Naming Your Own Price Mechanisms: Revenue Gain or Drain?

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Abstract

We experimentally study the profitability of pricing mechanisms that allow customers to quote their own prices, such as Priceline.com's "Name-Your-Own-Price" (NYOP). Presumably firms find this sales method profit-maximizing despite the concerns that NYOP web-sites can cannibalize profit from standard distribution channels. Using a laboratory experiment we compare outcomes between NYOP and posted-price settings. We find that NYOP mechanisms that do not conceal information about products increase profit and consumer surplus. When NYOP channels conceal information about products there is no significant change in profit unless the threshold above which bids are accepted is set near marginal cost, whereby profit decreases.

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1 Introduction

> *William Shatner (Priceline Negotiator)*: A guy is worried about naming his own price? I'm on it.
> *N.*: Naming your own price, huh?
> *Purchaser*: Yeah, they want $200 for a 4-star on the Vegas strip ... I'm going $190.
> *N.*: Oh, you're a wuss.
> *P.*: What?
> *N.*: Go lower.
> *P.*: $160.
> *N.*: Namby-pamby.
> *P.*: $140?
> *N.*: Cupcake.
> *P.*: I want to get a room.
> *N.*: It's a guaranteed 4-star room, mama's boy.
> *P.*: $99?
> *N.*: Now you're negotiating. [1] *The commercial for Priceline.com is named "Tough Love" and is available at http://tickets.priceline.com/promo/shatner_ pcln_ negotiator.asp as of 5/5/09.*

A Name-Your-Own-Price (NYOP) mechanism is one in which a buyer of a good submits a bid (price) to an agency to procure a good.[2] If that bid is greater than some unknown threshold provided to the agency by the firms it represents then the consumer receives the good and pays the submitted price. If not the consumer does not receive the good. The commercial underscores the basic benefits and costs of using an NYOP mechanism, in that the consumer can pay less than the listed rate but may not win the object. In the late 1990s priceline.com (Priceline) successfully pioneered this business model on the Internet and has been growing rapidly since then.[3]

Another feature of some NYOP web-sites, most notably Priceline, is the *opaque feature*. With an opaque feature customers do not have complete information with regard to the products and services they are about to purchase. For example, customers reserving a room would not know the hotel names and locations until after they pay for it. This aspect is downplayed in the commercial, as if all 4-star hotels are the same.[4] Yet, the opaque feature is not used by all NYOP web-sites. For example, the Danish website www.prisminister.dk provides full information about products including a brand name, a product model, and all technical characteristics.

The increasing popularity of NYOP mechanisms raises several questions. The first is what are the properties of the NYOP mechanism; in particular, how does it compare to a more standard posted price mechanism in terms of profit generated and its social efficiency. The second question is whether the combination of the NYOP and posted price options would negatively affect seller profit. A potentially serious concern is that seller's profit might decline since customers may now use a (cheaper) NYOP option instead of paying a (higher) posted price. The third question is why some NYOP web-sites such as Priceline use the opaque feature. Clearly, the opaque feature destroys some of the product value since a flight with unknown departure/arrival time and layover length is less valuable than a flight with a known itinerary. One would therefore

[2] This mechanism is also referred to in the literature as *reverse pricing* and it is different from an auction setting in that buyers do not compete with each other for a single unit.

[3] For example see *"Priceline.com Reports Financial Results for 2nd Quarter 2006; Gross Travel Bookings and Gross Profits Increase over 60% Year-over-Year"*, in Business Wire August 7, 2006.

[4] Note that even the term "4-star hotel" is vague, as some online sources state that the Bellagio is a 4-star hotel while others state that it is a 5-star hotel.

expect that this should also lead to a profit reduction. However, Priceline's supplier base is quite large and is growing[5] which indicates that suppliers find it profitable. Thus if the opaque feature does not decrease the seller's profit then we seek to determine the factors that are responsible for this and which contradict our initial intuition.

In this paper we use an experimental approach to address these questions. The experimental approach is appropriate in studying the NYOP mechanisms because the behavior of buyers crucially depends on two factors: buyers' risk attitude and buyers' beliefs about the threshold above which bids are accepted. A range of outcomes is possible in the NYOP setting depending on the assumptions one makes about these two factors. For example, when buyers are strongly risk-averse, NYOP performs better since buyers bid just below their valuation. When buyers are risk-neutral, the posted price is optimal (Riley and Zeckhauser (1983), pp. 288, 289). The advantage of the experimental approach and the reason why we adopt it is that we do not have to impose any assumptions on beliefs and risk attitude to be able to study the properties of the NYOP mechanism.

In the paper we design six treatments with the NYOP option that differ from each other in two dimensions: opacity level and available options/information. We consider three treatments without the opaque feature and three treatments with it. In all treatments we use induced values. In the treatments without the opaque feature, only one good is available and subjects know their value for that item. In the treatments with the opaque feature two goods are available. Subjects know their value for each good but if they use the NYOP mechanism they do not know which one of the two goods they will acquire. This corresponds to the fact that a hotel described as a four-star hotel by an opaque web-site represents many actual four-star hotels and a customer can value these hotels differently.

In terms of available options and information we consider three different conditions. There are two treatments where only the NYOP option is available and the only information that subjects have is their value(s). There are two treatments where only the NYOP option is available but customers are also shown the posted price, even though they cannot purchase the good using the posted price. Finally there are two treatments where both posted price and NYOP options are available. These last two treatments are most closely related to the current combination of mechanisms in use since customers can choose whether they would like to use an NYOP website or a website with standard posted pricing.

We compare the NYOP treatments with two posted price benchmarks. The first benchmark is the theoretical benchmark. This benchmark is computer generated assuming that a person acquires an item if and only if he has at least one valuation greater than the price and if two items are present the most valuable one will be acquired. The second benchmark is an experimental one. We conducted posted price treatments where only the posted price option was available and subjects could either accept or reject the price.

By comparing the outcomes of the six NYOP treatments with each other and with the posted price benchmarks we obtain the following results. First, treatments without the opaque feature do not significantly decrease the profit as compared to the posted-price benchmarks. In particular, in all three treatments the seller's proift is greater than in the theoretical benchmark. Second, the treatment where both posted-price and NYOP options are available generates the profit that is higher than the benchmark profits. Compared to the theoretical outcome the profit increase is 15% and compared to the posted-price treatment the increase is 6%. Third, adding the opaque feature to the NYOP agency substantially decreases the seller's profit except for the treatment where both NYOP and posted-price options are available. In that treatment the result depends on the threshold level above which bids are accepted. If the threshold level is close to marginal cost there is a statistically significant decline in profit. Higher threshold levels generate profit levels that are not

[5]For example, American Airlines signed exclusive opaque participation agreement with Priceline (see Priceline press-release for October 9, 2007).

statistically different from either of the two benchmarks.

An important implication of our results is that aside from the aforementioned exception with low threshold levels a combination of NYOP and posted price agencies does not lead to a decrease in profit regardless of whether the opaque feature is used.[6] The underlying cause behind this is as follows. A major potential source of the profit drain caused by the NYOP mechanism comes from customers who would originally pay a (high) posted price for the product and who can now use a (cheaper) NYOP option thereby bringing less profit to the seller. The analysis of the experimental data shows, however, that there are several factors that mitigate this profit loss. First, NYOP brings new customers whose values are below the posted price and who would not purchase the product when only the posted price is available. Second, often subjects with values much higher than the posted price would not use the NYOP agency at all. Instead they would opt to immediately purchase the product at the posted price which reduced the number of people switching from the posted price to NYOP. Finally, the NYOP mechanism allows more room for mistakes than the posted price and on several occasions subjects would submit bids above the posted price.[7] In the treatment without the opaque feature these three factors together proved to have much higher impact on profit than losses caused by the introduction of the NYOP mechanism and the total profit was higher than in the two posted price benchmarks.

When the NYOP channel is combined with the opaque feature the outcome changes as two additional factors become important. First, not only subjects with high values, relative to the posted-price, but also subjects with a large difference between their two values preferred to buy without bidding. This reduced potential profit losses (compared to the posted price) even further. Second, those who *were* bidding were submitting much lower bids and an increase in the number of customers was considerably more modest. These two effects canceled each other and overall there was no significant change in profit unless the threshold was set too close to marginal cost in which case the profit decreased.

The contribution of our paper is three-fold. First, we provide an experimental analysis of the NYOP pricing mechanism with and without the opaque feature. Second, we study the combination of NYOP and posted price options, which is a currently existing setting. We show that this combination does not decrease the profit unless the NYOP has the opaque feature *and* the threshold is set too close to the marginal cost. Finally, we show what factors prevent the NYOP from cannibalizing the posted price channels and keep the profit at the same or even higher levels than in the posted price only case.

The rest of the paper is organized as follows. The literature review is given in Section 2 and the specifics of the experimental design are discussed in section 3 We present results on bidding behavior and a profit comparison between NYOP and posted price mechanisms in section 4, and conclude with section 5.

2 Literature Review

The question of profitability of different pricing mechanisms has been previously studied in economic literature, though not in the NYOP context. In general, the result depends on the risk attitudes of buyers. For risk-neutral buyers Riley and Zeckhauser (1983) show that *"This fixed price strategy ... is optimal [for the seller] in comparison to any other, including all forms of buyer involvement such as quoting offers."* (p. 289). However, when buyers are risk-averse *"the fixed-price strategy is no longer optimal for the seller"*

[6] This has been a serious concern for some service providers. For example Northwest Airlines discontinued its relationship with Priceline on June 2002 for being increasingly concerned with Priceline's business model. Hotel industry expressed similar concern on the long-run risk of Priceline in cannibalization from primary selling channels (Wang et al. (2006)).

[7] Similar evidence comes from eBay where bidders would sometimes bid higher for goods being auctioned than the buy-it-now price for another available unit of the same good (Lee and Malmendier (2007)).

(Id. at p. 288). Maskin and Riley (1984) show that in the auction setting (one product, n buyers) and with risk-averse buyers "high bid" (i.e. 1^{st}-price sealed bid) auction is optimal. Under a different set of assumptions, primarily that auction sellers have a storage and auctioning cost and that posted price sellers have a display cost, Wang (1993) also finds that auctions are optimal, particularly if value distributions are dispersed.

Theory specifically focused on NYOP mechanisms is relatively sparse, particularly when opacity is present. Fay (2004) examines whether or not repeat bidding in NYOP auctions reduces profit and finds that either encouraging or discouraging repeat bidders may be profitable, depending on the percentage of the population that participates in repeat bidding. Shapiro and Shi (2008) study the opaque feature of Priceline and Hotwire.com and show that sellers can use the feature to price discriminate between different types of consumers and increase their overall profits. Ding et al. (2005) construct a model that incorporates frustration and excitement in NYOP mechanisms and propose that frustration and excitement levels of consumers will vary over time based on past experiences, and that this variation in frustration and excitement will lead to fluctuations in bids over time. Finally, Terwiesch et al. (2005) suggest that additional haggling time will keep those customers who are not price sensitive from cannibalizing profits. They also show that under certain conditions haggling profits will be higher than posted price profits.

The experimental literature on NYOP mechanisms is developing and it primarily focuses on bidding behavior and comparisons to select-your-price (SYP) mechanisms. With an SYP mechanism a list of possible bids is provided by the seller, where the probability of that bid being accepted decreases as the bid decreases. Chernev (2003) conducts experiments using generation mechanisms (such as NYOP) and selection mechanisms (such as SYP) to determine how confident bidders feel in their likelihood of success. Over multiple treatments he finds that participants feel more confident in selection mechanisms than in generation mechanisms, although in one treatment he finds that while participants are more confident with a selection mechanism they prefer to use an augmented generation mechanism (i.e. an NYOP mechanism with a minimum and maximum for the allowable bid submission range). Spann et al. (2005) use field and lab experiments to determine whether NYOP or SYP mechanisms generate higher revenue. In particular, they use SYP mechanisms with a low range of values as well as with a high range of values. They find that the SYP mechanisms generate more revenue for the seller, particularly the SYP mechanism that has a high range of values. Finally, Ding et al. (2005) look at the emotional aspect of NYOP bidding. They conduct experiments in which bidders participate in 20 consecutive rounds of NYOP with a constant value for an item and a known probability of winning for any bid level, with the probability of winning increasing as the bid increases. They find that participants increase bids when the previous bid was a loser and decrease bids when the previous bid was a winner. They ask the participants to self-report frustration and excitement levels with each bid submission and find that these emotions impact a bidder's strategy.

As the preceding paragraphs show there are multiple design choices which could be made, all varying from actual institutions in some respect. In what follows we have chosen to abstract from the framing effects present in Spann et al. and others primarily because we introduce the opaque feature in our laboratory experiments. As they have shown, the choice of frame may influence the value an individual places on the good, which would certainly affect the profitability of the mechanisms we consider. However, our goal is to establish the profitability of these mechanisms in the traditional paradigm where consumers have stable values, leaving as an open question how these framing choices would impact profitability when coupled with the opaque feature of NYOP mechanisms.

3 Design and Experimental Procedure

3.1 Design

Participants in the study were potential buyers of a hypothetical airline ticket. Depending on the treatment participants could have one or two options for purchasing the ticket: an NYOP option and a posted price option. Participants wishing to use the NYOP option needed to submit a bid for the ticket. If the submitted bid was above the threshold the subject would win the ticket and his payoff would be $v_t - b_t$, where v_t was the participant's value of the acquired ticket in round t and b_t was the participant's bid. If the bid was below the threshold then the participant did not win the item and she was not allowed to use the NYOP option in that round again. Participants wishing to use the posted price option simply needed to decide whether they were willing to pay the posted price for a particular ticket or not. If they decide to accept the price they receive payoff $v_t - p_t$, where p_t is the posted price in period t.

Treatments differed in the number of tickets from which subjects could choose. In one-value treatments only one type of ticket was available and each subject would receive a randomly generated value for this ticket. In two-value treatments there were two types of tickets, an AM ticket and a PM ticket. Consequently each subject would have two different randomly generated values — one for the morning ticket and one for the evening ticket. Two-value treatments were used to model the opaque feature of NYOP websites. Specifically, in two-value treatments participants bidding at the NYOP agency would not know whether they will acquire an AM ticket or a PM ticket until after they submit the bid. Participants were informed that if their bid was accepted then a computer would flip a fair coin to determine the type of the ticket.

In total there were six treatments with the NYOP option. Three of these treatments were one-value treatments and the other three were two-value treatments. For each number of values the treatments differed in whether the posted price was unknown, known, or available. In treatments with an unknown posted price participants knew only their value(s) and the only mechanism available to purchase a ticket was an NYOP mechanism. The purpose of these treatments was to study the properties of an environment where the only pricing mechanism is the NYOP and to compare it with the benchmark. In treatments with a known posted price participants could see a list price in addition to their value(s). However, the NYOP mechanism was still the *only* way to purchase the ticket. The purpose of making the list price known was two-fold. First, to create a natural intermediary between treatments where the posted price is unavailable and unknown and treatments where both posted price and the NYOP options are available (subjects have the same information as in the latter and the same options as in the former). Second, to provide some reference for participants, as bidders in actual NYOP auctions are likely to have some information about product prices in non-NYOP stores.

Finally, in treatments with an available posted price participants could decide whether they are willing to use the NYOP or the posted price option. In these treatments, subjects could either choose the list price, in which case they would acquire the ticket, pay the list price, and the round would end; or, they could submit a bid to the NYOP agency. If the bid was accepted they would acquire the ticket, pay their bid, and the round would end. If their bid was not accepted they could not bid again but they could still purchase the ticket at the list price. In addition, in the two-value treatment participants using the posted price could choose which ticket they were buying whereas participants using the NYOP agency could not. Overall the treatments with an available posted price are the closest to existing institutions. In particular, customers can ignore the NYOP option or if their bids are rejected they can always use the posted price option. Also, NYOP websites usually put some restrictions on repeat bidding. For example, on Priceline customers can bid again for the exact same product specification only after 24 hours has elapsed from their previous bid.

Table 1 summarizes the specifics of different treatments and introduces mnemonic names for them. All one-value (two-value) treatments have the number one (two) in their name. Treatments with unknown posted price are labeled as $U1$ and $U2$; treatments with known posted price are labeled as $K1$ and $K2$, and finally the two treatments where the posted price option was available are labeled as $A1$ and $A2$.

	PP Benchmark	NYOP-treatments. P_t is Unknown	Known	Available
One Value	P1	U1	K1	A1
Two Values	P2	U2	K2	A2

Table 1: Ticket values and information conditions in six NYOP treatments and two benchmark treatments.

One of the objectives of this study is to understand how the NYOP pricing mechanism compares with the posted price. In order to do that we used two benchmark settings with only the posted price option being available. One benchmark was purely theoretical. For each subject's value(s) a computer generated posted price outcomes. In one-value treatments the computer would purchase the ticket if and only if the ticket's value is greater than p_t. In two-value treatments the computer would only purchase the most valuable ticket and only if its value is greater than p_t. In the paper we will refer to outcomes of the theoretical benchmark as $Th1$ and $Th2$, where as before numbers 1 and 2 refer to one- and two-value treatments.

The second benchmark was experimental We conducted two posted price treatments $P1$ and $P2$ where subjects had access to the posted price option only. In these two treatments a subject's task was to decide whether she is willing to purchase the ticket or not given her valuation and the posted price. In addition to that in the $P2$ treatment subjects also needed to specify whether they would like to purchase an AM or a PM ticket.

3.2 Experimental Procedure

Each session consisted of 6 treatments with 12 rounds per treatment for a total of 72 rounds. In every session, four out of six treatments were U and A treatments. The remaining two treatments would be, depending on the session, either $K1$ and $K2$ or $P1$ and $P2$. To control for potential order effects of the treatments we used 4 different orderings in UKA sessions and 3 different orderings in UPA sessions.

The four orderings for UKA sessions that we used were ($U1, K1, A1, U2, K2, A2$); ($A1$,$K1$,$U1$,$A2$,$K2$,$U2$); ($U2, K2, A2, U1, K1, A1$) and ($A2, K2, U2, A1, K1, U1$). Notice that in each ordering either all three one-value treatments were run first or all three two-value treatments are run first. Furthermore, in each of these orderings either one feature from the information conditions is added or one is subtracted. For example, in the $U1, K1, A1, U2, K2, A2$ ordering participants initially see only their value with the NYOP mechanism (treatment $U1$), then the list price which cannot be used is added (treatment $K1$), and finally they see the list price and are able to purchase the ticket using the list price (treatment $A1$).

The three orderings for UPA sessions that we used were ($U1, P1, A1, U2, P2, A2$); ($A1$,$P1$,$U1$,$A2$,$P2$,$U2$) and ($U1, P1, A1, U2, P2, A2$). These orderings correspond to the first three orderings of UKA sessions with P treatments conducted instead of K. We did not use the analogue of ($A2, K2, U2, A1, K1, U1$) because $A2$ was the most complicated treatment (two different types of tickets plus two different methods of acquiring the ticket) and sessions that had $A2$ as the first treatment had the highest error rates for subjects.

All sessions were conducted at UNC Charlotte in 2007 and 2009. The subject pool consisted primarily of UNC Charlotte undergraduate students. A total of 112 subjects participated in the experiment with 16 subjects for each ordering. The experiment was programmed and conducted with the software z-Tree (Fischbacher, 2007). Each session lasted approximately 45-60 minutes and the average earnings, including

$5 show-up payments, were approximately $12.

The experimental procedure is as follows. At the beginning of each session participants were given the printed set of instructions for the first three treatments. The session monitor read the instructions aloud and answered questions by referring to the text of the instructions when possible. The 36 rounds with the first three treatments were then conducted. At the end of each round participants would learn their profit and in the two value treatments they would also learn which ticket, if any, they purchased. At the beginning of each new treatment font colors on the screen were changed and the session monitor would loudly announce the beginning of a new "phase". After the first three treatments were conducted the participants were given instructions for the remaining three treatments. The session monitor read the second set of instructions aloud and after answering all questions the last three treatments were conducted. At the end of the session two treatments were drawn at random and participants were paid their total earnings for those two treatments.[8]

3.3 Parameter Choices

Each period participants' values were chosen randomly from a uniform distribution over $[a_t, a_t + 400]$. For the two-value case, each value was drawn independently from the same distribution. Values of a_t were different in each of the 12 rounds of the treatments and were randomly drawn from $U(0, 1600)$. Thus the lowest possible value distribution was $U(0, 400)$ and the highest was $U(1600, 2000)$. The overall range of values between 0 and 2000 was meant to provide a reasonable range for airline ticket prices. Participants received no information on the distribution of values other than the information they saw on their screens (value(s) and in some treatments, list price). The rationale for this limited information is that it is unlikely that buyers would know the value distribution of all market participants when making actual purchasing decisions.

The seller's posted price(s) was set at the midpoint of the value distribution, $p_t = a_t + 200$. The seller's marginal cost was set equal to a_t. Thus for the one-value treatments p_t was equal to the monopoly price, and for the two-value treatments p_t was below the monopoly price.[9] The posted price was kept at the midpoint of the value distribution in the 2-value case in order to ease the comparison between one-value and two-value treatments and in an attempt to keep any beliefs that may have formed about the relationship of the posted price and the private values consistent. Once the value distribution and posted prices were established threshold prices were created. The threshold values were drawn uniformly between the seller's marginal cost, a_t, and the posted price, p_t. In two-value treatments the threshold for both types of tickets was the same.

In order to ease comparison across treatments values were generated in such a way so that there is no difference in subjects' valuations across treatments. This was arranged as follows. At first, values were randomly generated for all 12 rounds and all 16 participants in the $U2$ treatment. That is participant i in period t would have two values: $(v_{1,i,t}, v_{2,i,t})$. For the 12 rounds of the $K2$ treatment, participant 2 simply received participant 1's values in the $U2$ treatment, participant 3 received participant 2's value, etc., and participant 1 received participant 16's value. This way participant $i > 1$ in period t of the $K2$ treatment would have two values: $(v_{1,i-1,t}, v_{2,i-1,t})$. For the remaining treatments the same procedure was used to shift the values by one participant. In addition to that in the one-value treatments participants would only see the v_1 component of the (v_1, v_2) vector. As a result of such arrangement, in aggregate, for a given round

[8] Twenty-eight subjects participated in sessions in which only 1 treatment was randomly drawn. Since this was the first experiment run at our university using payment for decision–making we increased the payment to 2 randomly drawn treatment to boost participant pay without altering incentives. There are no differences in behavior between these treatments.

[9] The monopoly price in the two-value treatments is $a_t + 267$. It is determined by the first-order statistic from a uniform distribution when 2 values are drawn.

t all treatments use the same values, but each specific participant would receive different values in different treatments.

As mentioned earlier, one benchmark that we use to compare the NYOP with is the theoretical posted price benchmark. The outcomes for $Th1$ and $Th2$ were computer generated in the following manner. Each round t we took the values generated for round t of the $U2$ treatment: $\{(v_{1,i,t}, v_{2,i,t})\}_{i=1}^{16}$. In the one-value treatments we assumed that participants with $v_{1,i,t} \geq p_t$ would purchase the ticket. In the two-value treatments we assumed that participants with $\max\{v_{1,i,t}, v_{2,i,t}\} \geq p_t$ would purchase the ticket and that the ticket with the highest value would be purchased. Using this procedure we calculated consumer, producer and social surpluses for $Th1$ and $Th2$ scenarios and compared it with outcomes in the conducted treatments.[10]

A final yet important remark is that in $A1$ and $A2$ treatments we explicitly assume that the posted price does not change. Currently there is a lack of theoretical guidance with regard to how the posted price should change after the introduction of the NYOP option. In particular, there is no reason why it would not change. Thus $p_t = a_t + 200$ may be a sub-optimal price and the actual seller's profit might be greater than the one we obtain. The results obtained in A treatments are still informative since they represent a lower bound for seller's profit. Furthermore, they can be used to provide insight on how consumers bid when faced with NYOP mechanisms, leading to a fuller development of equilibrium price-setting behavior.

4 Results

In this section we introduce the results of our experiments. Often it will be convenient to present the data that is normalized with respect to the lower bound of the value distribution a_t. For example, if a participant's bid is $b_{i,t}$ the normalized bid is $b_{i,t} - a_t$. The normalized posted price then is always 200 since $p_t = a_t + 200$, and normalized subjects' valuations are uniformly distributed on $[0, 400]$. Recall that all treatments used the same set of values, so this normalization process affects all treatments in the same manner. Finally, in this section we will refer to an object acquired using the NYOP-option as a *won object* and to the object acquired using the posted price as a *purchased object*.

4.1 Basic Behavioral Tests

We begin by examining the extent to which participants violated the basic rationality rules used to determine the theoretical benchmark. In our analysis here we will only look at the A and P treatments. The reason is that all treatments were programmed in such a way that subjects could not bid more than their (highest) value. Consequently, in U and K treatments it was impossible to do anything that could be unambiguously classified as irrational.[11]

We check for the following violations: (1) how often participants bought the item using the posted price when the posted price was greater than their value, (2) how often participants failed to acquire the item when their value was greater than the posted price, (3) how often in A treatments participants submitted bids above the posted price, and finally (4) how often in $A2$ and $P2$ treatments participants used the posted price to purchase the lower valued object. Table 2 provides a breakdown of each of these occurrences by treatment ordering. Each cell is based on 192 observations, and so a count of 10 corresponds to approximately 5%.

[10] Recall that, in aggregate, for a given round t all treatments have the same values, and so it does not matter whether the values for $U2$ or for another treatment are used.

[11] Due to specifics of zTree software the basic warning messages are displayed in German. In particular, this would be the case if a participant would try to submit the bid above his (highest) value. While we did not officially document this, there were few instances when a participant raised his hand because of this warning message. This suggests that it was a very rare event when a participant would try to submit a bid above the highest value.

	First two treatments seen						
	$U1K1$	$A1K1$	$U2K2$	$A2K2$	$U1P1$	$A1P1$	$U2P2$
$A1$: Fail to buy if $v_{1,t} > p_t$	1	4	1	0	0	2	0
$A2$: Fail to buy if $\max\{v_{1,t}, v_{2,t}\} > p_t$	2	2	11	4	0	0	1
$A2$: Buy w/p_t but buy $\min\{v_{1,t}, v_{2,t}\}$	2	4	8	28	0	5	3
$A1$: Buy w/p_t when $p_t > v_{1,t}$	6	10	8	14	3	7	3
$A2$: Buy w/p_t when $p_t > \max\{v_{1,t}, v_{2,t}\}$	3	4	11	30	1	5	5
$A1$: $Bid > p_t$	7	2	7	4	0	0	1
$A2$: $Bid > p_t$	11	3	6	8	1	0	2
$P1$: Buy when $p_t > v_{1,t}$	*	*	*	*	12	12	12
$P2$: Buy when $p_t > \max\{v_{1,t}, v_{2,t}\}$	*	*	*	*	7	6	27
$P2$: Buy $\min\{v_{1,t}, v_{2,t}\}$	*	*	*	*	4	6	24
$P1$: Fail to buy if $v_{1,t} > p_t$	*	*	*	*	5	1	2
$P2$: Fail to buy if $\max\{v_{1,t}, v_{2,t}\} > p_t$	*	*	*	*	3	1	0

Table 2: Violations of basic rationality assumptions. Numbers in each cell are out of 192 observations. Thus cells with a count of 10 correspond to approximately 5% of observations.

Our first observation is that most cells when the one-value treatments were seen first contain less than 5% violations, and the majority of violations occur when the two-value treatments are seen first, particularly $A2$. The largest number of violations (30) occurs in $A2$ when participants buy using the posted price when the posted price is greater than the high value. These purchases occurred when $A2$ was the first treatment seen, suggesting a few participants may have been overwhelmed by all of the options and information that were available in $A2$.

Another observation is that if we compare the number of mistakes in A treatments across different orderings we will see that in orderings with P treatments subjects were making less mistakes. The most probable reason is that subjects would gain enough experience with the posted price environment in P treatments so that when the posted price becomes available in A treatments they were familiar with it. In contrast in sessions without P treatments, $A1$ or $A2$ would be the first time subjects meet the posted price which could be a cause for the higher rate of mistakes there.

On an individual level, a common pattern was that most participants would commit a violation zero or one times and two or three participants would be responsible for the bulk of violations. For example, in the $P2$ treatment there were, in total, 40 instances when subjects purchased the object when the posted price was above their values. The majority of those who made this mistake made it at most twice (15 subjects). At the same time there was a subject who repeated this mistake 9 times.

Overall, we conclude that the majority of participants did conform to the basic rationality assumptions and the rate of mistakes typically does not exceed 5-6% out of total number of observations. The majority of mistakes are coming from orderings where two-value treatments were seen first. Aside from very few exceptions most of the subjects who made mistakes were able to quickly realize their error and would not repeat the mistake.

4.2 Individual Behavior

In this section we analyze participants' bidding. The average and median normalized bids across treatments are presented in Table 3. The normalization process is the same as described at the beginning of the section.

Note that the median and average bids are taken only over the submitted bids, so that for the $A1$ and $A2$ treatments they exclude instances in which the participants purchased the good without bidding.

	$U1$	$K1$	$A1$	$U2$	$K2$	$A2$
Average	84.10	118.14	91.41	106.90	124.44	84.08
Median	106.00	146.00	117.00	110.50	136.00	99.00

Table 3: Average and median (normalized) bids across phases.

Several things can be noticed using Table 3. First, participants bid less in U treatments than in K treatments and this holds regardless of the number of values. The interpretation of this is quite straightforward: U treatments as compared to K treatments provide less cues to participants about where the threshold might lie. In the $U1$ treatment participants observe only one number which is v_1, whereas in the $K1$ treatment participants observe v_1 and p and both numbers are within 200 of each other. Thus in $K1$ participants are more likely to submit bids closer to v_1 and p than in $U1$. In other words, a person observing a value of 1800 and posted price of 1750 is less likely to submit a bid of 500 as compared to a person who observes only the value of 1800. For the same reason the average bid in $U2$ is less than in $K2$. In essence, the posted price is similar to an anchoring effect in that bidders condition their bids upon both their value and the posted price (the anchor). However, the interpretation is slightly different from that of a traditional anchor, as in Strack and Mussweiler (1997), McFadden (2001) and Ariely et al. (2003), among others. In our treatments the posted price does provide some information as to where the threshold will be, whereas in the classic studies of the impact of anchors on behavior the anchors are irrelevant to the decision at hand.

The difference between K and A treatments and its sign are also intuitive. In A treatments participants have the same information as in the corresponding K treatments, but since the posted price is available they are less likely to submit bids above the posted price. This decreases the average bid in $A1$ versus $K1$ and in $A2$ versus $K2$. In addition, in the $A2$ treatment goods purchased using the posted price option and the NYOP option are different and, moreover, those purchased using the NYOP option are inferior given the uncertainty involved. Consequently, participants willingness to bid in $A2$ is reduced even further and the average bid in $A2$ ends up smaller than in $U2$ and $A1$.

Comparing the corresponding one and two-value treatments a somewhat surprising finding is that participants do not bid less in two-value treatments except for the $A2$ treatment. A more expected result would be that since NYOP goods in $U2$ and $K2$ are inferior to NYOP goods in $U1$ and $K1$ participants would bid less in the former two treatments. The reason behind this is exactly the same as the one behind the difference in $K1$ and $U1$. Participants in $U2$ actually receive more information by observing two values instead of one as in $U1$. Consequently, their bids are closer to the values they observe.

Result 1. *Participants bid less in U and A treatments as compared to K treatments. Uncertainty about the NYOP good does not reduce the bidding in U2 and K2 treatments compared to the U1 and K1 treatments since this is outweighed by participants having more information. Having a posted price option available reduces bids and more so when participants have two values as in A2.*

Table 4 shows the results of fixed-effect panel-data estimation of how different factors affected subjects' bidding. In our analysis of participants' bidding we separate the U and K treatments from the A treatments because in the former all participants had to submit a bid, whereas in the latter they had an additional option of buying without bidding which some of them used. The following variables were studied as possible factors to explain bidding behavior: subjects' valuations $v_{1,t}$ and $v_{2,t}$, the posted price p_t, the difference in valuations $|v_{1,t} - v_{2,t}|$, the previous period profit, $Profit_{t-1}$, and a dummy variable for whether the object was won in the previous period or not ($Won_{t-1} = 1$ if it was).

	U1		K1		U2		K2	
	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
$v_{1,t}$	0.963	0.000	0.680	0.000	0.494	0.000	0.402	0.000
p_t	−0.035	0.177	0.302	0.000	−0.002	0.903	0.237	0.000
$Profit_{t-1}$	−0.430	0.000	0.081	0.209	−0.047	0.061	−0.022	0.398
Won_{t-1}	17.560	0.039	−9.136	0.279	−5.510	0.128	−4.086	0.313
$v_{2,t}$	*	*	*	*	0.487	0.000	0.353	0.000
$\|v_{1,t} - v_{2,t}\|$	*	*	*	*	−0.343	0.000	−0.247	0.000
$Constant$	−19.509	0.016	−57.009	0.000	−19.374	0.000	−34.314	0.000

Table 4: Fixed-effect Panel Data Regressions for the U and K Treatments

The effect of these variables on participants' bidding is intuitive. The coefficients on $v_{1,t}$ and $v_{2,t}$ are positive and statistically significant, demonstrating that participants with higher valuations submit higher bids. The posted price (p_t) also has a significant and positive effect when it was observable in the K treatments but is insignificant when it was unobservable in the U treatments. In the 2-value treatments participants with a larger difference in valuations submitted lower bids since the NYOP goods were less desirable for them. The variables $Profit_{t-1}$ and Won_{t-1} had no significant affect on participants' bidding except for in U treatments where $Profit_{t-1}$ is significantly negative and in the $U1$ treatment where Won_{t-1} is significantly positive. However, there is very little for subjects to condition their bids upon in these treatments and once other variables are introduced these factors become insignificant.

The analysis of behavior in the A treatments must be different since participants have an additional option of buying without bidding. This option was used 112 times out of 1344 in $A1$ (8.33%) and 251 times out of 1344 in $A2$ (18.67%). This is a high percentage when compared to that in Ding et al. (2005), who have less than 4% of participants buying without bidding. A high number of buying without bidding outcomes is especially surprising in the $A1$ treatment. First, participants do not lose anything if they submit a bid since the NYOP ticket is just as good as the posted price ticket and, moreover, the posted price option still can be used if the bid is rejected. Furthermore, by bidding in the $A1$ treatment participants actually gain by having a chance of getting the good cheaper than at the posted price. In the $A2$ treatment the situation is slightly different because participants do not know the exact valuation of the NYOP product they might obtain. It still might be possible to submit a very low bid that, if accepted, would make the subject's expected utility higher from the probabilistic outcome using the NYOP mechanism than the expected value of the certain outcome gained by purchasing the ticket at the posted price. However, such a bid could be infeasible given the non-negativity constraint on bids and, furthermore, participants might expect that bids should be reasonably close to the posted price in order to be accepted and decide not to bid. We also cannot rule out that bidders in our environment succumb to a certainty effect as described in Kahneman and Tversky (1979), in which they place more weight on certain outcomes than probabilistic ones.

To study what factors affected subjects' decision to buy without bidding a fixed-effect panel-data logit model was estimated with the dependent binary variable equal to 1 whenever buying without bidding occurs. Table 5 shows the results of this estimation. In particular, it follows from Table 5 that it is participants with higher (normalized) values who are more likely to buy without bidding. Summary statistics fortify this observation even further as the average normalized valuation of those who were buying without bidding in $A1$ was 294 (cf with the population average of 197 and normalized p of 200). This suggests that even in a very simple environment such as $A1$ there may be some non-monetary costs associated with bidding such as mental cost of deciding how much to bid, possible disutility of having the bid rejected, and, finally, pressing more buttons. For participants with high valuations who can guarantee themselves a high profit from the purchase the marginal gain from bidding might be less than these costs in which case they choose to buy without bidding. Our result is consistent with the predictions of Terwiesch et al. (2005) who also expect that small haggling costs will keep high value bidders from using the NYOP mechanism.

	A1		A2	
	Coef.	p-value	Coef.	p-value
$v_{1,t} - a_t$	0.018	0.000	0.006	0.000
p_t	-0.001	0.162	-0.001	0.052
$v_{2,t} - a_t$	$*$	$*$	0.006	0.000
$\|v_{1,t} - v_{2,t}\|$	$*$	$*$	0.006	0.000

Table 5: Analysis of Buying without Bidding using fixed-effect panel-data logit estimation. The dependent binary variable is equal to 1 whenever a participant buy without bidding.

In the $A2$ treatment the results are similar. Just as with $A1$, logit analysis shows that participants with higher values are more likely to buy without bidding. In addition, those participants who have a larger difference between their values are also more likely to ignore the NYOP option. Finally, the actual value of the posted price has a negative impact on the likelihood of buying without bidding. This is consistent with the observation that when the posted price is higher it is possible for participants to submit a very low bid so that the NYOP good is profitable regardless of its realized value. Consequently, participants facing higher p_t are less likely to buy without bidding.

Result 2: *In the A treatments many participants buy without bidding. In the A1 treatment participants with higher values were more likely to ignore the bidding option. In the A2 treatments participants with higher values and a larger difference in values were more likely to purchase the good without bidding.*

	A1		**A2**	
	Coef.	p-value	Coef.	p-value
$v_{1,t}$	0.680	0.000	0.465	0.000
p_t	0.290	0.000	0.172	0.063
$Profit_{t-1}$	-0.048	0.454	-0.056	0.141
Won_{t-1}	2.004	0.757	1.520	0.887
$Bought_{t-1}$	-16.017	0.144	-10.130	0.277
$Nobid_{t-1}$	11.247	0.437	4.829	0.611
$v_{2,t}$	*	*	0.330	0.000
$\|v_{1,t} - v_{2,t}\|$	*	*	-0.209	0.004
Const	-50.056	0.000	-12.860	0.283

Table 6: Regression analysis using the Heckman's estimator to account for self-selection bias.

For those participants who did bid in A1 and A2 treatments Table 6 shows the results of Heckman's two-step procedure that takes into account self-selection bias. The variable $Bought_{t-1}$ in Table 6 is a dummy variable equal to 1 if the item was purchased in the previous period using the posted price mechanism *after* submitting the unsuccessful bid. The variable $Nobid_{t-1}$ is a dummy variable that is equal to 1 if the item was purchased in the previous period using the posted price mechanism without submission of an NYOP bid.

Note that the bidding behavior in the A treatments has a similar pattern to the U and K treatments in that participants with higher values bid higher, participants with a larger difference in their values tend to bid lower, and bids are higher when the posted price is higher. Combining these results with our observations for the U and K treatments we receive the following result.

Result 3. *In all treatments, participants' value(s) had a significant and positive effect on participants' bids as did the posted price whenever it was observable. The difference in values, $|v_{1,t}-v_{2,t}|$, has a significantly negative effect on bids in all two-value treatments.*

4.3 Profit Comparison

As it was already discussed in 3.3 using the same posted price in A treatments as in P treatments may be sub-optimal for seller's profit. There are two reasons why we keep the posted-price the same. First, due to a lack of theoretical guidance it is unknown what the optimal posted-price should be and whether it should change or not. Second, even if the posted-price should change our results are still informative as they provide the lower bound for the profit level. In particular, if our result is that the seller's profit in $A1$ and/or $A2$ is at least as high or higher than in the benchmark then using the optimal price would only reinforce the conclusion that A treatments are not inferior in their profitability.

Treatment	Profit	Treatment	Profit
U1	101.46	U2	94.20
K1	106.26	K2	100.93
A1	115.10	A2	146.98
P1	108.68	P2	157.99
Th1	100.00	Th2	153.13

Table 7: Profit in different treatments and in the theoretical benchmark.

Table 7 shows the average profit earned by the seller in each of the eight treatments as well as the benchmark profit that the seller would earn using only the posted price. The profit in $U1$ and $K1$ treatments is slightly higher than the theoretical benchmark and is slightly lower than in the posted price treatment. The profit in $A1$ treatment is higher than the profit of the both of the benchmarks. Using a t-test, the $U1 - P1$ and $K1 - P1$ differences are insignificant and the $A1 - P1$ difference is marginally significant with p-value 0.075. When compared with the theoretical benchmark, the profit in $K1$ and $A1$ is significantly higher than that in $Th1$.

The profit increase in the $A1$ treatment as compared to the posted price benchmarks is surprising at first. It is surprising because one would expect that since tickets purchased using the NYOP-option and using the posted price-option are perfect substitutes and since there is no substantial bidding cost in $A1$ (especially compared with actual NYOP institutions) the seller would lose a considerable amount of profit on those participants who acquire the good by bidding below p_t instead of buying it at p_t.

Percentage of Subjects who Acquired the Product							
	NYOP	PP	Total		NYOP	PP	Total
U1	52%	*	52%	U2	54%	*	54%
K1	62%	*	62%	K2	61%	*	62%
A1	47%	22%	70%	A2	40%	45%	85%
P1	*	54%	54%	P2	*	79%	79%
Th1	*	50%	50%	Th2	*	77%	77%

Table 8: Number of transactions in different treatments as a percentage of total number of observations. The total number of observations was 1344 in U and A treatments, 768 in K treatments and 576 in P treatments.

There are two main reasons why this does not happen. First of all, since the NYOP agency "offers" the product at a cheaper price than p_t it increases the overall number of customers purchasing the product. As Table 8 shows in $A1$ treatments the share of the market served by the seller got as high as 70%, which is much higher than 50% of the theoretical benchmark and 54% of $P1$. Second, as discussed in Result 2, many agents with high values preferred to buy without bidding and so the seller received the same profit from these agents as he would receive in the benchmark. The only profit loss for the seller was coming from participants who had $v_{1,t} > p_t$ and whose bids got accepted. However, the considerable increase in sales in $A1$ was strong enough to overcome this source of the profit loss.

Result 4: *When participants have only one value, introducing the NYOP channel increases seller's profit. The main source of profit increase comes from a 30% — 40% increase in the number of customers. In addition to that many customers purchased the posted price good without bidding which also decreased a potentially cannibalizing effect of the NYOP channel.*

Analysis of the $A2$ treatment that captures the opaque feature of Priceline is slightly more complicated since additional factors affect the outcome. In particular, customers have less information about the NYOP ticket which thus is inferior to the ticket purchased at the posted price. On one hand this is beneficial for the seller because the customers with $\max\{v_{1,t}, v_{2,t}\} > p_t$ are less likely to use the NYOP agency at all. Furthermore, those that will use it will submit lower bids than in $A1$. Consequently, their bids are more likely to be rejected and they will still end up paying the posted price. The drawback of concealing the information is that participants will bid less for the NYOP good. In particular, it would imply that the profit loss from customers with $\max\{v_{1,t}, v_{2,t}\} > p_t$ whose bids were accepted is larger, and there will be less additional customers with $\max\{v_{1,t}, v_{2,t}\} < p_t$. As Table 7 shows the overall effect is that the profit in the $A2$ treatment is lower than both benchmark profits and the difference is significant (when compared to $P1$ the p-value of a t-test is 0.002 and when compared to $Th1$ it is 0.000). Our preliminary result is that introducing the NYOP option with the opaque feature leads to a decrease in profit.

Result 5. *The combination of the NYOP option with the opaque feature and the posted price leads to a statistically significant decrease in profit as compared to the benchmarks.*

Result 6. *The difference between* $A2$ *and* $A1$ *comes from the fact that the number of additional customers is much smaller and that participants submit lower bids than in A1, which decreases the profit from the introduction of NYOP channel.*

An important variable that determines the profitability of the NYOP channel is the threshold level above which submitted bids are accepted. In order to be able to study the role of the threshold we used 12 possible (normalized) values that were drawn from $U(0, 200)$. The lowest normalized value was 9 and the highest value was 192. The former means that almost any bid above the marginal cost would be accepted. The latter means that there is only a very narrow window between the threshold and the normalized posted price, $p(=200)$, in which bids would be accepted.

	One-value Treatments			**Two-value Treatments**		
Threshold	**A1**	P1	Th1	**A2**	P2	Th2
9	**127.83**	125.00	112.50	**135.93**	166.67	175.00
24	**112.71**	108.33	100.00	**130.19**	145.83	137.50
25	**136.16**	116.67	112.50	**127.84**	145.83	137.50
32	**100.61**	112.50	87.50	**132.25**	162.50	150.00
60	**121.57**	120.83	112.50	**161.62**	162.50	162.50
81	**106.62**	83.33	75.00	**137.57**	141.67	137.50
85	**113.22**	104.17	100.00	**148.49**	166.67	150.00
99	**110.50**	100.00	100.00	**153.18**	154.17	150.00
123	**104.85**	87.50	100.00	**155.75**	150.00	162.50
159	**96.95**	104.17	87.50	**153.74**	162.50	150.00
189	**113.04**	112.50	87.50	**168.15**	175.00	162.50
192	**137.15**	129.17	125.00	**159.02**	162.50	162.50

Table 9: Profit by (normalized) threshold values.

The tradeoff for the firm when it determines the threshold is that a lower threshold means more accepted bids and consequently a larger increase in a number of customers.[12] At the same time it means a higher loss of profit from the customers with values above the posted price whose bids get accepted. In Table 9 we show how seller profit varies for different threshold levels in the $A1$ and $A2$ treatments. First of all, we immediately see that for all but one threshold level $A1$ is more profitable than both $P1$ and $Th1$. The only exception is for the threshold value 159 when $A1$ is less profitable than $P1$.

In the $A2$ the relationship between profitability of different threshold levels is slightly more complicated and is captured by Figure 1. In particular, Figure 1 shows that the difference in profit is the largest for the lowest threshold level, whereas for all other threshold levels the benchmark and actual profit are much closer to each other.

Conducting t-tests for each threshold level we have that the only two levels that lead to a significant difference in profits are 9 and 32. For all other threshold levels the difference with $P2$ and $Th2$ profits was insignificant. The result suggests that $A2$ is significantly less profitable than the posted price benchmarks only for low threshold levels that are close to marginal cost. For higher threshold levels the difference in profit is statistically insignificant. Furthermore, if we conduct a t-test excluding the observations with low threshold levels of 32 and below then the difference in profits between $A2$ and posted price benchmarks becomes insignificant.[13]

Result 7. *Unless the threshold level is set too low the introduction of the NYOP channel does not significantly decrease profit. When the threshold level is set too low there is a significant decrease in seller's profit.*

[12] We ignore here the possibility that customers can learn the threshold with time.

[13] Exclusion of low threshold levels does not produce the sample selection problem since the threshold was exogenously determined.

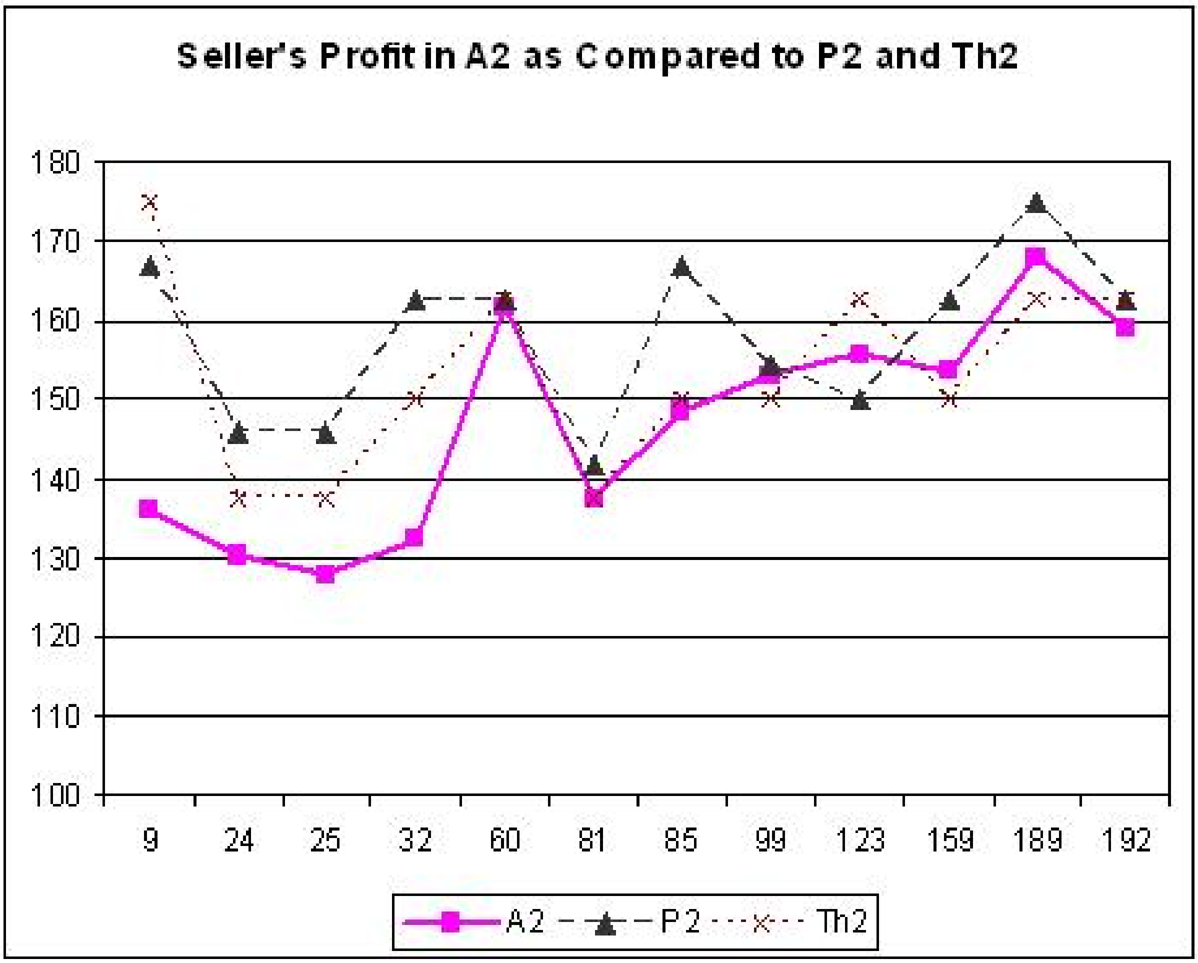

Figure 1: Seller's Profit in A2 as Compared to P2 and Th2

4.4 Consumer Surplus and Social Welfare

We conclude the section by comparing the consumer surplus and the social welfare in our treatments with the benchmark. As Table 10 shows, in the one-value treatments consumer surplus is the highest in $A1$ and is the lowest in $U1$. Using a t-test we find the difference in consumer surplus between $A1$ and both posted price benchmarks is significant at the 1% level. Such a considerable increase of the consumer surplus in $A1$ comes from the fact that more customers were served than in the benchmarks and those who were served were sometimes able to purchase the good at a (cheaper) NYOP price. As for the low performance of $U1$, it is most likely explained by the fact that many consumers tended to bit too low and as a result they would not purchase the good and receive zero surplus.

Treatment	Surplus	Profit	Welfare	Treatment	Surplus	Profit	Welfare
U1	36.20	101.46	137.66	**U2**	35.80	94.20	130.01
K1	48.62	106.26	154.88	**K2**	39.96	100.93	140.90
A1	56.92	115.10	172.02	**A2**	75.58	146.98	222.55
P1	41.23	108.68	149.91	**P2**	69.29	157.99	227.28
Th1	46.88	100.00	146.88	**Th2**	80.16	153.13	233.29

Table 10: Consumer and producer surplus, social welfare in different treatments.

In all four two-value treatments the consumer surplus is lower than in the theoretical benchmark. In NYOP treatments the main loss of surplus comes from the mismatch that occurs when the consumer with a higher value for an AM flight receives a PM ticket and vice versa. In addition to that the uncertainty by the opaque feature reduced subjects' willingness to bid, thereby decreasing the probability of getting any object at all, which explains the very poor performance of $U2$ and $K2$ treatments.

The $A2$ treatment performed much better and the consumer surplus there was higher than in the posted price treatment though lower than in the theoretical benchmark. The difference in surplus between $A2$ and $P2$ is insignificant with p-value 0.13 and the difference between $A2$ and $Th2$ is significant with p-value 0.01. The reason why in $A2$ the surplus is less than in the theoretical posted price benchmark is again because of the mismatch. However, in $A2$ this problem was alleviated by the availability of the posted price option. In particular, as we established earlier participants with a large difference in valuations — and thus with a large potential for efficiency loss — tend to ignore the NYOP option and use the posted price option right away. Therefore the loss in the surplus in $A2$ is not as large as in $K2$ and $U2$.

The difference in social welfare is similar to differences in consumer's surplus. In one-value treatments $K1$ and $A1$ lead to the highest social welfare which is due to the fact that more participants were served than in the benchmark (see Table 7). In two-value treatments the social welfare in both posted price benchmarks is the highest. The decrease in social welfare in the two-value treatments with the NYOP option comes from the aforementioned mismatch and also from participants' lower willingness to pay for the NYOP product which reduced seller's profit. In addition, seller's profit was lower in the NYOP treatments which decreased the social welfare even further. In $A2$ the decrease in welfare is the smallest among the NYOP treatments. In particular, using a t-test the difference is significant at the 1% when compared to $Th2$ and insignificant (p-value of 0.466) when compared to $P2$.

Result 8: *The combination of the posted price and the NYOP option without the opaque feature is beneficial both for consumers and producers.*

Result 9: *The NYOP option with the opaque price tends to reduce the consumer surplus and social welfare especially when compared to the theoretical benchmark. When $P2$ is used as the benchmark there is no significant difference in either consumer surplus or social welfare between $A2$ and $P2$.*

An important observation is that the consumer surplus and social welfare reported for the two-value treatments in Table 10 are *ex-post*. Thus, consumer surplus is calculated after it has been determined which ticket type the consumer will receive. At the ex-ante level, at least in $A2$, consumer surplus should weakly increase compared to the benchmark. This is because the posted price is the same in the benchmark and in $A2$. Thus, by ignoring the NYOP option each consumer can guarantee the same utility level as in the benchmark. Since in $A2$ ex-post consumer surplus decreases this suggests that at the ex-ante level there were some factors that are not captured in the ex-post analysis. For instance, some participants could enjoy the freedom of choosing their own price, as Chernev (2003) suggests, or be too optimistic about the chance of getting the ticket with highest valuation.

5 Concluding remarks

In this paper we experimentally study properties of the NYOP pricing mechanisms. We study the NYOP mechanisms with and without the opaque feature and we are specifically interested in understanding how the introduction of the NYOP channel affects seller's profit, consumer surplus and social welfare.

We show that without the opaque feature, the NYOP mechanism coupled with the posted price provides significant benefits to both consumers AND producers. When the NYOP agency is opaque then the NYOP+posted price combination does not perform better than the posted price benchmarks. However, it does not perform considerably worse either. In particular, seller's profit significantly decreases only if the threshold is set too close to the marginal cost and otherwise there is no significant difference in profits. Furthermore, while consumer surplus generated by NYOP+posted price combination is 6% lower than in the theoretical benchmark it ends up to be higher (though insignificantly) than in the posted price treatment.

On one hand the result that even with the opaque feature the NYOP+posted price combination does not decrease the profit unless the threshold is too low makes the fact that firms are willing to work with opaque NYOP web-sites less of a puzzle. However, a natural question is then why use the opaque feature at all if the NYOP without opaque feature performs much better. We believe there may be several explanations to that. First, there might be reasons that are not captured in our environment and that can make firms strictly prefer to use the opaque feature. For example, as Wang et al. (2006) argue using opaque agencies enables firms to be more flexible in price setting — especially having an excess in available capacity — without a fear of compromising an individual brand or pricing policy. Another rationale behind the opaque feature comes from the fact that the Priceline customers are more likely to purchase the same product many times (e.g. a ticket between New York City and Los Angeles) and consequently there is a substantial risk that customers might quickly learn the threshold range and decrease their bids. When this is not the case, as at www.prisminister.dk which sells consumer electronics, the NYOP website does not have the opaque feature. Indeed, it is simply less likely that one person would be buying a washer repeatedly and consequently the customer's information about the threshold is less precise.

As always, constraints play a role in choosing treatments. There are a variety of other treatments which could have been designed which may make the use of the NYOP mechanism even more profitable. Given that prior research in both laboratory and field experiments has found that the choice of frame can affect profitability, an interesting extension could be to investigate how various frames impact seller profit when the opaque feature is present. Also, if one could determine a profile of consumers types (e.g. risk tolerance level, degree of opportunity cost, etc.) who use NYOP mechanisms and then control for types within the laboratory it may be that NYOP mechanisms draw particular consumers who have features which increase its profitability. Finally, the limited number of tickets in the opaque feature may have led to different bids than if more tickets had been present.

Ultimately, even without these additions, our results show that from the seller's perspective the NYOP+posted price combination performed relatively well when compared to the posted price benchmarks without these additions. Such a good performance of the NYOP channel came despite the fact that our results are likely to underestimate the profitability of the NYOP+posted price combination since the optimal posted price could change with the introduction of the NYOP. This contributes to understanding properties of the NYOP and, most importantly, helps to explain why many sellers are willing to use the NYOP channels.

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