The Pay-What-You-Like Business Model: Warm Glow Revenues and Endogenous Price Discrimination

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Abstract

We explore the potential benefits of an up-and-coming business model called "pay-what-you-like" in an environment where consumers experience a warm glow by patronizing a particular firm. We show that, given a social norm regarding minimum contributions, a pay-what-you-like firm should announce a minimum suggested contribution, which is positive—but smaller than the profit-maximizing single price—so as to benefit from "endogenous price discrimination," whereby consumers differentially contribute more than the suggested minimum. Furthermore, a pay-what-you-like scheme can improve market efficiency by drastically reducing deadweight loss relative to a single price scheme. These results are robust to alternate motivations for generosity, including gift-exchange.

JEL Classification: L11, D42, D03, D64

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1 Introduction

Within the last year several news sources documented instances of an up-and-coming business model called "pay-what-you-like". The most publicized example occurred when Radiohead announced that their album *In Rainbows* could be downloaded at whatever price fans deemed reasonable. Restaurants, rental accommodations, and soccer clubs are also among those employing this business model. In fact, one pay-what-you-like Australian restaurant, Lentil as Anything, has expanded their enterprise from one to six locations since 2000 (Mantzaris, 2008). A recent and also highly publicized foray with the pay-what-you-like pricing scheme

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occurred when Panera Bread Company launched the "St. Louis Bread Company Cares Cafe" in Clayton, Missouri earlier this year (Horovitz, 2010).[1]

Some suggested that sales from the Radiohead album represented a new paradigm for the economics of album sales, but their success must also be attributed to how much the fans value the band itself (Ferguson, 2007). Therefore, the success of Radiohead and other pay-what-you-like (PWYL) firms contains an observation often overlooked by neoclassical theory: individuals not only care about the benefit they receive from a good, but, also that they are giving money to a particular enterprise. We will hereafter use the term "firm" broadly to apply to profit and not-for-profit corporations, individual proprietorships, partnerships, informal charities, and so forth.

While the PWYL pricing scheme will certainly not supplant more traditional pricing schemes, we will present a rational choice model to examine its viability that builds on a customer's distinct values over the firm's product and for the firm itself. Specifically, we will argue that, while the success of PWYL may vary from case to case, the PWYL firm is not destined to failure. Instead, we derive circumstances in which a PWYL firm can exceed the profits of a related, more traditional monopoly benchmark.

One approach to a PWYL firm would literally be that a publicly available donation box would provide any customer with the legal right to claim one unit of a good, e.g. a cup of coffee, for any donation $x \geq 0$. If an individual's valuation of a cup of coffee consisted of the usual intrinsic valuation, v_i, then the degenerate result would occur that everyone with $v_i > 0$ would claim a cup of coffee for free. Our model is more sophisticated in two respects. First, we separate the intrinsic valuation for the product itself, v_i, from a warm glow from doing business with the firm.[2] There are at least three reasons why the dual value might be appropriate:

1. Group identity: Customers develop ties to the firm as part of their identity, which they express by purchasing the firm's product.

2. Charitable support: Customers have an additional value over related charitable activities of the firm.

3. Existence support: Customers have the desire for the continued existence of the firm for its own sake. This could include customer values over future consumption possibilities or direct preferences over the

[1] The theory for this paper was written prior to Panera adopting this pricing scheme in Clayton, Missouri. In section 2, we formulate our theory based on a "minimum suggested contribution," while Panera primes customers by handing them a receipt with the dollar amount customers are charged at a more conventional Panera restaurant. Our presentation continues with a minimum suggested contribution, but we believe that the method used by Panera, as well as several others methods, are viable ways for pay-what-you-like firms to operationalize the opportunity for endogenous price discrimination, and the qualitative results we present are unchanged.

[2] The term "warm glow" (popularized by Andreoni [1990]) suggests that consumers gain utility from the act of patronizing a particular firm. In our model, warm glow is obtained *only* by patronizing the firm and cannot be achieved by an isolated donation. The assumption that individuals' incentives to donate are tied to receiving something in return is supported emprically by Karlan and List (2008) and Falk (2007).

attributes of the owners (the "buy local" movement being an example of the latter).[3]

Secondly, we note that many PWYL pricing schemes adopt a "suggested donation." We believe that the existence of an explicit requested level of contribution suggests an in-place social norm for firms using PWYL.[4] Since our goal is to accurately model this institution, we will incorporate the underlying social norm that most[5] individuals will not claim a unit of the product without donating at least the amount suggested by the firm. In our model, because there is heterogeneity in the way that customers value the product and value the firm, some consumers will rationally make a donation which is *greater than* the suggested donation of the firm, while others contribute exactly the suggested donation or nothing at all. We call this phenomenon "endogenous price discrimination."[6] This differs from traditional first-degree price discrimination in that it does not depend upon the firm negotiating and extracting the maximum trading surplus from each customer on each unit.

Ours is not the first study of the PWYL business model. In a series of three field experiments, Kim, Natter, and Spann (2009) found that while there is substantial variation in the amounts paid, all consumers gave a positive amount when asked to pay what they like as compensation for eating at a lunch buffet at a Persian restaurant, watching a movie at a cinema, or drinking a hot beverage. Furthermore, PWYL generated significantly more revenue than a posted-price benchmark for the Persian restaurant, but less revenue than the posted-price benchmark for the cinema.[7] We believe that the success of the Persian restaurant, and not the cinema, suggests that characteristics of a firm itself, and the way its clientele values those characteristics, are key factors in the profitability of PWYL.

To the best of our knowledge, all previous studies of the PWYL business model involve a firm whose only decision is to decide whether or not to use PWYL. In these models, the firm has no control over the contributions of consumers because they are determined by exogenous parameters such as the reference price consumers have for the good in question and certain parameters of the consumers themselves concerning how

[3] In a work concurrent with ours, Fernandez and Nahata (2009) construct a model whereby the existence value of consumers alone can support a Pay What You Like firm. Instead of a warm glow or a minimum contribution norm, they model two consumers who are motivated to contribute to a firm in order to make beneficial future interactions more likely. We choose to model existence value as part of a consumer's warm glow, because we believe a market with many self-interested consumers would instead be characterized by free-riding behavior, since the likelihood of any one consumer's contribution being pivotal to the existence of the firm would be small.

[4] There is empirical support for the idea that minimum contribution norms can develop based on explicit suggestion (Galbiati and Vertova, 2010) or information about the past contributions of others (Shang and Croson, 2005).

[5] For the purposes of analysis, we will assume that *all* individuals will adhere to the minimum contribution norm in Sections 2 and 3. We postpone the analysis of the inclusion of free-riders (those who consume the good without paying for it) until Section 4.

[6] Coffee shops commonly use other forms of price discrimination, such as non-linear pricing (McManus, 2007), which we abstract away from in the model by having a single homogeneous good.

[7] Obtaining data from a survey, Kim, et al (2009) find that consumers pay more when they have a higher reference price for the good, when their income is higher, and when they have a higher level of self-reported satisfaction, price consciousness, fairness, loyalty to the firm, and altruism. In our model, we will say that these factors are incorporated into the consumer's intrinsic valuation of the good, v_i, if they interact with the consumer's value for the product itself (e.g., satisfaction). The remaining characteristics (e.g., loyalty) will in part determine the way that a consumer experiences a warm glow from doing business with the firm.

much less than the reference price would like to pay.[8] However, we believe that a suggested donation is a valuable tool for a PWYL firm to use, and our model is novel in that we allow a PWYL firm to endogenously choose a suggested donation for their product. This suggested donation may in turn affect the reference price for the good in the minds of consumers by signalling to them what is an appropriate payment for the good or how much is needed from them in order to cover the firm's costs. For the remainder of this paper, we will model a PWYL firm which may or may not have charitable motivations, but is nonetheless a profit maximizing enterprise[9], whose only task is to find the profit-maximizing suggested donation.

In Section 2 we formalize the model, including the nature of consumer preferences and the rational choice implications of these consumers operating in a world of a minimal acceptable contribution norm. Following that, we explore alternate profit maximization scenarios for the firms that take the rational decisions of warm glow consumers into account. We characterize the optimal minimum suggested donation and specifically compare it to a naïve benchmark in which a firm, not understanding the difference between customers' intrinsic and warm glow values, attempts to behave like a traditional single-price monopolist. In Section 3 we use specific market examples to demonstrate that 1.) a PWYL firm can earn more revenue and generate more efficient outcomes than a traditional firm, and 2.) a profit-maximizing PWYL firm should choose a suggested minimum donation which is below the monopoly benchmark price. In Section 4 we will model the inclusion of free-riders in the market and show that this may have a critical role in determining the profitablity of a PWYL firm, even though many qualitative results of our model still hold. Finally, in Section 5 we briefly discuss some extensions such as a "gift exchange" motivation for the model.

2 A Theory of the Warm Glow of Patronization

In this section, we consider a scenario where a group of N consumers receive a warm glow from patronizing a socially-conscious, yet profit-maximizing, monopolist. In other words, for a consumer, i, with an intrinsic value of $v_i \geq 0$ for the good in question, we add a "warm glow" value of α to the consumer's utility if she receives the good from this particular firm. However, common sense tells us that the amount of warm glow received should depend on the amount of money contributed to the firm, because, for example, buying a good at cost does not *help* the firm at all. For simplicity, we assume that each consumer's utility is quasi-linear in money, which enables us to directly compare v and α to the money contributed to the firm. Specifically,

[8] In Section 5 we examine the consequences of an exogenous reference price for a firm who uses PWYL, where the firm can benefit from the fact that consumers reciprocate after being given the ability to pay a low price by returning some of that surplus to the firm.

[9] Following Norton (2008) we posit that not-for-profit enterprises may nevertheless maximize retained earnings; they are simply prohibited from distributing those earning to shareholders.

consumer i's utility is given by

$$u_i(x) = \begin{cases} v_i + \alpha(x) - x & \text{if the good is received} \\ 0 & \text{otherwise} \end{cases} \tag{1}$$

where $\alpha(x)$ is the warm glow received by donating x to the firm and receiving the good, and here it becomes clear that a consumer will donate and receive the good if the total benefit exceeds the cost.

2.1 Functional Form of Warm Glow

In our model, we will assume that consumers experience a warm glow when their contribution to a worthy cause is greater than what might be reasonably expected of them, either by themselves or others. We must therefore determine a reasonable expectation for how much a consumer would give to a PWYL firm. In our model, we adopt the commonly observed practice of PWYL firms using a "suggested donation" to the firm in exchange for one unit of the good. We will call this value ρ, and ρ will generally serve as the level of contribution which consumers feel they are expected to give.[10] If this is the case, then the consumers receive a warm glow based only on the part of their contribution which is greater than ρ, because it is precisely this amount which they perceive to be beyond their expected donation.

There is, however, an important exception to the rule that ρ serves as the baseline donation beyond which a warm glow is received. When the consumer's intrinsic value of the good, v_i, is less than ρ, then the consumer is likely to feel differently about their contribution. Specifically, since the consumer is only willing to pay v_i for the good itself, any contribution to the firm in excess of v_i is seen as a "gift" to the firm, whether or not such a gift could be considered part of some expected donation. Regardless of the suggestions made by the firm and the corresponding norm created by those suggestions, a consumer of this type will receive a warm glow based only on the part of their contribution which is greater than v_i, because the consumer would not have been willing to spend more than v_i for the good were they to buy it from another firm.

For simplicity, we will use the same terminology to describe a consumer who receives warm glow because their contribution exceeds the suggested donation and a consumer who receives warm glow because they are contributing more than their intrinsic value for the good itself. That is, we will define the amount $\min\{v_i, \rho\}$ as **compensation** for the good, and the amount $x - \min\{v_i, \rho\}$ as a **gift** to the firm, despite the fact that this interpretation only directly applies to the latter type of consumer. We can now describe the warm glow

[10] For the remainder of this paper, we will refer to ρ as the firm's "suggested minimum contribution" in order to emphasize the fact that donations in excess of ρ are welcome. We believe that firms might, in practice, use language which indicates this fact to the consumers, rather than language which connotes a (suggested) posted price.

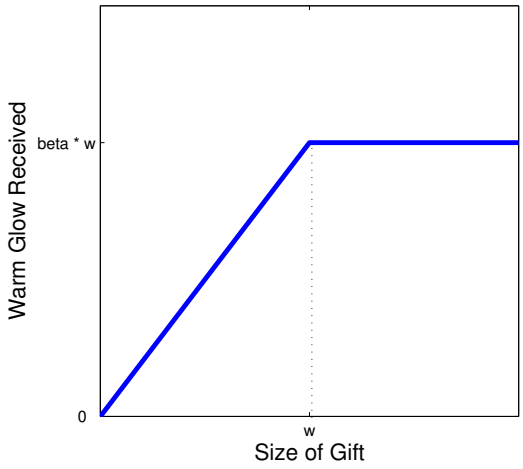

Figure 1: The Amount of Warm Glow Received as a Function of Gift Size

received by consumers as a function of their gift size.

While there are a host of different functional forms that warm glow could take in our model, we will henceforth make the simplifying assumption that warm glow, $\alpha(x)$, increases at a constant rate of $\beta > 1$ as a consumer increases the size of her gift.[11] In other words, for the cost of one dollar's worth of utility, a consumer can increase their utility from warm glow by β, which gives rational consumers an incentive to contribute more than the suggested donation of ρ. However, while we seek to model generous consumers, we are not talking about consumers who completely empty their wallets into the donation box every time they enter the store, as this specification alone would suggest. Rather, each consumer has an intrinsic value of $w_i \geq 0$, which we refer to as a **warm glow satiation point.** We can interpret w_i as the maximum gift that consumer i is willing to give to the firm and still receive an increasingly large warm glow.

Warm glow is therefore equal to β times the size of the gift, with the restrictions that 1.) warm glow cannot exceed βw_i and 2.) warm glow is equal to zero if $x < \rho$. More formally, we have the following definition:

Definition 1 *The **warm glow** of consumer i, with an intrinsic value of v_i, warm glow satiation point of w_i, who contributes $x \geq \rho$ to a firm whose suggested minimum contribution is ρ, is equal to $\alpha(x)$, where*

$$\alpha(x) = \beta * \min\left\{\left[x - \min\{v_i, \rho\}\right], w_i\right\}$$

[11] We believe that a piece-wise linear warm glow function is a good approximation of the utility received from donating to a worthy cause. If instead, $\alpha(x)$ is allowed to be any bounded, positive, concave function with $\alpha'(x) \geq 1$ for gift values below the satiation point, then the qualitative results of our model still hold.

2.2 Determining the Contributions of Consumers

Since the firm is profit maximizing, it is concerned with the largest amount that any particular consumer might contribute. Let z_i equal consumer i's willingness to pay. Then

$$z_i = v_i + \beta w_i \tag{2}$$

because a consumer will never contribute more than their value of the good plus their maximum warm glow. The values of v_i and w_i are common knowledge[12] and the parameter β is exogenous and fixed, which means the firm perfectly knows each consumer's willingness to pay. However, we will assume that is it not feasible for the firm to use first-degree price discrimination to extract the entire surplus from the market because such technology is not feasible or appropriate. Instead the firm can make use of a pay-what-you-like strategy and choose a minimum suggested contribution, ρ, so as to benefit from the endogenous price discrimination of various consumers. In other words, the firm will choose a single parameter, ρ, and those consumers with $z_i \geq \rho$ will obtain the good while possibly contributing more than ρ, while those with $z_i < \rho$ will not obtain the good.[13] To the best of our knowledge, our model is the only PWYL model to include inframarginal consumers (those with $z_i < \rho$) whose existence in the market is crucial in determining how to optimally benefit from endogenous price discrimination.

Given the functional form of warm glow, the utility function of consumer i can be written as

$$u_i(x) = \begin{cases} 0 & \text{for} \quad x < \rho \\ v_i - x + \beta \min\left\{\left[x - \min\{v_i, \rho\}\right], w_i\right\} & \text{for} \quad x \geq \rho \end{cases} \tag{3}$$

Noting that $u_i(x)$ is piecewise linear in x, we know consumer i's utility maximizing contribution to the firm, or x_i^*, will be one of the following four corner solutions

$$x_i^*(\rho) = \begin{cases} \rho + w_i & \text{for} \quad 0 \leq \rho \leq v_i \\ v_i + w_i & \text{for} \quad v_i < \rho \leq v_i + w_i \\ \rho & \text{for} \quad v_i + w_i < \rho \leq z_i \\ 0 & \text{for} \quad z_i < \rho \end{cases} \tag{4}$$

where v_i and w_i fully characterize a consumer, and z_i is her willingness to pay given in 2. The four possible

[12] It does not matter whether consumers' values are drawn from a known distribution or predetermined. There is no demand uncertainty, and we are investigating the firm's pricing decision under perfect information.

[13] It should be noted that the utility function given in 1 is a reduced-form representation of a consumer who values both money and the good in question. As the only input in equation 1 is the contribution, x_i, 1 implies a sufficiently large disutility of deviating from the minimum contribution norm (i.e., obtaining the good while contributing less than ρ) even though this disutility does not appear in 1 because there are no values of x_i for which the disutility is actually received.

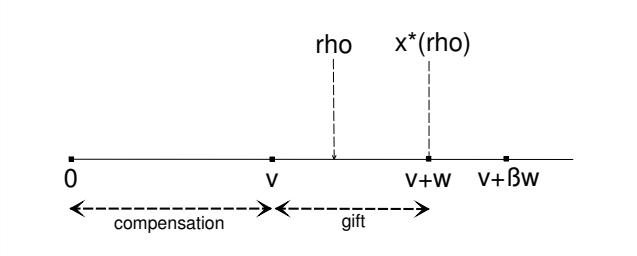

Figure 2: An Example of a Consumer's Optimal Contribution

contributions, given in 4 confirm the behavioral assumptions of our representative consumer. If the minimum suggested contribution is very low, the consumer gives ρ as compensation for the good, plus the maximum gift of w_i, as everything above ρ is perceived as a gift. If ρ climbs above the consumer's value, the consumer treats v_i as compensation for the good, because that is the most the consumer would have paid to a neutral firm, but still maximizes the warm glow by giving a gift of w_i in excess of her value (See Figure 2 for an example of this type of consumer). If ρ happens to be above $v_i + w_i$, the consumer does not want to give any more than ρ (part of which is seen as payment, and part which is seen as a gift), but she will still make a donation and obtain the good if her willingness to pay is greater than or equal to ρ. Finally, the consumer will not receive the good if ρ exceeds her willingness to pay.

2.3 Comparison of Benchmark Price to Optimal Suggested Minimum

We now consider the actions of a standard profit-maximizing firm who is given perfect information about each consumer's willingness to pay, z_i. For simplicity, we assume the firm is a monopolist which can produce at zero marginal cost, allowing for the possibility of large fixed costs which must be recovered by earning revenue. While the firm knows each z_i, the firm is unaware that $z_i = v_i + \beta w_i$; that is, the firm is unaware that a consumer's demand for the good comes from both an intrinsic value for the good and a desire to contribute to the firm. Suppose the firm hired an economist who was given only the schedule of z_i's and who misinterpreted them as standard willingness to pay valuations. That is, the advisor, unaware of the potential benefits of endogenous price discrimination, would look for the *prima facie* profit-maximizing single posted price of the good, which we refer to as the monopolist's benchmark price.

Definition 2 *The* ***benchmark price*** *of a monopolist with zero marginal cost, facing N consumers with willingness to pay of $\{z_i\}_{i=1}^N$ is equal to p^* where*

$$p^* = \arg\max_p \{p * q(p)\}$$

where $q(p) = |\{z_i : z_i \geq \rho\}|$, or the number of consumers whose willingness to pay is greater than or equal to the price, p.

The value of the benchmark price, p^*, is the same whether we interpret it as the profit-maximizing price for a posted-price firm, or the suggested minimum contribution in a pay-what-you-like firm who does not make a distinction between the consumer's two different sources of utility. In either case, some consumers may contribute more than the benchmark price (possibly using a tip jar) if it is in their interest to do so.

A sophisticated monopolist, however, is concerned with maximizing the sum of both sources of revenue, compensation and gifts. If a pay-what-you-like firm knows how much of each consumer's demand comes from intrinsic value for the good and how much is due to the warm glow of generosity, it can predict the contributions of each consumer and find the suggested minimum contribution which will generate the most profit.

Definition 3 *The **optimal suggested minimum contribution** of a monopolist with zero marginal cost, facing N consumers with valuations of $\{v_i\}_{i=1}^N$, warm glow satiations of $\{w_i\}_{i=1}^N$, and a marginal utility of giving of β is equal to ρ^* where*

$$\rho^* = \arg\max_{\rho} \left\{ \sum_{i=1}^{N} x_i^*(\rho) \right\}$$

where $x_i^*(\rho)$ is defined to be consumer i's contribution given the suggested minimum contribution of ρ as determined by 4.

The optimal suggested minimum contribution and the benchmark price should be uniquely determined by the values of $\{v_i\}_{i=1}^N$ and $\{w_i\}_{i=1}^N$, thus we will assume that the firm chooses the smallest value which serves as the respective maximum.

The following two lemmas will be useful for comparing the benchmark price and optimal suggested minimum.

Lemma 4 *The benchmark price, p^*, and the optimal suggested minimum contribution, ρ^*, must each be equal to z_i for some i.*

Proof. If $z_i = 0$ for all i, then p^* and ρ^* will both be equal to 0 as desired, so assume that $z_i > 0$, for some i. Assume that the monopolist chooses a suggested minimum of ρ which is not equal to any consumer's willingness to pay. If $q(\rho) = 0$, then the firm is not selling any goods, and by both measures profits will increase by lowering ρ so that at least one consumer buys the good. If $q(\rho) > 0$, then the firm can increase both measures of profits by raising the suggested minimum to $\min\{z_i : z_i > \rho\}$, because such a deviation will

increase the contributions of at least one consumer while not decreasing the contribution of any. Therefore ρ cannot be p^* or ρ^* unless it is in fact equal to some z_i. ■

The intuition behind Lemma 4 is the well-known fact that when facing discrete willingness to pay steps, a firm would never choose a price between the steps. Because of this lemma we need only compare the firm's outcome given a suggested minimum chosen from the set of all z_i, which we have assumed is common knowledge. Without loss of generality, we can re-index the consumers such that

$$z_1 \geq z_2 \geq ... \geq z_N$$

which implies that the suggested minimum which will result in the sale of i units is simply z_i. We can now define marginal revenue, $MR(i)$, as

$$MR(i) = R(i) - R(i-1), \text{ for all } i = 1, ..., N$$

where $R(i)$ is defined to be the total contributions gained from selling i units of the good at a suggested minimum of z_i. Any units which may have been purchased by equally willing to pay consumers, indexed by $j > i$, are assumed to go unsold. Similarly, we now define marginal benchmark revenue, $MBR(i)$, as

$$MBR(i) = iz_i - (i-1)z_{i-1}$$

which is the additional revenue gained under the benchmark assumption that each consumer pays only the price of the good.

Lemma 5 *The marginal revenue of selling the i-th unit, $MR(i)$, is greater than or equal to the marginal benchmark revenue of selling the i-th unit, $MBR(i)$.*

Proof. Having sold $i-1$ units, the suggested minimum must be decreased to z_i in order to sell the i-th unit, and the added revenue from consumer i is thus z_i. This is also the added revenue from consumer i under the benchmark assumption. Now consider the revenue lost from consumers $1, 2, ..., i-1$ due to a decrease in the suggested minimum from z_{i-1} to z_i. Under the benchmark assumption, the revenue lost from each

consumer is exactly $z_{i-1} - z_i$. However, knowing the contribution level, $x_i^*(p)$, given in 4, we can see that

$$\frac{d}{dp}x_i^*(\rho) = \begin{cases} 1 & \text{for} \quad 0 < \rho < v_i \\ 0 & \text{for} \quad v_i < \rho < v_i + w_i \\ 1 & \text{for} \quad v_i + w_i < \rho < z_i \\ 0 & \text{for} \quad z_i < \rho \end{cases} \tag{5}$$

which means that as price decreases, the first $i-1$ consumers' contribution decreases as a rate less than or equal to the rate at which price decreases, which means that the revenue lost from each consumer is less than or equal to the magnitude of the price decrease, or $z_{i-1} - z_i$. Therefore $MR(i) \geq MBR(i)$ as desired.

■

Equation 5 shows that a consumer's contribution may not be responsive to changes in the minimum suggested contribution. If ρ is chosen to be anywhere between a consumer's intrinsic value, v_i, and the sum of her value and warm glow satiation point, $v_i + w_i$, then that consumer's contribution is fixed at $v_i + w_i$. The existence of this type of consumer (see Figure 2 for an example) will be a catalyst for the sophisticated monopolist to lower its suggested minimum contribution, allowing infra-marginal consumers to obtain and pay for the good, while maintaining a high revenue from some of the supra-marginal consumers.

Proposition 6 *Given a monopolistic seller with no variable costs facing N consumers, each with 1.) an intrinsic value for consuming one unit of a good, v_i, 2.) a linearly increasing warm glow from giving to this monopolist, up to an individually determined maximum, w_i, and 3.) a strict adherence to a norm whereby no consumer receives the good unless they have contributed the suggested minimum, the optimal suggested minimum contribution in a pay-what-you-like business model is less than or equal to the benchmark posted price for the monopolist.*

Proof. By Lemma 4, $p^* = z_j$ for some j, and $\rho^* = z_k$ for some k, where j and k represent the number of units sold under each suggested minimum contribution decision. Assume that, contrary to the proposition, the optimal suggested minimum, ρ^*, is greater than the benchmark price, p^*. This means that $k < j$, because fewer units must be sold under the optimal suggest minimum. However, because p^* is the global maximizer of benchmark revenue, it must be the case that increasing the number of units sold from k to j weakly increases benchmark revenue. In other words, we know

$$\sum_{i=k+1}^{j} MBR(i) \geq 0$$

However, by Lemma 5 we know that $MR(i) \geq MBR(i)$, which implies

$$\sum_{i=k+1}^{j} MR(i) \geq \sum_{i=k+1}^{j} MBR(i) \geq 0$$

which means that total revenue weakly increases by increasing the number of units sold from k to j, which means that no value of ρ greater than p^* could have been the optimal suggested minimum, since setting $\rho = p^*$ would dominate it, given that the monopolist chooses the lowest suggested minimum when indifferent.

■

The intuition behind Proposition 6 is the following. When a firm has the luxury of choosing a lower bound to the amount of money that consumers will contribute in exchange for a good, they have an incentive to set the lower bound below the posted-price benchmark, because they will sell more units this way. In the pay-what-you-like scheme, there may be some consumers who still contribute as much as they would have at the posted-price benchmark due to their endogenous price discrimination. One might argue that this intuition suggests that the optimal suggested minimum should go all the way down to zero, but that is not the case. Our model assumes that consumers distinguish between gifts to the firm and compensation for the good, and a suggested minimum of zero implies that no money is necessary as compensation for the good, perhaps because the firm is not "asking" for anything to compensate them for the good. While setting $\rho = 0$ would mean that each consumer contributes the full value of w_i to the firm, the increased contributions in the form of gifts would not in general compensate for the loss of revenue in the form of compensation. It is therefore a non-trivial exercise to determine ρ^*.[14]

2.4 Welfare Implications of Pay-What-You-Like Scheme

This section formalizes the welfare implications of a pay-what-you-like scheme. Because we assume that the good is produced with no variable cost, any consumer who values the good but does not receive it adds to the deadweight loss in the market. Therefore, by increasing the number of consumers who receive the good, the pay-what-you-like scheme has the potential to increase efficiency, revenue for the firm, and flexibility for the consumer. This leads us to the following corollary of Proposition 6.

Corollary 7 *Given a monopolistic seller with no variable costs and N consumers as described in Proposition 6, if there is at least one consumer who would like to contribute more than the profit-maximizing benchmark price, p^*, then a pay-what-you-like pricing strategy is a Pareto improvement over a single posted price strategy.*

[14] In fact, for sufficiently small v_i's, $\rho^* = 0$, as the incentive to keep ρ above zero diminishes because each consumer's contribution is entirely a gift. However, for sufficiently small w_i's, $\rho^* = p^*$, as the firm's decision becomes increasingly identical to a traditional profit-maximizing monopolist as the gift-giving motive disappears. In general, $\rho^* \in [0, p^*]$.

Proof. Because ρ^* is the optimal suggested minimum given a pay-what-you-like strategy, the firm weakly prefers to let $\rho = \rho^*$ over setting $\rho = p^*$ given this strategy. However, they strictly prefer the pay-what-you-like strategy with $\rho = p^*$ to the single posted price of p^* because of the one consumer choosing to give more. Because $\rho^* \leq p^*$, each consumer can choose to pay p^* if they like, thus each consumer's choice under the pay-what-you-like strategy is weakly preferred to the single posted price strategy. ■

2.5 Continuous Demand Case

In the previous sections we consider a finite number of consumers, which results in a finite number of possibilities for p^* and ρ^*, due to the result of Lemma 4. Therefore, there are discrete jumps in the pricing decisions of the monopolist, and it may be the case that $p^* = \rho^*$ simply because both prices fall into the same discrete jump. To eliminate this possibility, we alter the model so that there is a continuum of consumers, indexed by $i \in [0, 1]$. Furthermore, we will assume the demand curve determined from consumers' willingness to pay is differentiable at the price, p^*. As before, consumer i has an intrinsic value of v_i and a warm glow satiation of w_i, which results in a willingness to pay of $z_i = v_i + \beta w_i$. As before, define p^* to be the profit-maximizing single posted price, and ρ^* the optimal suggested minimum contribution. In this version of the model, using the same intuition as before, we can prove the following stronger result.

Proposition 8 *Given a monopolistic seller with no variable costs and a continuum of consumers with properties 1-3 of Proposition 6, the optimal suggested minimum contribution, ρ^*, is strictly less than the profit-maximizing single posted price, p^*, if the demand curve is differentiable at p^* and there is a positive (Lebesgue) measure of consumers with the following property: $v_i \leq p^* < v_i + w_i$.*

Proof. Let $A \subseteq [0, 1]$ be defined such that $i \in A$ if and only if $z_i \geq p^*$. Let $B \subseteq [0, 1]$ be defined such that $i \in B$ if and only if $v_i \leq p^* < v_i + w_i$. Note that $B \subseteq A$, because $p^* < v_i + w_i$ implies that $z_i \geq p^*$. By the assumptions of the proposition, $\mu(A) \geq \mu(B) > 0$, where $\mu(.)$ is the standard Lebesgue measure. Because demand is differentiable at p^*, we know that marginal (benchmark) revenue is continuous at p^*, and because this is the profit maximizing single price, it must be zero. Benchmark revenue is equal to $p * \mu(A)$, and letting a be the absolute value of the slope of the demand curve at p^*, we have the formula for marginal benchmark revenue at p^* of

$$MBR(p^*) = p^* - \mu(A) * a = 0$$

or the marginal gain from additional buyers minus the marginal loss from those who were already buying. If the firm is concerned with actual marginal revenue, it will find that their marginal gains are the same as this benchmark formula (because every marginal consumer is already paying their maximum willingness to

pay), but their marginal losses are different. In fact, only $(\mu(A) - \mu(B)) * a$ is lost because those consumers who belong to B will not change their actual contributions to the firm due to an infinitesimal decrease in the suggested minimum. Therefore

$$\begin{aligned} MR(p^*) &= p^* - (\mu(A) - \mu(B)) * a \\ MR(p^*) &> p^* - \mu(A) * a = 0 \end{aligned}$$

which shows that the true marginal revenue of a decrease in the suggested minimum contribution is positive at p^*, which implies that the firm should increase the quantity sold by choosing ρ strictly less than p^* as desired. ■

As in the discrete case, when a pay-what-you-like scheme is used, the monopolist has an incentive to include more consumers in the market, which results in greater efficiency and, typically, a Pareto improvement.

3 Examples of Markets with Known Demand

For illustrative purposes, we provide in this section two natural market examples where a pay-what-you-like scheme results in higher revenue for the seller and higher economic efficiency relative to a single posted price scheme. Furthermore, these examples will demonstrate that a firm using the PWYL scheme while using the monopolist benchmark price as ρ can do strictly better by reducing the suggested minimum to the true optimal suggested minimum, ρ^*.

3.1 Example 1: Warm Glow Aligned With Value

In our first example, those consumers with the highest valuations for a particular good also have the strongest desire to contribute to the socially-conscious firm. Consider the actions of a monopolist with no marginal costs who faces demand from $N = 10$ consumers (with an adherence to the suggested minimum norm), each with a marginal utility of giving of $\beta = 2$, and whose intrinsic valuations and warm glow satiation points are given as:

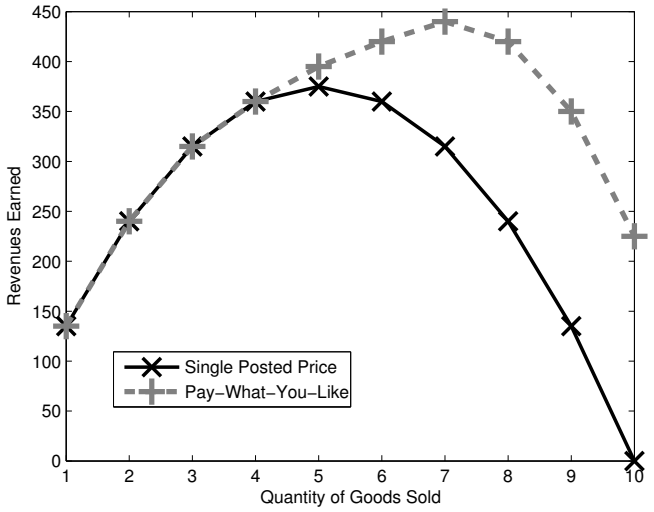

Figure 3: Revenues Earned by the Monopolist in Example 1

i	v_i	w_i	z_i
1	45	45	135
2	40	40	120
3	35	35	105
4	30	30	90
5	25	25	75
6	20	20	60
7	15	15	45
8	10	10	30
9	5	5	15
10	0	0	0

Quantity	"Price"	Quantity*Price	PWYL Contributions
1	135	135	135
2	120	240	240
3	105	315	315
4	90	360	360
5	75	375	395
6	60	360	420
7	45	315	440
8	30	240	420
9	15	135	350
10	0	0	225

In this example, warm glow satiations are equal to intrinsic valuations, both of which are a linear step function. Due to Lemma 4, both a traditional single-price firm and a pay-what-you-like firm need only consider setting a price (or suggested minimum) at the 10 values of z_i, which is equivalent to choosing the quantity of goods to sell. A traditional monopolist would choose $p^* = 75$, because this is indeed the point which maximizes the product of price and number of units sold. However, if a pay-what-you-like firm were to set a suggested minimum contribution of 75, there would be two consumers who meet the criteria given

at the end of Proposition 8 and have contributions similar to the consumer described in Figure 2. By reducing the suggested minimum to $\rho^* = 45$, the firm sells to two infra-marginal consumers while keeping contributions unchanged for these two highest-value consumers. Therefore, a PWYL firm has an incentive to lower the suggested minimum below the price that an economist would claim is profit maximizing having seen only the willingness to pay of the consumers in the market. As seen in Figure 3, not only does the Pay-What-You-Like scheme result in higher revenues for quantities above 4, but the addition of two otherwise infra-marginal consumers enhances efficiency by reducing the deadweight loss of the market by an impressive 70%, or from 150 to 45.

3.2 Example 2: Warm Glow Inversely Related to Value

In our previous example, warm glow satiation points were assumed to be equal to consumers' intrinsic values for the good, while in general, a person's desire to contribute to a particular firm might not be (positively) correlated with their desire for a particular good. In this example, we keep intrinsic values the same, but assume that warm glow satiations are inversely related to value and every other consumer has no warm glow at all:

i	v_i	w_i	z_i
1	45	0	45
2	40	10	60
3	35	0	35
4	30	20	70
5	25	0	25
6	20	30	80
7	15	0	15
8	10	40	90
9	5	0	5
10	0	50	100

Quantity	"Price"	Quantity*Price	PWYL Contributions
1	100	100	100
2	90	180	180
3	80	240	240
4	70	280	280
5	60	300	300
6	45	270	295
7	35	245	315
8	25	200	305
9	15	135	265
10	5	50	195

Once again, there are 10 unique values of z_i, so in both payment schemes, the firm's decision rests on determining the optimal number of units to sell. Given the price-quantity pairs from which to choose, the traditional monopolist would choose a price of $p^* = 60$. However, if a pay-what-you-like firm reduces its minimum suggested contribution to $\rho^* = 35$, it can benefit from the addition of two consumers ($i = 1, 3$) for

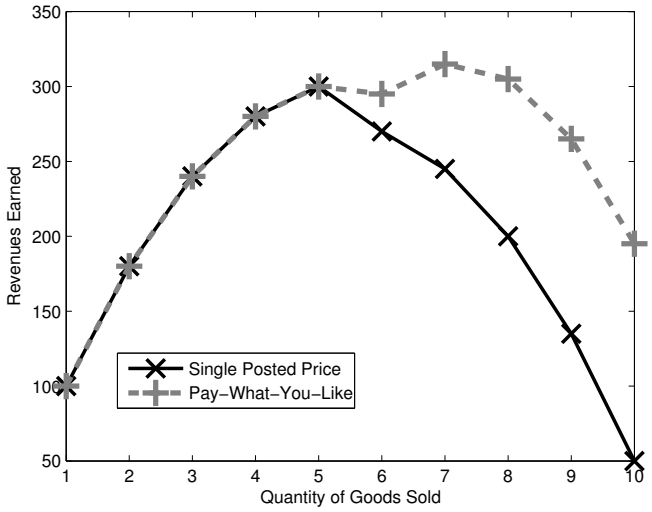

Figure 4: Revenues Earned by the Monopolist in Example 2

an added revenue of 70, while still receiving a contribution of 50 from 4 of the consumers ($i = 4, 6, 8, 10$) who would have contributed 60 if the suggested minimum contribution were 60 (for a revenue loss of 40) and a contribution of 45 from the consumer with index $i = 2$ (for a revenue loss of 15). Therefore, total revenue is 300 + 70 - 55 = 315 at $\rho = 35$, which is indeed the optimal suggested minimum contribution (See Figure 4). Once again deadweight loss is reduced by 66.7%, from 135 to 45.

4 Addition of Free-Riders to the Model

In this section we will discuss the implications of the addition of free-riders to the model. We will show that while the presence of free-riders could have drastic implications concerning the profitablity of the PWYL pricing scheme, the result that the optimal suggested minimum is less than the benchmark monopoly price still holds in the continuous demand case where free-riding is uniformly distributed among the consumers.

4.1 Continuous Demand Case

As in Section 2.5, we consider a continuum of consumers, indexed by $i \in [0, 1]$, with valuations v_i and warm glow satiations w_i. In order to update the model with the inclusion of free riders, we will say that each consumer is independently determined to be a free-rider with probability λ. The firm knows which consumers are free-riders before it makes any pricing decisions. By the law of large numbers, the set of free riders has a measure of exactly λ, while the set of remaining consumers has a measure of $1 - \lambda$. We define a **free-rider** to be a consumer who completely ignores the minimum contribution norm, and will therefore

always take one unit of the good without contributing anything to a PWYL firm. Of course, a traditional posted-price firm can still earn revenue from free-riders, as they will purchase the good if their willingness to pay is greater than or equal to the posted price.

Proposition 9 *Given a monopolistic seller with no variable costs and consumers indexed $i \in [0,1]$ with intrinsic values v_i, warm glow satiations w_i, each of whom is a free-rider with probability $\lambda \in (0,1)$, the optimal suggested minimum contribution, ρ^*, is strictly less than the profit-maximizing single posted price, p^*, if the demand curve is differentiable at p^* and there is a positive (Lebesgue) measure of consumers with the following property: $v_i \leq p^* < v_i + w_i$.*

Proof. We will show, as before, that the marginal revenue of the firm at p^* is positive. Let $L \subset [0,1]$ be the set such that $i \in L$ if and only if consumer i is not a free rider. Let A be the subset of $[0,1]$ such that $i \in A$ if and only if $z_i \geq p^*$. Let $A' = A \cap L$. By the law of large numbers, $\mu(A') = (1-\lambda) * \mu(A)$. Letting a be the absolute value of the slope of the demand curve (including free riders) at p^*, the marginal revenue of a traditional posted price firm at p^* is once again

$$MBR(p^*) = p^* - \mu(A) * a = 0$$

Now consider the demand from only those consumers in the set L. Since total demand is differentiable at p^*, and the set of consumers who belong to L are uniformly dense in the entire set of consumers, the function $Q(p) = |\{i \in L : z_i > p\}|$ must also be differentiable at p^*. By the law of large numbers, $\frac{dp}{dQ}$ evaluated at p^* is equal to $\frac{a}{1-\lambda}$, because for a given increase in price, there need to be $(1-\lambda)$ times as many consumers dropping out of L as compared to the original set. The marginal benchmark revenue from consumers in L at p^* is equal to $MBR'(p^*)$ where

$$MBR'(p^*) = p^* - \mu(A') * \frac{a}{1-\lambda}$$

but we can substitute in $(1-\lambda) * \mu(A)$ for $\mu(A')$ and because $\lambda < 1$, the $(1-\lambda)$ terms cancel out, and we have that

$$MBR'(p^*) = MBR(p^*) = 0$$

Let B' be the subset of L such that $i \in B'$ if and only if $v_i \leq p^* < v_i + w_i$ and $i \in L$, and as before, $\mu(A') \geq \mu(B') > 0$. Let $MR'(p^*)$ be the true marginal revenue of a PWYL firm if they were to choose $\rho = p^*$. As before, the true marginal gains are the same as before, but only $(\mu(A') - \mu(B')) * \frac{a}{1-\lambda}$ is lost

because those consumers who belong to B' will not change their contributions. Therefore

$$\begin{aligned} MR'(p^*) &= p^* - (\mu(A') - \mu(B')) * \frac{a}{1-\lambda} \\ MR(p^*) &> p^* - \mu(A') * \frac{a}{1-\lambda} = 0 \end{aligned}$$

which shows that the true marginal revenue of a decrease in the suggested minimum contribution is positive at p^*, which implies that the firm should increase the quantity sold by choosing ρ strictly less than p^* as desired. ■

What this analysis shows is that the presence of uniformly distributed free-riders does not change the fact that a PWYL firm chooses a lower "price" than a traditional firm. However, the addition of free-riders is likely to affect the revenue comparison of PWYL to posted price. Indeed, given sufficient information about the market and assuming that free-riders were uniformly distributed, we could find a critical value, λ^*, such that the PWYL firm generates more revenue if and only if $\lambda < \lambda^*$, where λ^* can be calculated by dividing the additional revenue gained by optimally switching to PWYL if there were no free-riders by the total revenue under PWYL with no free-riders. With the addition of free riders, a PWYL scheme may or may not constitute a Pareto improvement over a posted price scheme, but the efficiency of the market will still increase due to the reduction of the deadweight loss of the monopoly.

4.2 Discrete Demand Case

The addition of free riders to discrete demand can produce ambiguous results. If the identity of free riders is known by the firm, it is possible that a PWYL firm actually chooses a suggested minimum which is *above* the benchmark monopoly price. Consider the result if all the consumers with $z_i = \rho^*$ happen to be free-riders, where ρ^* is the optimal suggested minimum in the absence of free riders. (Recall that there must be at least one consumer with $z_i = \rho^*$.) In this case, there is no incentive for the firm to keep ρ at ρ^*, and they will be strictly better off by increasing ρ to z_j, where consumer j has the next highest willingness to pay among non free-riders.[15]

For a more concrete exploration of the effect of free-riders on the feasability of PWYL, let us turn to the examples of Section 3.1 and 3.2. The realization of which consumers turn out to be free riders will have drastic consequences on the profitablity of PWYL compared to traditional posted price, with the general rule that the higher the z_i of the free riders, the more devastating it will be to the PWYL firm. Instead of looking at specific realizations of free-riding behavior, it is more enlightening to consider the ex-ante

[15] It is important to note that this argument does not imply that setting $\rho = z_j$ is globally optimal for the firm, merely that it is an improvement over $\rho = \rho^*$. It is equally possible that the addition of free riders decreases the optimal suggested minimum.

decision of pricing scheme, knowing only the probability that any one consumer will be a free rider. Let us assume that each of the 10 consumers in the example given in Section 3.1 are chosen to be a free rider with probability λ. Assuming the firm cares about expected profit, the choice of ρ comes down to how many units the firm would like to potentially sell (each with probability $1-\lambda$), which has the same optimal number of units of 7 with an expected reveneue of $(1-\lambda)*440$, while the posted price scheme will result in a revenue of 375, which means that the PWYL scheme earns more revenue as long as

$$\lambda < \frac{440-375}{440} \approx .148$$

which means that the PWYL scheme remains the more profitable ex-ante choice as long as each consumer is less than 15% likely to be a free rider. Similiarly, in the example given in Section 3.2, the PWYL scheme can earn more, but with a slimmer margin of error for free-riding behavior, as the critical value of λ is

$$\lambda < \frac{315-300}{315} \approx .048$$

The previous comparisons shine light on the, perhaps tenuous, feasibility of the PWYL scheme when compared to a traditional posted price in the presence of free riders. It is important to recall that we are not making the unfair comparison of a market with warm glow to a market without warm glow. In fact, consumers' warm glow values are built in to the posted price calculations, and many are purchasing a product for far more than their intrinsic valuation for it. The overall willingness to pay of each consumer has not changed when comparing posted price to PWYL, rather, the key difference is the lack of endogenous price discrimination when prices are posted because we have made the behavioral assumption that all consumers' contributions collapse to the posted price when such a price exists.

5 Discussion and Extensions

The flavor of the results of this paper is robust to different ways of interpreting the generosity of customers of pay-what-you-like firms. For example, suppose consumers believe that there is a market benchmark price, p^*, which they would otherwise expect to pay. If a pay-what-you-like firm sets $\rho < p^*$, consumers believe they are receiving a "gift" of $p^* - \rho$. Furthermore, assume as a behavioral regularity that customers reciprocate with a gift equal to $\gamma(p^* - \rho)$ beyond the suggested minimum of ρ, with $0 < \gamma < 1$, unless by doing so they will spend more than the good is worth to them. A number of laboratory experiments (Fehr, Kirchsteiger, and Riedl, 1993, e.g.) and field experiments (Falk, 2007, e.g.) support the existence of this

type of reciprocity, known as gift exchange. Typically, reciprocity is regarded as a hard-wired behavioral phenomenon in certain individuals who "are *obligated* to the future repayment of favors, gifts, invitations, and the like." (Cialdini, 1992, p. 211, as quoted in Falk, 2007) Therefore, given the assumption of consumer reciprocation at a rate of γ, a consumer with valuation of v_i will make a donation to the firm equal to $x_i^*(\rho)$, where

$$x_i^*(\rho) = \begin{cases} \rho + \gamma(p^* - \rho) & \text{for} \quad 0 \leq \rho \leq \frac{v_i - \gamma p^*}{1-\gamma} \\ v_i & \text{for} \quad \frac{v_i - \gamma p^*}{1-\gamma} < \rho \leq v_i \\ 0 & \text{for} \quad v_i < \rho \end{cases} \tag{6}$$

Note that consumer contributions, $x_i^*(\rho)$, given the gift exchange interpretation of consumer behavior, are similar to the consumer contributions given the warm glow of patronization, given in Equation 4, in an important way: in both cases there are some consumers whose contributions are less responsive to changes in ρ than the customers of a traditional single posted price firm would be. Therefore, the pay-what-you-like firm incurs less revenue loss from those consumers who are already receiving the good than a traditional firm would when reducing its price. For this reason, the gift-exchange equivalent of Propositions 6 and 8 from Section 2 are also valid, and can be proved using exactly the same intuition.

If we consider the gift exchange model of consumer contributions given in Equation 6 while letting $\rho = 0$, we get the same model of consumer contribution which is given in Kim, et al. (2009), if we allow γ to be different for each consumer by creating a set of γ_i's. Then, Equation 6 collapses to $x_i^*(0) = \gamma_i p^*$, which means that consumers pay some proportion of the reference price for the good, just as in Kim, et al. (2009). In our model, all of the individual and firm characteristics which have been shown to affect how much an individual chooses to contribute to a PWYL firm are encapsulated in γ_i. The gift exchange model reported here is perhaps a more general way to model contributions to a PWYL firm, and perhaps by carefully setting a minimum suggested donation of $\rho > 0$, the firms in question could have earned more revenue, provided that the announcement of the suggested donation does not significantly reduce the consumers' reference price.

The real world implications of our model depend on the fact that consumers are responsive to the suggestions of the firm when it comes to how much they should contribute, that most consumers will not free ride, that they wouldn't simply donate money to the firm without receiving something in return, and that they might give more than the firm suggests. We believe that while it is rare for a firm to have a clientele that meet all of these standards, it is certainly possible.[16] The fact that key parameters for the success of PWYL are attributes of the customers is apparently recognized by the chairman of Panera, who is quoted

[16] Panera selected the city of Clayton, Missouri, a suburb of St. Louis, to introduce the PWYL pricing scheme. Clayton has a well-to-do and homogeneous population with 84.9% white and a large collection of professionals with a median family income of $107,346 (Census, 2000). The location could be explained by the company's roots in St. Louis; however, we inquired about the specific reasons for choosing Clayton and received no response from Panera management. Our belief is that a homogenous population provides the best opportunity for such a pricing scheme to succeed since norms of behavior would be more stable.

as saying, "It's a test of human nature. The real question is whether the community can sustain it" (Strom and Gary, 2010).

An alternative to our norm-based explanation for consumer responsiveness to the suggested minimum contribution is that the suggested minimum is a signal about the firm's underlying costs. Even though we have modeled a firm with zero variable costs, there could be a fixed cost that a firm needs to recover on a regular basis to survive. If the suggested minimum donation is a signal to the customer about the level of contribution needed for the firm to stay viable, a consumer concerned about the continued existence of the firm is likely to be very responsive to the suggested minimum.

Finally, the expansion of Lentil as Anything and the profitability of Calvin's Coffee Shop in Tallahassee demonstrate that there are conditions in which a social norm of a minimum contribution is widespread enough for successful implementation of pay-what–you-like. To better understand the pay-what-you-like business model, we believe that there are open questions which deserve further consideration. For example, what characteristics of a firm drive the widespread acceptance of a minimum contribution social norm? In order to provide pay-what-you-like firms with a more concrete economic analysis, we must continue to synthesize our understanding of how gift-exchange works, the warm glow an individual receives as a result of giving, and the tendency to adhere to in-place social norms.

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