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Delegating pricing power to customers: Pay What You Want or Name Your Own Price?☆,☆☆

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ABSTRACT

Pay What You Want (PWYW) and Name Your Own Price (NYOP) are customer-driven pricing mechanisms that give customers (some) pricing power. Both have been used in service industries with high fixed costs to price discriminate without setting a reference price. Their participatory and innovative nature gives rise to promotional benefits that do not accrue to posted-price sellers. We explore the nature and effects of these benefits and compare PWYW and NYOP using controlled lab experiments. We show that PWYW is a very aggressive strategy that achieves almost full market penetration. It can be profitable if there are promotional benefits and if marginal costs are low. In contrast, NYOP can be used profitably also if marginal costs are high and if there are no such benefits. It reduces price competition and segments the market. In a second experiment, we generate promotional benefits endogenously. We show that PWYW monopolizes the follow-up market but fails to be profitable. NYOP is less successful in penetrating the market but yields much higher profits.

1. Introduction

In many service industries such as hotels, airlines, or entertainment, firms have large fixed costs for capacity but face widely fluctuating demand. Some firms use so-called customer-driven pricing mechanisms to sell excess capacity in times of low demand. These pricing mechanisms delegate pricing power to consumers. “Pay What You Want” (PWYW) asks consumers to pay any price they like, including zero (Schmidt et al., 2015). “Name Your Own Price” (NYOP) asks consumers

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to submit a bid against a threshold that is set by the seller but unknown to buyers. A transaction takes place only if the offered price exceeds this threshold (Spann and Tellis, 2006). PWYW has been applied mainly in service industries such as hotels, restaurants or museums (Kim et al., 2009).[1] NYOP has been invented by Priceline, an online travel intermediary selling flights, hotel rooms, rental cars and vacation packages in the U.S. (Anderson, 2009; Dolan and Moon, 2000).[2]

The cost of using these pricing mechanisms is that the seller loses control over the price at which the product is sold. But these mechanisms also offer several direct and indirect benefits. They achieve endogenous price discrimination because different customers pay different prices depending on their valuations, their conception of fairness, their beliefs about acceptable bids, or their degree of risk aversion. Their participatory and innovative nature appeals to many consumers and often initiates word-of-mouth recommendations and favorable press coverage (Hinz and Spann, 2008; Kim et al., 2009). They can be a powerful tool to promote a product to a wider audience, in particular if the firm has a strong social media position with many fans and followers. Furthermore, PWYW and NYOP may have indirect promotional benefits by increasing demand for complementary products. For instance, the rock band Radiohead pioneered the use of the PWYW format on the Internet, giving consumers the opportunity to pay what they saw fit for their album "In Rainbows". Even though profit margins on the album itself might have been larger had they used posted prices, by choosing PWYW they were able to attract many new followers and increase demand for complementary products. According to Chesbrough (2010), "[w]hatever revenue Radiohead might have lost through its initial download experiment was more than compensated for by the far greater publicity the band received, which seems to have accounted for the surge in commercial sales, and no doubt also benefited ticket sales for its subsequent world tour" (p. 357).[3] Finally, offering low prices in reaction to off-peak demand bears the risk that consumers' reference prices are affected, which may significantly reduce their willingness to pay in periods with regular and peak demand (Kalyanaram and Winer, 1995).[4] Because PWYW and NYOP do not set an explicit price, they may circumvent this problem.[5]

Any seller considering to delegate pricing power to his customers in order to reap these benefits must decide whether to use PWYW or NYOP (or stick to traditional posted prices). In this paper we directly compare PWYW and NYOP to each other and to traditional posted prices. We use controlled lab experiments to make sure that PWYW and NYOP can be offered under the exact same conditions. We want to identify the driving forces of the behavior of buyers and sellers who are facing or employing these mechanisms. What determines how much buyers pay? Under what circumstances are PWYW and NYOP viable and when do sellers choose to use them? In particular, what is the role of the direct and indirect promotional benefits of using such mechanisms discussed above? How can they be employed as a competitive strategy to capture market share and to reduce competition? How do word-of-mouth benefits arise endogenously?

We find strong and important differences between PWYW and NYOP. PWYW appeals to all customers and achieves (almost) full market penetration. It can be used as a very aggressive strategy that drives competing posted-price sellers out of the market. Many consumers pay positive prices voluntarily, but PWYW is profitable only if costs are low and if there are additional benefits (e.g., press coverage, word-of-mouth recommendations, or spillover effects on complementary products). In contrast, NYOP is a much less aggressive strategy than PWYW. It relaxes price competition and leaves a significant share of the market to the competing posted-price seller. It is particularly appealing to low valuation customers who do not lose much if their bid is unsuccessful and for whom the price offered by a posted-price seller is too high. High-valuation customers, on the other hand, prefer to buy from the posted-price seller in order to avoid the risk that their bid is unsuccessful. NYOP can also be used for goods with high marginal costs and if there are no additional benefits because the seller can protect himself against selling his good below cost by setting an appropriate reserve price.

In a second set of experiments we endogenize direct promotional benefits due to media buzz and word-of-mouth advertising. We show that these benefits differ across PWYW and NYOP. For NYOP the additional benefits triggered by word of mouth are substantial. NYOP sellers are able to capture a larger market share and to make higher profits than traditional posted-price sellers. In contrast, PWYW is even more successful in capturing market share and monopolizes the market, but

[1] See for example http://www.bbc.com/travel/feature/20140730-pay-what-you-want-at-a-paris-hotel, http://www.freetoursbyfoot.com/new-york-tours/, http://www.accorhotels.com/owm002740-001-pay-what-you-want.shtml.

[2] Priceline's business model has been very successful, with a current market cap of $65.5 bn and gross profit of $7.6 bn (http://finance.yahoo.com/q/ks?s=PCLN+Key+Statistics). Other current examples of NYOP sellers include the Danish website prisminister.dk, or eBay sellers selling via eBay's Best Offer option.

[3] PWYW and NYOP can also be used as a temporary promotional tool to attract customers. For example, the ibis hotel Chennai City Centre has offered Pay What You Want-Deals for a limited travel period. The deal was advertised as 'special offer' on the hotel's website (http://www.accorhotels.com/owm002740-001-pay-what-you-want.shtml), presumably to increase brand awareness and thereby traveller demand in non-PWYW periods. Even though this may initially result in losses, they can be overcompensated if customers continue to frequent the service once it has reverted to regular posted prices. In contrast to the word-of-mouth effects discussed above, which target a previously untapped customer segment, here additional benefits arise from intertemporal spillover effects. Rather than catering to a different customer segment, intertemporal spillover effects therefore increase demand from the *same* customers at later points in time.

[4] For example, hotels in New York City experience low booking rates especially in January and February and apparently try to increase capacity utilization by lowering prices. See, e.g., http://www.nycedc.com/economic-data/travel-and-tourism. However, prices are not decreased enough to make full use of capacity, which may be explained by concerns about reference price effects.

[5] See Winer (1986), Wolk and Spann (2008) and Kim et al. (2014) on reference prices. However, it is not yet well understood how reference prices are formed in PWYW and NYOP.

the high market share does not translate into high profits because consumers are paying too little. We conclude that indirect promotional benefits are required for the viability of PWYW.

So far the literature on customer-driven pricing mechanisms has dealt with PWYW and NYOP separately. There are many case studies and field experiments on PWYW in specific industries. These include the music industry,[6] zoos and museums,[7] restaurants and wine bars,[8] online content,[9] hotels (Gautier and van der Klaauw, 2012) and travel agencies (León et al., 2012), souvenir photos in an amusement park (Gneezy et al., 2010), or the Google service Google Answers (Regner, 2014). These studies are highly instructive but they cannot identify the causal effects driving behavior in these markets.

There are a few laboratory studies that allow for more control of the environment. For example, Mak et al. (2015) use a laboratory experiment to study how subjects can coordinate their behavior to make PWYW viable even if they are not motivated by social preferences. Jung et al. (2014) conduct field and lab experiments to explain differences in payment behavior across two situations that are payoff-equivalent from the perspective of an individual consumer, Pay What You Want and Pay It Forward. Schmidt et al. (2015) also use laboratory experiments on PWYW markets to identify the causal effects that determine voluntary payments both in monopolistic and competitive markets. However, they focus on an environment in which (a few) buyers and a seller interact repeatedly, so that buyers have an incentive to keep the seller in business. This is an important concern for neighborhood restaurants and other local service industries with a stable customer base. In contrast, the present paper is concerned with industries in which firms face an anonymous customer base with one-shot interaction. With one-shot interaction between buyers and sellers it is much more difficult for PWYW to be viable. A key innovation of the current paper is the introduction of additional benefits that accrue to sellers employing a customer-driven pricing mechanism. We not only examine how additional benefits affect market outcomes when at least one seller uses PWYW or NYOP, but we also show that such benefits can arise endogenously. Finally, to the best of our knowledge, our paper is the first to compare and contrast how PWYW and NYOP perform relative to each other as a function of the environment.

Research on Name Your Own Price has been strongly influenced by the business model of Priceline. The majority of the related research focuses on NYOP sellers' design decisions such as repeated bidding and bidding fees (Fay, 2004; Spann et al., 2010), joint bidding for multiple items (Amaldoss and Jain, 2008), bid/price elicitation (Chernev, 2003; Spann et al., 2012) and haggling (Terwiesch et al., 2005). In addition, there are some papers studying the effects of competition on the profitability of a NYOP channel (Fay, 2009; Shapiro, 2011) and reasons for the existence of the channel itself (Wang et al., 2009).

Another stream of research on NYOP is concerned with buyers' bidding behavior and related papers analyze the role of bidders' emotions (Ding et al., 2005), expectations about changes in sellers' threshold level (Fay and Laran, 2009; Fay and Lee, 2015), information diffusion about seller's threshold level (Hinz and Spann, 2008) and adaptability of the threshold level (Hinz et al., 2011) on buyers' bidding behavior. Further, empirical research using historic NYOP bidding data analyzes bidder characteristics such as frictional costs (Hann and Terwiesch, 2003; Terwiesch et al., 2005), rationality (Spann and Tellis, 2006), risk aversion (Abbas and Hann, 2010) or willingness to pay (Spann et al., 2004).

The remainder of this paper is organized as follows: In Section 2, we describe the experimental design and procedures of our first set of experiments. Section 3 provides theoretical predictions for seller and buyer behavior in PWYW and NYOP. The results are discussed in Section 4. Section 5 reports the experimental design and results for the second set of experiments, in which one particular channel of additional benefits (i.e., word of mouth) is derived endogenously and explored in more detail. Section 6 concludes the paper. All formal proofs and the experimental instructions can be found in Appendix A.

2. Experimental design and procedures

2.1. General setup

To compare the functioning and the performance of PWYW and NYOP to traditional posted prices we consider three pairs of treatments.

1. In the first two treatments two sellers compete for customers. The first seller has to quote a posted price. The second seller can choose between quoting a posted price and delegating the pricing decision to customers. In treatment **PCFlex** (**P**WYW, **C**ompetition, **Flex**ible role) the flexible seller can opt for PWYW, in treatment **NCFlex** (**N**YOP, **C**ompetition, **Flex**ible role) he can opt for NYOP. With these treatments we analyze under what conditions sellers choose to use customer-driven pricing mechanisms if they have to compete against traditional posted-price sellers.

[6] PWYW has been used by the bands "Radiohead", "Nine Inch Nails", and "Moby" (Johnson and Cui, 2013) as well as by the online music label "Magnatune" (Regner and Barria, 2009).

[7] The zoo in Augsburg, Germany has successfully used PWYW in the winters of 2013, 2014, 2015 and 2016. One reason for doing so is to compete for consumers' attention when there are many other distractions (christmas markets, etc.) on offer. This strategy seems to work well: according to the data we received, visitor numbers tripled in PWYW periods (relative to the same period in previous years). PWYW is also employed by many museums such as the Metropolitan Museum of Art in New York or the Museum König in Bonn, Germany.

[8] Examples include the restaurant "Kish" in Frankfurt, Germany (Kim et al., 2010), or "Der Wiener Deewan" in Vienna, Austria, and wine bars like "Weinerei" in Berlin, Germany.

[9] For example Wikipedia and Humble Bundle.

2. In two control treatments one seller again has to quote a posted price while the other seller is now constrained to either using PWYW (in treatment **PCFix**) or to using NYOP (in treatment **NCFix**). Here the question is not whether the customer-driven pricing mechanism is preferred to quoting a posted price, but rather under what conditions these mechanisms are viable in a competitive environment.
3. Finally, we conducted two monopoly treatments in which there is just one seller. In treatment **PM** (**P**WYW, **M**onopoly) the monopolistic seller has to use PWYW, in **NM** (**N**YOP, **M**onopoly) he has to use NYOP. These treatments show how much customers are willing to pay voluntarily in the absence of alternative suppliers. They are also interesting in their own right because there are some markets with very little competition in which customer-driven pricing mechanisms are frequently used (e.g., museums, churches, etc.).

At the beginning of each session instructions are read aloud. Then subjects have to answer a set of control questions before the experiment starts. At the end of each session we elicit information about risk preferences and social preferences of the participants and their demographic characteristics.[10] In each treatment, subjects are randomly assigned to a role (i.e., buyer or seller) that remains fixed throughout the experiment. Each session consists of 24 subjects which gives us three markets in the competition treatments (two sellers facing six buyers in each market) and six markets in the monopoly treatments (one seller facing three buyers). All treatments are repeated for 20 periods, and subjects are randomly rematched every period. We conduct eight sessions of the competition treatments and another eight sessions of the monopoly treatments. In order to perfectly control the valuations of the buyers and the cost of the sellers we use an induced-value design (Smith, 1976).

A novel feature of our experimental design is a per-unit benefit that may accrue to sellers using a customer-driven pricing mechanism. In this first set of experiments the benefit is exogenously given. This reduces the complexity of the experimental design and allows for both direct benefits (media buzz and word-of-mouth recommendations that increase the customer base) and indirect benefits (promoting complementary products of the same seller). In a second set of experiments, reported in Section 5, we generate direct promotional benefits endogenously in the lab.

The benefit $b \in \{0, \bar{b}\}$ is proportional to the number of units sold. In order to identify the effect of b we assigned $\bar{b}$ randomly to 50 percent of all markets. Sellers know whether they enjoy a positive benefit from using a customer-driven pricing mechanism while customers know only that these benefits exist with probability 0.5. This design choice reflects the fact that most buyers do not know how large the positive external effects on sellers using customer-driven pricing mechanisms are (while they may havea better idea of the marginal cost of production).[11]

A total of 384 subjects participated in the experiment, 192 in the monopoly treatments and 192 in the competition treatments. Sessions lasted about 2 h and subjects earned on average 18 Euros (about 24 US Dollars at the time of the experiment), including a show-up fee of 4 Euros.[12] All sessions were conducted at the experimental laboratory of the University of Munich (MELESSA). The subject pool consisted mainly of students from a wide range of majors. Treatments were implemented using zTree (Fischbacher, 2007) and subjects were recruited using ORSEE (Greiner, 2004).

In the following subsections we describe the treatments in more detail.

2.2. Competition treatments

2.2.1. Competition with flexible roles

In treatments PCFlex and NCFlex one of the two sellers can choose whether to use posted prices or to use PWYW (NYOP, respectively) while the other (traditional) seller has to use a posted price. At the beginning of each period all subjects observe the per-unit production cost of the good which is the same for both sellers and drawn from $c \in \{10, 30, 50\}$. The flexible seller privately learns the per-unit benefit $b \in \{0, 40\}$ from using a customer-driven pricing mechanism and each buyer privately learns his valuation of the good which is drawn independently from $v \in \{10, 25, 40, 60, 120, 200\}$. Then each seller decides whether to enter the market, and the flexible seller decides which pricing method to use. Thereafter all buyers and sellers are informed about the market structure. Now the posted-price sellers set their prices, and a NYOP seller sets the (secret) threshold above which all price offers are accepted. Finally buyers decide whether and if so from which seller to buy. If they go for a posted-price seller they have to pay the posted price. If they go for a PWYW seller they get the good with certainty and can choose how much to pay for it voluntarily (including a price of zero). If they go for a NYOP seller they submit a bid.

[10] For risk preferences we use a menu of ten paired lottery choices adapted from Holt and Laury (2002). For social preferences we rely on the six primary social value orientation (SVO) slider items of Murphy et al. (2011). The SVO measure consists of a series of allocation decisions that can be used to locate decision makers on a circle, ranging from altruists and prosocials to individualists and competitive types. The measure is continuous and therefore lends itself well to the regression analyses described in more detail in Section 4. At the end of the experiment, one randomly selected decision of the Holt and Laury-task and one randomly selected allocation decision from the SVO measure are paid out.

[11] We assume that consumers are perfectly informed about costs, but imperfectly informed about the benefits of using PWYW or NYOP. Consumers often have some idea about the magnitude of production costs. For example it is obvious that the marginal cost of digital products is (close to) zero. For other products costs may be inferred from past prices or from prices offered by competing firms. But, of course, these inferences are often not perfect. On the other hand, it is much more difficult for consumers to understand the benefits that producers enjoy from using PWYW and NYOP. Most consumers are not aware that these pricing strategies generate promotional benefits to the seller. Even if they do think about them, it is very hard to properly assess their magnitude. Our informational assumptions capture the difference between the buyers' information about costs and benefits.

[12] In all competition treatments, subjects received an additional payment for completing a survey at the end of the experiment. This payment was announced upon completion of the main experiment, so that the decisions in the experiment cannot be distorted by income effects.

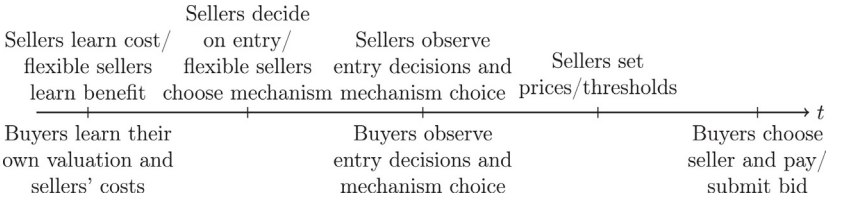

Fig. 1. Sequence of events in the flexible competition treatments.

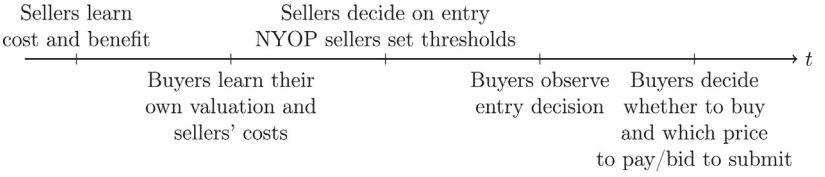

Fig. 2. Sequence of events for the monopoly treatments.

If the bid is greater than or equal to the secret threshold set by the seller, they pay their bid and receive the good. If the bid is smaller than the threshold, they do not receive it and do not have to pay. Finally, payoffs are made.

Fig. 1 summarizes the time and information structure of the competition treatments with flexible roles.

A seller who stays out of the market gets a payoff of zero. If seller j with cost c quotes a posted price p^P his payoff is given by

$$\pi_j^P = \sum_{i=1}^{6} \mathbf{1}_i^j [p^P - c], \tag{1}$$

where $\mathbf{1}_i^j$ is an indicator function equal to one if buyer i decides to buy from seller j. If seller j uses PWYW/NYOP his payoff is

$$\pi_j^{\text{PWYW/NYOP}} = \sum_{i=1}^{6} \mathbf{1}_i^j [p_i - c + b], \tag{2}$$

where p_i refers to the price paid in PWYW and the submitted bid in NYOP, respectively, and b is the per-unit benefit. Here, $\mathbf{1}_i^j$ is equal to one if buyer i decides to buy from seller j (and his submitted bid is greater than or equal to the threshold in the case of NYOP) and zero otherwise. The payoff of buyer i is given by $v_i - p_i$ if a transaction takes place, and zero otherwise, where v_i is his valuation and p_i the price he paid.

2.2.2. Competition with fixed roles

The competition treatments with fixed roles (treatments PCFix and NCFix) are identical to the treatments with flexible roles except for the fact that one of the sellers has to use either PWYW or NYOP if he enters the market.

2.3. Monopoly treatments

In two monopoly treatments (PM and NM) there is only one seller who is forced to use PWYW (NYOP, respectively) if he enters the market. Here there are only three buyers in each market. Costs and benefits are parameterized as in the competition treatments, while buyers' valuations are drawn from a restricted set, $v = \{40, 60, 120, 200\}$.[13] All sellers have the same cost–benefit combination in a given period as in the competition treatments and learn that combination before market entry. The time structure of the monopoly treatments is depicted in Fig. 2.

Seller j's payoff is given by

$$\pi_j = \begin{cases} \sum_{i=1}^{3} \mathbf{1}_i [p_i - c + b], & \text{if he entered the market} \\ 0, & \text{if he did not enter the market.} \end{cases} \tag{3}$$

[13] The competition treatments comprise a larger market and contain the additional valuations of 10 and 25. Therefore, profits cannot be directly compared between monopoly and competition treatments. However, in the monopoly treatments we are mainly interested in the behavior of buyers. For each given valuation of a buyer we can compare the behavior in the monopoly and the competition treatments.

Again, $\mathbf{1}_i$ is an indicator function equal to one if buyer i decides to buy (and his submitted bid is greater than or equal to the threshold in the case of NYOP) and zero otherwise. The payoff of buyer i is again $v_i - p_i$.

3. Theoretical predictions

As a benchmark for the experimental results we analyze the experimental treatments under the assumption that all buyers and sellers are fully rational and purely self-interested. It is well known from many other experimental studies that people are not fully rational and often motivated by social preferences. Nevertheless it will be useful to compare our experimental results to the predictions of the standard neoclassical model in order to better understand what is driving the observed behavior. To avoid uninteresting case distinctions we treat prices as continuous variables. Furthermore, we start out with the assumption that all subjects are risk neutral. The effects of risk aversion are discussed at the end of this section.

We solve the experimental games by backward induction. In the case of PWYW the analysis is straightforward:

Proposition 1. *A purely self-interested buyer facing a PWYW seller pays $p = 0$ and gets a strictly positive payoff $\pi_i = v_i - 0 > 0$. In all three PWYW treatments all buyers buy from the PWYW seller if this seller entered the market.*

- *In PCFix and PM the PWYW seller enters the market if and only if his benefit exceeds his cost, i.e., $b = 40$ and $c \in \{10, 30\}$. In this case he captures the entire market and makes a strictly positive profit while the PP seller makes a profit of zero. If the PWYW seller does not enter, the PP seller charges the monopoly price.*
- *In PCFlex the flexible seller always enters the market and chooses PWYW if and only if his benefit exceeds his cost, i.e., $b = 40$ and $c \in \{10, 30\}$. In this case he captures the entire market and makes a strictly positive profit. If the flexible seller chooses to offer a posted price, both sellers engage in Bertrand competition and make zero profits.*

Proposition 1 gives rise to the following prediction:

Prediction 1. *In all three PWYW treatments sellers use the PWYW pricing mechanism if and only if $b = 40$ and $c \in \{10, 30\}$. If PWYW is offered, then it captures the entire market, but all buyers pay a price of 0. The performance of PWYW is independent of competition.*

These results suggest that the additional benefits generated by PWYW (e.g., via word-of-mouth effects) are the only reason to use this mechanism. However, these results are based on the assumption that all buyers are purely self-interested. If some buyers have social preferences and are motivated by fairness or reciprocity, they may be willing to pay positive prices voluntarily. Furthermore, if a buyer feels obliged to make a positive payment under PWYW but does not want to engage in moral deliberations about how much to pay, he may prefer to buy from a posted-price seller, if such a seller is available.

Let us now turn to the NYOP treatments. In these treatments we ignore the entry decision because sellers could always guarantee non-negative profits if they entered. In fact almost all sellers choose to enter in the NYOP treatments.[14] If a seller uses the NYOP mechanism he has to set a secret threshold t. A buyer gets the good if and only if the price he bids exceeds this threshold, i.e., $p \geq t$. The following lemma shows how a NYOP seller optimally sets this threshold:

Lemma 1. *If a seller uses NYOP it is a (weakly) dominant strategy to set $t^* = \max\{c - b, 0\}$ in all treatments.*

Proof. See Appendix A.□

The intuition for this result is straightforward. The seller's "effective" marginal cost is $c - b$, and he cannot set a threshold smaller than zero. Clearly, it cannot be optimal to set the threshold below his effective marginal cost. Setting the threshold strictly above effective marginal cost cannot be optimal either, because the threshold is not observed by customers and cannot affect their behavior. Thus, the only effect of a threshold greater than the effective marginal costs is to reject some profitable price offers.

In the following we restrict attention to Perfect Bayesian equilibria in which a seller using the NYOP mechanism always chooses his (weakly) dominant strategy.[15]

Lemma 2. *In the competition treatments a posted-price seller chooses $p^P \geq c$ and makes zero profits in equilibrium.*

Proof. See Appendix A.□

The intuition is again straightforward. Either both sellers use posted prices, in which case Bertrand competition drives prices down to marginal costs and profits to zero, or the flexible seller uses NYOP. Given his optimal threshold consumers can always get the good by bidding c. Thus, the posted-price seller may either set $p = c$ (in which case he may capture some

[14] The fraction of sellers entering the market is above 98 percent in each of the three NYOP treatments.

[15] In the monopoly treatment this assumption is without loss of generality because $t = t^*$ is strictly optimal. In the duopoly treatments there are Perfect Bayesian equilibria in which the NYOP seller chooses a threshold $\bar{t} > c$, the posted-price seller offers p^P such that $c \leq p^P < \bar{t}$ and all buyers with $v_i > p^P$ buy from the posted-price seller. These equilibria are sustained by the beliefs of the buyers that the NYOP seller sets the high threshold $\bar{t} > c$, so they never buy from this seller. Given that they do not buy, the threshold $\bar{t}$ is (weakly) optimal. However, these equilibria are not trembling hand perfect. If there is an arbitrarily small probability that a buyer makes an offer to the NYOP seller, it is strictly optimal for the NYOP seller to set $t = t^*$.

Table 1
Optimal bidding behavior for risk-neutral EU maximizers.

Cost	Valuation					
	10	25	40	60	120	200
10	**0**	10	10	10	10	10
30	**0**	**0**	**0**	30	30	30
50	**10**	**10**	**10**	**10**	50	50

market share) or $p > c$ in which case all consumers shop with the NYOP seller, but the posted-price seller's profits are zero in any case.

What is the optimal behavior of a risk neutral and self-interested buyer? The buyer rationally anticipates that the NYOP seller chooses threshold $t^* = \max\{c - b, 0\}$. In NCFix and NM the buyer knows that the actual benefit is $b = 40$ or $b = 0$ with equal probability.

Lemma 3. *In treatments NCFix and NM a risk neutral buyer facing a NYOP seller offers*

$$p = \begin{cases} c & \text{if } v \geq \min\{2c, c + 40\} \\ \max\{c - 40, 0\} & \text{if } v < \min\{2c, c + 40\} \end{cases} \tag{4}$$

Proof. See Appendix A.□

The proof follows directly from Lemma 2 and the buyer's payoff function. Note that the buyer will bid aggressively only if his valuation is sufficiently small. Table 1 displays the optimal prices offered by a risk-neutral buyer to a NYOP seller as a function of the values that v_i and c could take in the experiment.

Boldfaced values indicate cases in which a risk neutral buyer optimally submits an aggressive, "risky" bid to the NYOP seller that is strictly smaller than the seller's cost. In these cases it is strictly optimal for a risk neutral buyer to buy from the NYOP seller. If, on the other hand, a safe bid of $p = c$ is optimal, then the buyer may also buy from the posted-price seller, provided that this seller charges $p^P = c$.

In NCFlex the analysis is slightly more complicated. In this treatment the seller chooses whether to use NYOP after privately observing the realization of b. Thus, his choice may signal information about the realization of b to the buyer. There exists a pooling equilibrium in which the flexible seller always uses NYOP and the buyer offers the prices given by Lemma 3.[16] However, there is also a separating equilibrium in which the seller uses NYOP if and only if $b = 40$.[17] Thus, if the buyers observe that NYOP is offered, they conclude in equilibrium that $b = 40$ and offer $p = \max\{c - 40, 0\}$ for all realizations of v. This separating equilibrium is less profitable for the seller than the pooling equilibrium because prices and profits are lower, so sellers prefer the pooling equilibrium. Nevertheless, we cannot rule out the possibility that buyers interpret NYOP as a signal that $b = 40$ and therefore bid more aggressively than they do in NCFix. But even in this case the NYOP seller makes strictly positive profits if $40 - c > 0$.

This analysis is summarized in the following prediction for the NYOP treatments:

Prediction 2.

1. *In all three NYOP treatments a NYOP seller sets the optimal threshold* $t^* = \max\{c - b, 0\}$. *In the competition treatments a posted-price seller sets* $p^P \geq c$ in equilibrium.
2. *Buyers with a low valuation* ($v < \min\{2c, c + 40\}$) *buy from the NYOP seller and offer* $p = \max\{c - 40, 0\}$ *which is successful in at least 50 percent of all cases. If buyers with a higher valuation buy from the NYOP seller, they offer either* $p = \max\{c - 40, 0\}$ or $p = c$ *which is successful with probability one in equilibrium. They may also buy from the posted-price seller, but only if the posted-price seller offers* $p^P = c$.
3. *NYOP sellers make positive profits on average, while posted-price sellers always make zero profits in equilibrium. Furthermore, NYOP sellers always have a higher expected market share than posted-price sellers. If there is competition, the seller prefers NYOP over posted prices.*

These predictions rest on several assumptions. First, we assumed that all subjects are rational and that rationality is common knowledge. Thus, buyers correctly anticipate the optimal threshold set by the NYOP seller. However, it is possible that some NYOP sellers fail to understand what the optimal threshold is and choose a threshold that is too high. Even if they

[16] In a pooling equilibrium sellers with $b = 0$ and with $b = 40$ both offer NYOP. Thus, the buyers' beliefs do not change and they offer the prices described by Lemma 3. No type of the seller can improve his payoff by choosing PP, because with PP Bertrand competition results in zero profits.

[17] In this separating equilibrium a seller with $b = 40$ uses NYOP and a seller with $b = 0$ uses PP. If buyers observe NYOP they believe with probability 1 that they face a seller with a high benefit and offer $p = \max\{c - 40, 0\}$. If they observe PP they believe that the seller has a benefit of 0, but here beliefs do not matter because Bertrand competition drives down the price to $p = c$. A seller with $b = 40$ has no incentive to choose PP because Bertrand competition would reduce his profit to 0. A seller with $b = 0$ has no incentive to deviate either because he will not be offered more than c if he chooses NYOP, so his profit would be again equal to zero. Thus, this is a separating equilibrium.

choose the threshold optimally, buyers may believe that sellers behave irrationally with some probability. This may induce buyers to offer prices that are higher than the optimal threshold. It may also induce buyers to buy from the posted-price seller where they get the good with certainty. Finally, buyers may not be fully rational and have difficulties to compute the optimal threshold themselves. Again, this may induce them to offer a price that is higher than the seller's cost or to choose the posted-price seller.

Second, we assumed that buyers are risk neutral. If a buyer is risk averse, he may prefer a "safe" offer $p = c$ even if the expected profit of a "risky" offer $p = \max\{c - 40, 0\}$ is higher. Furthermore, if there is no common knowledge of rationality, risk aversion will exacerbate the effects of strategic uncertainty discussed above, i.e., the buyer may be inclined to offer even higher prices to the NYOP seller or lean more toward the posted-price seller where he can get the good with certainty.

Finally, we assumed that buyers are purely self-interested. If a buyer cares about the utility of the seller, he may offer higher prices to the NYOP seller in order to achieve a more equal income distribution.

4. Results

We first analyze under what circumstances sellers choose to employ a customer-driven pricing mechanism and how successful these mechanisms are in penetrating the market and in making profits. Then, we analyze how buyers react to these mechanisms. Do they buy from a PWYW or NYOP seller or do they shy away from them? What prices do they pay? Do they behave differently if there is another posted-price seller as compared to a situation where the PWYW or NYOP seller is a monopolist? Finally, we analyze the competitive effects of sellers employing PWYW and NYOP relative to a posted price competitor.

4.1. Performance of customer-driven pricing mechanisms

Under what conditions do sellers choose to delegate pricing power to their customers?

Result 1 (Seller's choice of customer-driven pricing mechanism).

(a) In PCFlex almost all sellers choose to use PWYW if and only if PWYW offers an additional benefit and if production costs are not too high. If PWYW is chosen, then the PWYW seller captures almost all of the market and makes high profits, while the PP seller makes profits close to zero.
(b) In NCFlex almost all sellers choose to use NYOP if NYOP offers an additional benefit. If there is no benefit still about half of the sellers choose NYOP if costs are not too high. If NYOP is chosen then the NYOP seller captures about 60 percent of the market. If NYOP is chosen, it is significantly more profitable than quoting a posted price. NYOP sellers choose a threshold close to the optimal threshold in 75 percent of all cases.
(c) A flexible seller who chooses PWYW makes profits that are more than twice as high as the profits made by a flexible seller who chooses NYOP.

Support for Result 1 is provided by the descriptive statistics reported below. Table 2 reports the percentage of cases in which sellers opt for one of the customer-driven pricing mechanisms by cost and benefit levels. In both treatments all flexible sellers entered the market.

In PCFlex almost all sellers shy away from PWYW if $b = 0$. If there is a benefit and if $b > c$ all sellers choose PWYW, and 13 percent do so if $c = 50$ and $b = 40$. This result confirms Prediction 1. It seems that sellers are convinced that buyers are not going to make voluntary payments, so sellers avoid PWYW if this may result in losses. Note, however, that in the case where $c = 50$ and $b = 40$ there are twice as many sellers offering PWYW than if $c = 10$ and $b = 0$, even though the "effective" marginal cost is the same. This suggests that sellers expect buyers to pay more if their costs are high than if their costs are low.

In NCFlex almost all flexible sellers choose NYOP if there is a positive benefit. If there is no benefit, still almost 50 percent of the sellers opt for NYOP if costs are 10 or 30, and 17 percent do so if costs are 50. This result is consistent with Prediction 2. Furthermore, it suggests that the choice of NYOP could be interpreted as a signal that the seller is more likely to enjoy a high benefit.

Table 2
Seller's choice of customer-driven pricing mechanism.

Cost	PCFlex		NCFlex	
	$b = 0$	$b = 40$	$b = 0$	$b = 40$
$c = 10$	6%	100%	50%	100%
$c = 30$	0%	100%	43%	94%
$c = 50$	0%	13%	17%	100%
Total	2%	65%	40%	98%

Note: Entries in cells denote the percentage of cases in which sellers opt for one of the customer-driven pricing mechanisms, conditional on entering the market.

Table 3
Profits and market shares.

Treatment	Profits				Market shares	
	PWYW	PP	NYOP	PP	PWYW	NYOP
Competition flexible roles	127.1	0.9	58.1	15.7	94.2%	57.4%
Competition fixed roles	76.8	4.7	69.7	22.4	90.0%	69.8%
Monopoly	52.7		83.2		98.6%	97.8%

Note: Profits and market shares are conditional on market entry of both sellers and choice of the customer-driven pricing mechanism. Both profits and market shares are displayed as per period averages.

Using PWYW is highly profitable. The average profit of a PWYW seller is 127.1 points, as compared to a profit of almost zero of the competing PP seller. NYOP is somewhat less profitable with an average profit of 58.1 which is still much higher than the average profit of 15.7 of the corresponding PP seller (see Table 3). However, because sellers could choose whether or not to employ the customer-driven pricing mechanism, these numbers have to be interpreted carefully. In PCFlex sellers opted for PWYW only if the benefit was high, while in NCFlex many sellers also chose NYOP when there was no benefit. But even if we restrict attention to the cases with $b = 40$ and $c \in \{10, 30\}$ where almost all flexible sellers opted for customer-driven pricing mechanism the average profit under PWYW is 145.1 while NYOP sellers make only 95.6 on average.

The reason why PWYW is more profitable than NYOP if benefits are higher than costs is the fact that PWYW is much more successful in market penetration. If the flexible seller chooses PWYW he gets a market share of 94.2 percent.[18] If the flexible seller chooses NYOP his market share is only 57.4 percent.[19]

The overall picture of PWYW does not change much when we look at treatments PCFix and PM in which one seller had to use PWYW. Note that this seller could still decide not to enter the market. In fact, in PCFix the PWYW seller entered in only 51.7 percent of all cases (53.8 percent in PM). He stayed out of the market when there was no benefit ($b = 0$) and/or his cost was high ($c = 50$), so in the same situations in which he opted for posted prices in PCFlex. If he entered, he again captured almost the entire market (market share 90.0 percent). If $b = 40$ and $c \in \{10, 30\}$ the profits of the PWYW seller in PCFix are virtually identical to the profits in PCFlex. However, in PCFix some PWYW sellers enter the market when $b = 0$. In these cases they make losses on average, confirming the pessimistic beliefs of sellers in PCFlex. This explains why the average profit conditional on market entry is lower, see Table 3. It is also interesting to note that profits are negative if $b = 0$ and $c = 10$, but positive if $b = 40$ and $c = 50$, even though these two situations are strategically equivalent. Thus, it must be the case that buyers voluntarily paid higher prices if the seller had higher costs. We will get back to this question below.

NYOP sellers' profits in NCFix are not significantly different from profits in NCFlex. Moreover, we find that buyers do not submit lower bids in NCFlex as compared to NCFix. This indicates that the choice of NYOP does not provide an informative signal about the level of the benefit.

Did NYOP sellers set the thresholds optimally? By Proposition 1 it is a weakly dominant strategy to set $t = t^* = \max\{c - b, 0\}$. Across all treatments, 30.0 percent of the sellers choose exactly t^*, 72.4 percent choose a threshold within 10 points of t^*. There is no significant difference between treatments. On average the actually chosen threshold is 8.7 points higher than the optimal threshold, but this difference is decreasing over time suggesting that sellers learn to set the threshold optimally as they gain experience.[20]

4.2. Buyers' reactions to customer-driven pricing mechanisms

How did buyers react if they were offered customer-driven pricing mechanisms?

4.2.1. Pay What You Want

Result 2 (Voluntary payments under PWYW).

(a) Almost all buyers buy from a PWYW seller.
(b) The majority of buyers (56.2 percent) pay positive prices and 26.2 percent pay prices greater than or equal to the seller's cost. On average each buyer pays 9.8 points, which is a significant contribution to sellers' profits.
(c) Buyers tend to pay more the higher their valuation and the higher the seller's cost. Payments are higher the higher the social value orientation (SVO) of a buyer. Buyers also pay more if there is no competing posted-price seller. Voluntary payments tend to decrease over time.

[18] The PP seller gets only 3.3 percent of the market, 2.5 percent of the buyers do not buy.
[19] The PP seller gets 35.5 percent of the market and 7.1 percent of the buyers do not buy.
[20] A random-effects regression of the chosen threshold on the optimal threshold shows that t^* explains the actually chosen threshold very well. The coefficient of t^* is 0.9. The treatment dummies and the interaction effects are not significant, but there is a significant negative time trend.

Table 4
Prices paid under PWYW.

	PCFlex	PCFix	PM	Total
Average price paid	4.9	7.6	12.1	9.8
Fraction of buyers paying $p > 0$	38.1%	50.4%	64.1%	56.2%
Fraction of buyers paying $p \geq c$	15.9%	19.4%	32.2%	26.2%

Table 5
Prices paid under PWYW.

	(1) Price paid in PCFlex	(2) Price paid in PCFix	(3) Price paid in PM
Cost	0.058	0.212***	0.208***
	(0.094)	(0.061)	(0.037)
Valuation	0.092***	0.117***	0.102***
	(0.015)	(0.014)	(0.009)
Posted price of S^P	−0.001	−0.015	
	(0.026)	(0.027)	
Period	−0.586***	−0.650***	−0.359***
	(0.206)	(0.170)	(0.112)
SVO	0.421	0.638***	0.606***
	(0.317)	(0.227)	(0.133)
Constant	−19.701**	−19.139***	−18.431***
	(8.512)	(6.493)	(3.848)
Number of observations	226	335	763

Note: Entries in columns (1)–(3) are point estimates from random-effects tobit regressions on buyers' prices paid to the PWYW seller (left-censored at minimum price of 0). Standard errors are in parentheses.
*Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

The high market share of more than 90 percent of PWYW sellers shows that buyers do not hesitate to buy from a PWYW seller. The PWYW market share is higher compared to previous research which finds that there is some fraction of buyers who prefer not buying from a PWYW seller. This has been explained by a reluctancy to engage in the moral deliberations of how much to pay (Schmidt et al., 2015), self signaling (Gneezy et al., 2012) or privacy concerns (Regner and Riener, 2013). In the current study, however, this fraction is lower presumably because of the additional benefits that PWYW sellers enjoy. Buyers know that a seller who chooses to enter the market and offers PWYW is likely to enjoy this benefit, so the buyer does not have to feel bad about accepting a PWYW offer even if he pays less than the seller's cost. Thus, the additional benefit helps to make PWYW a very effective instrument for market penetration.

Table 4 reports the average prices paid as well as the fractions of buyers paying positive prices and prices greater than or equal to the seller's cost in all three PWYW treatments. These voluntary payments are a significant contribution to the sellers' profits under PWYW. This contradicts Proposition 1. Table 4 shows that social preferences do play an important role.

Prices are lowest in PCFlex, higher in PCFix and highest in PM. A possible explanation is that in PCFlex sellers had the outside option to choose posted prices which they almost always did if $b = 0$ and/or $c = 50$. Thus, in PCFlex PWYW was profitable even if no positive prices were paid. In contrast, in PCFix and PM the outside option was to stay out of the market, so sellers choose to enter with PWYW more often, even in situations in which they could make losses. This may have induced buyers with social preferences to be more generous. Furthermore, in the monopoly treatment buyers had more reason to be grateful if the PWYW seller entered the market. In the monopoly treatment, if the seller did not enter, buyers got a payoff of 0. In the competition treatment they could still buy from the PP seller and get positive payoffs. This is a possible explanation for the higher payments observed in the monopoly treatment. Finally, valuations are on average lower in PCFix and PCFlex, due to the addition of a low-valuation market segment in these latter treatments. Therefore we should expect average PWYW prices to be lower as well.

The regressions displayed in Table 5 show the driving forces of the behavior of buyers. Prices paid under PWYW are significantly increasing in the buyer's valuation and in the seller's cost. Thus, PWYW achieves endogenous price discrimination which is consistent with models of social preferences. The importance of social preferences is confirmed by the fact that social value orientation (SVO) also has a highly significant impact.[21] The price of the competing posted-price seller in the competition treatments has no significant effect. Note that the variable "Period" has a significantly negative coefficient. This suggests that PWYW is more successful if it is newly introduced and if buyers did not yet get used to it.

[21] In PCFlex the seller's cost and the buyer's SVO are not significant. This could be related to the fact that a seller's mechanism choice signals to buyers that the benefit exceeds the marginal cost, and hence PWYW is profitable even if buyers pay a price of zero.

Table 6
Bids submitted under NYOP.

	NCFlex	NCFix	NM	Total
Average bid	21.8	23.1	39.5	33.5
Fraction of successful bids	59.8%	61.4%	83.5%	75.5%

Table 7
Buyers' behavior if NYOP is chosen.

	(1) Choice of NYOP seller	(2) Buyer's bid in NCFlex	(3) Buyer's bid in NCFix	(4) Buyer's bid in NCFlex	(5) Buyer's bid in NCFix	(6) Buyer's bid in NM
Cost	−0.0447***					
	(0.00838)					
Optimal bid		0.251***	0.349***	0.0701	0.320***	0.686***
		(0.0731)	(0.0573)	(0.0689)	(0.0557)	(0.0222)
Posted price of S^p	0.0683***			0.342***	0.0929***	
	(0.00835)			(0.0407)	(0.0162)	
Valuation	−0.0223***	0.174***	0.190***	0.189***	0.186***	0.0402***
	(0.00164)	(0.0212)	(0.0156)	(0.0191)	(0.0151)	(0.00597)
Risk	0.103	−0.0330	0.520	0.0319	0.456	−0.135
Aversion	(0.0699)	(0.321)	(0.449)	(0.284)	(0.437)	(0.369)
SVO angle	−0.0191*	0.0990*	0.0830	0.0658	0.0802	0.00148
	(0.0107)	(0.0559)	(0.0578)	(0.0495)	(0.0562)	(0.0480)
Period	0.0612***	−0.0659	−0.229***	0.130	−0.111	−0.206***
	(0.0146)	(0.102)	(0.0846)	(0.0944)	(0.0844)	(0.0528)
Constant	−0.489	11.91***	8.507**	−3.670	2.964	23.69***
	(0.602)	(2.533)	(3.673)	(2.922)	(3.700)	(2.250)
Observations	1175	286	489	286	489	1409

Note: Entries in column (1) are point estimates from a random-effects logistic regression on buyers' choice of seller in treatments NCFlex and NCFix. The dependent variable is 1 if the buyer opted for the NYOP seller and 0 otherwise. Entries in columns (2)–(6) are point estimates from random-effects tobit regressions on buyers' submitted bids to the NYOP seller (left-censored at minimum bid of 0). Standard errors are in parentheses.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

4.2.2. *Name Your Own Price*

Result 3 (Bidding behavior under NYOP).

(a) If NYOP is offered under competitive conditions about 60 percent of all buyers choose the NYOP seller.
(b) Buyers are more likely to choose NYOP the lower their valuation, the lower the seller's cost and the higher the posted price of the competing seller.
(c) Most buyers submit bids that are significantly higher than the optimal threshold of the seller. On average they are also significantly higher than the actual thresholds chosen by sellers. Bids tend to increase with the valuation of the buyer.

NYOP is significantly less successful in market penetration than PWYW (see Table 3). Table 6 reports average bid amounts and the fraction of successful bids in all three NYOP treatments. Bids are higher in the monopoly treatment than in the competition treatments.

Regression (1) in Table 7 offers some insights into which buyers go for NYOP under which circumstances. The regression shows that buyers are less likely to choose a NYOP seller if their valuation is high and if the posted price of the competing seller is low. This is very intuitive. Given that not all NYOP sellers set the threshold optimally there is some strategic uncertainty whether a buyer gets the good under NYOP while he can be sure to get it if he pays the posted price of the competing seller. Thus, the higher his valuation (i.e., the more is at risk) and the lower the competing posted price the more is a buyer inclined not to buy from a NYOP seller. Surprisingly, our measure of risk aversion does not have a significant impact on buyers' choices. The buyers' social value orientation (SVO) is marginally significant (at the 10 percent level) suggesting that more socially minded buyers tend to use NYOP less often. The significant positive time trend suggests that buyers become more prone to use NYOP as they get more experienced.

Regressions (2)–(6) in Table 7 show the driving forces of the bids submitted if a buyer chooses the NYOP seller. The theoretically optimal bid derived under the assumption of common knowledge of rationality and risk neutrality (see Table 1) is highly significant in the NCFix and NM treatments. According to Prediction 2 the coefficients of "Optimal Bid" should be equal to 1, but they are much smaller.[22] The buyer's valuation also has a highly significant positive effect. Again, this is very

[22] The parameter estimates for Optimal Bid are significantly different from 1 for specifications (2)–(6) in Table 7. (2): $\chi^2(1) = 104.84$, $p < 0.001$; (3): $\chi^2(1) = 128.83$, $p < 0.001$; (4): $\chi^2(1) = 181.99$, $p < 0.001$; (5): $\chi^2(1) = 149.11$, $p < 0.001$; (6): $\chi^2(1) = 200.57$, $p < 0.001$.

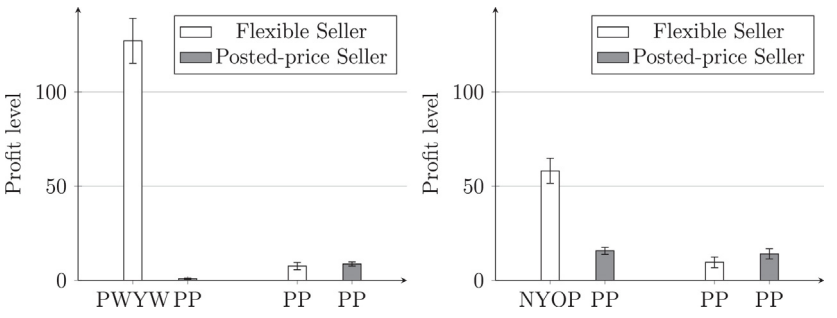

Fig. 3. The effects on competition.
Note: The left panel shows profit levels in PCFlex for the two different competitive environments. The two left-most bars indicate competition between a PWYW and a PP seller, while the bars on the right depict competition between two posted-price sellers. Profit levels for the NCFlex treatment are depicted analogously in the right panel. Throughout, the error bars show standard errors of the mean.

intuitive. Given that many sellers choose thresholds that are too high, buyers cannot be sure to get the good if they submit the theoretically optimal bid. Thus they will bid higher the more is at stake. In regression (4) and (5) we added the posted price of the competing seller. The higher this posted price the less attractive it is to switch and the higher is the bid. The posted price is also highly significant, but highly correlated with the optimal bid. We do not find a significant effect of our measure of risk aversion and of SVO. There is a significant negative time trend suggesting that buyers bid more aggressively as they gain more experience in NM.

4.3. *Customer-driven pricing mechanisms as a competitive strategy*

How do customer-driven pricing mechanisms affect competition? Fig. 3 compares profits of the seller using PWYW or NYOP to the profits of his posted price competitor. In Section 4.1 we have already seen that if PWYW is used it is highly profitable and captures almost the entire market. Thus, not surprisingly, the profits of the competing posted-price seller are very close to zero. If, on the other hand, the flexible seller also chooses posted prices, then both sellers share the market equally and make small profits.[23] Thus, the competing PP seller suffers if the flexible seller chooses PWYW.

Perhaps surprisingly this is not the case with NYOP. Profits of the PP seller are unaffected if the flexible seller opts for NYOP, while profits of the flexible seller go up significantly. This suggests that NYOP relaxes competition. In fact the markup charged by a PP seller competing against a NYOP seller in the two competition treatments is 18.8, which is significantly higher than the markup of 7.8 charged by PP sellers against a flexible seller who has chosen to use a posted price in NCFlex. NYOP relaxes price competition because the NYOP seller does not quote a price. Furthermore, because NYOP is most attractive to low valuation customers, PP sellers can focus on high-valuation customers and charge them a higher price.

Result 4 (The effects on competition). PWYW is an aggressive competitive strategy driving a competing posted-price seller out of the market. This is not the case for NYOP. NYOP leaves room for competing sellers and it relaxes price competition. Both sellers are better off if one of them uses NYOP.

It is important to note that additional benefits are an important precondition for most PWYW sellers to enter the market in a competitive situation. However, if these benefits exist, then a PWYW seller captures almost the entire market. This is different for a NYOP seller. NYOP can be profitable even if there is no additional benefit and if costs are high. Furthermore, a NYOP seller captures only about 60 to 70 percent of the market, leaving (mostly high-valuation) customers for a posted-price competitor.

5. Endogeneous benefits

So far we considered a setting in which the promotional benefits of customer-driven pricing mechanisms are exogenously given. This setup reduces the complexity of the experimental design and allows for multiple channels through which additional benefits may come about. In this section we analyze direct promotional benefits that arise if media buzz and word-of-mouth recommendations induce more consumers to buy the good. The question is under what conditions these benefits arise endogenously.

[23] The (combined) profit of 8.2 is higher than the theoretically predicted profit of zero. However, many other experiments have already shown that sellers set prices somewhat above marginal costs even if they are engaged in Bertrand competition. See, e.g., Dufwenberg and Gneezy (2000).

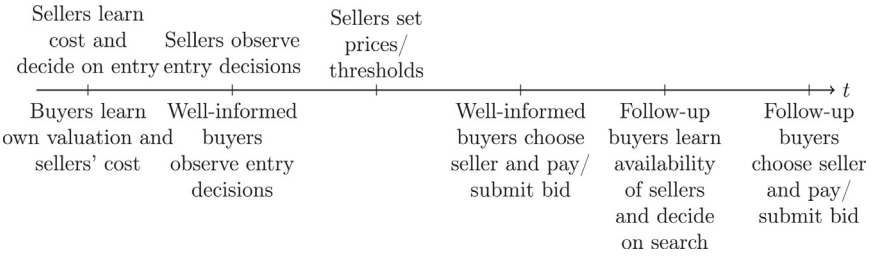

Fig. 4. Sequence of events in the endogenous benefit treatments.

5.1. Experimental design and procedures

Consider the following variation of our previous design. Each market has two sellers and six buyers. However, we now split demand into two groups: there are two well-informed buyers, who are fully aware of the market structure, and four follow-up buyers, who have to rely on word of mouth to learn which sellers are in the market. We model word-of-mouth advertising in reduced form: the purchasing decisions of the well-informed buyers directly affect the market structure for follow-up buyers. If both well-informed buyers purchase at the PWYW seller, for example, only the PWYW seller is visible to follow-up buyers. However, follow-up buyers may become fully informed about which sellers are in the market if they pay an additional search cost.

Furthermore, in the new NYOP treatment we added the realistic feature that buyers can still buy from the posted-price seller if the bid submitted to the NYOP seller was not successful. Thus, if buyers submit a bid to a NYOP seller, they do not face the risk that they cannot consume the good if their bid fails. This should encourage more buyers to try out NYOP and to bid more aggressively.

A total of 144 subjects participated in the second set of experiments, 72 in each treatment (**P**WYW **C**ompetition **E**ndogenous **B**enefit (**PCEB**) and **N**YOP **C**ompetition **E**ndogenous **B**enefit (**NCEB**)). Sessions were conducted at MELESSA. We restricted the subject pool to subjects who had not participated in any session of the first set of experiments. Sessions lasted two hours and average earnings amounted to 25 Euros (about 27 US Dollars at the time of the experiment), including a show-up fee of 4 Euros.[24]

5.1.1. Timing and information structure

At the beginning of each period, buyers and sellers are informed about production costs ($c \in \{5, 10, 20, 30, 50\}$).[25] In addition, buyers learn their valuations ($v \in \{10, 25, 40, 60, 120, 200\}$). Then, sellers decide on entry. Upon observing the entry decisions, well-informed buyers decide whether and where to purchase.

If at least one well-informed buyer has opted for the PWYW/NYOP seller, this seller will be available for follow-up buyers at no additional cost. The same holds true for posted-price sellers. If only one seller is available to follow-up buyers, they can invest search costs ($c_s = 10$) to find out whether the other seller has entered the market; if so, they can also purchase from this seller.[26] If the market for well-informed buyers was split equally, both sellers are available at no additional cost.

After observing the market structure follow-up buyers make their purchasing decisions. If a buyer submitted an unsuccessful bid to a NYOP seller, he can turn to the posted price seller if this seller is available to him. Thus, availability of sellers for follow-up buyers in the NYOP treatment depends on the interaction between well-informed buyers and sellers. If one of the well-informed buyers submits an unsuccessful bid and subsequently purchases at the posted price, both sellers are available to follow-up buyers. If, however, both well-informed buyers interact with only one seller, then only this seller is available to follow-up buyers. We summarize this structure in Fig. 4.[27]

5.2. Results

Table 8 reports the total profits and market shares achieved in PCEB and NCEB. The results are striking. If the PWYW seller chooses to enter, then he is extremely successful in monopolizing the market. On average, his market share is almost 90 percent. In fact, almost all well-informed buyers choose the PWYW seller and follow-up buyers never get to see the

[24] As in the first set of experiments, treatments were implemented using zTree (Fischbacher, 2007) and subjects were recruited using ORSEE (Greiner, 2004).

[25] We expected that additional benefits of using PWYW potentially exist only for low cost levels. Therefore, we kept the original cost levels from the first experiment and added two low cost levels (5 and 20) to the set.

[26] To keep the PCEB and NCEB treatments symmetric, buyers have to take the decision whether or not to invest search costs before deciding where to purchase. In NCEB it is also conceivable that the buyer invests the search cost if his purchase with the NYOP seller was unsuccessful, but because there is no "unsuccessful purchase" with PWYW this cannot be implemented in the PCEB treatment.

[27] Due to space constraints we do not depict the nodes where buyers have the opportunity to purchase after having submitted an unsuccessful bid (given that both sellers are available).

Table 8
Profit and market share totals.

	PCEB				NCEB			
	Profit		Market share		Profit		Market share	
	PP	PWYW	PP	PWYW	PP	NYOP	PP	NYOP
$c=5$	3.4	8.9	11%	89%	22.5	50.5	32%	64%
$c=10$	5.8	−5.8	11%	86%	21.9	38.6	28%	53%
$c=20$	7.5	−54.4	25%	75%	18.8	36.8	27%	66%
$c=30$	0	−97.5	0%	79%	16.4	29.6	23%	36%
$c=50$	0	−174.0	0%	92%	15.2	21.5	11%	28%
Total	4.2	−9.0	10%	87%	20.4	38.8	27%	54%

Note: Cells show average per period profits and market shares generated by the different seller types in treatments PCEB and NCEB, conditional on entry of both sellers.

Table 9
Additional benefits PWYW and NYOP.

	PCEB		NCEB	
	PP	PWYW	PP	NYOP
$c=5$	1.7	2.3	15.4	28.0
$c=10$	3.7	−3.8	13.2	23.4
$c=20$	2.5	−44.5	12.1	22.3
$c=30$	0	−71.5	11.8	12.3
$c=50$	0	−104.5	5.3	8.5
Total	2.4	−8.0	12.7	21.9

Note: Cells show average per period profits generated by the different seller types on the follow-up markets in treatments PCEB and NCEB, conditional on entry of both sellers.

posted-price seller. However, this strategy is not very profitable. If costs are low ($c=5$), the PWYW seller makes a small profit, but if costs increase, PWYW makes losses because buyers do not pay enough voluntarily to cover the seller's costs.[28] Thus, direct promotional benefits alone are not sufficient to make PWYW profitable.

A completely different picture arises in NCEB. If a NYOP seller enters the market his profits are substantial and 70 percent higher than the profits of the posted-price seller, but he monopolizes the market less often than a PWYW seller. We observe that a large majority (73 percent) of the well-informed buyers make an offer to the NYOP seller. However, if their bids fail, they turn to the PP seller. Thus, follow-up buyers get to see the PP seller more often. Even if they only see the NYOP seller they often search for an additional seller before making their purchase. The average market share of the NYOP seller is twice as high as the average market share of the PP seller, but significantly lower than the market share of the PWYW seller.

In order to measure the word-of-mouth benefits consider the profits obtained in the follow-up market which are reported in Table 9. In PCEB the profits of the PWYW sellers from the follow-up consumers are close to zero or strictly negative. Profits of the competing PP sellers are also close to zero because their market share is very small. However, in NCEB profits on the follow-up market of the NYOP sellers are always positive and almost twice as large as the profits of the competing PP seller. Profits per transaction are very similar across seller types: a PP seller makes 13.5 points on average, while a NYOP seller gets 10.6 points. This suggests that higher profits are not driven by increased profit margins, but by the increased sales volume due to word-of-mouth advertising.

Result 5 (Direct promotional benefits). *In PCEB, PWYW sellers capture* 90 percent*of the follow-up market. However, they fail to make significant profits from this high market share even if costs are low. Thus, word-of-mouth advertising alone generates benefits in terms of market share but not in terms of profits.*

In contrast, in NCEB there are additional monetary benefits that arise endogenously through word-of-mouth advertising. NYOP sellers attract a twice as large market share on the follow-up market as compared to their PP competitors which translates into substantial profits that are 70 percent higher than the profits of competing PP sellers.

6. Conclusions

Our analysis shows that PWYW and NYOP are effective methods of endogenous price discrimination. Both of these marketing strategies delegate (some) pricing power to buyers, and both strategies avoid setting a reference price. However, despite these similarities the two pricing strategies work very differently and should be used under different circumstances.

[28] It has to be noted that very few PWYW sellers entered the market when costs were high. Thus, the high average losses reported in Table 8 are based on very few observations.

PWYW price discriminates by appealing to social preferences. There is a significant fraction of the population that is willing to voluntarily pay positive prices, which generates some revenues. Prices paid increase with the consumer's valuation, with his prosociality, and with the seller's cost. However, these revenues alone are often not sufficient to cover costs – especially in large anonymous markets in which customers shop only once and have no interest in keeping the firm in business. In such situations, an additional promotional benefit (such as increased press coverage or word-of-mouth recommendations), as well as low marginal costs may be necessary for PWYW to be viable. Because PWYW achieves (almost) full market penetration, it is a very aggressive strategy driving other posted-price sellers out of the market.

NYOP achieves price discrimination by creating strategic uncertainty. Low valuation buyers find NYOP very attractive because it offers a chance to get the good at a lower price. High-valuation buyers prefer a posted-price seller, because they do not want to take the risk of not getting the good if their bid is below the seller's secret threshold. Thus, NYOP can be employed to access new customer segments that did not buy the good beforehand while most existing (high-valuation) customers still buy at the posted price. Notably, social preferences do not affect how much consumers bid. NYOP has the advantage that the seller can protect himself against losses by setting an appropriate threshold. Therefore, NYOP can also be used profitably if there is no additional benefit and if marginal costs are high. The drawback of NYOP is that it is less successful in penetrating the market and leaves room for additional posted-price sellers. In fact, NYOP is a strategy that relaxes price competition and increases total industry profits.

We find that direct promotional benefits can arise endogenously through a word-of-mouth channel. For PWYW the main benefit is that it monopolizes the market, but it fails in generating significant profits, in particular if costs are high. This suggests that PWYW requires indirect promotional benefits (such as the promotion of complementary goods offered by the same seller) to be viable. The examples of Radiohead and ibis, as discussed in the introduction, are a case in point. NYOP is less successful in terms of market share, but more successful in generating profits. In fact, profits of a NYOP seller are 70 percent higher as profits of the competing PP seller in our experiment.

From a managerial perspective, PWYW is most likely to be successful if capacity constraints are negligible, marginal costs are low and the seller profits from spillover effects on complementary products. It is a very aggressive strategy that achieves high market penetration but low profits. NYOP, on the other hand, can be employed even if costs are high, and it relaxes price competition. Furthermore, NYOP can be used as a complementary way to sell excess capacity via third-party intermediaries on a permanent basis. It successfully segments the market into high-valuation customers who are more inclined to buy at posted prices and low-valuation customers who would not have bought the good at regular prices. NYOP can therefore be employed parallel to posted prices in order to access new customer segments.

We used laboratory experiments to make sure that PWYW and NYOP are offered under the exact same conditions and to control the monetary costs and benefits of buyers and sellers. But, of course, this raises the issue of external validity. An important topic of future research is to conduct field experiments and field studies to validate our results in natural environments.

Our study raises several new questions and opens avenues for future research. First, our laboratory analysis is well suited to identify causal effects and to understand the functioning of customer-driven pricing mechanisms. However, it does not tell us much about the magnitude of the observed effects in real markets. Therefore, testing our predictions in the field would be very interesting. Second, we test word-of-mouth as one channel for direct promotional benefits. Further research should explore indirect promotional benefits in more detail. Finally, we ignored some aspects of customer-driven pricing mechanisms, such as joint bidding in NYOP or public minimum/recommended prices, that merit future research.

Appendix A: Proofs.

Proof of Lemma 1. Because the threshold is set secretly it cannot affect the behavior of the buyers nor of a competing seller. Note that the threshold has to be nonnegative. Suppose that the seller sets a threshold $\hat{t} > t^*$. Buyers offering a price $p \geq \hat{t}$ receive the good and pay the offered price under both $\hat{t}$ and t^*. Buyers offering a price $p < t^*$ do not receive the good and do not pay anything under both thresholds. Thus, in these cases the threshold does not make a difference. However, if a buyer offers a price p such that $t* \leq p < \hat{t}$, then the buyer does not get the good under threshold $\hat{t}$ and the seller makes zero profit, while the buyer gets the good under threshold t^* and the seller makes a positive profit of $p - c + b > 0$ from this customer. Thus, the seller is better off with threshold t^* than with threshold $\hat{t} > t^*$. Similarly, suppose that the seller sets a threshold $\hat{t} < t^*$. Again, if $p < \hat{t}$ or if $p \geq t^*$ it does not make a difference whether the threshold is $\hat{t}$ or t^*. However, if $\hat{t} \leq p < t^*$ then the buyer gets the good under threshold $\hat{t}$ yielding a negative profit of $p - c + b < 0$ for the seller, while the buyer does not get the good and the seller's profit is zero under threshold t^*. Thus, setting $t^* = \max\{c - b, 0\}$ is indeed a (weakly) dominant strategy. □

Proof of Lemma 2. Two cases have to be distinguished. (1) If both sellers are posted-price sellers (which may happen in the flexible competition treatment) the unique (Bertrand) equilibrium of this game is that both posted-price sellers charge $p^P = c$. (2) If a posted-price seller faces a NYOP seller the NYOP seller sets the threshold $t^* = \max\{c - b, 0\}$ and all buyers buy from him if $p^P > c$. In this case the posted-price seller makes a profit of zero. If he sets $p^P = c$ some buyers may buy from him, but his profit is again zero. Charging $p^P < c$ can only yield losses and is dominated by $p^P = c$. □

Proof of Lemma 3. If the buyer makes an offer to the NYOP seller he should either offer $p = c$ which gets him the good with certainty or $p = \max\{c - 40, 0\}$ which is successful with probability 0.5. The safe bid is optimal if $v_i - c \geq \frac{1}{2}[v_i - \max\{c - 40, 0\}]$, which is equivalent to $v_i \geq \min\{2c, c + 40\}$.

□

Appendix B. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.jebo.2017.01.019.

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