetability will be the seller, whereas the firm with a high level of targetability cannot be, because only such a firm can expect a positive selling price from the rival firm that is higher than the damage the rival firm with a higher targetability can inflict upon the firm. When the size of their loyal customers is sufficiently different, no exchange can take place, as the firm with a small loyal franchise will never want to improve the rival's targetability and, hence, help the rival to compete for switchers. However, the firm with a large loyal franchise and low targetability can sell its information to the competing firm with a small loyal segment, as the latter gains from improved targetability with little adverse impact on the former.

Proposition 7 provides not only a new prescription for the management of information assets but also a rational explanation for the phenomenon of exchanging information with competitors, which happens often in the catalog retailing industry. From the vantage point of our analysis, we can see that the practice of information exchanges in that industry is quite reasonable. Proposition 7 also points out that as individual marketing matures with a high degree of targetability, the opportunity for profitable information sharing also disappears. This perhaps explains why some other catalog companies, such as Spiegel, with much sophistication in collecting customer information, do not participate in information exchange or list rental (*Catalog Age* 1997). Moreover, this finding explains why business-to-business catalog marketers are less likely to exchange customer information than consumer goods catalog retailers (*Catalog Age* 1996). This is because business-to-business catalog marketers usually deal with a small number of customers with long-term relationships. Thus, they are more likely to have reached a high level of targetability than consumer goods catalog retailers.

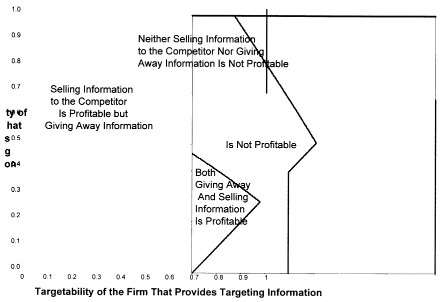
5.4. Information Selling Strategy of a Monopoly Vendor

The perspective of win-win competition has many strategic implications not only for an information-rich industry as a whole and for the competing firms therein, but also for information vendors. Consider a monopoly vendor selling individual customer information to two competing firms engaged in individual marketing, as in our model. We assume that the monopoly vendor can provide the level of targetability at $\bar{I} < 1$ to one or both firms. We further assume $\bar{I}$ is known to both potential buyers. The vendor may choose to sell nonexclusively to both firms or to sell exclusively to one firm by committing not to sell to the other. How should the vendor sell its customer information?

As discussed in Villas-Boas (1994), in the case of nonexclusive selling, the seller who has information that allows a firm to achieve targetability $\bar{I}$ and can make a take-it-or-leave-it offer to both firms will achieve a total selling price of $[\hat{\pi}_1(\bar{I}, \bar{I}) - \hat{\pi}_1(0, \bar{I})] + [\hat{\pi}_2(\bar{I}, \bar{I}) - \hat{\pi}_2(\bar{I}, 0)]$, when $\hat{\pi}_i(I_1, I_2)$ is firm i's equilibrium profit given by Lemma 1. Put differently, the monopoly vendor can extract all the gains that a firm can make from acquiring the targetability $\bar{I}$. In the case of exclusive selling, the vendor's price will be equal to a firm's maximum willingness to pay to keep the targetability out of the rival's hand, which is $[\hat{\pi}_1(\bar{I}, 0) - \hat{\pi}_1(0, \bar{I})]$ for Firm 1 and $[\hat{\pi}_2(0, \bar{I}) - \hat{\pi}_2(\bar{I}, 0)]$ for Firm 2. The following proposition summarizes the vendor's optimal selling strategy with proofs provided in the appendix.

Proposition 8. *A monopoly vendor of targeting information can optimally choose to sell its information nonexclusively if the targetability associated with the information*

Figure 5 Information Selling Strategy for a Monopoly Vendor*



is sufficiently low, i.e., $\bar{I}$ is small. Otherwise, it always sells exclusively. Furthermore, when selling exclusively is optimal, the vendor prefers to sell to the firm with a small loyal segment when it can impart a high level of targetability to a firm.

Figure 5 illustrates this proposition at $\gamma_1/\gamma_2 = 1.5$ and $\chi = 1/3$. Intuitively, when the targetability for sales is low, an increase in both firms' targetability leads to win-win competition and, hence, it is optimal for the information vendor to sell nonexclusively to capture more value from its information. However, when the targetability for sales is high, an increase in both firms' targetability will lead to a prisoner's dilemma. In that case, an exclusive selling strategy will prevent the dissipation of industry profit and will help the vendor to capture more value from the exclusive buyer. As $\bar{I}$ increases, the vendor initially favors the firm with a large loyal following and then the firm with a small loyal following as the exclusive buyer. This is because at a high level of targetability, the firm with a small loyal following is most willing to pay, as it relies relatively more on the switching segment for profit, to take the targetability off the hands of the rival firm.

Interestingly, Proposition 5 suggests that a firm with a small loyal following can outcompete the firm with a large loyal following, as long as the small firm's targetability is sufficiently superior. Proposition 6 suggests that a firm with a small loyal following can acquire a higher level of targetability when the cost of information acquisition is not too high. Proposition 8 further points out that an information vendor prefers the firm with a small loyal following as the exclusive buyer when its customer information leads to a high level of targetability. Together, these three propositions imply an intriguing possibility: In an industry in which a high level of targetability can be quickly achieved, a firm with a smaller loyal base can leapfrog a firm with a larger loyal base.

6. Conclusion

Our main contribution in this paper is to uncover the mistargeting effect in individual marketing. By examining this effect alongside other effects previously identified in the literature, we are able to provide a more complete picture of the incentive environment for individual marketing.

We show that when individual marketing is feasible, *but* imperfect, a competitive advantage that a firm gains from its improved targetability need not be detrimental to its rival firm. In fact, the rival can benefit from it. This is because, as a firm becomes better at distinguishing its loyal customers from switchers, it gains the confidence to charge a higher price to its perceived loyal customers. Therefore, the improvement in targetability can lessen price competition in the market, which is exacerbated by firms' misclassifications of customers in the first place, and results in win-win competition. The win-win competition comes about despite the market itself not expanding and all firms behaving noncooperatively. A prisoner's dilemma occurs only when targetability in a market reaches a sufficiently high level.

This win-win perspective on individual marketing is not simply an academic curiosity. It has many important managerial implications. First of all, because of the win-win competition, information sharing among competing firms can be an optimal strategy for managing information assets. Indeed, it can even be optimal for a firm, going against its managers' competitive instinct, to give away its customer information to its competitor without any compensation in return. Second, as the improvements in targetability can lead to both win-win competition and a prisoner's dilemma, protecting customer privacy becomes a strategic issue, an issue that concerns not only an individual firm but also the industry as a whole. At the nascent stage of individual marketing, when the achievable targetability in an industry is low, it is important to share customer information. However, it behooves firms in an industry to develop self-regulations at an early stage to protect customer privacy so as to ensure win-win competition in the industry. Thus, an industry's control over the issue of privacy is not only prudent politics but also a business imperative. Third, again because of the win-win competition, an information vendor must pick its buyer judiciously. When its information is associated with a low (high) level of targetability, the vendor should make the information available nonexclusively (exclusively). When the vendor does sell its information exclusively, it should target as the buyer the firm with a small loyal following when it can impart a sufficiently high level of targetability to a firm. Finally, individual marketing may provide a good opportunity for a small firm to leapfrog a large firm. The key to leapfrogging is a high level of targetability or customer knowledge.

It is important to note that, although our analysis is conducted in the context of a simple model, many of our key assumptions can be easily relaxed without altering our basic conclusions. We discuss a few extensions here.

First, our basic model can be extended to the case in which neither firm can identify the rival's loyal customers perfectly and each may misclassify them as its own loyal customers or switchers (Chen 1999). This scenario corresponds to an individual-marketing situation in which targeting is based on information about prospective instead of current customers (Deighton et al. 1994). In this case, the mistargeting effect continues to play a pivotal role, and our conclusions about the win-win competition remain intact. As an additional insight, although a firm always charges higher prices to the perceived price-insensitive customers than to the perceived price-sensitive customers, as in our basic model, it always charges higher prices to the perceived loyal customers of its own among the perceived price-insensitive customers, because there are more true loyal customers in that group.

Second, in our basic model, the size of each firm's loyal customers is taken as given. However, it is straightforward to extend our model to allow each firm to invest in building customer loyalty. We can do so by following the example of McGahan and Ghemawat (1994), adding a preceding stage to our pricing game. In specific, assume that the market shares for the two firms at the beginning of the first period are s_1 and s_2, respectively. In the second period, $s_1\theta_1$ size of customers will be loyal to Firm 1, and $s_2\theta_2$ size of customers will be loyal to Firm 2, where $0 < \theta_1, \theta_2 < 1$. The rest, $1 - s_1\theta_1 - s_2\theta_2$ in size, are switchers. Two firms choose θ_1 and θ_2 simultaneously in the first period. The cost for Firm i to build loyal segment $s_i\theta_i$ is $\frac{1}{2}ks_i\theta_i^2$ $(k > 1)$.

We can show that the firm with the larger market share always invests more in building customer loyalty for any given level of targetability. As an interesting insight, we find that at the industry level, the total investment in loyalty and the total size of loyal customers both increase with targetability. This is because a higher targetability increases the payoffs from loyal customers, which in turn encourages a firm to invest more to nurture customer loyalty. Thus, in a more dynamic setting, nurturing loyal customers and gaining from them go hand in hand.

Our conclusions are also robust to variations in many other institutional details. For instance, we can allow differential knowledge on the part of firms about their loyal versus their switching customers. We can also vary the demand and cost structures or the number of firms in the market without altering our basic conclusions.[14] The reason for the robustness is that our basic model captures in a parsimonious way the essential effects of individual marketing.

There are two directions that future research can pursue. First, our analysis examines only pricing and promotion strategies in detail. A more comprehensive view of individual marketing can be obtained by incorporating other marketing mix variables so that issues such as mass customization, target advertising, and channel coordination can be examined in an integrated model. Second, future theoretical modeling can explore more institutional details specific to certain types of industries, which can then lend them-

[14] The technical details for these extensions are provided in Chen (1999).

selves easily to empirical testing. We hope that our study inspires more interest in—and paves the way for—these future explorations.[15]

Appendix

PROPOSITION 1 AND LEMMA 1 (EQUILIBRIUM SOLUTIONS).

Define for $i = 1, 2$,

$$a_{i1} = \gamma_i Pr_i(l_i|L_i), \qquad a_{i2} = \chi Pr_i(l_i|S)Pr_{3-i}(l_{3-i}|S),$$
$$a_{i3} = \chi Pr_i(l_i|S)Pr_{3-i}(s_{3-i}|S),$$
$$b_{i1} = \gamma_i Pr_i(s_i|L_i), \qquad b_{i2} = \chi Pr_i(s_i|S)Pr_{3-i}(l_{3-i}|S),$$
$$b_{i3} = \chi Pr_i(s_i|S)Pr_{3-i}(s_{3-i}|S). \tag{14}$$

Comparing the above definitions to the notations used in §4, we have $\phi_i = a_{i1}$, $\psi = a_{12} = a_{22}$, and $\varphi = b_{13} = b_{23}$.

When only one firm has perfect targetability, or $I_i = 1$, Firm i can perfectly identify all customers so that it charges $p_{iL_i} = 1$ to get all surplus from its loyal customers. When both $I_1 = 1$ and $I_2 = 1$, both firms can perfectly identify all customers. Thus, both firms charge the reservation price, 1, to their loyal customers. Because the marginal costs are zero for both firms, each firm sets price to zero for switchers as a result of the Bertrand competition in that segment. Thus, the pure strategy equilibrium is characterized by $p_{1L_1} = p_{2L_2} = 1$ and $p_{1S} = p_{2S} = 0$.

When $I_i < 1$, there is no pure strategy equilibrium because (i) to get b_{13} (b_{23}) and a_{12} (a_{22}) sizes of switchers, Firm 1 (Firm 2) has incentives to set p_{1S} and p_{1L_1} (p_{2S} and p_{2L_2}) to undercut max (p_{2S}, p_{2L_2}) (max(p_{1S}, p_{1L_1})) when that value is not too much lower than 1; and (ii) otherwise Firm i would set p_{iS} and p_{iL_i} to 1 to only capture its loyal customers.

Now we construct the mixed-strategy equilibrium for the case where at least one of I_1 and I_2 is less than 1. We have (i) the joint support of Firm i's prices, i.e., $\{p_{iL_i}\} \cup \{p_{iS}\}$, is continuous; (ii) neither firm can have a mass point below 1 in its joint price support; (iii) at most one firm can have probability mass at 1 in its joint price support; and (iv) the joint price support is from p_b to 1 for both firms, where p_b is to be determined. The proofs for these properties are essentially the same as the proofs for Propositions 2 to 5 in Narasimhan (1988).

Define $\tilde{H}_{i1}(p) = Pr(p_{iL_i} \geq p)$ and $\tilde{H}_{i2}(p) = Pr(p_{iS} \geq p)$. Firm i's profit from its perceived loyal segment is

$$\pi_{iL_i}(p_{iL_i}) = [a_{i1} + a_{i2}\tilde{H}_{3-i1}(p_{iL_i}) + a_{i3}\tilde{H}_{3-i2}(p_{iL_i})]p_{iL_i}$$
$$= [a_{i1} + d_{i1}\tilde{H}_{3-i}(p_{iL_i})]p_{iL_i}, \tag{15}$$

where $d_{i1} = \chi Pr_i(l_i|S)$ and $\tilde{H}_{3-i}(p_{iL_i} = Pr_{3-i}(s_{3-i}|S)\tilde{H}_{3-i2}(p_{iL_i}) + Pr_{3-i}(l_{3-i}|s)\tilde{H}_{3-i1}(p_{iL_i})$. The first term on the right side of (15) is Firm i's profit from its loyal customers who are correctly identified by Firm i. The second term is Firm i's profit from the switchers who are misclassified by both firms. The third term is Firm i's profit from the switchers who are misclassified by Firm i as its loyal customers but correctly identified by the other firm. Similarly, Firm i's profit from its perceived switchers is

$$\pi_{iS}(p_{iS}) = [b_{i1} + b_{i2}\tilde{H}_{3-i1}(p_{iS}) + b_{i3}\tilde{H}_{3-i2}(p_{iS})]p_{iS}$$
$$= [b_{i1} + d_{i2}\tilde{H}_{3-i}(p_{iS})]p_{iS}, \tag{16}$$

where $d_{i2} = \chi Pr_i(s_i|S)$ and $\tilde{H}_{3-i}(p_{iS}) = Pr_{3-i}(s_{3-i}|S)\tilde{H}_{3-i2}(p_{iS}) + Pr_{3-i}(l_i|S)\tilde{H}_{3-i1}(p_{iS})$. The first term on the right side of (16) is Firm i's profit from its loyal customers who are misclassified as switchers by Firm i. The second term is Firm i's profit from the switchers who are correctly identified by Firm i but misclassified by the other firm as its loyal customers. The third term is Firm i's profit from the switchers who are correctly identified by both firms.

By the property of the mixed strategy Nash equilibrium, $\pi_i = \pi_{iL_i}(p_{iL_i}) + \pi_{iS}(p_{iS})$ is invariant for all p_{iL_i} and p_{iS} on their equilibrium supports. From (15) and (16), we can see that given the other firm's price distributions, $\pi_{iL_i}(p_{iL_i})$ is not dependent on p_{iS}, and $\pi_{iS}(p_{iS})$ is not dependent on p_{iL_i}. Thus, $\pi_{iL_i}(p_{iL_i})$ should be invariant for all p_{iL_i} on the equilibrium price support, and $\pi_{iS}(p_{iS})$ should be invariant for all p_{iS} on the equilibrium price support.

Now we claim that for $I_i > 0$ there is no more than one common point on the equilibrium supports of p_{iL_i} and p_{iS}. Without loss of generality, we prove this claim for Firm 1 as follows: when there exist two prices, p_a and p_b, on the supports of both p_{1L_1} and p_{1S}. From (15) and the invariant property of $\pi_{1L_1}(p_{1L_1})$, we have

$$\pi_{1L_1}(p_a) = \pi_{1L_1}(p_b)$$
$$\Rightarrow [a_{11} + d_{11}\tilde{H}_2(p_a)]p_a = [a_{11} + d_{11}\tilde{H}_2(p_b)]p_b$$
$$\Rightarrow \frac{p_b\tilde{H}_2(p_b) - p_a\tilde{H}_2(p_a)}{p_a - p_b} = \frac{a_{11}}{d_{11}}. \tag{17}$$

Similarly, from (16) and $\pi_{1S}(p_a) = \pi_{1S}(p_b)$, we have

$$\frac{p_b\tilde{H}_2(p_b) - p_a\tilde{H}_2(p_a)}{p_a - p_b} = \frac{b_{11}}{d_{12}}. \tag{18}$$

Comparing (17) with (18), we have $a_{11}/d_{11} = b_{11}/d_{12} \rightarrow I_1 = 0$, which contradicts $I_1 > 0$. Hence, the claim holds.

We further claim that if $I_i > 0$, $p_{iL_i} \geq p_{iS}$ for all p_{iL_i} and p_{iS} on their equilibrium supports. The proof is as follows. Consider Firm 1. If $I_1 = 1$, then $p_{1L_1} = 1$ but $p_{1S} \leq 1$. Thus, the claim is true in this case. Suppose that the above claim is not true for $I_1 < 1$. Because we have already proved that for $I_1 < 1$ the joint support of p_{1L_1} and p_{1S} is continuous with the support of p_{1L_1} and the support of p_{1S} is not overlapping, there must exist an interval (p_a, p_o) on the support of p_{1L_1} and an interval (p_o, p_b) on the support of p_{1S}, such that $p_b - p_o = p_o - p_a$. Because $(p_{1L_1}, p_{1S}) = (p_a, p_b)$ is in equilibrium but $(p_{1L_1}, p_{1S}) = (p_b, p_a)$ may not be, we must have that $\pi_{1L_1}(p_a) + \pi_{1S}(p_b) \geq \pi_{1L_1}(p_b) + \pi_{1S}(p_a)$. Applying (15) and (16) to this inequality, we have

[15]The authors thank the editor, the area editor, and two anonymous referees for their constructive comments. They also thank Lynnea Brumbaugh-Walter for her editorial comments. However, the authors are responsible for any remaining errors in the paper.

$$(d_{11} - d_{12})\frac{p_a\tilde{H}_2(p_a) - p_b\tilde{H}_2(p_b)}{p_b - p_a} \geq (a_{11} - b_{11}). \tag{19}$$

Then applying (15), (16), and $p_b - p_o = p_o - p_a$ to $\pi_{1L_1}(p_a) = \pi_{1L_1}(p_o)$ and $\pi_{1S}(p_b) = \pi_{1S}(p_o)$, respectively, we get

$$\frac{p_o\tilde{H}_2(p_o) - p_b\tilde{H}_2(p_b)}{p_b - p_a} = \frac{1}{2}\frac{a_{11}}{d_{11}},$$

$$\frac{p_a\tilde{H}_2(p_a) - p_o\tilde{H}_2(p_o)}{p_b - p_a} = \frac{1}{2}\frac{b_{11}}{d_{12}}. \tag{20}$$

Equation (20) implies

$$\frac{p_a\tilde{H}_2(p_a) - p_b\tilde{H}_2(p_b)}{p_b - p_a} = \frac{1}{2}\left(\frac{a_{11}}{d_{11}} + \frac{b_{11}}{d_{12}}\right). \tag{21}$$

Applying (21) to (19), we see that the condition for (19) to hold is $I_1 \leq 0$, with the equality holding at $I_1 = 0$. This contradicts the assumption $I_1 > 0$. Hence, the claim holds.

If $I_i = 0$, from the proofs for the above two claims, the price supports of p_{iL_i} and p_{iS} can overlap, and $\pi_i(p_{iL_i}, p_{iS}) = \pi_i(p_a, p_b) = \pi_i(p_b, p_a)$ for all p_a and p_b on the joint support of p_{iL_i} and p_{iS}. Thus, the distributions of p_{iL_i} and p_{iS} are completely exchangeable. This implies that the distributions of p_{iL_i} and p_{iS} are identical when $I_i = 0$ and that they are the same as Firm i's equilibrium price distribution in the case in which it always sets $p_{iL_i} = p_{iS}$, i.e., conducting mass marketing.

When $0 < I_i < 1$, from the above discussion there exists p_{mi} such that p_{iL_i} is distributed from p_{mi} to 1 and p_{iS} is distributed from p_b to p_{mi}. Also, we have the boundary conditions $\tilde{H}_{i1}(p_{mi}) = 1$, $\tilde{H}_{i2}(p_b) = 1$, $\tilde{H}_{i2}(p_{mi}) = 0$, and $\tilde{H}_{i1}(1) = q_i$, where q_i is the probability mass for Firm i at the reservation price with $q_1q_2 = 0$. If $I_i = 0$, we have $\tilde{H}_{i1}(p) = \tilde{H}_{i2}(p) = \tilde{H}_i(p)$ and the boundary conditions for Firm i change to $\tilde{H}_i(p_b) = 0$ and $\tilde{H}_i(p_b) = q_i$. When $I_i = 1$, we have $p_{mi} = 1$ and the boundary conditions for Firm i change to $\tilde{H}_{i2}(p_b) = 0$ and $\tilde{H}_{i2}(p_{mi}) = q_i$.

The equilibrium price strategies can then be solved by applying the above boundary conditions to (15) and (16). In all cases, the equilibrium solution is unique. For $0 < I_1 < 1$, $0 < I_2 < 1$, and $\phi_i \geq \phi_j$ ($i = 1, 2$, $j = 3 - i$), we have

(i) $$p_{m1} = p_{m2} = p_m = \frac{\phi_i}{\phi_i + \psi}, \quad p_b = \frac{(\chi - \varphi)}{\chi}p_m,$$

$$q = \frac{\phi_i - \phi_j}{\phi_i + \psi},$$

(ii) $$\tilde{H}_{i1}(p) = \frac{-\phi_j}{\psi} + \frac{\phi_j + \psi q}{\psi}\frac{1}{p},$$

(iii) $$\tilde{H}_{j1}(p) = \frac{-\phi_i}{\psi} + \frac{\phi_i}{\psi}\frac{1}{p},$$

(iv) $$\tilde{H}_{i2}(p) = \tilde{H}_{j2}(p) = \frac{(\chi - \varphi)}{\varphi}\left(\frac{\phi_i}{\phi_i + \psi}\frac{1}{p} - 1\right),$$

(v) $$\hat{p}_{iL_i} = \frac{\phi_i - \phi_j}{\phi_i + \psi} + \left(1 - \frac{\phi_i - \phi_j}{\phi_i + \psi}\right)\frac{\phi_i}{\psi}\ln\left(\frac{\phi_i - \psi}{\phi_i}\right),$$

(vi) $$\hat{p}_{jL_j} = \frac{\phi_i}{\psi}\ln\left(\frac{\phi_i + \psi}{\phi_i}\right), \quad \text{and}$$

(vii) $$\hat{p}_{iS} = \hat{p}_{jS} = \frac{\chi - \varphi}{\varphi}\frac{\phi_i}{\phi_i + \psi}\ln\left(\frac{\chi}{\chi - \varphi}\right),$$

where $\hat{p}_{iL_i}$ and $\hat{p}_{iS}$ are Firm i's average equilibrium prices for its perceived loyal customers and perceived switchers, respectively. When $I_i = 1$, Firm i's pricing strategy can be obtained by letting $I_i \to 1$ in the above results. When $I_i = 0$, the conditional distributions, $\tilde{H}_i[p \mid p \in (p_{mi}, 1)]$ and $\tilde{H}_i[p \mid p \in (p_b, p_{mi})]$, are given by $\tilde{H}_{i2}(p)|_{I_i \to 0}$ and $\tilde{H}_{i2}(p)|_{I_i \to 0}$ as obtained above. When both $I_1 = 0$ and $I_2 = 0$, the equilibrium results reduce to those of Narasimhan (1988).

Firms' equilibrium profits and expected market shares can be derived from their definitions. The results are presented in Lemma 1 of the paper. It is easy to prove that $\partial\hat{p}_{iL_i}/\partial I_i > 0$, $\partial\hat{\pi}_i/\partial I_i \geq 0$, $\partial^2\hat{\pi}_i/\partial I_i^2 \leq 0$ if $\hat{s}_i \geq \hat{s}_j$, and $\partial^2\hat{\pi}_i/\partial I_i^2 > 0$ when otherwise. Furthermore, $\partial\hat{\pi}_i/\partial I_i = 0$ and $\partial^2\hat{\pi}_i/\partial I_i^2 = 0$ only if $I_j = 1$.

Proof of Proposition 2. Because $\gamma_1 = \gamma_2 = \gamma$ and $I_1 > I_2 = 0$, we must have $\phi_1 > \phi_2$ in this case. By applying Lemma 1, we can show $\partial\hat{\pi}_1/\partial I_1 > 0$ and $\partial^2\hat{\pi}/\partial I_1^2 < 0$. Thus, Firm 1's profit increases with its own targetability, but Firm 2's profit is concave with respect to Firm 1's targetability. By solving $\partial\hat{\pi}_2/\partial I_1|_{I_1=I^*} = 0$, we can obtain

$$I^* = \frac{(1 - \chi)(1 + 3\chi)}{4\chi^2}\left[\frac{(1 + \chi)}{\sqrt{(1 - \chi)(1 + 3\chi)}} - 1\right].$$

Moreover, it can be shown that $\partial I^*/\partial_\chi < 0$ and I^* is between 0 and 0.5. The discussion for the $\gamma_1 \neq \gamma_2$ case can be found later in this appendix.

Proof of Proposition 3. In this case, we have $\phi_1 = \phi_2$ because $\gamma_1 = \gamma_2 = \gamma$ and $I_1 = I_2 = I$. From Lemma 1, we can show $\hat{\pi}_1 = \hat{\pi}_2 = \hat{\pi}$ and

$$\frac{\partial^2\hat{\pi}}{\partial I^2} = \left(\frac{\partial^2\hat{\pi}_1}{\partial I_1^2} + 2\frac{\partial^2\hat{\pi}_1}{\partial I_1\partial I_2} + \frac{\partial^2\hat{\pi}_1}{\partial I_2^2}\right)\Bigg|_{I_1=I_2=I} < 0.$$

Therefore, firms' profits are concave with respect to I. Solving for

$$\frac{\partial\hat{\pi}}{\partial I}\Bigg|_{I=I^*} = \left(\frac{\partial\hat{\pi}}{\partial I_1} + \frac{\partial\hat{\pi}}{\partial I_2}\right)\Bigg|_{I_1=I_2=I^*} = 0,$$

we have

$$I^* = \frac{(1 - \chi)(1 + 3\chi)}{4\chi^2}\left[\frac{(1 + \chi)}{\sqrt{(1 - \chi)(1 + 3\chi)}} - 1\right].$$

The discussion for the $\gamma_1 \neq \gamma_2$ case can be found in the next paragraph.

Proof of Proposition 4. Assume $\gamma_1 \geq \gamma_2$ and $0 < I_i < 1$. This proposition is equivalent to the following conditions: (i) $\partial\hat{\pi}_i/\partial I_i > 0$; (ii) $\partial\hat{\pi}_i/\partial I_j > 0$ if $I_1 \to 0$, $I_2 \to 0$, $\gamma_1 - \gamma_2 \to 0$, and $\phi_i < \phi_j$; (iii) $\partial\hat{\pi}_i/\partial I_j < 0$ if $\phi_i \geq \phi_j$; (iv) $(\partial\hat{\pi}_i/\partial I_i) + (\partial\hat{\pi}_i/\partial I_j) > 0$ if $I_1 \to 0$, $I_2 \to 0$, and $\gamma_1 - \gamma_2 \to 0$. The above (i)–(iv) can then be proved by using the results of Lemma 1. In particular, for $\gamma_j > \gamma_i$ and $I_j > I_i$, we have $\partial\hat{\pi}_i/\partial I_j|_{\gamma_i\to 0} < 0$. This result is used in the discussion of Proposition 2. Also, for $\gamma_j > \gamma_i$ and $I_i = I_j$, we have $(\partial\hat{\pi}_i/\partial I_i + \partial\hat{\pi}_i/\partial I_j)|\gamma_{i\to 0} < 0$. This result is used in the discussion of Proposition 3.

Endogenizing Targetability. To endogenize targetability, we can specify an additional stage that precedes our pricing game, where each firm independently chooses its targetability by investing in information technology. From Lemma 1, we can see that $\hat{\pi}_i(I_1, I_2)$ is continuous in I_1, I_2. Also, we have proved that $\partial\hat{\pi}_i/\partial I_i \geq 0$ and $\partial^2\hat{\pi}_i/\partial I_i^2 \leq 0$ hold when $\hat{\pi}_i \geq \hat{\pi}_{3-i}$ and that $\partial^2\hat{\pi}_i/\partial I_i^2 \geq 0$ when $\hat{\pi}_i < \hat{\pi}_{3-i}$, with $\partial\hat{\pi}_i/\partial I_i = 0$ and $\partial^2\hat{\pi}_i/\partial I_i^2 = 0$ when $I_j = 1$. In addition, we can show $\partial^2\hat{\pi}_i/\partial I_i I_j < 0$. Let $c_i(I_i)$ be the cost for Firm i to achieve targetability I_i. We assume that $c_i(0) = c_i'(0) = 0$ and $c_i(1) = \infty$ to ensure an interior solution. Given these properties of $\hat{\pi}_i$ and the assumptions about the cost function, the existence of pure strategy equilibrium is a standard result of the fixed-point theorem. For any I_1^* and I_2^* in the equilibrium, we have, by the definition of Nash Equilibrium, i.e., $\hat{\pi}_1(I_1^*, I_2^*) - c_1(I_1^*) \geq \hat{\pi}_1(0, I_2^*)$ and $\hat{\pi}_2(I_1^*, I_2^*) - c_2(I_2^*) \geq \hat{\pi}_2(I_1^*, 0)$. From Proposition 2, when $|\gamma_1 - \gamma_2| \to 0$, i.e., when the difference in firms' loyal followings is small enough, we have $\hat{\pi}_1(0, I_2^*) \geq \hat{\pi}_1(0, 0)$ and $\hat{\pi}_2(I_1^*, 0) \geq \hat{\pi}_2(0, 0)$. Thus, when the difference in firms' loyal followings is small enough, we must have $\hat{\pi}_i(I_1^*, I_2^*) - c_i(I_i^*) \geq \hat{\pi}_i(0, 0)$ for $i = 1, 2$.

Proof of Proposition 7. The signs of $\partial\hat{\pi}_i/\partial I_i + \partial\hat{\pi}_i/\partial I_j$ and $\partial\hat{\pi}_i/\partial I_j$ are examined in detail earlier in the appendix. Proposition 7 falls out directly from these discussions.

Proof of Proposition 8. Assuming $\gamma_1 > \gamma_2$ and applying Lemma 1, we have $\{[\hat{\pi}_1(\bar{I}, \bar{I}) - \hat{\pi}_1(0, \bar{I})] + [\hat{\pi}_2(\bar{I}, \bar{I}) - \hat{\pi}_2(\bar{I}, 0)] - [\hat{\pi}_1(\bar{I}, 0) - \hat{\pi}_1(0, \bar{I})]\}|_{\bar{I}\to 0} = (\partial\hat{\pi}_1/\partial I_2 + \partial\hat{\pi}_2/\partial I_2)|_{I_1=I_2=\bar{I}\to 0} > 0$ and $\{[\hat{\pi}_1(\bar{I}, \bar{I}) - \hat{\pi}_1(0, \bar{I})] + [\hat{\pi}_2(\bar{I}, \bar{I}) - \hat{\pi}_2(\bar{I}, 0)] - [\hat{\pi}_2(0, \bar{I}) - \hat{\pi}_2(\bar{I}, 0)]\}|_{\bar{I}\to 0} = (\partial\hat{\pi}_1/\partial I_1 + \partial\hat{\pi}_2/\partial I_1)|_{I_1=I_2=\bar{I}\to 0} > 0$, as proved in this appendix. Thus, the seller adopts nonexclusive selling strategy when $\bar{I}$ is small enough. Also, we have that $\{[\hat{\pi}_2(0, \bar{I}) - \hat{\pi}_2(\bar{I}, 0)] - [\hat{\pi}_1(\bar{I}, \bar{I}) - \hat{\pi}_1(0, \bar{I})] - [\hat{\pi}_2(\bar{I}, \bar{I}) - \hat{\pi}_2(\bar{I}, 0)]\}|_{\bar{I}\to 1} = \chi Pr_1(l_1|S) > \{[\hat{\pi}_1(\bar{I}, 0) - \hat{\pi}_1(0, \bar{I})] - [\hat{\pi}_1(\bar{I}, \bar{I}) - \hat{\pi}_1(0, \bar{I})] - [\hat{\pi}_2(\bar{I}, \bar{I}) - \hat{\pi}_2(\bar{I}, 0)]\}|_{\bar{I}\to 1} = \chi Pr_2(l_2|S) > 0$. Hence, the seller sells exclusively to the firm with fewer loyal customers when $\bar{I}$ is large enough. Our simulations further show that there always exists a critical value $\bar{I}^*$ such that when $\bar{I} < \bar{I}^*$, the vendor sells nonexclusively, and when $\bar{I} \geq \bar{I}^*$, the vendor sells exclusively first to the firm with a large loyal following and then to the firm with a small loyal following as $\bar{I}$ increases.

References

Bakos, Y. J. 1997. Reducing buyer search costs: Implications for electronic marketplaces. *Management Sci.* **43**(12) 1676–1692.

Balasubramanian, S. 1998. Mail vs. mall: A strategic analysis of competition between direct marketers and conventional retailers. *Marketing Sci.* **17**(3) 181–195.

Blattberg, R. C., J. Deighton. 1991. Interactive marketing: Exploiting the age of addressability. *Sloan Management Rev.* **5**(14)

Brandenburger, M. A., B. J. Nalebuff. 1996. *Co-opetition.* Doubleday, New York.

Bult, J. R., T. Wansbeek. 1995. Optimal selection for direct mail. *Marketing Sci.* **14**(4) 378–394.

——, ''Database Marketing—A Potent New Tool for Selling,'' *Business Week,* 5 September 1994.

——, ''Lists and Database (Mailing List versus Database Marketing),'' *Catalog Age,* 1 August 1996.

——, ''To Exchange or Not to Exchange,'' *Catalog Age,* 1 December 1997.

Chen, Y. 1999. Targetability and individual-marketing competition. Unpublished doctoral dissertation. Washington University, St. Louis, MO.

Colombo, R. A., D. G. Morrison. 1989. Note: A brand switching model with implications for marketing strategies. *Marketing Sci.* **8**(1) 89–99.

——, ''Dying for Credit Cards,'' *Credit Card Management,* 1 May 1997.

Deighton, J., D. Peppers, M. Rogers. 1994. Consumer transaction databases: present status and prospects. Blattberg, Glazer, Little, eds. *The Marketing Information Revolution.* Harvard Business School Press, Boston, MA.

——, ''Next Generation Marketing: Data Sharing,'' *Direct Marketing,* March 1996.

——, ''The Year of Self-Regulation,'' *DM News,* 3 February 1998.

——, ''A Price on the Priceless,'' *The Economist,* 12 June 1999, 61–62.

Gal-Or, E. 1985. Information sharing in oligopoly. *Econometrica.* **53**(2) 329–343.

Gerstner, E., D. Holthausen. 1986. Profitable pricing when market segments overlap. *Marketing Sci.* **5**(1) 55–69.

Kotler, P. 1997. *Marketing Management,* 9th ed. Prentice-Hall, Upper Saddle River, NJ.

Lal, R., J. D. C. Little, J. M. Villas-Boas. 1996. A theory of forward buying, merchandising, and trade deals. *Marketing Sci.* **15** 21–37.

——, M. Sarvary. 1999. When and how is the Internet likely to decrease price competition? *Marketing Sci.* **18** 485–503.

Lederer, J. P., A. P. Hurter, Jr. 1986. Competition of firms: Discriminatory pricing and location. *Econometrica* **54**(3) 623–640.

Steve Lohr, ''Seizing the Initiative on Privacy: On-Line Industry Presses Its Case for Self-Regulation,'' *The New York Times,* 11 October 1999.

——, ''Small Long-Distance Carriers Are Chipping Away at the 'Big Three,''' *Los Angeles Times,* 3 February 1997.

McCorkell, G. 1997. *Direct and Database Marketing.* Kogan Page Limited, London.

McGahan, A. M., P. Ghemawat. 1994. Competition to retain customers. *Marketing Sci.* **13**(2) 165–176.

Montgomery, A. L. 1997. Creating micro-marketing pricing strategies using supermarket scanner data. *Marketing Sci.* **16**(4) 315–337.

Narasimhan, C. 1988. Competitive promotional strategies. *J. Bus.* **61**(4) 427–449.

Petrison, L. A., R. C. Blattberg, P. Wang. 1997. Database marketing: Past, present, and future. *J. Direct Marketing.* **11**(4) 109–125.

Porter, M. E. 1985. *Competitive Advantage: Creating and Sustaining Superior Performance.* Free Press, New York.

——, ''Using database to seek out the (brand) loyal shoppers,'' *Progressive Grocers* **74**(2) 10.

Rockwell, M. 1997. Carriers Combat Costly Customer Churn—Locking in Users by Offering a Package of Multiple Services Is One Preferred Strategy. *InternetWeek.* October 6. p. T21.

Rossi, P. E., G. M. Allenby. 1993. A Baysian approach to estimating household parameters. *J. Marketing Res.* **30**(May) 171–182.

——, R. E. McCulloch, G. M. Allenby. 1996. The value of purchase history data in target marketing. *Marketing Sci.* **15**(4) 321–340.

Sarvary, M., P. M. Parker. 1997. Marketing information: A competitive analysis. *Marketing Sci.* **16**(1) 24–38.

Shaffer, G., Z. J. Zhang. 1995. Competitive Coupon Targeting. *Marketing Sci.* **14**(4) 395–416.

——, ——. 1996. Micromarketing in the Information Age: Optimal pricing and promotional strategies. Working paper.

Thisse, J-F., X. Vives. 1988. On the strategic choice of spatial price policy. *Amer. Econom. Rev.* **78**(1) 122–137.

Varian, R. H. 1980. A model of sales. *Amer. Econom. Rev.* **70**(4) 651–659.

Villas-Boas, J. M. 1994. Sleeping with the enemy: Should competitors share the same advertising agency? *Marketing Sci.* **13**(2) 190–202.

Vives, X. 1984. Duopoly information equilibrium: Cournot and Bertrand. *J. Econom. Theory.* **34** 71–94.

——. 1990. Trade associations disclosure rules, incentives to share information, and welfare. *Rand J. Econom.* **21**(3, Autumn) 409–430.

——, ''New policy to require marketers to disclose private-data sharing,'' *The Wall Street Journal,* 7 July 1999.

Young, S. ''AT&T marketing reaches out and touches the wrong someone,'' *Dow Jones News Service,* 15 August 1997.

Zettelmeyer, F. 1996. The strategic use of consumer search cost. Working paper, MIT, Cambridge, MA.

This paper was received November 22, 1999, and was with the authors 2 months for 3 revisions; processed by Sridhar Moorthy.