This article was downloaded by: [155.246.103.35] On: 05 April 2017, At: 19:49
Publisher: Institute for Operations Research and the Management Sciences (INFORMS)
INFORMS is located in Maryland, USA

Management Science

Publication details, including instructions for authors and subscription information:
http://pubsonline.informs.org

Behavior-Based Pricing: An Analysis of the Impact of Peer-Induced Fairness

Krista J. Li, Sanjay Jain

To cite this article:
Krista J. Li, Sanjay Jain (2016) Behavior-Based Pricing: An Analysis of the Impact of Peer-Induced Fairness. Management Science 62(9):2705-2721. http://dx.doi.org/10.1287/mnsc.2015.2265

Full terms and conditions of use: http://pubsonline.informs.org/page/terms-and-conditions

This article may be used only for the purposes of research, teaching, and/or private study. Commercial use or systematic downloading (by robots or other automatic processes) is prohibited without explicit Publisher approval, unless otherwise noted. For more information, contact permissions@informs.org.

The Publisher does not warrant or guarantee the article's accuracy, completeness, merchantability, fitness for a particular purpose, or non-infringement. Descriptions of, or references to, products or publications, or inclusion of an advertisement in this article, neither constitutes nor implies a guarantee, endorsement, or support of claims made of that product, publication, or service.

Copyright © 2015, INFORMS

Please scroll down for article—it is on subsequent pages

INFORMS is the largest professional society in the world for professionals in the fields of operations research, management science, and analytics.
For more information on INFORMS, its publications, membership, or meetings visit http://www.informs.org

MANAGEMENT SCIENCE
Vol. 62, No. 9, September 2016, pp. 2705–2721
ISSN 0025-1909 (print) | ISSN 1526-5501 (online)

http://dx.doi.org/10.1287/mnsc.2015.2265
© 2016 INFORMS

Behavior-Based Pricing: An Analysis of the Impact of Peer-Induced Fairness

Krista J. Li, Sanjay Jain
Mays Business School, Texas A&M University, College Station, Texas 77843 {kjli@indiana.edu, sanjay.jain@utdallas.edu}

Firms tracking consumer purchase information often use behavior-based pricing (BBP), i.e., price discriminate between consumers based on preferences revealed from purchase histories. However, behavioral research has shown that such pricing practices can lead to perceptions of unfairness when consumers are charged a higher price than other consumers for the same product. This paper studies the impact of consumers' fairness concerns on firms' behavior-based pricing strategy, profits, consumer surplus, and social welfare. Prior research shows that BBP often yields lower profits than profits without customer recognition or behavior-based price discrimination. By contrast, we find that firms' profits from conducting BBP increase with consumers' fairness concerns. When fairness concerns are sufficiently strong, practicing BBP is more profitable than without customer recognition. However, consumers' fairness concerns decrease consumer surplus. In addition, when consumers' fairness concerns are sufficiently strong, they reduce inefficient switching and improve social welfare.

Keywords: fairness; behavior-based pricing; dynamic pricing; game theory; behavioral economics
History: Received February 24, 2014; accepted March 18, 2015, by J. Miguel Villas-Boas, marketing. Published online in *Articles in Advance* December 28, 2015.

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 19:49 . For personal use only, all rights reserved.

1. Introduction

Firms often use Internet cookies, IP addresses, loyalty cards, and user log-ins to track and store information about an individual customer's purchase history. This enables the firms to charge a customized price based on purchase history. Practice of such behavior-based pricing (BBP) is common in a wide range of industries (Fudenberg and Tirole 2000, Fudenberg and Villas-Boas 2006). For example, cash registers print out customized coupons based on the content of customers' grocery carts (Woolley 1998). Airlines want passengers to identify themselves before they see fares so that airlines can charge passengers based on their booking history (Seaney 2013, *Washington Internet Daily* 2013). Amazon, the largest e-commerce vendor, sold the same DVD movies for different prices to different customers based on purchase history (Streitfeld 2000). Behavioral-based pricing is also commonly used by competing firms. For example, phone, Internet, and insurance providers offer discounts for new customers to switch from a competitor. Credit card companies offer zero interest rate for new customers to transfer balance from a competing company (Chen 2005). However, past customers who continue to stay with the same company are not qualified to receive these favorable offers. Prices of the same product are effectively different between new and past customers who differ in purchase history.

The prevalence of behavior-based price discrimination has raised significant concerns about price fairness. Consumers dislike buying a product and finding out that their friends or neighbors or someone on the Internet are getting exactly the same product for a lower price. According to a survey of American shoppers online and off-line, 76% of American adults said they would be bothered to learn that other people pay less for the same products (Turow et al. 2005). Consumers perceive price discrimination to be unfair, especially if they pay higher prices than others (Huppertz et al. 1978, Haws and Bearden 2006, Jin et al. 2014), and therefore a firm's behavior-based price discrimination can backfire. For example, Amazon angered customers, who discussed DVDs at the website DVDTalk.com and noticed that they were charged as much as 40% more than other consumers (Streitfeld 2000, Taylor 2004). Consumers' resentment about firms' BBP practice has also caught the attention of public policy makers. There has been a debate among policy makers about forcing firms to disclose BBP practice to customers. For instance, in 2012, theEnsuring Shoppers Transparency in Online Pricing (E-STOP) Act[1] was suggested to promulgate rules requiring Internet merchants to disclose to consumers whether their personal information was accessed for price discrimination. A violation of this act would be deemed unfair or deceptive under the Federal Trade Commission Act.

[1] H.R. 6508, 112th Cong., 2nd sess. (September 21, 2012).

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 19:49 . For personal use only, all rights reserved.

As the public becomes increasingly aware of firms' BBP practice and concerned about fairness of price discrimination, firms cannot be blind to such concerns. Customers' fairness concerns have important implications for firms, because consumers may not buy products sold at "unfair" prices, even though the material value of products exceeds those unfair prices (Rabin 1993, Campbell 1999, Anderson and Simester 2010). Therefore, firms serving fairness-minded consumers need to carefully think about the following questions: How should firms adjust BBP strategies to respond to consumers' fairness concerns? How would consumers' fairness concerns affect firms' profits? When consumers exhibit fairness concerns, is BBP a profitable business practice? For public policy makers who aim to protect consumers and improve welfare, it is important to understand the implications of consumers' fairness concerns on consumer surplus and social welfare. Despite the importance of these questions, existing research on behavior-based pricing has not incorporated consumers' fairness concerns into a formal analysis. In this paper, we attempt to fill this gap.

One common finding in the BBP literature is that when firms recognize customers and condition prices on purchase history, profits are lower than when firms can credibly forsake customer recognition or behavior-based price discrimination (Fudenberg and Villas-Boas 2006). This is because when purchase history information is available, each firm is better off when it unilaterally uses this information for price discrimination: it offers a higher price to its past customers and a lower price to poach the competitor's customers. However, when all firms use purchase history information and poach each other's customers, behavior-based pricing works to the detriment of all firms. This is because firms cannot extract surplus from past customers as much as when poaching is banned. Price competition becomes more intense, and profits are lower than without customer recognition. Therefore, firms would be better off if they could commit to abandoning behavior-based price discrimination. Some research has attempted to show conditions under which BBP can be profitable. This has been primarily achieved by augmenting the strategy space of firms. For example, Acquisti and Varian (2005) allow sellers to provide enhanced services to previous customers and show that sometimes BBP can be profitable. Pazgal and Soberman (2008) show that the firm that has more capability to provide benefits for its past customers can benefit from behavior-based discrimination. Shin and Sudhir (2010) allow firms to charge different prices to high-value customers and low-value customers. They again find that BBP can sometimes be more profitable. In this paper, we incorporate consumers' fairness concerns in a standard dynamic pricing model and investigate whether fairness concerns can make BBP a business practice that yields higher profits than without customer recognition.

We build a two-period model with horizontally differentiated firms selling nondurable products. Consumers have heterogeneous valuations and are uniformly distributed on a Hotelling line. In the first period, consumers' valuations are private information, which can be partially revealed by their purchase decision made in this period. At the beginning of the second period, a firm can observe an individual consumer's purchase history and recognize whether a consumer purchased from itself or a competitor. Based on this information, firms can charge different prices to its past customers and the competitor's customers. We model fairness concerns by assuming that in any period if a customer is charged a higher price than the firm charges other customers, the customer who pays the higher price experiences a negative utility because of perceived unfairness of the price discrimination (Ho and Su 2009, Chen and Cui 2013). In the second period, past customers who stay with the same firm pay a higher price than competitor's customers who receive a switching discount. Hence, past customers exhibit fairness concerns. We analyze how the degree of the fairness concerns affects consumer decision and firms' competitive pricing strategy. In addition, we examine the implications of fairness concerns on firms' profits, consumer surplus, and social welfare.

We find that firms' total discounted profits from conducting BBP increase with consumers' fairness concerns. This result arises despite the fact that fairness concerns lead to lower profits in the second period. However, our results show that fairness concerns soften price competition and reduce price sensitivity of demand in the first period. As a result, fairness concerns allow firms to charge higher prices and increase profits in the first period. The increase in the first-period profits offsets the decrease in the second-period profits, and total discounted profits over two periods increase with the degree of fairness concerns. Furthermore, when fairness concerns are strong enough, the total discounted profits with BBP exceed the total discounted profits without customer recognition. In addition, intuition suggests that past consumers who are unfairly price discriminated by a firm would be motivated to switch to the competing firm. In doing so, the consumer would receive a switching discount from the competing firm and avoid the uneasy feeling of being unfairly charged by the original firm. However, this intuition ignores the strategic impact of fairness concerns on firms' prices. In contrast to this intuition, we find that fairness concerns discourage switching, because fairness concerns

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 19:49 . For personal use only, all rights reserved.

lead to lower prices for past customers but higher poaching prices for switching customers. These price changes encourage consumers to stay with their original firm even though they are unfairly discriminated. We also show that as consumers become more concerned about price fairness, consumer surplus decreases. This result implies that although public policies that require firms to disclose their practice of BBP to consumers can raise consumers' awareness of price discrimination, growing concerns of price fairness can hurt consumers. Finally, fairness concerns discourage inefficient switching, enhancing social welfare when consumers are sufficiently concerned about price fairness. These findings can guide firms to design BBP strategies in today's marketplace with fairness-minded consumers, shed light on the public policy implications of growing concerns about price fairness, and add new insights to the literature.

We extend our main model to verify the robustness of our results and examine the differences between fairness concerns and alternative behavioral mechanisms. Specifically, we consider a more general framework that allows for several alternative behavioral factors. First, we allow consumers to form price perception based on historical prices they paid. Second, we capture the potential utility gain experienced by consumers who switch and receive a deal or possible fairness concerns expressed by these advantageously discriminated consumers. Third, we allow consumers' fairness concerns to be endogenously determined by the number of consumers who receive a discount. Last, we extend our base model to allow for switching costs. Our results hold in these extensions and reveal the unique role played by fairness concerns.

1.1. Related Literature

Our work is closely related to the behavior-based pricing literature (see Fudenberg and Villas-Boas 2006 for a comprehensive review). Villas-Boas (2004) analyzes a market with an infinitely lived monopolist and overlapping generations of consumers who each lives for two periods. In his model, the firm can recognize past customers but cannot differentiate between customers who did not buy last period and customers who just entered the market. He shows that the monopolist is worse off than if it could not recognize its previous customers. Villas-Boas (1999) studies competition in a similar setup. He shows that firms lower prices to attract competitors' previous customers, and prices are lower than when there is no customer recognition. Fudenberg and Tirole (2000) study competing firms' poaching behavior and show that poaching reduces total discounted profits. Even though fairness is not incorporated in their model, the authors acknowledge that "loyal customers may feel resentment if they know that others receive better terms" (p. 643). Acquisti and Varian (2005) study the optimality of conditioning prices on purchase history when firms can commit to doing so or not. They show that if competitive sellers offer enhanced services to previous customers, conditioning prices on purchase history can be profitable. However, in the standard framework with constant product offerings, a seller will not find it optimal to price discriminate between high-value and low-value customers, even though it is feasible to do so. Pazgal and Soberman (2008) allow differentiated firms to be able to make a credible commitment about whether to conduct BBP and offer additional benefit to past customers. They show that BBP generally leads to lower profits for firms with identical ability to add value to the second-period offer. Shin and Sudhir (2010) allow consumer preferences to change over time and consumers are heterogeneous in purchase quantity. They allow firms to charge different prices to high-value and low-value past customers. They show that if consumers are sufficiently heterogeneous in purchase quantity and preferences are sufficiently stochastic over time, BBP can be profitable for firms. Zhang (2011) examines endogenous location choice in a two-period poaching model, in which firms can offer customized products and prices to consumers based on purchase history. She shows that behavior-based personalization reduces design differentiation and intensifies price competition between firms. Our work attempts to make a contribution to this body of literature by examining the implications of consumers' fairness concerns on firms' behavior-based pricing strategy and showing that when consumers are fairness-minded, BBP can generate higher profits than without customer recognition.

This paper is closely related to the growing stream of literature that incorporates fairness concerns into firms' optimal strategies. Fehr and Schmidt (1999) propose a model of "inequity aversion" to capture the notion that consumers experience a disutility from receiving a payoff that is different from the others. Disadvantageous inequity affects consumers more strongly than advantageous inequity. In particular, fairness concerns that arise from situations in which agents' preferences depend on payoffs of peers are categorized as *peer-induced fairness*, and those depend on payoffs of other economic agents such as firms are categorized as *distributional fairness*. Cui et al. (2007) examine optimal channel coordination when channel members have distributional fairness concerns. Guo (2015) studies firms' optimal selling strategies and welfare implications when buyers are concerned about distributional fairness and ex ante uncertain about seller's variable cost. The author shows that seller's ex ante profits may increase as more buyers become inequity averse. Guo and Jiang (2015) examine a firm's quality and pricing decisions when consumers have distributional fairness concerns and are

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 19:49 . For personal use only, all rights reserved.

uncertain about firm's costs. They find that inequity aversion may benefit an efficient firm and hurt an inefficient firm and reduce consumers' monetary payoffs. Ho and Su (2009) analyze ultimatum games played sequentially by a leader and two followers. They find that peer-induced fairness between followers is two times stronger than distributional fairness between leader and follower. Chen and Cui (2013) show that a uniform price for branded variants may arise in equilibrium because of consumers' concerns of peer-induced fairness. We study firms' behavior-based price discrimination, where consumers are mostly concerned about the discriminatory prices they pay in comparison to prices other consumers pay. Therefore, we consider the impact of peer-induced fairness on firms' BBP strategy. We also develop a model that incorporates fairness concerns in a dynamic setting.

Feinberg et al. (2002) also examine situations in which consumers care about prices that are available to other consumers. In their framework, consumers are less likely to purchase from firms that offer a better deal to other consumers. Their results suggest that as more consumers become aware of prices that are offered to switchers, firms will not find it profitable to offer better deals to switchers. In contrast to their research, we develop a utility-based model with endogenous pricing in a dynamic setting. We find that endogenizing prices changes the results substantially. In particular, we show that with endogenous prices, fairness concerns can decrease switching because firms adjust second-period prices to alleviate fairness concerns that encourage consumers to stay with their original firm. Furthermore, we find that fairness concerns can make BBP with lower prices to switchers more profitable. This is because past customers' fairness concerns allow firms to raise first-period prices when purchase history is available.

Another stream of related research is the literature on switching costs (see Klemperer 1995 and Farrell and Klemperer 2007 for extended surveys). Klemperer (1987b) studies a two-period duopoly model where consumers are partially locked in by switching costs in the second period. He shows that switching costs soften price competition and increase profits in the second period but could make first-period price competition more intense. Klemperer (1987a) shows that noncooperative behavior in the presence of switching costs can lead to collusive outcomes in mature markets (i.e., the second period). However, competition in the new market (i.e., the first period) becomes more intense. The author finds that firms are worse off paying customers to switch than offering uniform pricing. Shaffer and Zhang (2000) study firms' price discrimination between their own customers and their rivals' customers when consumers face endogenous switching costs. They find that sometimes it may be profitable to charge a lower price for one's own customers. Our paper differs from this stream of research by focusing on the impact of consumers' fairness concerns on firms' behavior-based pricing strategy, which in turn affects consumers' switching decision and firms' profits.

Our paper also adds to the burgeoning research in marketing that incorporates consumers' psychological behaviors into quantitative models. This stream of research enriches traditional economic models and provides new insights (e.g., Amaldoss and Jain 2005, Cui et al. 2007, Villas-Boas 2009, Kuksov and Villas-Boas 2010, Chen et al. 2010, Guo and Zhang 2012).

The rest of the paper is organized as follows. In §2, we introduce the model setup and present the benchmark model. In §3, we present the main model and analysis. In this section, we investigate how fairness concerns impact firms' BBP strategy in a duopoly. In §4, we extend the base model in several aspects. We conclude with managerial implications and directions for future research in §5.

2. Model

We consider a two-period model of a duopoly.[2] In each period, two horizontally differentiated firms sell a nondurable product to consumers. Each consumer demands at most one unit of the product in a period. Let r denote the base value of the product. We assume r is sufficiently high so that the market is fully covered and two firms compete for the marginal consumer. Consumers are uniformly distributed over a Hotelling line with range $[0, 1]$. Firm A is located at 0, and firm B is located at 1. A consumer's location on the line is denoted by θ. Without fairness concerns, if a consumer at θ purchases a product from A at price p_a, his utility in that period is $r - t\theta - p_a$, where t represents the transportation cost. If the consumer purchases a product from B at price p_b, his utility is $r - t(1-\theta) - p_b$. To focus on the effect of fairness concerns, we assume there are no switching costs. In §4.4, we will incorporate switching costs into the model. Finally, the respective discount factors for firms and consumers are δ_f and δ_c.

2.1. No Customer Recognition

First consider the benchmark model without customer recognition or behavior-based price discrimination. Behavior-based price discrimination may not exist either because it is illegal and banned by law or because firms do not have the ability to store or utilize

[2] For completeness, in the Technical Appendix B (available as supplemental material at http://dx.doi.org/10.1287/mnsc.2015.2265), we analyze how fairness concerns affect a monopolist that conducts behavior-based pricing.

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 19:49 . For personal use only, all rights reserved.

purchase history information. In this case, firms cannot charge customized prices. The two-period game becomes a repetition of a static game. We summarize the equilibrium of this benchmark model in Lemma 1 (see the Technical Appendix A for the proof).

Lemma 1 (Equilibrium Without Customer Recognition). *Without customer recognition, in each period, two firms simultaneously charge a price of t. Each firm serves half of the market and earns a profit of $t/2$. Over two periods, each firm earns a total discounted profit of $(1+\delta_f)t/2$.*

Since firms do not price discriminate among consumers, all consumers pay the same price and do not exhibit fairness concerns.

3. Customer Recognition

Now consider situations in which firms can recognize consumers and use purchase history collected in period 1 to price discriminate consumers in period 2. We solve for the symmetric pure-strategy equilibrium backwards. We will discuss consumer choice and firms' pricing decisions in each period separately.

3.1. The Second Period

In the second period, firms have information of consumers' purchase history. The purchase history indicates if a consumer purchased the product from firm A or B in period 1, which reveals the consumer's relative preference for two firms' products. From a firm's perspective, the purchase history partitions the second-period market into two segments: a segment of past consumers who purchased from the firm in period 1 and a segment of consumers who purchased from the competitor in period 1. Given this information, a firm can charge all consumers the same price. However, such uniform pricing is (weakly) dominated by a customized pricing scheme. As a result, each firm has an incentive to charge two different prices to customers in the two segments.

Now let us understand how fairness concerns affect firms' pricing strategy in the second period. Let a_o and a_c denote the prices firm A charges its own customers and the competitor's customers in the second period, respectively. Similarly, let b_o and b_c denote the second-period prices B charges its own customers and competitor's customers, respectively. In equilibrium, high-valuation customers located near the two firms purchase repetitively from their preferred firms, whereas low-valuation customers near the center of the line switch (see Figure 1).

The consumer at θ_a is indifferent between buying from firm A at price a_o and switching to buy from firm B at the poaching price b_c. When consumers care about the fairness of firms' pricing strategy, having to pay a higher price than others for the same product is perceived as unfair. With such fairness concerns, the consumer at θ_a is characterized as follows:

$$\begin{aligned} r - t\theta_a - a_o - \lambda \cdot \max(a_o - a_c, 0) \\ = r - t(1-\theta_a) - b_c - \lambda \cdot \max(b_c - b_o, 0). \end{aligned} \quad (1)$$

The left-hand side of (1) is the utility of buying from firm A at the past-customer price a_o. If this past-customer price is higher than the price a_c that switchers pay, paying the price premium of $(a_o - a_c)$ induces negative feelings of unfairness, and the magnitude of disutility is $\lambda \cdot \max(a_o - a_c, 0)$.[3] The parameter λ represents the degree of consumers' fairness concerns and ranges from $[0, 1]$.[4] If $\lambda = 0$, fairness concerns do not exist and consumption utility is not affected by price differential relative to other consumers. Here, we assume that all consumers share the same λ; i.e., consumers are homogeneous in their concerns about price fairness. We will relax this assumption and consider heterogeneity in consumers' fairness concerns.

The right-hand side of (1) is the utility of switching to firm B to buy at B's poaching price b_c. If the poaching price b_c is higher than B's past-customer price b_o, consumers who switch would exhibit fairness concerns. The decrease in utility caused by this fairness concern is $\lambda \cdot \max(b_c - b_o, 0)$. Consumers who pay a lower price than others may also perceive firms' price discrimination to be unfair. However, research has shown that disadvantageously discriminated consumers are more concerned about price fairness than those who are advantageously discriminated (Loewenstein et al. 1989, Fehr and Schmidt 1999). Consistent with prior research, we model the disadvantageous fairness concerns (Ho and Su 2009, Guo 2015, Guo and Jiang 2015). However, we relax this assumption in §4.1 and find that our results are even stronger when we allow for advantageous inequity aversion. Alternatively, one may argue that these consumers may experience a utility gain from paying less for the same product than other consumers. Although this utility gain is not driven by

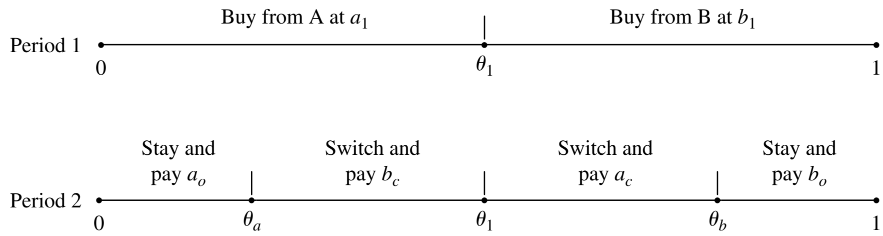
[3] An alternative approach would be to assume that consumers care about the prices that they pay in period 2 relative to what they paid in period 1. If period 2 prices are higher, then consumers experience fairness-based disutility. However, as we will see later in our analysis and as has been shown in the prior literature, prices under behavior-based pricing decrease over time. Therefore, under this approach the analysis reduces to the standard model. Alternatively, since the first-period prices are higher than the second-period prices, consumers may experience a gain when they use the price they paid in the first period as a reference price to evaluate the second period prices. In §4.2, we will extend our base model to consider this situation.

[4] We assume that λ is bounded by 1. If λ exceeds 1, it would imply that a consumer would be willing to give up more than \$1 to avoid \$1 price difference that he overpays in comparison to prices other consumers pay, which seems implausible.

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 19:49 . For personal use only, all rights reserved.

Figure 1 Consumer Choices in Periods 1 and 2



fairness concerns, it may arise as a result of the behavioral pricing scheme. In §4.1, we will consider a general setup to account for both these effects.

From (1) it follows that

$$\theta_a = \frac{1}{2} - \frac{a_o - b_c}{2t} - \frac{\lambda \cdot \max(a_o - a_c, 0)}{2t} + \frac{\lambda \cdot \max(b_c - b_o, 0)}{2t}. \tag{2}$$

The first two terms give the representation of the marginal consumer in the absence of fairness concerns. The last two terms reflect the shift in the marginal consumer driven by consumers' fairness concerns. In the equilibrium that poaching prices are lower than past-customer prices, we can see that if prices do not change, λ shifts θ_a to the left; i.e., the direct effect of fairness concerns is to encourage switching. However, λ also affects the past-customer price a_o and the poaching price b_c. The total impact of λ on switching will also depend on how fairness concerns affect firms' strategic pricing decisions, which in turn affects switching. We will discuss the total impact of fairness concerns on consumer switching after solving for the second period prices and present the result in Proposition 1.

The consumer who is indifferent between staying with firm B and switching to firm A is characterized by θ_b, where

$$r - t(1-\theta_b) - b_o - \lambda \cdot \max(b_o - b_c, 0) = r - t\theta_b - a_c - \lambda \cdot \max(a_c - a_o, 0), \tag{3}$$

$$\theta_b = \frac{1}{2} + \frac{b_o - a_c}{2t} + \frac{\lambda \cdot \max(b_o - b_c, 0)}{2t} - \frac{\lambda \cdot \max(a_c - a_o, 0)}{2t}. \tag{4}$$

Each firm's second-period profits consist of profits generated by selling to the firm's past customers and the competitor's customers whom the firm poaches from the competitor. Firms' profit functions in the second period are

$$\Pi_{a2} = a_o\theta_a + a_c(\theta_b - \theta_1), \tag{5}$$

$$\Pi_{b2} = b_o(1-\theta_b) + b_c(\theta_1 - \theta_a). \tag{6}$$

In Technical Appendix A we show that for $\theta_1 \in (\frac{1}{3}, \frac{2}{3})$, in any pure-strategy equilibrium, poaching prices must be lower than past-customer prices. Furthermore, we show that for a symmetric first-period pricing equilibrium, a second-period pure-strategy pricing equilibrium exists where $a_o^* > a_c^*$.[5] Therefore, past customers express fairness concerns because they pay higher prices than switching customers. Table 1 provides the equilibrium second-period prices as functions of the first-period market share (θ_1). As θ_1 increases, i.e., firm A's first-period market share expands, prices in this segment (a_o^* and b_c^*) increase. At the same time, firm B's first-period market share shrinks, and prices in this segment (a_c^* and b_o^*) decrease. In the symmetric equilibrium, $\theta_1^* = \frac{1}{2}$, and the equilibrium prices in the second period are $a_o^* = b_o^* = ((2+\lambda)/3(1+\lambda))t$, $a_c^* = b_c^* = ((1+2\lambda)/3(1+\lambda))t$. It is important to note that these behavior-based prices are lower than the equilibrium price of t in the static game without price discrimination (see Lemma 1). The second-period profit is $\Pi_{a2}^* = \Pi_{b2}^* = ((5+5\lambda-\lambda^2)/18(1+\lambda))t$. This profit is also lower than the profit of $t/2$ in the static game. These results reinforce the standard finding in the literature that conditioning firm decisions on purchase history results in lower prices and profits in the second period than in the case without recognition (Fudenberg and Tirole 2000, Zhang 2011).

Proposition 1 (Second-Period Pricing and Switching). *As consumers become more concerned about fairness (i.e., λ increases), prices charged to past consumers decrease and poaching prices increase. As λ increases, fewer consumers switch.*

Intuition suggests that consumers' fairness concerns constrain the degree to which firms can price discriminate among customers. This intuition is valid. Any price difference among consumers decreases past consumers' willingness to buy from the same firm. To mitigate this negative impact of price discrimination, firms lower the high prices charged to past consumers and raise the low poaching prices offered to competitors' consumers to reduce the price differential among consumers. As fairness concerns become

[5] We use this result that poaching prices are lower than past-customer prices in the rest of the paper.

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 19:49 . For personal use only, all rights reserved.

Table 1 Period 2 Prices and Profits

	General form	$\theta_1^* = \frac{1}{2}$
a_c^*	$\left[-\dfrac{4(1+\lambda)}{3+3\lambda-2\lambda^2}\theta_1 + \dfrac{9+21\lambda+10\lambda^2-4\lambda^3}{3(1+\lambda)(3+3\lambda-2\lambda^2)}\right]t$	$\dfrac{1+2\lambda}{3(1+\lambda)}t$
a_o^*	$\left[\dfrac{2(1-\lambda)}{3+3\lambda-2\lambda^2}\theta_1 + \dfrac{3+9\lambda+2\lambda^2-2\lambda^3}{3(1+\lambda)(3+3\lambda-2\lambda^2)}\right]t$	$\dfrac{2+\lambda}{3(1+\lambda)}t$
b_c^*	$\left[\dfrac{4(1+\lambda)}{3+3\lambda-2\lambda^2}\theta_1 - \dfrac{3+3\lambda+2\lambda^2+4\lambda^3}{3(1+\lambda)(3+3\lambda-2\lambda^2)}\right]t$	$\dfrac{1+2\lambda}{3(1+\lambda)}t$
b_o^*	$\left[-\dfrac{2(1-\lambda)}{3+3\lambda-2\lambda^2}\theta_1 + \dfrac{9+9\lambda-4\lambda^2-2\lambda^3}{3(1+\lambda)(3+3\lambda-2\lambda^2)}\right]t$	$\dfrac{2+\lambda}{3(1+\lambda)}t$
θ_a^*	$\dfrac{1-\lambda^2}{3+3\lambda-2\lambda^2}\theta_1 + \dfrac{3+9\lambda+2\lambda^2-2\lambda^3}{6(3+3\lambda-2\lambda^2)}$	$\dfrac{2+\lambda}{6}$
Π_{a2}^*	$\theta_a^* a_o^* + (1-\theta_a^*-\theta_1^*)a_c^*$	$\dfrac{5+5\lambda-\lambda^2}{18(1+\lambda)}t$

stronger, the two customized prices get closer. If $\lambda = 1$, firms charge the same price from both the past and new customers.[6]

From (2), it is easy to see that in the symmetric equilibrium where poaching prices are lower than past-customer prices, holding prices constant, the direct effect of fairness concerns is to encourage switching. This is intuitive, because when past customers become resentful about being price discriminated, staying with the same firm induces a disutility because of the perceived unfairness. The marginal consumer who was indifferent between staying and switching without fairness concerns now prefers to switch, because the utility of staying decreases with fairness concerns. However, in addition to this direct effect, there are opposing pricing effects. As the first part of the proposition shows, fairness concerns affect consumers' incentives to switch in three ways. First, fairness concerns reduce the incentives to switch to a competitor since the poaching prices are higher. Second, fairness concerns increase the incentives to stay with the current firm because the past-customer prices are lower. Third, by reducing the price differential between the two customized prices, firms reduce the disutility of being unfairly overcharged. These pricing effects make staying more bearable and switching less attractive, thereby encouraging past customers to stay with their current firm. These pricing effects outweigh the direct effect of fairness on inducing switching. As a result, stronger fairness concerns lead to more consumers staying with their current firm, even though they are unfairly price discriminated for their loyalty.

Proposition 2 (Second-Period Profits). *As consumers become more concerned about fairness (i.e., λ increases), second-period profits decrease.*

Recall that firms use uniform pricing when purchase history information is not available. The aforementioned pricing changes driven by fairness concerns appear consistent with the expected effects because of lack of customer information. It seems to suggest that fairness concerns act in the same way as lack of customer information, which also dissuades firms from price discrimination in the second period. If this is the case, we would expect that as fairness concerns become stronger, both firms poach each other's consumers less aggressively, competition becomes softer, and the second-period profits increase. However, in contrast to this intuition, we find that as fairness concerns become stronger, second-period profits *decrease*. To understand this result, note that there are two opposing effects of λ on prices. First, λ leads to higher poaching prices. This effect would increase second-period profits. However, an increase in λ also leads to a decrease in the prices charged from past customers. This effect would decrease second-period profits. The decrease in the past-customer price has the same magnitude as the increase in the poaching price, as $|\partial a_o/\partial\lambda| = |\partial a_c/\partial\lambda| = 3t/(1+\lambda)^2$. However, the switcher segment is smaller than the loyal segment.[7] Furthermore, as Proposition 1 shows, λ also leads to fewer switchers, and more customers who choose to pay the past-customer price. Thus, the negative effect of decrease in the past-customer price is for a larger segment of customers, which becomes larger as λ increases. Therefore, overall second-period profits decrease as λ increases.

This result underlines one important difference between the impact of fairness concerns and lack customer information. In addition to the opposite effect on second-period profits, fairness concerns and lack of customer information also affect the second-period prices differently. Specifically, lack of customer information increases the price offered to past customers. This is because when customer information becomes available, firms poach each other's customers. As a result, firms cannot charge high prices to their loyal customers who are offered a deal by the competitor. However, when customer information becomes unavailable, such poaching is impossible, and past-customer prices increase. By contrast, fairness concerns lead to lower prices charged to past customers, because past customers exhibit fairness

[6] Note that behavior-based prices in the second period are lower than price in the static game. When $\lambda = 1$, although firms charge past and new customers the same price, this price is $t/2$, lower than the static price t that firms charge without customer recognition.

[7] In equilibrium, $\theta_a^* = \frac{1}{3} + \lambda/6$, $\theta_b^* = \frac{2}{3} - \lambda/6$, and $\theta_1^* = \frac{1}{2}$. The size of A's loyal segment is $M_l = \theta_a^*$, and the size of A's switcher segment is $M_s = \theta_b^* - \theta_1^*$. The loyal segment is larger than the switcher segment because $M_l - M_s = \frac{1}{6} + \lambda/3 > 0$, which is positive and increasing in λ.

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 19:49 . For personal use only, all rights reserved.

Table 2 **Fairness vs. Lack of Information: Relative to BBP Without Fairness**

	Lack of information	Fairness concerns
Period 2 profits	Increase	Decrease
Past-customer price	Increase	Decrease
Poaching price	Increase	Increase
Period 1 price	Decrease	Increase
Period 1 profits	Decrease	Increase
Total discounted profits	Increase	Increase

concerns when paying the higher price than new customers who switch from the competitor. To mitigate fairness concerns, firms reduce the price charged to past customers. In addition, lack of customer information and fairness concerns both increase the poaching price; however, the mechanism is very different. The poaching price increases with lack of information because competition is softer without customer information. However, poaching price increases with fairness concerns because lower poaching prices increase the perception of unfairness. To mitigate these fairness concerns and induce past customers to buy, firms raise the poaching price. Furthermore, lack of customer information leads to lower prices and profits in the first period (Villas-Boas 1999, Fudenberg and Tirole 2000), whereas fairness concerns lead to higher prices and profits in the first period (see Table 2 for a summary of comparison between fairness effects and lack of customer information). We will analyze the impact of fairness concerns on the first-period pricing and profits in the next subsection.

3.2. The First Period

Now let us analyze consumer choice and firms' price competition in the first period. Consider the marginal consumer located at θ_1. This consumer rationally anticipates that he will switch firm in the second period. Therefore, his choice in period 1 is determined by prices in period 1 as well as the poaching prices he will face when he switches firm in period 2. If this consumer buys from firm A at price a_1 in period 1, he will switch to firm B at price b_c in period 2.[8] The corresponding utility in two periods is

$$r - t\theta_1 - a_1 + \delta_c[r - t(1-\theta_1) - b_c(a_1, b_1)], \tag{7}$$

where $b_c(a_1, b_1)$ and $b_o(a_1, b_1)$ are the consumer's rational expectation of the poaching price and past-customer price in the second period by firm B, given the first-period prices. Similarly, if this consumer buys from firm B at price b_1 in period 1, he will switch to firm A at price a_c in period 2. The utility for doing so is

$$r - t(1-\theta_1) - b_1 + \delta_c[r - t\theta_1 - a_c(a_1, b_1)], \tag{8}$$

[8] As is standard in the literature, we assume that the consumers have rational expectations about the future prices.

where $a_c(a_1, b_1)$ and $a_o(a_1, b_1)$ are the rational expectation of the poaching price and past-customer price that firm A charges in the second period. Since this marginal consumer at θ_1 is indifferent between these two options, the terms in (7) and (8) must be equal. Imposing the rational expectations conditions and from Table 1 it follows that (details are in Technical Appendix A):

$$\theta_1 = \frac{1}{2} - \frac{a_1 - b_1}{2t(1 + ((1+\lambda+2\lambda^2)/(3+3\lambda-2\lambda^2))\delta_c)}. \tag{9}$$

At the beginning of period 1, firms set period 1 prices a_1 and b_1 to maximize the total discounted profits generated from two periods. The profit functions are

$$\begin{aligned} \Pi_a &= \Pi_{a1} + \delta_f \Pi^*_{a2}(\theta_1) = a_1\theta_1 + \delta_f \Pi^*_{a2}(\theta_1), \\ \Pi_b &= \Pi_{b1} + \delta_f \Pi^*_{b2}(\theta_1) = b_1(1-\theta_1) + \delta_f \Pi^*_{b2}(\theta_1). \end{aligned} \tag{10}$$

First-order conditions with respect to a_1 and b_1 give the equilibrium outcome. Since results for the two firms are symmetric, we report the equilibrium results for firm A only. Table 3 provides the equilibrium outcome. If $\lambda = 0$, the model and equilibrium outcome reduce to those without fairness concerns as in the conventional poaching model. We have $a_1^* = ((3+\delta_c)/3)t$, $a_o^* = \frac{2}{3}t$, $a_c^* = t/3$, $\Pi_a^* = ((9 + 3\delta_c + 5\delta_f)/18)t$, $\Pi_{a2}^* = (5/18)t$, and $\theta_a^* = \frac{1}{3}$. When fairness concerns exist, i.e, $\lambda > 0$, we will analyze how the degree of fairness concerns (λ) affects firms in the first period. We will first present our findings and then explain the intuitions in detail.

Proposition 3 (First-Period Prices and Profits). *As λ increases, i.e., consumers become more concerned about fairness, first-period prices and profits increase.*

The result, therefore, shows that while fairness concerns decrease firms' second-period profits, they increase profits in the first period. Since firms split the market equally, profits increase because prices increase. Let us understand why first period prices increase with consumers' fairness concerns. Given that two firms are symmetric, let us take firm A's perspective. The derivative of firm A's total discounted profits over two periods with respect to A's first period price is

$$\frac{\partial \Pi_a}{\partial a_1} = \frac{\partial \Pi_{a1}}{\partial a_1} + \delta_f \frac{d\Pi^*_{a2}(\theta_1)}{d\theta_1} \frac{\partial \theta_1}{\partial a_1}, \tag{11}$$

where the first term on the right-hand side is the marginal impact of the first-period price on the first-period profits, and the second term is the marginal impact of the first-period price on the second-period profits through altering the first-period market share. An increase in λ affects the equilibrium first period prices by directly altering the marginal impact of the

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 19:49 . For personal use only, all rights reserved.

Table 3 Period 1 Price, Period 1 Profits, and Total Discounted Profits

a_1^*	$\dfrac{3\delta_c(1+2\lambda+3\lambda^2+2\lambda^3)+\delta_f\lambda(7+7\lambda-2\lambda^2)+3(3+6\lambda+\lambda^2-2\lambda^3)}{3(1+\lambda)(3+3\lambda-2\lambda^2)}t$
Π_{a1}^*	$\dfrac{3\delta_c(1+2\lambda+3\lambda^2+2\lambda^3)+\delta_f\lambda(7+7\lambda-2\lambda^2)+3(3+6\lambda+\lambda^2-2\lambda^3)}{6(1+\lambda)(3+3\lambda-2\lambda^2)}t$
Π_a^*	$\dfrac{9\delta_c(1+2\lambda+3\lambda^2+2\lambda^3)+\delta_f(15+51\lambda+23\lambda^2-19\lambda^3+2\lambda^4)+9(3+6\lambda+\lambda^2-2\lambda^3)}{18(1+\lambda)(3+3\lambda-2\lambda^2)}t$

first-period prices on both first- and second-period profits. It turns out that both these effects are positive (we provide the intuition below). This implies that an increase in λ will shift the reaction curves for first-period prices outward. Since prices are strategic complements, an increase in λ therefore leads to higher first-period prices.

3.2.1. Marginal Impact of First-Period Prices on Second-Period Profits. Let us first consider the impact of first-period prices on second-period profits. In the standard symmetric poaching model, the second term $\delta_f(d\Pi_{a2}^*(\theta_1)/d\theta_1)(\partial\theta_1/\partial a_1)$ in (11) equals zero. This means that firms' incentive to manage their second-period profits—in particular, the incentive to mitigate the negative impact of customer recognition—does not affect their first-period pricing strategy. This is because when θ_1 is around the center of the Hotelling line, the first-period market share has no first-order effect on the second-period profits.[9] Hence, (11) reduces to $\partial\Pi_a/\partial a_1 = \partial\Pi_{a1}/\partial a_1$, which implies that firms set first period prices to maximize the profit generated from the first period alone. Although firms are forward looking, firms do not shift first-period prices for strategic reasons of improving second-period profits (Fudenberg and Tirole 2000, Zhang 2011).

However, this result no longer holds when consumers exhibit fairness concerns. *When consumers care about price fairness, an increase in the first-period market share has a negative first-order effect on the second-period profits.* Aggressive pricing in the first period would lead to lower profits in the second period.

To see this, in the symmetric equilibrium, the marginal effect of the first-period market share on the second-period profits is

$$\left.\frac{d\Pi_{a2}^*(\theta_1)}{d\theta_1}\right|_{\theta_1=1/2} = -\left[\frac{(7+7\lambda-2\lambda^2)\lambda t}{3(1+\lambda)(3+3\lambda-2\lambda^2)}\right] \le 0, \qquad (12)$$

where the equality holds only when $\lambda = 0$. Note that when there are no fairness concerns, we get the familiar result that second-period profits are not affected by the first-period market share (Fudenberg and Tirole 2000, Zhang 2011). However, in the presence of fairness concerns, i.e., when $\lambda > 0$, a firm's first-period market share has a negative impact on its profit in the second period. Furthermore, this effect becomes stronger as λ increases, as can be easily seen using (12).[10]

This effect arises because an expansion in a firm's first-period market share affects the firm's second-period pricing in two ways. First, since the firm has a larger customer base in the second period, its price for past customers to repurchase should be higher. However, fairness concerns do not allow the firm to raise this price as much as without fairness concerns. Second, given that the market is fully covered and does not expand, the firm that prices more aggressively in the first period would face a smaller competitor in the second period, and the customers to poach would lie closer to the competitor. The firm would have to poach with a lower price. However, a lower poaching price makes the price for past customers appear more unfair. By lowering the poaching price, the firm may lose past customers to the competitor, and the second-period profits would decline.[11] Therefore, in the presence of fairness concerns, pricing aggressively to gain market share in the first period negatively affects profits in the second period. Furthermore, this impact becomes stronger as λ increases. Consequently, as λ increases, firms have lower incentives to compete aggressively in the first period.

3.2.2. Marginal Impact of First-Period Prices on First-Period Profits. Now consider the impact of first-period prices on first-period profits. Note that without customer recognition, $\theta_1 = \frac{1}{2} - (p_a - p_b)/2t$ as in

[9] This occurs because as a firm's first-period market share expands, the firm in the second period will serve a larger segment of own customers and a smaller segment of competitor's customers. This market partition allows the firm to make more profits from its own segment but fewer profits from the competitor's segment. When θ_1 is around the center of the Hotelling line, the marginal gains from the firm's own segment are exactly canceled out by the marginal losses in the competitor's segment. Therefore, first-period market share has no direct impact on second-period profits.

[10] The derivative of the right-hand side of (12) with respect to λ is $-t(12\lambda^4+4\lambda^3+17\lambda^2+42\lambda+21)/(3(1+\lambda)^2(3+3\lambda-2\lambda^2)^2) < 0$.

[11] To see how second-period prices change with first-period market share, we have $\partial a_o^*(\theta_1)/\partial\theta_1 = (2(1-\lambda)/(3+3\lambda-2\lambda^2))t > 0$ and $\partial a_c^*(\theta_1)/\partial\theta_1 = -(4(1+\lambda)/(3+3\lambda-2\lambda^2))t < 0$. Hence, as the first-period market share increases, the second-period past-customer price increases and poaching price decreases, which intensifies the perceived price unfairness.

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 19:49 . For personal use only, all rights reserved.

the standard static model of horizontal competition (see proof of Lemma 1 in Technical Appendix A). The marginal impact of a change in prices on sales is $\partial\theta_1^*/\partial p_a = -1/2t$. With customer recognition, the marginal impact of a change in first-period prices on first-period sales is given from (9):

$$\frac{\partial\theta_1^*}{\partial a_1} = \frac{-1}{2t(1+((1+\lambda+2\lambda^2)/(3+3\lambda-2\lambda^2))\delta_c)} < 0. \quad (13)$$

If $\lambda = 0$, i.e., fairness concerns do not exist, $|\partial\theta_1^*/\partial a_1| = 1/(2t(1+\delta_c/3)) \le 1/(2t)$, and strict inequality holds as long as $\delta_c > 0$. It implies that even without fairness concerns, consumers who are not completely myopic are less sensitive to period 1 prices than without recognition (Fudenberg and Tirole 2000). To understand this result, first note that the size of the first-period market share determines the poaching price that firms use. A firm that has a larger market share is more aggressive in poaching and charges a lower poaching price in the second period. In particular, in equilibrium we have

$$a_c - b_c = \frac{4(1-2\theta_1)(1+\lambda)}{3+3\lambda-2\lambda^2}t. \quad (14)$$

If firm A has a smaller customer base (i.e., $\theta_1 < \frac{1}{2}$), its poaching price a_c is higher than B's poaching price b_c. Consider the marginal consumer at $\theta_1^* = \frac{1}{2}$ who is indifferent between buying from A and B when both firms offer the same prices. If this consumer buys from B as a result of a slight increase in A's first-period price, the new indifferent consumer is at $\theta_1^* < \frac{1}{2}$. Using (14), we see that in this case $a_c - b_c > 0$. Hence, A's poaching price a_c is larger than B's poaching price b_c and the consumer who buys from B in the first period gets the poaching price offered by A, which is a worse deal in the second period. Therefore, for forward-looking customers, a small price increase today increases the discount they receive upon switching in the next period. Consequently, anticipating better switching deals, consumers are less sensitive to an increase in first period prices. This result holds even without fairness concerns.

Now, let us examine how fairness concerns affect consumers' price sensitivity in the first period. Intuition might suggest that fairness would make consumers in the first period more price sensitive, since poaching prices increase as a result of fairness concerns (see Proposition 2). However, this intuition is not correct; in fact, we have

$$\frac{\partial^2\theta_1^*}{\partial a_1\partial\lambda} = \frac{4\delta_c\lambda(2+\lambda)}{(1+((1+\lambda+2\lambda^2)/(3+3\lambda-2\lambda^2))\delta_c)^2 t} > 0. \quad (15)$$

The above relationship implies that consumers with stronger fairness concerns are less price sensitive in the first period. The reason for this is that the marginal consumer always switches, and therefore what determines his price sensitivity is how the difference in the switching price, i.e., $(a_c - b_c)$, changes with λ. We have

$$\frac{\partial}{\partial\lambda}(a_c - b_c) = \frac{8(1-2\theta_1)(2+\lambda)\lambda t}{(3+3\lambda-2\lambda^2)^2}. \quad (16)$$

The above relationship implies that as fairness concerns increase, the larger firm provides a relatively better switching deal. The reason is as follows. Suppose θ_1 decreases from $\frac{1}{2}$ as a result of a slight increase in firm A's first-period price. This change in market share requires the smaller firm A to raise its poaching price and the larger firm B to cut its poaching price. When consumers have fairness concerns, A has a stronger incentive to raise its poaching price than B's incentive to cut its poaching price, as a lower poaching price makes their past-customer price appear more unfair. As a result, fairness concerns lead to relatively higher switching price offered by A and better switching deal offered by B, which gives more incentives for consumers to stay with A to receive B's switching deal. Thus, an increase in fairness concerns makes consumers even less price sensitive. Consequently, an increase in fairness concerns makes the first-period profits less sensitive to first-period prices.

The analysis of the impact of first-period prices on profits shows that the effect on first-period profits is driven by consumer expectations of future poaching prices, whereas the effect on second-period profits is driven by firm expectations of the negative impact of first-period market share on second-period profits. It is important to note the role of consumer and firm discount factors. As consumers become more patient, the marginal impact of first-period profits on first-period prices becomes stronger. On the other hand, as firms become more patient, the effect of second-period profits on first-period prices becomes more important.

It is also useful to note that in equilibrium the first-period prices are higher than the second-period prices, even for firm's own customers. Hence, when firms conduct behavior-based pricing, prices decline over time. In particular, we have

$$\begin{aligned} a_1^* - a_o^* &= (3\delta_c(1+2\lambda+3\lambda^2+2\lambda^3)+\lambda\delta_f(7+7\lambda-2\lambda^2) \\ &\quad +3+9\lambda+4\lambda^2-4\lambda^3) \\ &\quad \cdot(3(1+\lambda)(3+3\lambda-2\lambda^2))^{-1}t > 0, \end{aligned} \quad (17)$$

$$\begin{aligned} a_1^* - a_c^* &= (3\delta_c(1+2\lambda+3\lambda^2+2\lambda^3)+\lambda\delta_f(7+7\lambda-2\lambda^2) \\ &\quad +6+9\lambda-\lambda^2-2\lambda^3) \\ &\quad \cdot(3(1+\lambda)(3+3\lambda-2\lambda^2))^{-1}t > 0. \end{aligned} \quad (18)$$

After discussing each of the two periods separately, we analyze the total discounted profits each firm makes over two periods. Comparing the equilibrium

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 19:49 . For personal use only, all rights reserved.

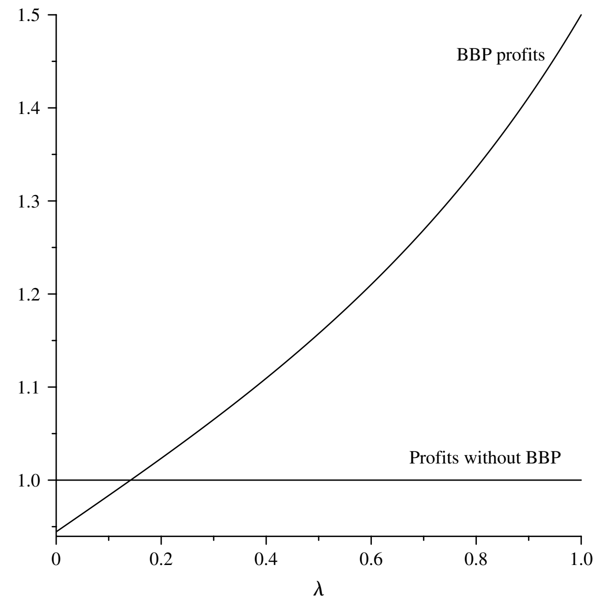
outcomes with customer recognition and fairness concerns in Table 2 and the equilibrium outcomes without customer recognition in §2.1, we have the following result.

Proposition 4 (Total Discounted Profits). *When consumers' fairness concerns are sufficiently strong, firms' total discounted profits with behavior-based price discrimination exceed the total discounted profits without customer recognition.*

Existing research typically finds that firms' total discounted profits with behavior-based price discrimination are lower than the total discounted profits without customer recognition (Fudenberg and Tirole 2000, Villas-Boas 1999, Acquisti and Varian 2005, Pazgal and Soberman 2008). The intuition is that when consumers reveal their preferences through buying from their preferred firms in the first period, firms offer low prices to poach the competitor's customers who reveal lower preferences. Poaching weakens firms' ability to extract surplus from their high-valuation customers and intensifies competition. As a result, profits with behavior-based poaching are lower than profits without customer recognition. This negative impact of customer recognition has also been found in contexts where firms make other dynamic decisions such as behavior-based personalization in product designs (Zhang 2011).

Here, we show that when consumers exhibit fairness concerns, behavior-based pricing can be more profitable than pricing without customer recognition. The intuition follows from the results and discussions in the two separate periods. On one hand, fairness concerns reduce firms' profits in the second period by reducing the price charged to past customers. On the other hand, fairness concerns increase firms' profits in the first period by softening price competition and reducing price sensitivity. The increase in the first-period profits offsets the decrease in the second-period profits, and total discounted profits over two periods increase with fairness concerns.[12] Furthermore, when fairness concerns are sufficiently strong, i.e., $\lambda > \underline{\lambda}$, total discounted profits are higher than profits without customer recognition. In the case that $\delta_c = \delta_f$, the condition for behavior-based pricing to be profitable reduces to $\lambda > \underline{\lambda} \approx 0.14$ (see Figure 2). In the general case that $\delta_c \neq \delta_f$, the threshold $\underline{\lambda}$ is such that $(9(1+2\underline{\lambda}+3\underline{\lambda}^2+2\underline{\lambda}^3))/(12+3\underline{\lambda}-14\underline{\lambda}^2+\underline{\lambda}^3-2\underline{\lambda}^4) = \delta_f/\delta_c$ (see Technical Appendix A for detailed proof).[13]

Figure 2 **BBP Profits Vary with Fairness Concerns** ($\delta_c = \delta_f$)



Now let us look at the implications of consumers' fairness concerns on consumer surplus and social welfare. We measure consumer surplus using two different approaches. In the first approach, we measure the monetary payoff of consumers without the direct effect of fairness concerns on consumer utility. Note that even in this case, we incorporate the indirect effect of fairness concerns on prices. With this approach, for a customer located at θ who purchases from firm A in both periods, his surplus would be $(1+\delta_c)(r-t\theta)-a_1-\delta_c a_o$. The second approach to compute surplus is to include the fairness component, i.e, the direct disutility of being unfairly price discriminated. In this way, the customer in the previous example would receive a surplus of $(1+\delta_c)(r-t\theta)-a_1-\delta_c a_o-\delta_c\lambda(a_o-a_c)$, where the term $-\delta_c\lambda(a_o-a_c)$ captures the disutility of experiencing price unfairness in the second period. In the following discussion, to simplify exposition, we focus on the case that $\delta_f=\delta_c$ and $t=1$. In Technical Appendix A, we show that these results hold for a broader range of parameters.

Proposition 5 (Consumer Surplus). *Consumers' fairness concerns decrease consumer surplus.*

[12] These results can still hold when the disutility of fairness concerns is a concave or convex function of the price difference between repeat customers and switchers. With these nonlinear functional forms, all results from the second period hold. The first-period results, i.e., as fairness concerns become stronger, first-period prices increase and total discounted profits exceed total discounted profits without customer recognition, can hold if the functional form is concave or not too convex (e.g., $f(x)=x^{1.1}$). With functional forms that are too convex, first-period prices and total discounted profits of behavior-based pricing can decrease with fairness concerns.

[13] As λ increases from 0 to 1, $9(1+2\lambda+3\lambda^2+2\lambda^3)/(12+3\lambda-14\lambda^2+\lambda^3-2\lambda^4)$ increases to infinity. The threshold $\underline{\lambda}$ decreases if consumers are more forward looking because profits of BBP increase with both θ_c and θ_f, where the profits without customer recognition are $(1+\delta_f)t/2$, increasing with δ_f only and are independent of θ_c.

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 19:49 . For personal use only, all rights reserved.

Public policy makers aim to raise public awareness of firms' practice of behavior-based price discrimination, with the best intention of protecting consumers from being unfairly price discriminated by firms. The hope is that as consumers become more conscious about price fairness, consumers can make better choices that are good for consumers as a whole. However, such an analysis misses out on the fact that firms would optimally adjust to such changes in the environment. Once we incorporate these strategic price adjustments, we find that consumer surplus derived using both approaches *decreases* with the degree of consumers' fairness concerns. Thus, as consumers become more informed about firms' price discrimination and more concerned about price fairness, consumers as a whole are worse off.

To understand this result, first consider the monetary consumer surplus where we do not consider the disutility of fairness concerns in deriving consumer surplus. Fairness concerns affect this measure of consumer surplus in several ways. On the positive side, fairness concerns decrease inefficient switching to less preferred firms and lower the prices that past customers pay. These effects enhance consumer surplus. On the negative side, fairness concerns increase poaching prices and the first-period prices. In addition, with fairness concerns, consumers who would previously switch to enjoy the lower poaching price now stay with their past firms and pay the higher price. These shifts lead to lower consumer surplus. The negative aspect dominates the positive aspect; therefore, consumer surplus decreases with fairness concerns.

Incorporating the disutility of fairness concerns into the computation of consumer surplus generates two more effects. Consumers who do not switch experience the disutility of fairness concerns. As λ increases, fewer consumers switch (as given in Proposition 1). Hence, more customers would feel unfairly treated. On the other hand, as λ increases, the price difference between the past-customer price and the poaching price shrinks, which decreases the disutility of unfairness. When λ is less than $\bar{\lambda} \approx 0.47$, the negative impact dominates. If $\lambda > \bar{\lambda}$, the positive aspect dominates. However, even in this case, as λ increases, the positive aspect associated with adding the fairness component cannot outweigh the aforementioned negative changes in the monetary consumer surplus. Therefore, consumer surplus including the fairness component also decreases with fairness concerns.

Now let us analyze how fairness concerns affect social welfare. From the perspective of social planners, if firms and consumers discount future payoff at the same rate, pricing only determines the transfer between consumers and firms and does not affect the overall welfare. In this case, the impact of fairness concerns on social welfare excludes its impact on prices. Proposition 1 shows that in equilibrium, as consumers become more concerned about fairness, fewer consumers switch. Such switching is socially inefficient because consumers switch to their less preferred firms. Since consumers' fairness concerns reduce inefficient switching, we expect that social welfare would increase with fairness concerns. This intuition is true if we compute social welfare without incorporating the disutility of fairness concerns in deriving consumer surplus. If we include the disutility of experiencing price unfairness, social welfare can increase with the degree of fairness concerns when such concerns are sufficiently strong.

Proposition 6 (Social Welfare). *Fairness concerns increase the social welfare derived based on monetary payoff. Fairness concerns increase the social welfare including the disutility of price unfairness if such concerns are sufficiently strong such that* $\lambda > \hat{\lambda} \approx 0.26$.

The intuition is as follows. Including the disutility of unfairness directly reduces social welfare. As λ increases, it does two things. First, it reduces inefficient switching, which enhances the monetary social welfare. Second, it magnifies the disutility of price unfairness. When λ is small, its impact on reducing switching is not enough to offset its disutility on social welfare. In this case, social welfare decreases with λ. When λ is sufficiently large, its impact on reducing switching dominates and social welfare increases.

4. Model Extensions

In this section, we relax some assumptions made in the main analysis to generalize our results and seek new insights. In the base model, consumers form price perception by comparing their own price with other consumers' prices. However, we only consider fairness concerns for those consumers who pay a higher price than their peers. In addition, we modeled fairness concerns by capturing the utility loss of paying a higher price than other consumers, whereas the utility gain of paying a lower price than others is assumed away. In §4.1, we incorporate fairness concerns or utility gain for those consumers who get a favorable price relative to their peers. In §4.2, we consider situations where price perception is also affected by prices that consumers paid in the first period. In the base model, we assumed that all consumers exhibit the same degree of fairness concerns about price discrimination. In §4.3, we consider the case where consumers' fairness concerns are endogenously determined by the number of consumers who are offered a lower price to buy the same product. In §4.4, we allow consumers to face switching costs when they switch firms in the second period. To focus

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 19:49 . For personal use only, all rights reserved.

on the new insights generated by the extensions, we set $\delta_c = \delta_f = 1$ and $t = 1$. We summarize the key findings and discuss intuitions below. Detailed analysis can be found in Technical Appendix A.[14]

4.1. Consumers Who Pay Lower Prices Experience a Utility Gain or Exhibit Fairness Concerns

In our base model, we captured the psychological phenomenon that past customers experience a utility loss when they pay higher prices than others. New customers receive the same product at a discounted price and may experience a utility gain for getting a deal. To incorporate this in the model, we modify the base model and allow for this possibility. Let the parameter g represent the degree of utility gain of receiving a deal. Then the marginal consumer at θ_a is characterized by

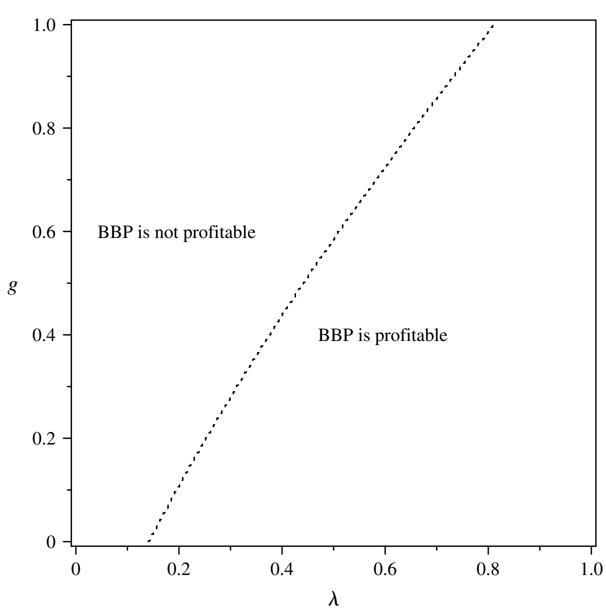
$$r-\theta_a-a_o-\lambda(a_o-a_c)=r-1+\theta_a-b_c+g(b_o-b_c)$$
$$\theta_a=\frac{1}{2}-\frac{a_o-b_c}{2}-\frac{\lambda(a_o-a_c)}{2}-\frac{g(b_o-b_c)}{2}, \tag{19}$$

where the term $g(b_o - b_c)$ is the utility gain received by the consumer when he switches to firm B and pays a lower price b_c while other consumers pay a higher price b_o for the same product. The marginal consumer at θ_b is analogously defined.

With this utility gain alone and without fairness concerns, first-period market share has a *positive* effect on second-period profits. This is because having a larger market share or customer base motivates the firm to charge a higher price for past customers, which enhances the gain for switching customers. Meanwhile, the larger firm faces a smaller competitor whose customers have stronger preferences for the competitor's product. To poach these consumers, the firm reduces the poaching price, which further enhances the gain experienced by switching customers. For these reasons, firms price aggressively in the first period for the purpose of improving second-period profits. This force drives first-period prices to decrease, opposite to the effect of fairness concerns that drives first-period prices to increase. In addition to this effect of second-period profits on first-period prices, there is an opposing effect of first-period profits on first-period prices. Note that the marginal consumer in the first period switches firms in the second period. When getting a deal induces a gain, a decrease in firm A's market share leads to a decrease in B's poaching price to a larger degree than without the utility gain, because B has incentives to lower the poaching price to enhance the gain experienced by switching customers. The prospect of receiving a lower poaching price and a better deal makes the marginal consumer in the first period less sensitive to first-period prices. This effect motivates firms to charge higher prices in the first period, against the force to reduce first-period prices for the benefits of second-period profits. When the strength of the utility gain is small, the impact of second-period profits on prices dominates and first-period prices decrease. When the utility gain is sufficiently strong, the impact of first-period profits on prices dominates and first-period prices increase. However, total profits with the utility gain alone are lower than profits without customer recognition.

If the utility gain of getting a deal and the utility loss of paying higher prices coexist, results in our main model still hold, though the impact of the utility loss driven by fairness concerns are softened by the presence of utility gain associated with getting a deal. Specifically, as fairness concerns become stronger, the poaching price increases and the past-customer price decreases, to a smaller degree than in the absence of the utility gain of getting a deal. This is because firms need to balance the need to manage fairness perception and the need to exploit the gain perceived by switching consumers. The benefit of fairness concerns on improving overall profits is attenuated by the presence of the utility gain, because the utility gain alone leads to lower profits. Because consumers value the utility gain more, fairness concerns need to be stronger for behavior-based pricing to be profitable (see Figure 3).

Figure 3 BBP Profits with Utility Gain of Getting a Deal (g)



[14] In addition to these extensions, we also investigated how heterogeneous fairness concerns among consumers affect our results. We show that when 14% or more consumers are aware about prices that other consumers pay and have fairness concerns, BBP can be more profitable than the case without customer recognition. Details are in Technical Appendix §A-4.3. In addition, we extend the base model to allow consumer preferences to change over time and show that our main results still hold (see §A-4.4).

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 19:49 . For personal use only, all rights reserved.

In the model of Fehr and Schmidt (1999), inequity-averse consumers also exhibit fairness concerns and experience a utility loss when they receive a better deal than their peers. This can be easily modeled in the current framework by assuming that $g < 0$. Hence, an alternative interpretation of $g < 0$ is that it captures the degree of fairness concerns experienced by new customers who pay lower prices than past customers. Our analysis shows that our results become even stronger in this case. This is intuitive, since the parameter g makes it even less attractive for firms to price discriminate between past and new customers, because price discrimination leads to fairness concerns and lower utility for not only past customers who pay higher prices but also new customers who pay lower prices. Therefore, the effects we identified in the base model become stronger. In such cases, behavior-based pricing can increase firms' profits in a larger range of situations.

4.2. Consumers' First-Period Price Serves as a Reference Price

Our main model has focused on the peer-induced fairness where peer consumers' prices serve as reference prices to judge the fairness of one's own price. Since consumers purchase repetitively over two periods, the price that a consumer pays in the first period may also influence how the consumer perceives prices in the second period. As discussed in the main model, second-period prices with behavior-based poaching are lower than first-period prices. Hence, consumers may experience a gain when they pay lower prices in the second period with reference to the higher prices they paid in the first period. Let γ denote the degree of this reference price effect. The marginal consumer at θ_a in the second period satisfies the condition that

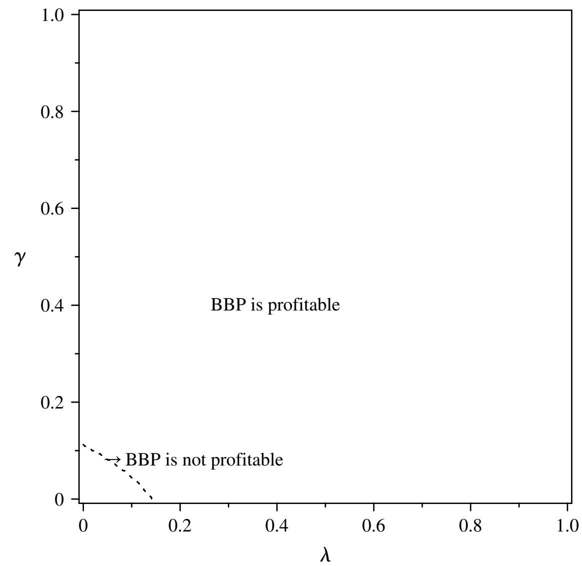
$$\begin{aligned} r - \theta_a - a_o - \lambda(a_o - a_c) + \gamma(a_1 - a_o) &= r - 1 + \theta_a - b_c + \gamma(a_1 - b_c), \\ \theta_a = \frac{1}{2} - \frac{a_o - b_c}{2} - \frac{\lambda(a_o - a_c)}{2} - \frac{\gamma(a_o - b_c)}{2}&, \end{aligned} \tag{20}$$

where θ_b can be obtained analogously. With this reference price effect, results in our main model still hold. Moreover, as consumers value the reference gains more strongly, there is a larger range of situations for behavior-based pricing to be more profitable than without customer recognition (see Figure 4). This is because this reference effect alone also increases firms' total profits.

The intuition is that with first-period prices as a reference price, consumers perceive the low poaching price more favorably because it offers a larger gain than the past-customer price does. Because consumers value the reference gains more strongly, consumers are more motivated to switch, which leads to lower prices in the second period. Now the marginal consumer in the first period anticipates receiving a lower poaching price. First-period demand becomes less sensitive to first-period prices. Consequently, firms can raise first-period prices to make more profits. If the reference effect does not exist (i.e., $\gamma = 0$ in Figure 4), the model reduces to the base model. BBP is profitable when fairness concerns are sufficiently strong. As the reference effect becomes stronger, for a smaller degree of fairness concerns, BBP can be profitable. Therefore, fairness concerns operate in a more general context where historical prices impact consumers' price perceptions.[15]

It is also important to understand how fairness concerns and historical reference price impact firms differently. With the reference price alone, first-period prices do not have a direct effect on second-period profits if fairness concerns do not exist. This is because the first-period reference price impacts perceptions of the second-period past-customer prices

Figure 4 BBP Profits with Period 1 Price as Reference



[15] In this setup, when an old customer of firm A switches to firm B in period 2, we assume the price that the customer paid for product A in period 1 serves as the reference price. Since the two products are differentiated, it is also possible that B's first period price may be the reference price for customers who switch from A to B. In this case, the indifferent customer at θ_a becomes

$$r - \theta_a - a_o - \lambda(a_o - a_c) + \gamma(a_1 - a_o) = r - 1 + \theta_a - b_c + \gamma(b_1 - b_c),$$
$$\theta_a = \frac{1}{2} - \frac{a_o - b_c}{2} - \frac{\lambda(a_o - a_c)}{2} + \frac{\gamma(a_1 - b_1 - a_o + b_c)}{2}.$$

The marginal consumer at θ_b can be derived analogously. One notable difference is that the first-period prices impact the locations of the second-period customers directly. As a result, the optimal prices in the second-period are functions of first-period prices. In this case, all results hold qualitatively (see §4-2 of Technical Appendix A for details).

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 19:49 . For personal use only, all rights reserved.

and poaching prices to the same degree. As first-period prices increase, the marginal gain from the competitor's segment is canceled out by the marginal loss in a firm's own segment even in the presence of the reference price effect. This difference underlines the distinct mechanisms through which fairness concerns and historical reference price influence firms: both effects lead to less price-sensitive demand in the first period. However, with fairness concerns, first period market share exerts a negative effect on second-period profits, whereas with historical reference price alone, first-period market share has no first-order effect on second-period profits.

4.3. The Degree of Fairness Concerns Is Endogenous

In our main model, we represent the degree of consumers' fairness concerns with an exogenous parameter λ. The disutility of paying a price premium $(a_o - a_c)$ is formulated as $-\lambda(a_o - a_c)$. This is consistent with the literature on fairness concerns. However, it is plausible that a consumer may be more resentful in the case where many others receive a lower price than the case where only a few are offered a lower price. Hence, the degree of fairness concerns could depend on the number of consumers who are offered the better deal. As this number increases, consumers experience a higher level of inequity. To represent this, we modify the base model. Let us consider the consumer at $\theta \le \theta_a$. In equilibrium, this consumer chooses to stay with firm A, and he will incur fairness-based disutility. Since firm A offers a switching deal to B's customers whose $\theta \ge \theta_1$, the consumer who stays with A experiences a higher level of disutility when θ_1 is lower; i.e., more consumers receive a better deal from A. Hence, the consumer's utility is

$$r - \theta - a_o - \lambda(1 - \eta\theta_1)(a_o - a_c). \tag{21}$$

The degree of fairness concerns is captured by $\lambda \cdot (1 - \eta\theta_1)$, which is decreasing in θ_1. Since $\theta_1 \in [0, 1]$, we consider $\eta < 1$ to ensure that fairness concerns still exist and induce a utility loss. Also note that if the parameter $\eta = 0$, then the model reduces to the base case. In this setup, the marginal consumer at θ_a satisfies the following condition:

$$\begin{aligned} r - \theta_a - a_o - \lambda(1 - \eta\theta_1)(a_o - a_c) &= r - (1 - \theta_a) - b_c, \\ \theta_a &= \frac{1}{2} - \frac{a_o - b_c}{2} - \frac{\lambda(1 - \eta\theta_1)(a_o - a_c)}{2}. \end{aligned} \tag{22}$$

Similarly, the consumer who stays with firm B exhibits fairness concerns, and the concerns are stronger as θ_1 increases; i.e., more consumers receive the offer from firm B. Hence, the marginal consumer at θ_b satisfies the condition

$$\begin{aligned} & r - (1 - \theta_b) - b_o - \lambda[1 - \eta(1 - \theta_1)](b_o - b_c) \\ & \quad = r - \theta_b - a_c, \\ & \theta_b = \frac{1}{2} + \frac{b_o - a_c}{2} + \frac{\lambda[1 - \eta(1 - \theta_1)](b_o - b_c)}{2}. \end{aligned} \tag{23}$$

Using this framework, results in our base model still hold. Specifically, as λ increases, the second-period prices offered to past customers decrease, poaching prices increase, fewer consumers switch, and second period profits decline. Moreover, the total profits of BBP increase with λ and can exceed profits without customer recognition when λ exceed a threshold. It is important to note that in this setup, the first-period market share θ_1 has another impact on second-period profits in addition to what we have discussed in the base model. Specifically, from firm A's perspective, as θ_1 increases, it reduces the segment of competitor's consumers who receive the poaching deal and therefore softens past customers' fairness concerns. This effect generates a positive relationship between first-period market share and second-period profits, counteracting with the negative relationship in the base model. Our results show that for $\eta < 1$, the overall impact of first-period market share on second-period profits is still negative, consistent with the base model.[16] As a result, BBP profits increase and can exceed profits without customer recognition.

4.4. Switching Costs

Consumers may face switching costs when they switch to a new firm. Switching costs can be actual learning costs, inertia, or psychological resistance to changes (Klemperer 1987a, b). Here, we extend the base model by assuming that consumers incur a cost when they switch firms. Let s denote the switching cost. We assume that $s \in (0, 1)$ such that some consumers have preferences that are higher than the switching costs. In this case, the marginal consumer at θ_a becomes

$$r - \theta_a - a_o - \lambda(a_o - a_c) = r - (1 - \theta_a) - b_c - s, \tag{24}$$

$$\theta_a = \frac{1}{2} - \frac{a_o - b_c}{2} - \frac{\lambda(a_o - a_c)}{2} + \frac{s}{2}. \tag{25}$$

Similarly, we can obtain θ_b and solve for the symmetric pure-strategy equilibrium (see Technical Appendix A for details).

[16] In the symmetric equilibrium, $\theta_1^* = \frac{1}{2}$. If we allow η to exceed 1 but less than 2 so that in equilibrium fairness concerns still generate a negative utility, then when η is sufficiently large, the overall impact of the first-period market share on the second-period profits can be positive. However, an increase in η reduces the price sensitivity of the first-period consumers. The two effects of η roughly cancel out, and our main result still holds (see §A-4.5 of Technical Appendix A for details).

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 19:49 . For personal use only, all rights reserved.

When consumers who express fairness concerns also face switching costs, we find that the effects of fairness concerns on the second-period prices and profits are stronger than without switching costs. The reason is that switching costs discourage consumers from switching, leading to a larger segment of past customers who experience fairness concerns. Therefore, firms need to adjust prices to a greater extent, and second-period profits decline more with fairness concerns. The benefit of fairness concerns on raising first-period prices and profits still exist.[17]

5. Conclusion

As technology allows firms to easily track and store customers' purchase information, the practice of behavior-based pricing is increasingly important for online and off-line firms. At the same time, consumers are more knowledgeable about prices paid by other consumers and more aware of firms' practices of behavior-based price discrimination. Consumers who pay a higher price than others feel unfairly treated by firms. Price (un)fairness has become a serious concern that affects consumers' purchase decisions. In this paper, we attempt to understand how firms should adjust behavior-based pricing strategy to take consumers' fairness concerns into account. We consider a two-period model with competing firms that recognize own and competitor's customers from purchase history and poach the competitor's customers at a discounted price. Past customers pay higher prices and exhibit fairness concerns about firms' price discrimination in the second period.

We show that when consumers exhibit fairness concerns, firms can obtain higher total discounted profits from conducting behavior-based pricing than without customer recognition. This is because with fairness concerns, the first-period market share has a negative first-order impact on the second-period profits. This effect motivates firms to raise first-period prices for the benefit of second-period profits. In addition, consumers' fairness concerns reduce consumers' price sensitivity in the first period, which gives more incentives for firms to raise first-period prices. As first-period prices increase, first-period profits increases and drive the total discounted profits of BBP to exceed the total discounted profits without customer recognition.

We also show that consumers' fairness concerns reduce price differential and encourage consumers to stay with their preferred firms, which enhances social welfare. Finally, the growing awareness of price fairness among consumers does not benefit consumers as a whole. Instead, as consumers become more fairness-minded, consumer surplus decreases. This finding cautions public policy makers who intend to increase public awareness of firms' price discrimination practices to protect consumers. Such actions may raise consumers' consciousness about price unfairness but hurt all consumers when firms adjust their BBP strategies to respond to consumers' fairness concerns.

In our theoretical analysis, we only considered one decision variable: price. In practice, firms can offer products of customized quality or customized services to customers based on revealed preferences in purchase history. Therefore, it would be useful to explore how fairness concerns influence consumers' buying decisions and firm's quality and price offerings. It would also be interesting to investigate the implications of fairness concerns on firms' other strategies. Finally, researchers can empirically test how fairness affects consumer decisions in various contexts. It would be interesting to incorporate consumers' fairness concerns and empirically assess the profitability of behavior-based targeting in the presence of fairness concerns.

[17] We can also examine the case with only switching costs by setting $\lambda = 0$. Switching costs lead to firms charging higher prices for the customers who are "locked in" than the prices offered to the competitor's customers. These effects are directionally consistent with the impact of fairness concerns. However, it is useful to note several distinctions between the effects of switching costs and fairness concerns (see Technical Appendix A for detailed comparisons). Switching costs increase the price for past customers who are locked in with the firm and decrease the price for customers who are locked in with the competitor. Consequently, switching costs increase second-period profits. However, fairness concerns have the opposite impact. In addition, with switching costs, the first-period market share has a positive impact on second-period profits, because firms with a larger customer base can exploit the locked-in customers with higher prices and make more profits. However, with fairness concerns, the first-period market share negatively impacts second-period profits.

Supplemental Material

Supplemental material to this paper is available at http://dx.doi.org/10.1287/mnsc.2015.2265.

Acknowledgments

The authors thank the department editor, associate editor, and two anonymous reviewers for their constructive comments.

K. J. Li's current affiliation is the Kelley School of Business, Indiana University, Bloomington, Indiana 47405. S. Jain's current affiliation is the Naveen Jindal School of Management, University of Texas at Dallas, Richardson, Texas 75080.

References

Acquisti A, Varian HR (2005) Conditioning prices on purchase history. *Marketing Sci.* 24(3):367–381.

Amaldoss W, Jain S (2005) Conspicuous consumption and sophisticated thinking. *Management Sci.* 51(10):1449–1466.

Anderson ET, Simester D (2010) Price stickiness and customer antagonism. *Quart. J. Econom.* 125(2):729–765.

RIGHTSLINK

Downloaded from informs.org by [155.246.103.35] on 05 April 2017, at 19:49 . For personal use only, all rights reserved.

Campbell M (1999) Perceptions of price unfairness: Antecedents and consequences. *J. Marketing Res.* 36(2):187–199.

Chen Y (2005) Oligopoly price discrimination by purchase history. *Pros and Cons of Price Discrimination* (Swedish Competition Authority, Stockholm).

Chen Y, Cui TH (2013) The benefit of uniform price for branded variants. *Marketing Sci.* 32(1):36–50.

Chen Y, Iyer G, Pazgal A (2010) Limited memory, categorization, and competition. *Marketing Sci.* 29(4):650–670.

Cui TH, Raju JS, Zhang ZJ (2007) Fairness and channel coordination. *Management Sci.* 53(8):1303–1314.

Farrell J, Klemperer P (2007) Coordination and lock-in: Competition with switching costs and network effects. Armstrong M, Porter A, eds. *Handbook of Industrial Organization*, 1st ed., Vol. 3 (Elsevier, Amsterdam), 1970–2072.

Fehr E, Schmidt KM (1999) A theory of fairness, competition, and cooperation. *Quart. J. Econom.* 114(3):817–868.

Feinberg FM, Krishna A, Zhang ZJ (2002) Do we care what others get? A behaviorist approach to targeted promotions. *J. Marketing Res.* 39(3):277–291.

Fudenberg D, Tirole J (2000) Customer poaching and brand switching. *RAND J. Econom.* 31(4):634–657.

Fudenberg D, Villas-Boas JM (2006) Behavior-based price discrimination and customer recognition. Hendershott TJ, ed. *Handbook on Economics and Information Systems* (Emerald Group Publishing, Bingley, UK), 377–436.

Guo L (2015) Inequity aversion and fair selling. *J. Marketing Res.* 52(1):77–89.

Guo L, Zhang J (2012) Consumer deliberation and product line design. *Marketing Sci.* 31(6):995–1007.

Guo X, Jiang B (2015) Signaling through price and quality to consumers with fairness concerns. Working paper, Washington University in St. Louis, St. Louis.

Haws KL, Bearden WO (2006) Dynamic pricing and consumer fairness perceptions. *J. Consumer Res.* 33(3):304–311.

Ho T-H, Su X (2009) Peer-induced fairness in games. *Amer. Econom. Rev.* 99(5):2022–2049.

Huppertz JW, Arenson SJ, Evans RH (1978) An application of equity theory to buyer-seller exchange situations. *J. Marketing Res.* 15(2):250–260.

Jin L, He Y, Zhang Y (2014) How power states influence consumers' perceptions of price unfairness. *J. Consumer Res.* 40(5):818–833.

Klemperer P (1987a) Markets with consumer switching costs. *Quart. J. Econom.* 102(2):375–394.

Klemperer P (1987b) The competitiveness of markets with switching costs. *RAND J. Econom.* 18(1):138–150.

Klemperer P (1995) Competition when consumers have switching costs: An overview with applications to industrial organization, macroeconomics and international trade. *Rev. Econom. Stud.* 62(4):515–539.

Kuksov D, Villas-Boas JM (2010) When more alternatives lead to less choice. *Marketing Sci.* 29(3):507–524.

Loewenstein GF, Thompson L, Bazerman MH (1989) Social utility and decision making in interpersonal contexts. *J. Personality Soc. Psych.* 57(3):426–441.

Pazgal A, Soberman D (2008) Behavior-based discrimination: Is it a winning play, and if so, when? *Marketing Sci.* 27(6):977–994.

Rabin M (1993) Incorporating fairness into game theory and economics. *Amer. Econom. Rev.* 83(5):1281–1302.

Seaney R (2013) Airfare expert: Do cookies really raise airfares? *USA Today* (April 30), http://www.usatoday.com/story/travel/columnist/seaney/2013/04/30/airfare-expert-do-cookies-really-raise-airfares/2121981/.

Shaffer G, Zhang ZJ (2000) Preference-based price discrimination in markets with switching costs. *J. Econom. Management Strategy* 9(3):397–424.

Shin J, Sudhir K (2010) A customer management dilemma: When is it profitable to reward one's own customers? *Marketing Sci.* 29(4):671–689.

Streitfeld D (2000) On the Web price tags blur: What you pay could depend on who you are. *Washington Post* (September 27).

Taylor C (2004) Consumer privacy and the market for customer information. *RAND J. Econom.* 35(4):631–650.

Turow J, Feldman L, Meltzer K (2005) Open to exploitation: American shoppers online and offline. Report, Annenberg Public Policy Center, University of Pennsylvania, Philadelphia.

Villas-Boas JM (1999) Dynamic competition with customer recognition. *RAND J. Econom.* 30(4):604–631.

Villas-Boas JM (2004) Price cycles in markets with customer recognition. *RAND J. Econom.* 35(3):486–501.

Villas-Boas JM (2009) Product variety and endogenous pricing with evaluation costs. *Management Sci.* 55(8):1338–1346.

Washington Internet Daily (2013) Online price discrimination, transparency concerns central to expected DOT rule. 14:168.

Woolley S (1998) I got it cheaper than you. *Forbes* (November 2), http://www.forbes.com/forbes/1998/1102/6210082a.html.

Zhang J (2011) The perils of behavior-based personalization. *Marketing Sci.* 30(1):170–186.