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Pay-as-You-Wish Pricing

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Abstract

Some firms use a curious pricing mechanism called “pay as you wish” pricing (PAYW). When PAYW is used, a firm lets consumers decide what a product is worth to them and how much they want to pay to get the product. This practice has been observed in a number of industries. In this paper, we theoretically investigate why and where PAYW can be a profitable pricing strategy relative to the conventional “pay as asked” pricing strategy (PAAP). We show that PAYW has a number of advantages over PAAP such that it is well suited for some industries but not for others. These advantages are: 1) PAYW helps a firm to maximally penetrate a market; 2) it allows a firm to price discriminate among heterogenous consumers; 3) it helps to moderate price competition. We derive conditions under which PAYW dominates PAAP and discuss ways to improve the profitability of PAYW.

Keywords: Pricing Strategy, Competitive Price Discrimination, Self-Determined Price

1 Introduction

Pricing a product or service is typically a seller's responsibility or in some cases a joint responsibility for the seller and the buyer if the seller allows, or if the buyer insists on, haggling. As the seller, it is not always easy to execute that responsibility. At the point of sales, the seller may want to charge the buyer as much as feasible, but the buyer may want to pay as little as possible. There lies the potential conflict in every business transaction that frequently poisons a seller-buyer relationship. It is this conflict that most sellers struggle to deal with and most buyers complain about. Therefore, it is not surprising that when Radiohead, the English alternative rock band, announced on October 9, 2007, that it would let fans to decide how much they would pay, if anything, for downloading its new album *In Rainbows*, it immediately caught the media's attention as well as the imagination of sellers and buyers alike in the marketplace. With this seemingly novel pay-as-you-wish pricing mechanism (PAYW), the band does not have to sweat over what price it charges for its album and fans have nothing to complain about the price they pay.

Of course, PAYW is not new. For ages, street musicians have used this pricing mechanism to make a living; museums, such as the Metropolitan Museum of Art in New York city, and other non-for-profit organizations routinely let visitors to decide how much they pay. There are many more examples like these where firms relinquish their role as the price setter to consumers. In this paper, we take a first analytical look at this pricing mechanism to see how and where it may work.

The practice of PAYW raises many questions. First, can PAYW only be used profitably in an industry with zero or low marginal costs? One would be tempted to say yes based on the afore-mentioned examples, except that in the restaurant business, where the marginal cost can be substantial, PAYW is frequently used, too. The restaurant Just Around the Corner in London, for instance, was reported to have operated profitably under this pricing mechanism for over two decades. One World Cafe' in Salt Lake City, Utah, is also one such thriving restaurant. There are apparently similar examples elsewhere in the world. Then, a deeper question is: how do marginal costs play a role in determining whether PAYW is a more profitable pricing mechanism than, say, the commonly used "pay as asked" pricing mechanism (PAAP)? Second, how do consumers play a role in the profitability of PAYW? For instance, is it more likely that PAYW would dominate PAAP as a pricing mechanism if there is a higher concentration of higher willingness to pay customers in the market, or a higher concentration of low willingness to pay customers is actually more conducive to the profitability of PAYW? Finally, is it better to use PAYW, instead of PAAP, in a more

competitive industry or in a less competitive industry? Our answers to these questions will help us to articulate the special role of PAYW in the pricing toolkit. They will also help us to shed light on the observed practices of pay-as-you-wish pricing.

In this paper, we arrive at our answers to these questions through analyzing a simple, yet instructive theoretical model with a number of extensions. Our analysis will help us to achieve three research objectives. First, our theoretical modeling allows us to identify the advantages of PAYW over PAAP as a pricing mechanism so as to accord it a special role in the pricing toolkit. Our analysis shows that PAYW can help a firm to achieve maximal market penetration, implement price discrimination, and moderate price competition. Second, by deriving the conditions under which PAYW dominates PAAP, we show that PAYW can be a profitable pricing mechanism in industries where there is a sufficient number of fair-minded customers, where the distribution of consumers is skewed toward the low end in terms of consumer willingness to pay, and where the marketplace is very competitive due to low product differentiation. Our analysis further suggests that zero or very low marginal costs are not necessary for the application of PAYW. Third, our analysis shows that requiring or suggesting a minimum price is a good way to improve the profitability of PAYW, as firms have done in practice.

PAYW pricing has attracted increasing attention from researchers in recent years. Kim et. al. (2009) examined factors that influence the participation and willingness-to-pay of consumers in the context of PAYW pricing through field experiments. They find consumer fairness considerations to be an important driver for the profitability of PAYW pricing. Besides consumer fairness concerns, researchers have also suggested that the viability of PAYW pricing mechanism may be affected by many factors such as altruism, customer satisfaction and customer loyalty (Kim et. al. 2009), the warm-glow experience from customers (Isaac et. al. 2010), customers' self-interests of keeping the firm in business (Mak et. al. 2010), social norm and customer mood (Reiner and Traxler 2012), the consumer identity and self-image considerations (Gneezy et. al. 2012), and market structure (Schmidt et. al. 2015). Schmidt, et. al. (2015) uses laboratory experiments to analyze the PAYW strategy. Their experiments confirm that PAYW successfully increases market penetration and that consumers' payments increase with the firm marginal costs. Furthermore this paper verifies our finding that PAYW can moderate price competition. In contrast, our paper relies on an analytical model that complements their experiments and analyzes other pricing strategies (PAYW with minimum price and Suggested price). In addition, Gneezy et. al. (2010) show that the combination of PAYW and charitable giving can be significantly more profitable than that of fixed-price and charitable giving.

We view consumer fairness concerns as the main motivator for consumers to pay positive prices under PAYW. Our research contributes to this line of inquiry through analytically investigating how consumer fairness, firm's marginal cost, consumer heterogeneity, and competition affect a firm's choice of PAYW vs. PAAP. We also derive conditions for the optimal use of minimum price and suggested price in the implementation of PAYW pricing. Our research also contributes to a growing literature in marketing and economics that explores the strategic pricing implications of fair-minded customers (e.g. Fehr and Schmidt 1999, Feinberg, Krishna and Zhang 2002, Cui, Raju, and Zhang 2007, Chen and Cui 2013). Our focus here is on how fairness interacts with other factors such as marginal costs, product differentiation, etc., to make PAYW as a compelling, profitable pricing mechanism. Our research also contributes to the literature on competitive price discrimination where numerous studies explore how firm-initiated price discrimination can intensify price competition to the detriment of competing firms (e.g. Thisse and Vives, 1988, Shaffer and Zhang 1995, 2000 and 2002, Fudenberg and Tirole 2000). In contrast, we show that while competing firms achieve price discrimination through PAYW, they can all benefit from it, as price discrimination here is entirely at consumers' discretion.

In what follows, we start with a simple model and then gradually add complications in successive sections to isolate how various factors may affect the profitability of PAYW. We conclude in Section 6 with suggestions for future research.

2 A Simple Model and Analysis

The use of PAYW for "In Rainbows" album was apparently quite successful financially for Radiohead. According to comScore, a global Internet information provider, 40% of the US downloaders paid an average of \$8.05 for each download, while 36% of worldwide downloaders paid \$6 on average¹. Radiohead subsequently disputed those numbers, hinting that more fans have paid². What is not in dispute is the fact that many loyal fans paid up even though they did not have to and that the low marginal cost for each download was conducive to using such a pricing scheme. Therefore, our modeling will start with two basic factors driving the success of PAYW: fair-minded customers and a low marginal cost. In practice, as pointed out in Cui, et al (2007), firms may also care about fairness. We shall

¹For the original report, see <http://ir.comscore.com/releasedetail.cfm?ReleaseID=273165>.

²According to industry insiders, "even utilizing those figures Radiohead most likely did considerably better financially than if a major label released the album for them." See <http://www.mp3newswire.net/stories/7002/radiohead-comscore.html>.

abstract away from this complication for now and discuss the implications of relaxing this assumption in the concluding section.

Consider a market where a firm (such as Radiohead) sells a product (or album)³. We assume that the firm incurs a marginal production cost of c per unit with $0 \leq c < 1$. To sell the product to consumers, the firm can choose one of two pricing strategies: PAAP or PAYW. We assume that each consumer purchases at most one unit of the product and that each consumer derives a different level of consumption utility from the product, which we denote with r_i . Here, r_i is also consumer i 's willingness to pay for the product. To model consumer heterogeneity, we assume that r is a random variable drawn from a probability density function $\phi(r)$, defined over the domain $[0, 1]$, with the corresponding cumulative distribution function $\Phi(r)$. For now we let r to be distributed uniformly over $[0, 1]$, i.e., $\phi(r) = 1$, and will relax this assumption in Section 4. We normalize the total market size to one and assume that both the firm and consumers are risk neutral. The consumer i 's utility from purchasing a product is given by:

$$u_i = r_i - p_i - \beta \max\{(p_i - r_{i0}), 0\} - \gamma \max\{(r_{i0} - p_i), 0\}, \quad (1)$$

where p_i is the price paid by consumer i , r_{i0} is the fair price perceived by the consumer, and $\beta \geq 0$ and $\gamma \geq 0$ are two positive constants such that $\beta \max\{(p_i - r_{i0}), 0\}$ captures consumer's disutility towards disadvantageous inequality and $\gamma \max\{(r_{i0} - p_i), 0\}$ captures consumer's disutility towards advantageous inequality (Fehr and Schmidt 1999). Note that the existence of a commonly agreed equitable division of surplus in a transaction as discussed in Fehr and Schmidt (1999) implies the existence of a commonly agreed fair price for that transaction. To see this, we note that the total surplus in a transaction in our model is given by $r_i - c$. If the fair share of this surplus for the consumer is $(1 - \lambda)(r_i - c)$, then the fair price r_{i0} that the consumer needs to pay to claim his or her fair share is given by the equation $r_i - r_{i0} = (1 - \lambda)(r_i - c)$. Here, λ is the firm's equitable share of the total surplus. It can also be interpreted as the generosity of the consumer. A consumer with higher λ (i.e., a more generous consumer) implies that the consumer is willing to give the firm a higher share of the total surplus. Then, we have $r_{i0} = \lambda r_i + (1 - \lambda)c$. We shall maintain this definition of the fair price throughout this paper. Note the conceptual difference between γ and λ . The parameter γ only affects the magnitude of disutility from advantageous inequality while the parameter λ affects the fair price perceived by consumer, which influences the disutility from both advantageous and disadvantageous inequality.

³We use the terms product and service interchangeably throughout the paper.

What this utility function captures is inequity aversion on the part of a fair-minded consumer. By this specification, a fair-minded consumer would derive negative utility when she experiences disadvantageous inequity, which occurs when $p_i \geq r_{i0}$, or advantageous inequity, which occurs when $r_{i0} \geq p_i$ (see Fehr and Schmidt 1999 for more details). If $r_i < c$, we will set $r_{i0} = c$. Here, we implicitly assume that consumers know the seller's marginal cost c . This may be a reasonable assumption for online music productions as the marginal cost is very low or zero⁴. Similarly, low or zero marginal costs for information products or museum visits prevail. Of course, in very competitive commodity industries, such costs are also transparent to consumers. Indeed, Internet today has made the costs of many products transparent to consumers as any teardown analysis of a device gets disseminated quickly⁵. We let γ follow a distribution with the corresponding density and cumulative distribution functions of, $h(\gamma)$ and $H(\gamma)$ respectively, with $\gamma < \frac{1}{\lambda}$. This assumption will allow us to endogenize the fraction of consumers who are free-loaders, as we will see shortly⁶.

To sell the product to consumers, the firm can choose one of the two pricing strategies: PAAP or PAYW. When the firm chooses PAAP, it sets a price denoted by p . In this case, as a firm with pricing power, it is never optimal for the firm to set a price such that the marginal consumers pay less than their perceived fair price. If this were not the case, then, the reservation prices for marginal consumers, \tilde{r}_i , would be determined by

$$\tilde{r}_i - p - \gamma_i(\lambda\tilde{r}_i + (1 - \lambda)c - p) = 0, \text{ where } \lambda\tilde{r}_i + (1 - \lambda)c \geq p.$$

However, we can easily show that as long as $p > c$, which must be the case for the firm with pricing power, we must have

$$\tilde{r}_i = \frac{p(1 - \gamma_i) + (1 - \lambda)\gamma_i c}{1 - \lambda\gamma_i} < p, \text{ for all } \gamma_i < \frac{1}{\lambda}.$$

This would then imply $\lambda\tilde{r}_i + (1 - \lambda)c < p$, a contradiction. Thus, the optimal solution occurs with marginal consumers suffering through disadvantageous inequity. Said differently, when the firm behaves optimally, it wants to charge and is charging a price higher than the equitable price. Because of this, the firm is worse off if β is larger, a fact that we will use later to prove our claims. A consumer with r_i will purchase the product at the

⁴We thank AE for making this suggestion.

⁵A good example is how quickly consumers know the cost of iphone 6 that IHS estimated to be between \$200 and \$247 depending on specific models. See <http://recode.net/2014/09/23/teardown-shows-apples-iphone-6-cost-at-least-200-to-build/>

⁶Here, the assumption of $\lambda\gamma < 1$ does allow these two variables to be positively or negatively correlated in the allowable parameter space. However, until the behavior literature suggests specific correlation, we shall maintain this more general parameter space. We thank an anonymous reviewer for clarifying this point.

posted price p if and only if $r_i \geq p + \frac{\beta(1-\lambda)(p-c)}{1+\lambda\beta} = r^*$ and the firm's profits are then simply given by:

$$\pi_u = \int_{r^*}^1 [(p-c)\phi(r)dr]. \quad (2)$$

The expressions for the firm's optimal price and profits under PAAP are given respectively by:

$$p^* = \frac{1+c+\beta(\lambda+2c-c\lambda)}{2(1+\beta)}, \text{ and } \pi_U = \frac{(1-c)^2(1+\lambda\beta)}{4(1+\beta)}. \quad (3)$$

When the firm adopts PAYW, it does not set a price for the product. Instead, each consumer decides the amount she pays. Consumers with valuation $r_i \geq c$ pay zero dollars if $\gamma_i \leq 1$, as the utility from avoiding advantageous inequity for these consumers is always smaller than disutility associated with paying a price. However, they will pay the perceived equitable price r_{i0} if $\gamma_i > 1$. Similarly, consumers with valuation $r_i < c$ pay zero dollars if $\gamma_i \leq 1$ and do not buy if $\gamma_i > 1$. We define $\theta = \int_0^1 h(\gamma_i)d(\gamma_i)$ as the proportion of consumers that do not pay for the product. Note that the consumer's payment is always not larger than r_{i0} and, depending on λ and γ_i , the consumer may pay up to their reservation price r_i ($r_{i0} = r_i$ if $\lambda = 1$). In this case, the firm's profits are given by:

$$\pi_p = \int_c^1 [(1-\theta)\lambda(r_i-c)\phi(r_i)dr_i] - c\theta. \quad (4)$$

Note that the profit function above is not at all related to β . This is because a fair-minded consumer will never pay voluntarily a price higher than the equitable price. If she does, she will suffer on two accounts: the disutility from a higher price and the disutility from disadvantageous inequity! Also note that if $\theta = 1$, then π_p is negative so that PAYW can never be optimal. This suggests that at least some consumers should have $\gamma_i > 1$ for PAYW to be profitable. This is intuitive as $\gamma_i > 1$ implies that a consumer care more about not being unfair to the seller than saving from price paid. We leave the estimate of γ_i and the measure of the segment size of fair-mind consumers (i.e., those with $\gamma_i > 1$) to future empirical research.

The profits for the firm if it adopts PAYW are:

$$\pi_p = \frac{\lambda(1-\theta)(1-c)^2}{2} - c\theta. \quad (5)$$

As the firm adopts the PAYW only when $\pi_p > \pi_u$, we can show that PAYW is optimal if and only if

$$c < 1 - \frac{2\theta(1+\beta) - 2\sqrt{\theta(1+\beta)[\theta(1+\beta)(1-2\lambda) + \lambda(2+\beta) - 1]}}{1 - \lambda[2+\beta - 2\theta(1+\beta)]} = c^*(\beta, \theta, \lambda). \quad (6)$$

Condition (6) offers some quick insights about where PAYW can be a superior pricing mechanism relative to PAAP.

Proposition 1. *At any given θ , β and for sufficient large λ , the marginal cost c must be sufficiently small for a firm to choose PAYW over PAAP. However, a low marginal cost is not a sufficient condition. Even at the zero marginal cost, PAYW will not dominate PAAP as a pricing mechanism if too many of the consumers are freeloaders ($c^*(\beta, 1, \lambda) < 0$).*

Proposition 1 is consistent with our observations that PAYW is mostly used in industries with small marginal costs. It also confirms a very intuitive idea: a firm will adopt PAYW if consumers are sufficiently “fair-minded” in that they are willing to compensate the firm voluntarily even when they do not have to and they feel bad or suffer disutilities when they are not paying an equitable price. Therefore, the success of PAYW will critically hinge on the kind of customers a firm attracts.

We note that the firm’s profits under PAAP decreases with β as we have pointed out before, while the firm’s profits under PAYW is independent of β . This means that we can simplify our analysis hereafter without sacrificing any generality of our substantive conclusions and analyze the case of $\beta = 0$ for two reasons. First, consumers will never voluntarily create this disutility by paying more than the fair price. Second, by setting $\beta = 0$, we simply make PAAP more profitable so that we actually stack the deck against us, showing that PAYW can be chosen over PAAP⁷.

3 Managing Profitability under PAYW

If a firm decides to give PAYW a try, can it do anything further to enhance its profitability? The answer is affirmative. Here we discuss two approaches favored by practitioners: PAYW with the minimum price and PAYW with a suggested price.

3.1 PAYW with the Minimum Price

A firm may adopt PAYW, but with an enhanced feature of the minimum price: setting the lower bound for the price paid, but allowing consumers to pay as much as they wish as long as the payment exceeds this lower bound. For example, the organizers of the 2005 Los-Angeles Human Rights Watch Annual Dinner⁸ announced that “Sponsorship packages

⁷This intuition is readily confirmed in Appendix G where we assume, as in Fehr and Schmidt (1999), $\beta > \gamma > 0$.

⁸See www.hrwcalifornia.org/south/LAdinner2005/dinner2005.htm

start at \$3,000...” Does this minimum price always enhance the firm’s profitability? If it does, how? We investigate these two questions here.

To start, we assume that the firm sets a minimum price, \underline{p} . With the minimum price, freeloaders (θ in size) purchase a unit if and only if their $r \geq \underline{p}$, and must pay the minimum price \underline{p} when making their purchase. Fair-minded consumers ($1 - \theta$ in size) are not affected by the minimum price if $\underline{p} < c$ as only those with $r \geq c$ will make a purchase. However, if $\underline{p} \geq c$, fair-minded consumers buy only if $r \geq \underline{p}$ and pay $\max[c + \lambda(r - c), \underline{p}]$. Thus, there are three relevant intervals we need to consider: $\underline{p} < c$, $c \leq \underline{p} \leq \lambda + (1 - \lambda)c$, and $\underline{p} > \lambda + (1 - \lambda)c$ ⁹

It is easy to see that when $\underline{p} < c$ the firm’s profits increases with \underline{p} , as the buying behavior of fair-minded consumers is not at all affected by the minimum price. Consequently, the firm is better off raising the minimum price toward c . At the other end, when $\underline{p} > \lambda + (1 - \lambda)c$, the firm’s profits are weakly dominated by PAAP, as the firm is effectively charging all consumers the same price. Thus, the only relevant case for finding the firm’s optimal minimum price is where $c \leq \underline{p} \leq \lambda + (1 - \lambda)c$.

Note that PAYW is a special case of PAYW plus the minimum price with \underline{p} set at 0. This means that the firm can never do worse with the option of setting the minimum price if the minimum price is set optimally. Under PAYW plus the minimum price, the firm can force high willingness-to-pay freeloaders to pay the minimum price and screen out the rest who are not willing to pay the price and are a drag for the firm’s profitability. In addition, the firm can collect more payments from those fair-minded customers with $r \in [\underline{p}, \frac{\underline{p} - (1 - \lambda)c}{\lambda}]$ who would have paid voluntarily a price lower than \underline{p} . However, the down side is that PAYW plus the minimum price will also screen out the fair-minded customers with $r \in [c, \underline{p}]$ who would have paid a price higher than the marginal cost c . Therefore, how much setting the minimum price will improve the firm’s profitability will depend on the tradeoffs among these factors.

Under the uniform distribution of r , when $c \leq \underline{p} \leq \lambda + (1 - \lambda)c$, the firm’s profits are

$$\pi_p^{2m} = (1 - \theta) \left[\frac{\lambda(1 - c)^2}{2} + \frac{(1 - 2\lambda)(\underline{p} - c)^2}{2\lambda} \right] + \theta(\underline{p} - c)(1 - \underline{p}). \quad (7)$$

The firm’s problem is to choose the minimum price that maximizes this profit expression. Define $\underline{p} = \frac{\theta\lambda(1 - c)}{2\lambda - 1 + \theta} + c$ as the price that maximizes equation (7). Thus, the following proposition summarizes our analysis.

⁹ $\lambda + (1 - \lambda)c$ is a cutoff point because $\max[c + \lambda(r_i - c), \underline{p}] = c + \lambda(r_i - c)$ can occur only if $\underline{p} \leq \lambda + (1 - \lambda)c$ as we have $r_i \leq 1$.

Proposition 2. *The firm's optimal minimum price when consumers' consumption utilities are distributed uniformly, \underline{p}^* , is $\text{Max}[c, \text{Min}[\underline{p}, \lambda + (1 - \lambda)c]]$. Furthermore, the optimal minimum price increases with the marginal cost c ($\frac{\partial p^*}{\partial c} > 0$), increases with the proportion of freeloaders θ ($\frac{\partial p^*}{\partial \theta} > 0$), and decreases with the generosity of fair-minded consumers λ ($\frac{\partial p^*}{\partial \lambda} < 0$).*

Intuitively, PAYW plus the minimum price is essentially a pricing mechanism that allows the firm to charge the minimum price to freeloaders and variable prices to fair-minded consumers and it is a hybrid instrument that combines PAAP and PAYW. As the firm has more an incentive to charge high willingness-to-pay freeloaders and screen out the rest when c or θ is larger, it will raise the minimum price as stated in Proposition 2. This incentive is only tampered by the fact that a higher minimum price will also screen out more fair-minded consumers, especially when they become more generous. From this perspective, it is easy to see why we have $\underline{p}^* = c$ when $\theta = 0$ as expected, for such a price is not binding for any fair-minded consumers. Furthermore, it is easy to show that we have $\underline{p}^* \leq \frac{1+c}{2}$, the optimal price under PAAP. The lower minimum price would allow the firm to expand the demand among fair-minded consumers.

3.2 Suggested Price

Another common practice is PAYW with a suggested price: a firm does not provide an explicit lower bound for the price, but does post a suggested price. More specifically, a firm may suggest a price but let consumers pay as much as they wish. For instance, The Metropolitan Museum of Art in New York City suggests a donation of \$25 for admission. This pricing mechanism is designed to affect fair-minded consumers. It has no effect on freeloaders, as they will simply disregard the suggestion.

To see how a suggested price may enhance a firm's profitability, we need to modify our previous model and introduce the purchase decision rules for fair-minded consumers when a suggested price, p_s , is present. We assume that with probability z a consumer ignores the suggested price in her decision making. With probability $(1 - z)$, however, a consumer is influenced by suggested price in such a way that she may feel embarrassed for paying less than the suggested price. Therefore, if $c + \lambda(r - c) \geq p_s$, fair-minded consumers pay $c + \lambda(r - c)$; if $c + \lambda(r - c) < p_s \leq r$, with probability z they pay $c + \lambda(r - c)$, and with probability $(1 - z)$ they pay p_s ; if $c + \lambda(r - c) \leq r < p_s$, with probability z consumers purchase the product and pay $c + \lambda(r - c)$, with probability $0.5(1 - z)$ consumers purchase

the product and pay r and with probability $0.5(1-z)$ do not make any purchase at all;¹⁰ if $r < c$, fair-minded consumers do not purchase as before.

Under the uniform distribution of r , when $\frac{p_s - (1-\lambda)c}{\lambda} \leq 1$, the firm's profits are given by the following expression¹¹

$$\pi_s^1 = (1-\theta) \left[\int_{\frac{p_s - (1-\lambda)c}{\lambda}}^1 \lambda(r-c)dr + \int_{p_s}^{\frac{p_s - (1-\lambda)c}{\lambda}} [z\lambda(r-c) + (1-z)(p_s - c)]dr \right. \\ \left. + [z\lambda + (1-z)\frac{1}{2}] \int_c^{p_s} (r-c)dr \right] - \theta c$$

and when $\frac{p_s - (1-\lambda)c}{\lambda} > 1$, the firm's profits are given by

$$\pi_s^2 = (1-\theta) \left[\int_{p_s}^1 [z\lambda(r-c) + (1-z)(p_s - c)]dr + [z\lambda + (1-z)\frac{1}{2}] \int_c^{p_s} (r-c)dr \right] - \theta c$$

The firm's problem under PAYW with a suggested price is to choose the optimal suggested price, p_s , that will maximize the profit functions (π_s^1 and π_s^2). The following proposition summarizes our analysis.

Proposition 3. *The firm's optimal suggested price when consumers' valuations are distributed uniformly is: $p_s = \begin{cases} \frac{2+c}{3} & \text{if } \lambda \leq \frac{2}{3}, \\ c & \text{if } \lambda > \frac{2}{3}. \end{cases}$ The suggested price always increases with the marginal cost c . In addition, a higher price is suggested if fair-minded consumers are not sufficiently generous.*

As shown in Proposition 3, the optimal suggested price is independent of θ . This is expected as the suggested price does not affect the behavior of freeloaders. Proposition 3 also suggests that it can be optimal to set $p_s = c$ when λ is large enough. When $\lambda > \frac{2}{3}$, any suggested price larger than c will cause some fair-minded consumers to drop out of the market and the cost of such drop-outs would be too large relative to any gain from the suggested price. To avoid this cost, the firm can set the suggested price at c so that it does

¹⁰When $p_s > r$, it is possible that those who feel embarrassed for not paying p_s may decide not to purchase at all. However, it is also possible that consumers may feel justifiable to pay r and make a purchase as this is the best the consumer can do. In order to take into account both possibilities, we assume a 50 percents split between these two possibilities. Using other splits of those possibilities significantly complicates the mathematical derivations but will not qualitatively change our results.

¹¹ $c + \lambda(r-c) \geq p_s$ can occur only if $\frac{p_s - (1-\lambda)c}{\lambda} \leq 1$ because $r \leq 1$.

not alter the buying behavior of the fair-minded consumers at all. Then, PAYW with a suggested price is functionally the same as PAYW.

Although PAYW with the minimum price and PAYW with a suggested price can both enhance a firm's profitability, they are clearly not equivalent pricing mechanisms. PAYW with the minimum price, as the analysis in this section shows, targets freeloaders, while PAYW with a suggested price focuses on exploiting fair-minded consumers. Then, how should a firm choose between the two? We answer that question in the following proposition.

Proposition 4. *If fair-minded consumers are sufficiently generous ($\lambda > \frac{2}{3}$), the firm is better off adopting PAYW with the minimum price. If they are not sufficiently generous ($\lambda \leq \frac{2}{3}$), PAYW with the minimum price is optimal if $\theta > \text{Max}\{1 - 2\lambda, \theta^*(z, c, \lambda)\}$;¹² PAYW with a suggested price is optimal if $\theta \leq \text{Min}\{\theta^*(z, c, \lambda), \frac{[(1-c)^2[1-z(4-6\lambda)]]}{[4[1+c+c^2-z(1-c)^2]+6z\lambda(1-c)^2]}\}$ and PAAP is optimal if $\frac{[(1-c)^2[1-z(4-6\lambda)]]}{[4[1+c+c^2-z(1-c)^2]+6z\lambda(1-c)^2]} \leq \theta \leq \text{Min}\{1 - 2\lambda, \theta^*(c, \lambda)\}$.*

Intuitively, what Proposition 4 suggests is that if the fair-minded consumers are sufficiently generous, the focus of a pricing decision maker should be on getting freeloaders to pay through a minimum price. If the fair-minded consumers are not sufficiently generous, the focus should be still on freeloaders if there are a sufficient number of them in the market. If the number is sufficiently low, the firm can still profitably deploy PAYW by focusing on fair-minded consumers and using a suggested price.

Interestingly, our conclusions seem quite consistent with practice based on some casual observations. In political fundraising where there are likely many generous donors as well as many free-loaders who have the capacity to pay, organizers frequently imposing a minimum price as the example at the beginning of subsection 3.1 illustrates. In the case of supporting civic culture and communities, *e.g.* Met and yoga studios, there are likely much fewer true freeloaders¹³. This is also where we observe frequently the usage of a suggested price in conjunction with PAYW¹⁴.

¹²Where $\theta^*(z, c, \lambda) = \frac{2-2z-c[1-2c(1-z)]-4z-5\lambda-\lambda[c(4-5c)+5z(1-c)^2]+3\lambda(1-z)(1-c)^2+B}{2[1+c+c^2-z(1-c)^2]+3z\lambda(1-c)^2}$ and $B = \sqrt{[3c^2 - 2\lambda[1 - z - c[2 - 2z - c(4 - z)]] + 3\lambda 2(1 - c)2(1 - z)][3 - 2\lambda[4 - z - c(2 - c)(1 - z)] + 3\lambda 2(1 - c)2(1 - z)]}$.

¹³Our conjecture that there are more free-loaders in political fundraising as many of them may feel that their mere presence and time spent at the event has already contributed to the candidate as a demonstration of support.

¹⁴See "To Pay or Not to Pay," by Sumanthi Reddy, THE WALL STREET JOURNAL, November 10, 2011. We thank an anonymous reviewer for suggesting this connection.

4 Non-uniform distribution of reservation prices

Up to this point, our analysis has focused on marginal costs, freeloaders, and customer generosity as the determinants for choosing PAYW over PAAP, and on how to improve PAYW if it is chosen. This analysis is conducted under the assumption that consumer willingness to pay is uniformly distributed. However, in reality, consumer distribution is unlikely to be uniform and there can be more consumers with high reservation prices than those with low reservation prices in the market and *vice versa*. Then, to explore the determinants for PAYW further, two questions arise naturally. First, does a firm's incentive to adopt PAYW increase when there is more a concentration of high reservation price consumers? Intuitively, the answer should be affirmative, as a higher reservation price customer has a higher perceived equitable price and hence pays more when she is free to choose what to pay. Second, is it always the case that a higher marginal cost reduce a firm's incentives to adopt PAYW regardless of how consumers are distributed in the marketplace? The answer to this question is also affirmative, on the first blush, as the increase in marginal costs can only increase a firm's cost of adopting PAYW when free loaders are around. We now investigate both questions by specifying a more general distribution function.

Consider, for instance, that consumers' reservation prices are generated from a trapezoid distribution function with $\phi(r) = a + 2(1 - a)r$ and $\Phi(r) = ar + (1 - a)r^2$, where $0 \leq a \leq 2$. Note that when $a = 1$, we recover the uniform distribution. When $a < 1$, we have the case where the firm's customers are more affluent in the sense that more consumers have high reservation prices ($\frac{\partial \phi(r)}{\partial r} > 0$). When $a > 1$, the firm faces more consumers with low reservation prices ($\frac{\partial \phi(r)}{\partial r} < 0$)(see Figure 1).

In order to get more intuition without being hampered by unnecessarily complex expressions, we set $\theta = 0$, i.e., all consumers pay when the firm follows the PAYW strategy. Clearly, this assumption will make PAYW a more attractive pricing mechanism relative to PAAP and hence all conclusions in this section should be interpreted in the context of this assumption¹⁵. However, our analysis here focuses on the distribution of consumers as an incremental determinant, and our conclusions will not be substantively altered as long as free loading is not so severe that PAYW is never selected over PAAP.

With a trapezoid distribution, if the firm adopts PAAP, its optimal price and profit are given by:¹⁶

¹⁵We thank an anonymous reviewer for suggesting this caution.

¹⁶The following apply to cases of $a \neq 1$. The optimal price and profits of PAAP and PAYW for $a = 1$ are given in (3) and (5).

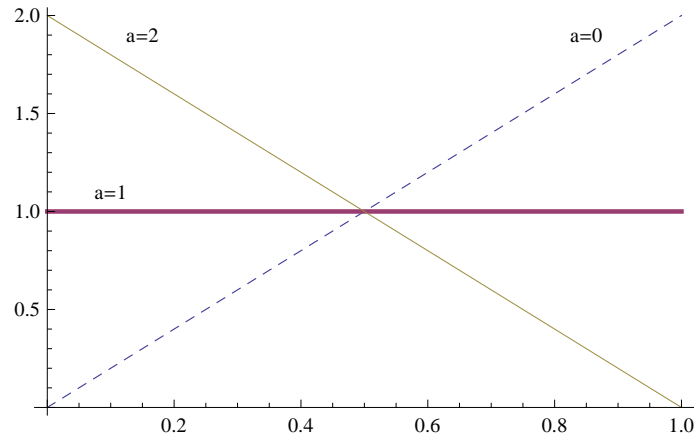


Figure 1: Probability Density Function of Trapezoid Distribution

$$p_u = \frac{(1-a)c - a + Z}{3(1-a)}, \quad \pi_u = \frac{[3 - 2a - c(1-a) + Z][2ac - a - 2c + Z][3 + c - a(1+c) + Z]}{27(1-a)^2}, \quad (8)$$

$$\text{where } Z = \sqrt{[a - (1-a)c]^2 + 3(1-a)(1+ac)}.$$

If the firm adopts PAYW, we can use equation (3) to derive the firm's profit as

$$\pi_p = \frac{\lambda}{6}(1-c)^2[2(2+c) - a(1+2c)].$$

Before we proceed, define

$$\lambda^*(c, a) = \frac{2[3 - c - a(2-c) - Z][a + 2c - 2ac - Z][3 + c - a(1+c) + Z]}{[-9(1-a)^2(1-c)^2[4 - a + 2c(1-a)]]}.$$

A comparison of these two profit functions leads to the following proposition.

Proposition 5. *The firm should adopt PAYW when fair-minded consumers are sufficiently generous ($\lambda > \lambda^*(c, a)$), but should adopt PAAP if they are not ($\lambda \leq \lambda^*(c, a)$). Furthermore, λ^* decreases with a . λ^* decreases with c for $0 \leq a < 1$, but increases with c for $1 < a \leq 2$.¹⁷*

¹⁷The results in Proposition 5 holds also for $\beta > 0$. As expected, λ^* decreases with β because the profits from PAAP decrease with β but the profits from PAYW are invariant with β . Please see Appendices A and G for details.

The first part of Proposition 5 essentially confirms our previous conclusion in Proposition 1 that consumer generosity is conducive to the adoption of PAYW. More importantly, however, the second part of Proposition 5 suggests that how consumers' utilities are distributed, a in our case, is also an important determinant in a firm's pricing choice. Here, we find that it is not a higher concentration of high willingness consumers that is more conducive to the adoption of PAYW, but to the contrary, a higher concentration of low willingness to pay consumers that will motivate the firm to use PAYW. In other words, the greater the concentration of the low willingness to pay consumers, the lower the portion of the value that consumers must transfer to the firm to induce it to adopt PAYW. Interestingly, anecdotal evidence seems to support this conclusion that PAYW tends to be observed, by and large, in markets where there is a concentration of low willingness to pay customers, whether it is for selling music, museum admissions, or food and beverages.

The intuition behind this conclusion is that under PAYW, the firm's demand is $1 - \Phi(c)$, while under PAAP, it is $1 - \Phi(p^*)$. Given that $p^* > c$, this must mean that the demand enhancing effect of PAYW is stronger when a is larger, as more consumers have low consumption utilities in the neighborhood of the marginal cost c , the cutoff point for marginal consumers under PAYW.¹⁸ In other words, a larger a will add more profitable sales as the firm switch from PAAP to PAYW.

Proposition 5 also shows that the effect of changes in marginal costs on the threshold level of λ depends on the level of a . As expected, the adoption of PAYW is less likely (a higher λ^*) if the marginal cost c is larger. However, this happens only when there is a small concentration of high willingness to pay consumers ($a > 1$). When there is a larger concentration of high willingness to pay consumers ($a < 1$), the adoption of PAYW actually becomes more likely (a lower λ^*) as c increases. In other words, a higher marginal cost gives the firm more, instead of less, incentives to adopt PAYW, when more consumers in the market have high willingness to pay. This perhaps explains why in a high marginal cost industry, like in the restaurant business, a firm like *Around the Corner* can profitably use PAYW. The key is to attract a high concentration of high willingness to pay customers!

Intuitively, when $a < 1$, the demand enhancing effect of PAYW becomes stronger when c increases as more consumers are excluded from buying the product under PAAP than under PAYW. Consequently, the firm is more likely to adopt PAYW when $a < 1$ and c

¹⁸Precisely, we have $\Phi(p^*) - \Phi(c) = \Phi\left(c + \frac{1 - \Phi(p^*)}{\phi(p^*)}\right) - \Phi(c) = \frac{1 - \Phi(p^*)}{\phi(p^*)} \phi(p')$ according to the mean value theorem where $c < p' < p^*$ and $p' = \frac{c + p^*}{2}$ under the trapezoid distribution. Because p^* decreases with a as more consumers are in the low end of the consumption utility distribution and $\frac{\phi(p')}{\phi(p^*)}$ increases with a as the curve of $\phi(r_i)$ becomes "steeper" with a increasing, we have $\frac{1 - \Phi(p^*)}{\phi(p^*)} \phi(p')$ increases with a .

increases. We can see this from the fact that there are more consumers in the high end of the consumption utility distribution so that we have $\phi(c) < \phi(p^*)$, where $\phi(c)$ is the marginal demand reduction under PAYW when c increases, and $\phi(p^*)$ is the marginal demand reduction under PAAP when c increases (p^* increases with c). In contrast, $\phi(c) > \phi(p^*)$ when $a > 1$ because there are more consumers at the low end of the consumption utility distribution. Therefore, the demand enhancing effect of PAYW becomes weaker when c increases so that the firm is less likely to adopt it. The above discussion also explains why λ^* is invariant with c when consumers' willingness to pay follows a uniform distribution as $\phi(c) = \phi(p^*)$ in that case.

In summary, the analysis in this section suggests three testable hypotheses. First, when consumers are more generous in that they are willing to let the firm to keep more of the surplus in a transaction, the firm is more likely to adopt PAYW. Second, a higher concentration of low willingness to pay customers are conducive to a firm's adopting PAYW, all else being equal. Third, a higher marginal cost can incentivize a firm to adopt PAYW if there is a concentration of high willingness to pay consumers.

5 Competition

Our analysis so far has shown that the PAYW strategy can be optimal for a monopoly firm. When competition is absent, the PAYW strategy can dominate the PAAP strategy primarily because of the fact that PAYW allows a firm to maximally take advantage of the market demand and to price discriminate among heterogenous consumers. However, it is not clear if in a competitive context, the same incentives would motivate a firm to choose PAYW over PAAP. In their pioneering research, Thisse and Vives (1988) show that firms always have an incentive to choose a flexible pricing policy in a competitive context such that price discrimination by all competing firms is a unique equilibrium. Furthermore, in such an equilibrium, the competing firms are all worse off than if they both choose to set a uniform price, charging all consumers the same price. In this section, we investigate how competition affects a firm's choice between PAYW and PAAP and whether competing firms are always worse off when choosing PAYW. Once again, we avoid the complication of having freeloaders, whose presence will affect whether PAYW will be chosen over PAAP, but not why competition may or may not be conducive to a firm's choice of PAYW.

To do that, we relax the monopoly assumption and assume that there are two competing firms A and B that are located at the two ends of the Hotelling line bounded between zero and one. Both firms (A and B) incur the same marginal costs per unit c . Consumers

are uniformly distributed along the Hotelling line and incur a constant unit transportation costs, t . Thus, a consumer located at x on the Hotelling line incurs a disutility of tx if he purchases the product from firm A and $t(1-x)$ if he purchases the product from firm B. As before, we assume that consumers all have the same consumption utility from the product in the market denoted by V and they are fair-minded as defined before in Equation 1 with $0 \leq \lambda \leq 1$. As before, we shall focus our analysis on the case of $\beta = 0$ ¹⁹.

Competing firms play a two-stage game. In the first stage, each firm to choose one of the two strategies: PAYW (P) or PAAP (U). As each firm has two options for its pricing strategy, there are four subgames: both firms follow the PAAP strategy (UU), both firms follow the PAYW strategy (PP), one firm follows the PAYW strategy and the second chooses the PAAP strategy (PU) and (UP). In the second stage, prices are set independently or realized depending upon the choices in the first stage.

It is straightforward to analyze these four subgames and derive the equilibrium for the competitive pricing policy game²⁰. We summarize our analysis in the following proposition.

Proposition 6. *When consumers are sufficiently fair-minded, i.e. $\lambda \geq \lambda^*$, where $0 < \lambda^* = \frac{4t}{4V-4c-t} < 1$, the unique Pareto dominance equilibrium is for both firms to choose PAYW (PP). If otherwise, both firms choose PAAP (UU)²¹. In the equilibrium where firms choose PAYW, they can both be better off than if they were both to choose PAAP. Furthermore, if the market is less differentiated and hence more competitive (a smaller t), competing firms are more likely to choose PAYW (a smaller λ^*).*

Proposition 6 offers two interesting insights about PAYW as a pricing mechanism. First, PAYW can help a firm to achieve price discrimination as does location-specific pricing discussed in Thisse and Vives (1988). However, by choosing PAYW, a firm does not acquire the same pricing flexibility that the location-specific pricing policy bestows a firm. Said differently, PAYW does not allow a firm to set any price for a specific location at will, as consumers at different locations decide themselves what to pay. For that reason, competing firms do not always choose to price-discriminate through PAYW in our model, while they do in Thisse and Vives (1988) in a bid to acquire pricing flexibility. Second, PAYW can help firms to achieve price discrimination without intensifying price

¹⁹As can be easily seen from Appendix G, assuming $\beta > 0$ does not affect our results below if we assume that the fair price, r_{i0} , of a firm given the price of its competitor is the price that makes a consumer indifferent between buying from the focus firm or buying from the competing.

²⁰The analysis of the four cases are in the Appendix F.

²¹When multiple equilibria exist, we use the Pareto dominance criterion to refine the equilibria

competition, in contrast to location-specific pricing that always worsens price competition as shown by Thisse and Vives. Indeed, PAYW can moderate price competition, as prices in the market become autonomous and competing firms no longer set any prices. For that reason, competing firms may not be caught in a Prisoner's dilemma situation. Also for that reason, the more competitive the marketplace becomes, because of less product differentiation (a smaller t), the more likely it is for competing firms to adopt PAYW. In a more competitive market, a firm simply has more an incentive to surrender its pricing discretion to consumers.

Therefore, it is not surprising that we tend to see PAYW in more competitive industries and during economic downturns.

6 Conclusion

We have shown in this paper that given the right conditions, a firm may very well do better letting consumers to decide how much a product is worth and how much they pay to get the product, instead of posting a price itself. PAYW can dominate PAAP as a pricing mechanism because it, first and foremost, helps a firm to achieve maximum market penetration. By letting buyers to determine the prices they pay, the firm has taken away the last obstacle that a consumer faces in making a purchase. Furthermore, PAYW is also an effective way for a firm to implement price discrimination. Traditionally, price discrimination is achieved through either consumer self-selection or firm targeting. PAYW is essentially an autonomous price discrimination mechanism that allows consumers to pay different prices out of their fairness concerns or conscience. This form of price discrimination has the unique advantage of moderating price competition: competing firms no longer set prices so that they cannot help but competing on factors other than price.

The right conditions we have identified for adopting PAYW are essentially three. First, the existence of fair-minded customers in a market and their sufficient generosity are the necessary conditions for PAYW to be more profitable than PAAP. If all consumers are self-interested and economically rational, PAYW can never be an optimal strategy for selling a product unless, of course, the firm uses PAYW to achieve some other strategic objectives. When these conditions are present, we have shown that the marginal cost of the product needs to be sufficiently small, too, but not necessarily close to zero. A lower marginal cost should allow a firm to tolerate more freeloaders. Second, as PAAP is most effective at exploiting the high end of a demand, while PAYW the low end, it is not surprising that a high concentration of low willingness to pay customers is conducive to a firm adopting

PAYW. For the same reason, in a high-end market where there is a high concentration of high willingness to pay customers, a higher marginal cost should give a firm more an incentive to adopt PAYW in place of PAAP. Third, a highly competitive marketplace is where PAYW is more likely to dominate PAAP. In the extreme case of perfect competition, for instance, competing firms will charge a price equal to marginal costs under PAAP and make zero profit. However, under PAYW, firms cannot and do not compete on price. They make the profit that fair-minded consumers are willing to let them.

Our analysis has also shown that a firm can improve its profitability under PAYW by imposing a minimum price or posting a suggested price. The minimum price can screen out freeloaders while the suggested price can modify the paying behaviors of fair-minded customers. Indeed, from our model, we can see that anything that a firm can do to encourage consumers to become more fair-minded can also achieve the same objective.

Thus, the parsimonious models in our analysis have allowed us to uncover some of the major factors conducive to a firm's choice of PAYW and the improvement mechanisms for PAYW. However, the future research can take at least two intriguing directions, which we have barely scratched the surface here²². First, we have investigated the case where all consumers know the marginal cost of a product. This may not be the case in some industries. A natural question is then how consumer cost uncertainties may affect a firm's incentives to adopt PAYW? Would a high technology company, for instance, have more or less an incentive to adopt PAYW, all else being equal, if consumers have little knowledge about its costs? Second, in our models, we only allow consumers to be fair-minded. In practice, firms can also be fair-minded in some contexts. How could the fairness concern on the part of firms affect their choice of PAYW relative to PAAP? We venture to suggest that both directions promise some good insights into the present and future practice of PAYW.

7 Appendix

A - Proposition 1: Analysis of the case when $\beta > 0$ and r_i follows a uniform distribution:

Under the uniform distribution of r_i , the optimal price and profits of a firm that adopts the PAAP are given respectively by:

$$p^* = \frac{1 + c + \beta(\lambda + 2c - c\lambda)}{2(1 + \beta)}, \text{ and } \pi_U = \frac{(1 - c)^2(1 + \lambda\beta)}{4(1 + \beta)}.$$

²²We thank the review team for this paper to encourage us to think in these directions.

Note that the profits under PAAP decreases with β : $\frac{\pi_u^*}{\partial\beta} = \frac{(1-c)^2(-1+\lambda)}{4(1+\beta)^2} < 0$. The profits for the firm if it adopts PAYW are:

$$\pi_p = \frac{\lambda(1-\theta)(1-c)^2}{2} - c\theta. \quad (9)$$

As the firm adopts the PAYW only when $\pi_p^1 > \pi_u^1$, we can show that PAYW is optimal if and only if

$$c < 1 - \frac{2\theta(1+\beta) - 2\sqrt{\theta(1+\beta)[\theta(1+\beta)(1-2\lambda) + \lambda(2+\beta) - 1]}}{1 - \lambda[2 + \beta - 2\theta(1+\beta)]} = c^*(\beta, \theta, \lambda). \quad (10)$$

B - Proposition 2: In order to find the optimal minimum price we derive the profits $\pi_p^{2m} = (1-\theta)\left[\frac{\lambda(1-c)^2}{2} + \frac{(1-2\lambda)(p-c)^2}{2\lambda}\right] + \theta(p-c)(1-p)$ with respect to price, p . This first order condition yields $p^* = \frac{\theta\lambda - (1-\theta-2\lambda+\theta\lambda)c}{1-\theta-2\lambda} = c - \frac{\theta\lambda(1-c)}{1-\theta-2\lambda}$. Deriving the optimal price with respect to costs yields; $\frac{\partial p^*}{\partial c} = 1 + \frac{\theta\lambda}{1-\theta-2\lambda}$, which is positive for values of $\theta \leq 1-2\lambda$ or $\theta \geq \frac{1-2\lambda}{1-\lambda}$. Deriving the optimal price with respect to θ ; yields $\frac{\partial p^*}{\partial\theta} = \frac{\lambda(1-c-2\lambda+2c\lambda)}{(1-\theta-2\lambda)^2} = \frac{\lambda(1-c)(1-2\lambda)}{(1-\theta-2\lambda)^2}$, which is positive for $\lambda > \frac{1}{2}$ (always true for PAYW to be optimal). Deriving the optimal price with respect to λ ; yields $\frac{\partial p^*}{\partial\lambda} = -\frac{\theta(1-c)(1-\theta)}{(1-\theta-2\lambda)^2}$, which is always negative (as $c < 1$ and $\theta < 1$).

C - Proposition 3: We first find the optimal suggested price that maximizes π_p^{1s} . The first order condition of π_p^{1s} with respect to p_s ; $\frac{\partial \pi_p^{1s}}{\partial p_s}$, yields $p_{1s}^* = c$. The first order condition of π_p^{2s} with respect to p_s ; $\frac{\partial \pi_p^{2s}}{\partial p_s}$, yields $p_{2s}^* = \frac{2+c}{3}$. Comparing these two optimal profit function we get; $\pi_p^{1s}(p_{1s}^*) = -c\theta + \frac{\lambda(1-c)^2(1-\theta)}{2}$ and $\pi_p^{2s}(p_{2s}^*) = -c\theta + \frac{[2+z(3\lambda-2)](1-c)^2(1-\theta)}{6}$. It is easy to see that $\pi_p^{1s}(p_{1s}^*) - \pi_p^{2s}(p_{2s}^*) = \frac{(1-c)^2(1-\theta)(1-z)(3\lambda-2)}{6}$ which is positive for $\lambda > \frac{2}{3}$. Thus, the optimal suggested price is given by $p_s = \frac{2+c}{3}$ if $\lambda \leq \frac{2}{3}$ and $p_s = c$ if $\lambda > \frac{2}{3}$. Note that $\frac{2+c}{3} - c = \frac{2(1-c)}{3} > 0$.

D - Proposition 4: The firm profits when it adopts the PAYW with minimum price are $\pi_p^{2m} = \frac{(1-c)^2\lambda[1-2\theta(1-\lambda)-2\lambda]}{2(1-\theta-2\lambda)}$, the firms profits when it adopts the PAYW with suggested price are $\pi_p^{1s} = \frac{\lambda}{2}(1-\theta)(1-c)^2 - c\theta$, for $\lambda > \frac{2}{3}$ and $\pi_p^{2s} = -c\theta + \frac{[2+z(3\lambda-2)](1-c)^2(1-\theta)}{6}$, for $\lambda \leq \frac{2}{3}$, the firm profits when it adopts the PAAP pricing strategy is $\pi_u^1 = \frac{(1-c)^2}{4}$.

For values of $\lambda > \frac{2}{3}$, $\pi_p^{2m} - \pi_p^{1s} = \frac{\theta[\lambda[4c+\theta(1-c)^2]-2c(1-\theta)]}{2(-1+\theta+2\lambda)}$ which is positive for all values as $\theta > 0 > \frac{c(2-4\lambda)}{2c+\lambda(1-c)^2}$. $\pi_p^{2m} - \pi_u^1 = \frac{(1-c)^2(1-\theta)(1-2\lambda)^2}{4(-1+\theta+2\lambda)}$ which is always positive for $\theta > 1-2\lambda$ (as $1-2\lambda < 0$ for $\lambda > \frac{1}{2}$).

For values of $\lambda \leq \frac{2}{3}$, $\pi_p^{2m} - \pi_p^{2s} = c\theta + \frac{[2+z(3\lambda-2)](1-c)^2(1-\theta)}{6} + \frac{(1-c)^2\lambda[1-2\lambda-2\theta(1-\lambda)]}{2(1-\theta-2\lambda)}$ which is positive for values of $\theta > \theta^*(z, c, \lambda)$. $\pi_p^{2m} - \pi_u^1 = \frac{(1-c)^2(1-\theta)(1-2\lambda)^2}{4(-1+\theta+2\lambda)}$ which is positive for $\theta > 1 - 2\lambda$. $\pi_p^{2s} - \pi_u^1 = \frac{(1-c)^2(1-\theta)[2-z(2-3\lambda)]}{6} - c\theta - \frac{(1-c)^2}{4}$ which is positive for $\theta < \frac{[(1-c)^2[1-z(4-6\lambda)]]}{[4[1+c+c^2-z(1-c)^2]+6z\lambda(1-c)^2]}$.

E - Proposition 5: The firm profits when she adopts the PAYW pricing strategy

are: $\pi_u^1 = \frac{[3-2a-c(1-a)+Z][2ac-a-2c+Z][3+c-a(1+c)+Z]}{27(1-a)^2}$. The firm profits when she adopts the PAAP pricing strategy are $\pi_p^1 = \frac{\lambda}{6}(1-c)^2[2(2+c) - a(1+2c)]$. It is easy to verify that $\pi_u^1 - \pi_p^1 = 0$ for $\lambda = \lambda^*(c, a) = \frac{2[3-c-a(2-c)-Z](a+2c-2ac-Z)[3+c-a(1+c)+Z]}{[-9(1-a)^2(1-c)^2[4-a+2c(1-a)]]}$

F - Proposition 6: We start with the analysis of the scenario where both firms follow the PAAP strategy (*UU*). Assume V is sufficiently large so that the market is always covered. In this case consumer located in x gains surplus of $V - tx - p_1$ if buying the product from firm A and gains surplus of $V - t(1-x) - p_2$ if buying the product from firm B . Firms' A and B profits are $\pi_{uu}^A = (p-c)\tilde{x}$ and $\pi_{uu}^B = (p-c)(1-\tilde{x})$ respectively, where \tilde{x} is the location of a consumer that is indifference between purchasing a unit from firm A or from firm B . It is easy to show that in equilibrium, the price and the firms' profits are given by $p_{uu} = c + t$, $\pi_{uu}^A = \pi_{uu}^B = \frac{t}{2}$.

Next, we analyze the scenario where both firms follow PAYW strategy (*PP*): In this case a consumer located in $x < \frac{1}{2}$ will purchase from firm A as the consumption utility from firm A 's product, $V - tx$, is higher than that from firm B 's product, which is $V - t(1-x)$. This consumer will then pay $c + \lambda(V - tx - c)$ to firm A . Similarly, a consumer located at $x > \frac{1}{2}$ will buy from firm B and pays $c + \lambda(V - t(1-x) - c)$ to firm B . Therefore, firms' profits are $\pi_{pp}^A = \lambda \int_0^{\frac{1}{2}} (V - tx - c) dx$ and $\pi_{pp}^B = \lambda \int_{\frac{1}{2}}^1 [V - t(1-x) - c] dx$ respectively. It is easy to show that $\pi_{pp}^A = \pi_{pp}^B = \frac{\lambda(4V-t-4c)}{8}$.

Finally, we analyze the scenario where firm A follows the PAYW strategy and firm B follows the PAAP (*PU*). Denote a consumer's maximum willingness to pay to firm A given firm B 's price as p_t . p_t is the price that makes the consumer indifferent between buying from firm A and firm B , which is determined by $V - tx - p_t = V - t(1-x) - p_2$ and results in $p_t = t(1-2x) + p_2$. We assume that a consumer will buy from firm A if and only if $p_t \geq c$ and she will pay $c + \lambda(p_t - c)$ if he buys from firm A . This implies that a consumer will buy from firm A if the maximum surplus he can get from firm A and still being fair (i.e., paying at least c) is higher than the surplus she can get from firm B . Then she will give a λ portion of the maximum total surplus from the transaction, $p_t - c$, to firm A if she buys from it. From $p_t \geq c$, we have $x \leq \frac{t-c+p_2}{2t}$. Thus, consumers

with $x \leq \frac{t-c+p_2}{2t}$ buys from firm A while the others buy from firm B. Firms' A and B profits are then given by $\pi_{pu}^A = \int_0^{\frac{t-c+p_2}{2t}} \lambda(p_t - c)dx = \lambda \int_0^{\frac{t-c+p_2}{2t}} [t(1-2x) + p_2 - c]dx$ and $\pi_{pu}^B = (p_2 - c) \left(1 - \frac{t-c+p_2}{2t}\right)$. Solving for the optimal price of firm B, we obtain $p_2 = c + \frac{t}{2}$. Consequently, firms A and B profits are given by $\pi_{pu}^A = \frac{9t\lambda}{16}$ and $\pi_{up}^B = \frac{t}{8}$ respectively.

Because $\pi_{uu}^A \geq \pi_{pu}^A \rightarrow \lambda \leq \frac{8}{9}$, $\pi_{pp}^B \geq \pi_{pu}^B \rightarrow \lambda \geq \frac{t}{4V-4c-t}$, and $\frac{t}{4V-4c-t} < \frac{8}{9}$ as $V > 2t + c$ is required for the full market coverage under *UU* case, we have *UU* to be equilibrium if $\lambda \leq \frac{8}{9}$ and *PP* to be equilibrium if $\lambda \geq \frac{t}{4V-4c-t}$. For *PP* to be equilibrium of Pareto dominance, we need $\pi_{pp} > \pi_{uu} \rightarrow \lambda > \frac{4t}{4V-4c-t}$. Also, $\frac{4t}{4V-4c-t} < \frac{8}{9}$ as $V > 2t + c$. Therefore, *PP* is the Pareto dominance equilibrium if $\lambda > \lambda^* = \frac{4t}{4V-4c-t}$ and *PP* is the unique equilibrium if $\lambda > \frac{8}{9}$. Note that $\frac{\partial \lambda^*}{\partial t} = \frac{16(V-c)}{(4V-4c-t)^2} > 0$.

G- This section reports a numerical study of the PAYW and PAAP strategies analyzed in this paper for values of $\beta > \gamma$. Below are the profits expression of the PAAP and the PAYW strategies when $\beta > 0$ and r_i follows a trapezoid distribution:

$$\pi_u = \frac{[3 - 2a - c(1 - a) + Z][2ac - a - 2c + Z][3 + c - a(1 + c) + Z]}{27(1 - a)^2(1 + \beta)^3(1 + \lambda\beta)},$$

and

$$\pi_p = \frac{\lambda}{6}(1 - c)^2[2(2 + c) - a(1 + 2c)],$$

where,

$$Z = \sqrt{[a - (1 - a)c]^2 + 3(1 - a)(1 + ac)}.$$

We constructed 180 scenarios from all combinations of the following parameters: c (0, 0.2, 0.4, 0.6, 0.8), beta (1.5, 4, 6.5, 9) and a (0, 0.25, 0.5, 0.75, 1, 1.25, 1.5, 1.75, 2). The following tables contain the threshold values of (λ^*) such that for values of $\lambda > \lambda^*$, PAYW strategy is optimal and for $\lambda < \lambda^*$ PAAP strategy is optimal.

c=0:

a			β	
	1.5	4	6.5	9
0	0.353	0.214	0.154	0.12
0.25	0.337	0.203	0.145	0.113
0.5	0.320	0.191	0.136	0.105
0.75	0.303	0.179	0.127	0.098
1	0.286	0.167	0.118	0.091
1.25	0.269	0.156	0.109	0.084
1.5	0.256	0.146	0.103	0.079
1.75	0.246	0.140	0.098	0.075
2	0.242	0.138	0.096	0.074

c=0.2:

a			β	
	1.5	4	6.5	9
0	0.332	0.199	0.142	0.110
0.25	0.322	0.192	0.137	0.106
0.5	0.311	0.184	0.131	0.101
0.75	0.299	0.176	0.124	0.096
1	0.286	0.167	0.118	0.091
1.25	0.272	0.157	0.111	0.085
1.5	0.258	0.148	0.104	0.080
1.75	0.247	0.141	0.099	0.076
2	0.242	0.138	0.096	0.074

c=0.4:

a			β	
	1.5	4	6.5	9
0	0.315	0.187	0.133	0.103
0.25	0.310	0.183	0.130	0.101
0.5	0.303	0.179	0.127	0.098
0.75	0.295	0.173	0.123	0.095
1	0.286	0.167	0.118	0.091
1.25	0.275	0.159	0.112	0.086
1.5	0.262	0.151	0.106	0.082
1.75	0.249	0.142	0.100	0.077
2	0.242	0.138	0.096	0.074

c=0.6:

a			β	
	1.5	4	6.5	9
0	0.303	0.179	0.127	0.098
0.25	0.300	0.176	0.125	0.097
0.5	0.296	0.174	0.123	0.095
0.75	0.292	0.171	0.121	0.093
1	0.286	0.167	0.118	0.091
1.25	0.278	0.161	0.114	0.088
1.5	0.267	0.154	0.108	0.084
1.75	0.253	0.145	0.102	0.078
2	0.242	0.138	0.096	0.074

c=0.8:

a			β	
	1.5	4	6.5	9
0	0.293	0.172	0.122	0.094
0.25	0.292	0.171	0.121	0.0935
0.5	0.291	0.170	0.120	0.0929
0.75	0.289	0.169	0.119	0.0921
1	0.286	0.167	0.118	0.091
1.25	0.281	0.164	0.116	0.0892
1.5	0.275	0.159	0.112	0.0865
1.75	0.262	0.151	0.106	0.0815
2	0.242	0.138	0.096	0.0741

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