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Pay-what-you-want because I do not know how much to charge you[☆]



José F. Tudón M.

Department of Economics, The University of Chicago, 1126 E. 59th St., Chicago, IL 60637, United States

HIGHLIGHTS

- The paper presents an economic rationale behind pay-what-you-want pricing.
- Sellers prefer pay-what-you-want when demand uncertainty is high.
- The result depends on the existence of any positive fraction of altruists.
- In some cases, pay-what-you-want trumps monopoly or any other pricing mechanism.

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ABSTRACT

With any positive fraction of altruistic consumers in the population who give away any positive fraction of their gains from trade, there exists a high enough level of uncertainty about demand such that the monopolist prefers pay-what-you-want over the traditional monopoly or any other pricing mechanism. Low marginal costs facilitate the adoption of pay-what-you-want. Consumer welfare always increases with pay-what-you-want.

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1. Introduction

Pay-what-you-want is a pricing mechanism in which the producer allows the consumer to choose the price she pays for a given product. Should the price be too low, the producer cannot refuse to sell. Because standard economic theory predicts that consumers will choose to pay zero, if a producer chooses pay-what-you-want, she exposes the firm to the risk of bankruptcy. Therefore, standard theory cannot explain that, in practice, consumers do not pay zero and that firms actually implement pay-what-you-want.

Indeed, pay-what-you-want is being implemented successfully in several markets. Some examples include the rock band

Radiohead and the Magnatune record label (Regner and Barria, 2009), the Google answer service (Regner, 2009), restaurants, snack bars, and cinemas (Kim et al., 2009, 2010; Riener and Traxler, 2012), and sales campaigns of hotels and travel agencies (Gautier and van der Klaauw, 2012; León et al., 2012). However, because the characteristics of those markets (and levels of success) run the gamut, researchers have struggled to develop a theoretical framework that allows us to assess (i) under which conditions pay-what-you-want is optimal for producers and (ii) what are its welfare implications.

This paper posits that under a high enough level of uncertainty about demand, a monopolist producer prefers the pay-what-you-want mechanism over the traditional monopoly. Moreover, low marginal costs facilitate the adoption of pay-what-you-want. I briefly address the behavior of the consumer and discuss how consumer welfare increases while output may extend beyond efficiency. Thus, pay-what-you-want becomes appropriate for markets in which the good's valuation is uncertain but consumer welfare trumps overproduction.

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E-mail address: jtudon@uchicago.edu.

2. The model

Suppose that a monopolist produces a single homogeneous good with marginal cost c in a market with a large number of consumers with unknown demand. The monopolist must decide how to price its product to maximize profits. The monopolist chooses between two mechanisms: either the traditional monopoly or pay-what-you-want.¹

On the consumer side, I assume that when the consumer faces pay-what-you-want, she will give away part of her gains from trade. The economics literature has documented numerous examples that support this assumption. Either in field experiments (Gneezy et al., 2010, 2012), laboratory experiments (Schmidt et al., 2014) or in the real world (see Section 1), the fact remains that people do pay positive prices when they are not required to. As the origins of this behavior, some authors have suggested altruism, warm glow, social pressure, social norms and traditions, charitable giving, moral concerns or supporting the cause.² I focus on altruism but other behaviors will be discussed later on as extensions of the analysis. Formally,

Assumption 1. If the monopolist chooses pay-what-you-want, the consumer gives away a fraction $\theta \in (0, 1]$ of her gains from trade.

I also assume that when the consumer does not face pay-what-you-want, she behaves as a rational, standard homo economicus. Schmidt et al. (2014) find evidence that supports the assumption by analyzing pay-what-you-want in a laboratory experiment where consumers face posted price firms and pay-what-you-want firms. The authors discover that consumers switch their behavior according to the market structure. More precisely,

Assumption 2. If the monopolist chooses the traditional monopoly, the consumer behaves rationally.

The monopolist is uncertain about demand, which may be subject to shocks. Define inverse demand as $D(q, \alpha)$, where the shock α is distributed according to F with mean μ and variance σ^2 .

The main result of this paper is that for any level of altruism, small as it may be, there exists a high enough level of uncertainty such that the monopolist prefers pay-what-you-want over the traditional monopoly. More formally,

Theorem 1. With linear demand, for any altruism level $\theta \in (0, 1]$, there exists a high enough σ^2 such that the expected profits from pay-what-you-want are higher than that of the traditional monopolist.

While it seems trivial that the monopolist prefers pay-what-you-want because the consumer gives away money, note that the result holds for any level of altruism.³

Proof. As a first case, let demand be $D(q, \alpha) = \alpha - q$, which can be interpreted as uncertainty about the size of the market or about willingness to pay. Note that pay-what-you-want expected profits are equal to:

$$\pi^{pwyw} = \int \frac{\theta}{2} (\alpha - c)^2 dF(\alpha) = \frac{\theta}{2} [\sigma^2 + (\mu - c)^2]. \quad (1)$$

On the other hand, a risk-neutral traditional monopolist must choose q_m to maximize expected profits $\pi^m = \int q(\alpha - q - c)dF(\alpha) = \mu q - q^2 - cq$. Therefore, the monopolist sets

$$q^m = \frac{\mu - c}{2} \Rightarrow \pi^m = \frac{\mu - c}{4}. \quad (2)$$

Fix any $\hat{\theta} \in (0, 1]$, and define $\hat{\sigma}^2 \equiv (\mu - c)(2\hat{\theta})^{-1} - (\mu - c)^2$. Thus, if $\sigma^2 \geq \hat{\sigma}^2$ then $\pi^{pwyw} > \pi^m$, and the monopolist prefers pay-what-you-want over the traditional monopoly.

As a second case, let $D(q, \alpha) = 1 - \alpha q$, which can be interpreted as uncertainty about the elasticity of demand. In this case,

$$\pi^{pwyw} = \frac{\theta(1-c)^2}{2} \int \frac{1}{\alpha} dF(\alpha) \approx \frac{\theta(1-c)^2}{2} \left[\frac{1}{\mu} + \frac{\sigma^2}{\mu^3} \right], \quad (3)$$

where the approximation comes from a Taylor expansion. Analogously to the first case, $\pi^m = q - \mu q^2 - cq$, which is maximized at

$$q^m = (1-c)/2\mu \Rightarrow \pi^m = (1-c)^2/4\mu. \quad (4)$$

Fix any $\hat{\theta} \in (0, 1]$, and define $\hat{\sigma}^2 \equiv \mu^2/2\hat{\theta} - \mu^2$. Thus, if $\sigma^2 \geq \hat{\sigma}^2$ then $\pi^{pwyw} > \pi^m$. Therefore, pay-what-you-want can be supported in equilibrium with high enough uncertainty. \square

Intuitively, as the variance increases, the firm will consistently overshoot and undershoot the optimal monopoly price. In contrast, if the firm chooses pay-what-you-want, profits auto-regulate because they follow closely the movements of demand. Remarkably, Eqs. (1) and (3) show that pay-what-you-want profits are increasing in the variance of demand.⁴ Thus, pay-what-you-want buffers negative shocks while exploiting positive shocks.⁵

Finally, Theorem 1 gives us an additional insight about marginal costs. Comparing Eqs. (1) and (2), we can see that the marginal cost decreases the pay-what-you-want profits in a quadratic fashion while only linearly for the monopoly. But this difference only holds for the first case, uncertainty about the size of the market, because for the second case, uncertainty about the elasticity, the marginal cost appears quadratically both in Eqs. (3) and (4). Thus, when the willingness to pay is difficult to predict, we should expect firms with low marginal costs to use pay-what-you-want. This explains why we see pay-what-you-want in the music or videogames digital industries but not in the luxury sports cars industry.

Corollary 1. When willingness to pay is uncertain, low marginal costs facilitate the adoption of pay-what-you-want.

3. Relationship to Segal's optimal pricing mechanism

Segal (2003) adds a layer of uncertainty by studying the case of a monopolist that is not only uncertain about demand but also uncertain about the distribution of demand. As Segal (2003) pointed out, "the optimal pricing mechanism in this situation sets a price for each buyer on the basis of the demand distribution inferred statistically from other buyers' bids". In the simple case in which the sellers marginal cost is constant, the optimal mechanism

⁴ Though Chao et al. (2015) consider a different model, they show the exact opposite: pay-what-you-want profits decrease when demand uncertainty increases. However, their result stems from uncertainty not about the willingness to pay but about an exogenous reference point, to which consumers want to conform.

⁵ Segal (2003) characterizes the optimal auction with a known demand distribution, and shows that it can normally be represented as the Vickrey–Groves–Clarke mechanism in which the seller manipulates her supply curve in a way that depends on the demand distribution. Because pay-what-you-want profits are increasing in uncertainty, Segal's pricing mechanism may be dominated by pay-what-you-want. See Section 3.

¹ Segal's optimal pricing mechanism will be discussed in Section 3.

² See Fehr and Schmidt (2006) for a survey and also Azar (2007) for a review of the related tipping literature.

³ Implicitly in this theorem, I also assume that the marginal cost is not prohibitively high as to eliminate all gains from trade in equilibrium.

offers each buyer the optimal monopoly price against the demand curve inferred from other buyers' bids.⁶

However, in Segal's optimal pricing mechanism, "with a small number of buyers, the seller's Bayesian prior affects her posterior beliefs about the distribution of valuations, and thereby optimal pricing. The optimal mechanism is thus still not completely "detail-free" in the sense of Wilson (1987)—the dependence on the seller's prior is simply pushed to a higher level".

In the present context, uncertainty about the distribution of demand requires a Bayesian prior about the mean and variance of the demand shock. From Eqs. (1) and (3), the expected profits from pay-what-you-want are increasing in the variance of the demand shock. Therefore, the seller's prior of the variance will determine if pay-what-you-want profits dominate Segal's optimal mechanism profits. In other words, if the monopolist believes that demand is highly uncertain, pay-what-you-want constitutes the optimal pricing mechanism.

Besides the preceding discussion, there is a second reason that further rationalizes pay-what-you-want as the optimal pricing mechanism: pragmatically, Segal's optimal pricing mechanism is difficult to implement. By requiring extensive knowledge on the buyers' bids, Segal's mechanism implicitly demands for sophisticated economics agents. On the other hand, pay-what-you-want is easier to understand and to instrument.

4. Extensions and welfare

This paper assumes that consumers are altruistic because they give away part of their gains from trade.⁷ Still, we can also think about other behavioral types of consumers to which this analysis extends.

Warm glow consumers, for instance, pay positive prices because they enjoy doing so. But, because the price they choose to pay does not depend on their valuation of the good, the pay-what-you-want profits does not depend on the variance of demand.⁸ Therefore, pay-what-you-want cannot be rationalized in a population consisting of only warm glow consumers. Nonetheless, as a corollary of Theorem 1, if there are altruistic consumers in the population, the monopolist may prefer to set pay-what-you-want when she is uncertain about overall demand.

Corollary 2. *If there is any positive proportion of altruistic consumers in the population, who give away any positive fraction of their gains from trade, then there exists a high enough level of uncertainty that makes the monopolist prefer pay-what-you-want over the traditional monopoly.*

By the same token, the same can be said about other behavioral types of consumers. While the literature describes several, sometimes complex, behavioral types, we can abstract from the plethora of individual thinking by classifying consumer types into broad behaviors. In particular, suppose that consumers can be roughly organized into "true", "zero" and "fixed" consumers. True consumers are simple consumers that always pay their true

valuation; if they think that the good is worth \$10, they will pay \$10. Zero consumers behave equally simple by paying always zero; they represent the homo economicus. Finally, the fixed consumer always pays a fixed price; for example, they will always pay \$5 to download a CD as long as they believe it is worth more than \$5.⁹ We assume that these three simple behavioral types summarize the rest of consumers that we observe in the world.

However, we do not need to get into detail with any of these behavioral types since the altruistic type and the warm glow type commensurate all three of them. An economy with altruistic consumers that give away a fraction θ of their gains from trade corresponds to an economy where a fraction θ of the population is a true consumer, while the rest are zero consumers. Moreover, the warm glow consumer is a special case of a fixed consumer. Therefore, Corollary 2 holds.

On the welfare side, by the weak axiom of revealed preference, the consumers must be better off with pay-what-you-want. Moreover, with consumers that give away a fraction of their gains from trade, output reaches the efficient level. On the other hand, with other types of consumers, such as the warm glow type, production could increase beyond the (traditional) social optimum because the warm glow factor increases the willingness to pay. Consumers will still be better off but a central planner would balance overproduction and consumer welfare.

5. Concluding remarks

Pay-what-you-want can be rationalized as an optimal pricing strategy for sufficiently high levels of uncertainty of demand. Low marginal costs facilitate its adoption. Moreover, when the monopolist chooses the pay-what-you-want mechanism, consumer welfare increases. Finally, pay-what-you-want becomes appropriate with consumer goods for which overproduction is not an issue (museums or public goods, for example) but for which the valuation is uncertain.

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⁶ Note that the pay-what-you-want mechanism cannot be included in the standard theory of mechanism design and is therefore not considered by Segal's analysis.

⁷ One might also consider strategic buyers who give away a fraction from their gains from trade to keep a pay-what-you-want seller in the market. However, when the number of consumers grows to infinity, such strategic reasons fade away.

⁸ In a simple model, the utility of a warm glow consumer can be modeled as $u = v - p + g(p)$, where the valuation v is random and $g(p)$ is an homogeneous warm glow component ($g'(p) > 0$). Thus, g increases the willingness to pay but is not correlated with the valuation. See Andreoni (1989) or Andreoni (1990) for a more general theory of warm glow. Feddersen and Sandroni (2009) offers a literature review.

⁹ As with the warm glow consumer, there is an implicit assumption. According to Gneezy et al. (2012), "individuals feel bad when they pay less than the 'appropriate' price, causing them to pass on the opportunity to purchase the product altogether". Consequently, I conservatively assume that consumers do not buy whenever their valuation is below the price they would like to pay.

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