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Jeffrey D. Shulman

*University of Washington*, [jshulman@u.washington.edu](mailto:jshulman@u.washington.edu)

Xianjun Geng

*the University of Texas at Dallas*, [geng@utdallas.edu](mailto:geng@utdallas.edu)

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# DOES IT PAY TO SHROUD ADD-ON FEES?

Jeffrey D. Shulman, Michael G. Foster School of Business, University of Washington, Seattle, Washington 98195, USA, [jshulman@u.washington.edu](mailto:jshulman@u.washington.edu)

Xianjun Geng, Naveen Jindal School of Management, the University of Texas at Dallas, Richardson, TX 75080, USA, [geng@utdallas.edu](mailto:geng@utdallas.edu)

## Abstract

*Add-on pricing, also known as drip pricing, is a common practice whereby firms prominently post base prices yet are less forthcoming about add-on prices. Although some consumers find add-on prices before the purchase decision, others only discover the add-on prices later in the purchase process. This paper presents an analytical model predicting the profit and welfare implications of hidden add-on fees. Whereas practitioners posit that hidden add-on pricing benefits firms at the disadvantage of consumers, the consensus from the academic literature is that any gains from hidden add-ons are negated by competition in base prices. This paper has two main preliminary findings. First, it resolves discrepancy between theory and practice by finding a profit improvement effect of hidden add-on prices under circumstances for which prior literature predicts profit irrelevance. In this regard, the model identifies a new mechanism driving the profit-improvement result. Second, it finds when firms can be worse off by having more consumers uninformed of add-on pricing before choosing from which firm to buy. The findings have implications for managers considering hidden add-on pricing as well as policy makers who seek to regulate this practice.*

*Keywords: Game Theory, Add-on Pricing, Shrouded Prices, Pricing.*

# 1 INTRODUCTION

Firms often choose not to actively advertise their add-on fees, and in some cases even shroud them. For example, hotels often do not disclose their Internet-access fees or parking charge until guests arrive or ask the hotel directly. Airlines in recent years added various types of add-on fees that are often not disclosed prominently at time of booking. Credit card issuers bury fees for services such as foreign transactions in fine prints. As Ellison (2005) and Gabaix and Laibson (2006) observe, such shrouding behavior of firms leads some consumers to make base purchase decisions before they can observe add-on fees. In fact, it is estimated that the average adult pays \$942 each year in hidden fees and surcharges (Pugh 2008).

It is widely believed in the popular press that such hidden add-on fees represent a profit boon for sellers. For example, Sullivan (2007, p4) argues “companies under pressure to keep advertised prices low have seized on trickery to pump profits up. The most successful firms are now the ones that hide their prices best.” However, the academic literature theorizes that, in most cases, shrouding add-on fees will have no effect on firm profitability (Lal and Matutes 1994; Verboven 1999; Gabaix and Laibson 2006). This paper intends to fill in the gap between theory and practice by identifying new conditions under which shrouded add-on fees benefit competing firms. Moreover, it challenges the view that having add-on fees unobserved by a greater proportion of consumers will always improve profitability.

Consumer advocates and policy makers have expressed a view that consumers who use an add-on will be better off if a larger number of consumers are informed about the add-on fees before choosing from which firm to buy. “Hidden fees are one of the worse problems,” says Ed Mierzwinski, consumer program director at U.S. Public Interest Group (Weise 2012). In 2012, the Department of Transportation implemented rules requiring airlines to display a link on their homepages to any change in bag fees for at least three months (Snyder 2012). “These new rules will help protect consumers from hidden costs and provide passengers with some relief,” said Senator Jack Reed (D-RI). This paper examines whether having more consumers informed about add-on fees actually benefits consumers who use the add-on.

In summary, the objective of this research is to address the following research questions.

1. Does it pay for firms to shroud add-on fees even if there is no quality asymmetry between sellers and there is not a significant difference in price sensitivity between consumers who use the add-on and consumers who do not?
2. Does having more consumers uninformed about add-on fees always lead to higher firm profits?
3. How does the co-existence of rational consumers informed and uninformed about add-on fees affect consumer welfare?

This research-in-progress presents preliminary findings regarding the first two research questions. In addressing the first research question, the research identifies a new mechanism by which shrouding add-on fees can increase profitability. By shrouding, we refer to the practice of leaving add-on prices less prominently displayed, also known as drip pricing (Muir, Seim, Vitorino 2013). It is an important question because factors affecting add-on usage (e.g., personal relevance, consumption situation, available alternatives) may not necessarily strongly correlate with sensitivity to inter-firm price differences (though we acknowledge such correlation is a possibility in particular industries and add-ons). Previous literature suggests shrouding add-on fees in this circumstance does not affect profitability. The implication of our model is that shrouding add-on fees may benefit firms in more situations than previously viewed in the literature. This helps resolve a discrepancy between theory and practice while helping managers better understand the likely consequences of their decision to withhold advertisement of (or even deliberately shroud) add-on fees.

In addressing the second research question, the research finds that having more consumers uninformed about add-on fees before making their firm choice is not always beneficial to firms. In other words firms may earn greater profit when a greater proportion of the market is informed about the add-on fees. As a consequence, there are circumstances identified by the research under which firms should welcome policy interventions aimed at improved, albeit not complete, pricing transparency.

The rest of the paper sequentially discusses relevant literature, describes the model, and presents the preliminary results and concluding remarks.

## 2 LITERATURE

A growing literature studies the antecedents and implications of shrouded add-on fees in competitive markets (e.g., Ellison 2005; Gabaix and Laibson 2006). We focus our review of this literature on how prior work answers the following two questions: whether add-on pricing benefits competing firms; and whether such benefit, if it exists, increases in the number of uninformed consumers (i.e., consumers who do not observe add-on fees when they make base purchases). On the profitability of add-on pricing, one known finding that is robust to most model variations is the profit-irrelevance result: firm profits earned on add-ons are competed away due to equivalently diminished profits earned on base prices (Lal and Matutes 1994; Verboven 1999; Gabaix and Laibson 2006). This profit-irrelevance result collides with the belief in popular press that firms benefit from shrouding add-on fees (e.g., Sullivan 2007, p4). Furthermore, this profit-irrelevance result is also at odds with some recent empirical findings: Chetty, Looney, and Kroft (2009) and Ellison and Ellison (2009) provide evidence that withholding information of add-on fees can benefit firms; Brown, Hossain, and Morgan (2010) finds that given add-on fees are hidden, firm profits increase in these fees.

Two recent papers seek to explain when the profit-irrelevance result can be overturned. Ellison (2005) finds add-on pricing improves firm profitability only if there is a significant and negative correlation between consumer price sensitivity and add-on valuation, which creates an adverse selection problem softening price competition. Shulman and Geng (2013) demonstrate that vertical differentiation between sellers in both the quality of the add-on and the quality of the base product, when coupled with consumer bounded rationality can lead competing firms to profit from add-on pricing. Our research does not impose correlation between consumer price sensitivity and add-on valuation, or quality asymmetry, or bounded rationality.

## 3 THE MODEL

We consider a linear city model similar to the ones in Ellison (2005) and Shulman and Geng (2013). Two firms, 1 and 2, engage in horizontal competition on a linear city with unit measure. Firm 1 (2) occupies location 0 (1). Each firm offers a *base good* at marginal cost  $c_b$  and an *add-on* at marginal cost  $c_a$ . Following Ellison (2005), we consider two alternative games. In a benchmark *standard pricing game*, each firm  $j$ ,  $j = 1, 2$ , advertises both its base price  $p_{jb}$  and its add-on fee  $p_{ja}$ . In an *add-on pricing game*, both firms advertise only base prices. Hereafter we frequently refer to the base price under add-on pricing game as the "posted base price," or "posted price" in short to highlight its observability.

On the consumer side, we use a parsimonious three-consumer-segment setup to capture the following two observations that often apply in practice. The first observation is that some consumers value add-ons while others do not. We refer to the former (latter) as *non-base (base)* consumers. For example, while consumers who own a laptop or tablet computer may value Internet-access offered by a hotel, consumers who do not own an internet enabled device do not value the add-on. While we acknowledge that in some cases the value for the add-on is driven by differences in the marginal utility of income (as is required for the profit improvement result in Ellison 2005), the valuation of add-on

usage also depends on personal relevancy, availability of alternatives, and the consumption situation which may not always map onto the marginal utility of income.

The second observation is that if firms do not prominently advertise add-on fees, among non-base consumers (i.e., consumers who value the add-ons) some observe the add-on fees prior to their shopping decisions while others do not. We refer to the former (latter) as *informed* (*uninformed*) consumers. As noted in the introduction, the heterogeneity in knowledge regarding the add-on prices may stem from differences in search costs. For instance shrouded prices may be available only to those who contact the firm directly or who carefully read the fine print, actions potentially taken only by consumers with low search costs. Note in a model of rational consumers, “there is no room in the scheme for unanticipated consequences” (Simon 1955, p. 103). Thus, our model of uninformed consumers applies equivalently to situations in which the uninformed consumers are not even informed that the add-on carries a separate charge as well as when the uninformed consumers are informed that there is an add-on price but are not informed of its value. The equivalence comes from the fact that rationality requires that uninformed consumers form accurate expectations of add-on prices in equilibrium

We normalize consumer population to 1 and assume there are  $1 - \alpha$  *base* consumers where  $0 < \alpha < 1$ . In the add-on pricing game where firms do not prominently advertise add-on fees,  $\alpha(1 - \beta)$  consumers are *informed* consumers who both observe the add-on fees prior to their shopping decisions and value the add-on while  $\alpha\beta$  are *uninformed* consumers who value the add-on yet do not know its price at the time of the firm decision.

The equilibrium concept we use is sequential equilibrium. In the add-on pricing game, let  $\hat{p}_{ja}(p_{1b}, p_{2b})$  denote uninformed consumers' expectation of firm  $j$ 's add-on fee upon observing both firms' posted prices,  $j = 1, 2$ . All consumers have unit demand of the base good with reservation value  $v_b$ , and non-base consumers have unit demand of the add-on with reservation value  $v_a$  where  $v_b > c_b$  and  $v_a > c_a$ . Consistent with Ellison (2005), Gabaix and Laibson (2006) and Shulman and Geng (2013), we assume  $v_b$  is large enough for full market coverage to avoid having key findings obscured by technical discussions of the magnitude of  $v_b$ .

Within each consumer segment, consumers are also differentiated by a stylized taste parameter,  $\theta$ , that is uniformly distributed on  $[0, 1]$  and represents a consumer's location on the linear city. Consumer  $i$  at location  $\theta_i$  suffers a fit cost of  $t\theta_i (t(1 - \theta_i))$  if she purchases from firm 1 (2).

We focus attention on situations in which firms choose to serve both informed and uninformed consumers. As such, we assume  $t > (v_a - c_a) / 3$ , i.e., the level of horizontal differentiation is sufficiently large relative to the add-on value. This assumption rules out the possibility that a firm abandons all informed consumers in pursuit of a maximum margin on the add-on over uninformed consumers.

Our timelines of the two games, depicted in Figure 2, follow the ones in Ellison (2005) with differences that are not substantial to the analysis yet simplifies our narrative. There are two points to note about the add-on pricing timeline. First, the sequential choice of advertised prices and hidden add-ons is consistent with the convention established by the literature (e.g., Lal and Matutes 1994; Ellison 2005) and thus allows for isolation of the factors driving our unique results. Second, the unique results are subsequently shown to hold in an alternative timeline involving simultaneous price-setting.

As shown in Figure 2, in the add-on pricing game we assume that uninformed consumers have to purchase the base good before observing the add-on fees. This fits the scenario where consumers purchase nonrefundable air tickets or hotel stays in advance and then observe check-in luggage charges or Internet-access fees upon arrival. We further assume that, once a consumer has purchased the base good from a firm, she is stuck with this firm in that she can only pick between purchasing the

add-on from the same firm or not to purchase the add-on.

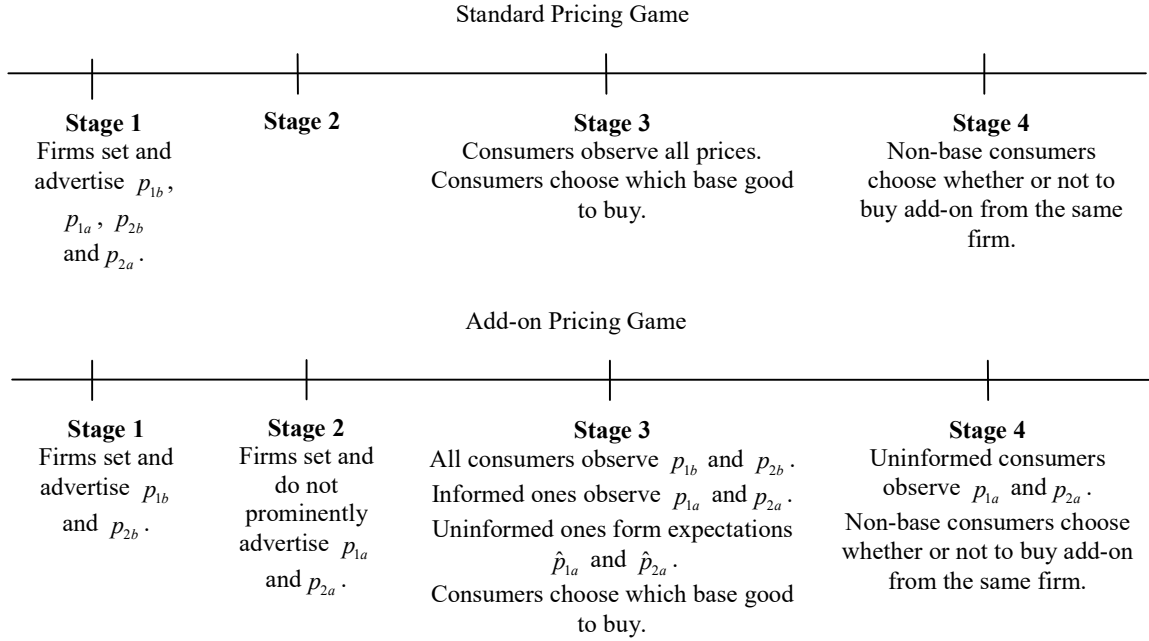


Figure 2. Timelines of the Games

## 4 PRELIMINARY RESULTS

We now analyze equilibrium outcomes under add-on pricing and standard pricing games, and compare them. The latter game is straightforward to solve, and discussed only briefly in Subsection 4.2 as a benchmark. We consider the add-on pricing game before comparing it to the benchmark. Using backward induction, we first characterize consumer choices in Stages 3 and 4 conditional on observed firm prices and uninformed consumer expectations. We then discuss rational beliefs of uninformed consumers in Stage 3 and firm add-on fees in Stage 2. Finally we discuss equilibrium firm pricing, firm profits and consumer surplus.

The behaviors of each of the three consumer segments must first be analyzed:  $(1 - \alpha)$  base consumers,  $\alpha(1 - \beta)$  informed consumers and  $\alpha\beta$  uninformed consumers. The last two segments together are referred to as non-base consumers. In Stage 4 and conditional on Stage 3 purchase of the base good, non-base consumers purchase the add-on from the same firm if the add-on fee is no more than  $v_a$ . Hereafter we consider only  $p_{ja} \leq v_a$  to rule out the uninteresting and never optimal case (as long as  $v_a > c_a$ ) where a firm charges a too high add-on fee and gets no sales on the add-on.

In Stage 3, informed consumers observe add-on fees  $p_{1a}$  and  $p_{2a}$  prior to making purchase decisions. The location of the marginal informed consumer that is indifferent between the two firms,  $\theta_I$ , satisfies  $v_b + v_a - t\theta_I - p_{1b} - p_{1a} = v_b + v_a - t(1 - \theta_I) - p_{2b} - p_{2a}$ . Therefore,  $\theta_I = 1/2 + (p_{2b} + p_{2a} - p_{1b} - p_{1a}) / (2t)$ . Uninformed consumers do not observe add-on fees prior to making shopping decisions; instead, they form rational expectations of these fees,  $\hat{p}_{1a}(p_{1b}, p_{2b})$  and  $\hat{p}_{2a}(p_{1b}, p_{2b})$ . Accordingly, the marginal uninformed consumer is located at  $\theta_U = 1/2 + (p_{2b} + \hat{p}_{2a}(p_{1b}, p_{2b}) - p_{1b} - \hat{p}_{1a}(p_{1b}, p_{2b})) / (2t)$ . Lastly, the marginal base consumer is located at  $\theta_B = 1/2 + (p_{2b} - p_{1b}) / (2t)$ . Demand of each firm's base good,  $\gamma_{jb}$ , and add-on,  $\gamma_{ja}$ , are

$$\gamma_{jb} = \frac{1}{2} - \eta(j) \frac{(p_{1b} - p_{2b}) + \alpha(1 - \beta)(p_{1a} - p_{2a}) + \alpha\beta(\hat{p}_{1a}(p_{1b}, p_{2b}) - \hat{p}_{2a}(p_{1b}, p_{2b}))}{2t} \text{ and}$$

$$\gamma_{ja} = \frac{\alpha}{2} - \eta(j)\alpha \frac{(p_{1b} - p_{2b}) + (1 - \beta)(p_{1a} - p_{2a}) + \beta(\hat{p}_{1a}(p_{1b}, p_{2b}) - \hat{p}_{2a}(p_{1b}, p_{2b}))}{2t}, \text{ where } \eta(j) = 1 \text{ if}$$

$j = 1$ , and  $\eta(j) = -1$  if  $j = 2$ . Therefore, in the add-on pricing game and for any given base prices and add-on fees, firm profits are

$$\pi_j = (p_{jb} - c_b)\gamma_{jb} + (p_{ja} - c_a)\gamma_{ja} \quad (1)$$

for  $j = 1, 2$ . We next analyze firm add-on pricing, which will affect consumers' rational beliefs.

#### 4.1 Rational Beliefs

Given any posted base prices  $p_{1b}$  and  $p_{2b}$  in the add-on pricing game, we solve for the add-on fees of firms  $(p_{1a}^*, p_{2a}^*, \hat{p}_{1a}, \hat{p}_{2a} \mid p_{1b}, p_{2b})$  such that:

- firms optimize add-on fees given uninformed consumer beliefs, i.e.,

$$p_{ja}^* = \arg \max_{p_{ja}} \pi_j(p_{ja}, p_{-ja}^*, \hat{p}_{1a}, \hat{p}_{2a} \mid p_{1b}, p_{2b}) \text{ for } j = 1, 2, \quad (2)$$

- and firms anticipate that the Stage 3 beliefs of uninformed consumers will be consistent with equilibrium firm strategy, i.e.,

$$\hat{p}_{ja} = p_{ja}^* \text{ for any } (p_{1b}, p_{2b}) \text{ and } j = 1, 2. \quad (3)$$

To avoid repetition in describing actions, payoffs, and beliefs regarding each firm, we let " $-j$ " indicate the firm other than firm  $j$ . We only need to consider beliefs of uninformed consumers because for base consumers their belief is not relevant to their actions, and for informed consumers they will directly observe add-on fees before making purchase decisions. Solutions to (2) for  $j = 1, 2$  can be derived by using (1) and solving the first-order conditions. By solving for the rational belief for uninformed consumers given any posted base prices  $p_{1b}$  and  $p_{2b}$ , we have:

**Proposition 1** *Given  $p_{1b}$ ,  $p_{2b}$ , and assume that  $p_{jb} \geq p_{-jb}$ . The unique rational expectation of add-on fees for uninformed consumers are the following:*

- $(\hat{p}_{ja}, \hat{p}_{-ja}) = (\frac{t}{1 - \beta} + c_a + c_b - p_{jb}, \frac{t}{1 - \beta} + c_a + c_b - p_{-jb})$  if  $p_{-jb} > \frac{t}{1 - \beta} + c_a + c_b - v_a$ .
- $(\hat{p}_{ja}, \hat{p}_{-ja}) = (\frac{t + p_{-jb} + (1 - \beta)(c_a + c_b) + v_a}{2 - \beta} - p_{jb}, v_a)$  if  $p_{-jb} \leq \frac{t}{1 - \beta} + c_a + c_b - v_a$  and  $p_{jb} > \frac{t + p_{-jb} + (1 - \beta)(c_a + c_b - v_a)}{2 - \beta}$ .
- $(\hat{p}_{ja}, \hat{p}_{-ja}) = (v_a, v_a)$  if  $p_{jb} \leq \frac{t + p_{-jb} + (1 - \beta)(c_a + c_b - v_a)}{2 - \beta}$ .

All proofs are omitted due to page limit. The result in part (iii) of Proposition 1 is consistent with prior works including Lal and Matutes (1994), Verboven (1999), Ellison (2005), and Gabaix and Laibson (2006). When both firms charge low enough posted base prices, uninformed (but rational) consumers expect firm  $j$  to charge the maximum add-on fee (i.e., the consumer's reservation value on its add-on) and consumers take this into account in their purchase decisions.

Part (i) of Proposition 1, in contrast, contributes a new insight to the add-on pricing literature: when both firms' posted base prices are higher than  $t / (1 - \beta) + c_a + c_b - v_a$ , instead of expecting a maximal possible add-on fee, uninformed consumers rationally expect firm  $j$ 's add-on fee to be an inner solution that *linearly decreases in its posted base price*. This is consistent with the empirical finding of Derdenger, Liu and Sun (2012) that aggressive price cuts on cameras by Olympus and Fuji (base goods) did not improve sales and the conjecture that forward planning consumers anticipated the higher memory card prices (add-on). Notice that the existence of enough informed consumers is instrumental to this new finding: for any given  $p_{jb}$ ,  $p_{jb} > t / (1 - \beta) + c_a + c_b - v_a$  will not hold if  $1 - \beta$  is close enough to zero. Therefore, our assumption that informed and uninformed consumers coexist in this model plays a pivotal role in driving this new finding.

The result regarding  $\hat{p}_{ja}(p_{1b}, p_{2b})$  in part (ii) of Proposition 1 is analogous to part (i) with one difference. As now uninformed consumers observe a very low  $p_{-jb}$ , they rationally expect firm  $-j$  to charge the maximum add-on fee  $v_a$ . The fact that firm  $-j$ 's add-on fee is now binding at  $v_a$  influences firm  $j$ 's optimization problem, and as a response firm  $j$  sets the add-on fee at a level lower than  $t / (1 - \beta) + c_a + c_b - p_{jb}$  though the fee still decreases in  $p_{jb}$ .

We next study firm profits by solving Stage 1 of the add-on pricing game.

## 4.2 Firm Profits

In Stage 1, the firms simultaneously choose posted prices to maximize profit. The equilibrium prices and profits are presented in the following Proposition. For notational convenience, denote

$$\beta_1 \triangleq \min\left\{1 / \left(\frac{1 + \sqrt{(1 - \alpha)}}{2} + \frac{t}{\sqrt{(1 - \alpha)}(v_a - c_a)}\right), \frac{v_a - c_a}{t + v_a - c_a}\right\} \text{ and } \beta_2 \triangleq \max\left\{1 / \left(\frac{1 + \sqrt{(1 - \alpha)}}{2} + \frac{t}{\sqrt{(1 - \alpha)}(v_a - c_a)}\right), \frac{v_a - c_a}{t + v_a - c_a}\right\}.$$

**Proposition 2** *In the add-on pricing game:*

- (i). If  $\beta < \beta_1$ , there exists a unique pure strategy equilibrium with base prices  $p_{1b}^* = p_{2b}^* = t + c_b$  and add-on fees  $p_{1a}^* = p_{2a}^* = \frac{\beta t}{1 - \beta} + c_a$ . Firm profits are  $\pi_1^* = \pi_2^* = (1 + \frac{\alpha\beta}{1 - \beta}) \frac{t}{2}$ .
- (ii). If  $\beta > \beta_2$ , there exists a unique pure strategy equilibrium with base prices  $p_{1b}^* = p_{2b}^* = t + c_b - \alpha(v_a - c_a)$  and add-on fees  $p_{1a}^* = p_{2a}^* = v_a$ . Firm profits are  $\pi_1^* = \pi_2^* = \frac{t}{2}$ .

So far our analysis focuses on the add-on pricing game. Results for the benchmark standard pricing game, where add-on fees are advertised, are derived straightforwardly from simultaneously solving each firm's first order conditions and yield the same results as setting  $\beta = 0$  in Proposition 2. Therefore, in the standard pricing game, each firm's equilibrium based price is  $t + c_b$ , add-on fee is  $c_a$ , and profit is  $t / 2$ . Part (ii) of Proposition 2 is consistent with the findings in Lal and Matutes (1994): though firms charge a high margin on the add-ons, profits from the add-ons are competed away due to low posted base prices. Consequently, the add-on pricing game results in the same profit for each firm,  $t / 2$ , as the benchmark standard pricing game, a.k.a. the profit-irrelevance result.

Part (i) of Proposition 2 overturns the profit-irrelevance result when non-base consumers consist of both uninformed and informed segments, and the latter accounts for a proportion of non-base consumers greater than  $1 - \beta_1$ . In this case, firms will pick posted base prices in Stage 1 such that the rational expectation of uninformed consumers will be a decreasing a function of base price according to Part (i) of the rational belief system specified in Proposition 1. Consequently, uninformed consumers, in making the base good purchase decision, are less price-sensitive with respect to the



observed posted prices than the informed consumers. Firms then face less competitive pressure in pricing base goods as compared to a standard pricing game, and thus avoid losses from loss-leader pricing. On the other hand, in Stage 2 firms can still gain from the information disadvantage of uninformed consumers by setting above-marginal-cost add-on fees, as shown in Part (i) of Proposition 2. Part (i) of Proposition 2 thus shows that the existence of enough informed consumers enables firms to avoid the perils of loss-leader pricing while reaping the benefit of high margins on add-ons.

An examination of the equilibrium profit from Proposition 2 yields two more observations. First, add-on pricing does not benefit firms (as compared to standard pricing) for *both* extremes values of  $\beta$ . In other words, if all non-base consumers are informed, or if they are all uninformed, the profit-irrelevance result holds. Previous papers on rational consumers have studied both extremes yet not the middle; this model thus highlights the importance of explicitly accounting for both informed and uninformed consumers. We present an implication for profitability in the following corollary.

**Corollary 1** *Firm profit is greater when a small proportion of the market is uninformed about add-on fees (i.e.,  $0 < \beta < \beta_1$ ) than when a large proportion of the market is uninformed about add-on fees (i.e.,  $\beta > \beta_2$ ).*

Corollary 1 shows that firm profitability can be improved by having more consumers informed about add-on fees. When there are too many consumers who are uninformed about the add-on fees, all consumers rationally expect add-on fees to be set at their maximum. Thus, a market consisting of too many uninformed consumers can actually intensify competition and reduce profit. It is only when there is a reasonable amount of informed consumers (i.e.,  $0 < \beta < \beta_1$ ) that the common intuition of profit increasing in  $\beta$  holds.

Currently we are working on the research question regarding consumer surplus. We expect to have a more complete picture of our research findings by the conference time.

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