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 10/16/07.*

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 sellers such as Priceline combine the NYOP mechanism with an opaque feature since using the opaque feature is equivalent to destroying some of the product value. A flight with unknown departure/arrival time and layover length is less valuable than a flight with a known

[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.

itinerary. One would naturally 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 what factors are responsible for this and contradict the 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. In the NYOP setting depending on the assumptions one makes about these two factors a range of outcomes is possible. 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 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 the treatments without the opaque feature, only one good is available and subjects know how much they value it. 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 something 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.

By comparing the outcomes of the six treatment with each other and with a benchmark in which *only* a posted price is available we obtain the following results. We show that in all three treatments without the opaque feature the seller's profit is at least as large as in the posted-price benchmark. Furthermore, if *both* the posted price and NYOP options are available then the seller's profit increases by as much as 20% compared to the posted-price benchmark. 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 the latter 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 the profit. Higher threshold levels generate profit levels that are not statistically different from the benchmark.

An important implication of our results is that 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 who can now use a (cheaper) NYOP option thereby bringing less profit to the seller. The analysis of the experimental data shows, however, that

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

[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)).

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 very high values would not bid at the NYOP agency at all, instead opting 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 increased by 20%.

When the NYOP channel is combined with the opaque feature the outcome changes as two additional factors become important. First, in addition to the subjects with high values the subjects with a very large spread in values prefer to buy without bidding. This reduced potential profit losses (compared to the posted-price) even further. On the other hand, those who *were* bidding were submitting much lower bids and an increase in the number of customers was considerably more modest. Consequently, overall there was no significant increase in profit and if the threshold was set too close to marginal cost the profit actually 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 mechanisms and show that this combination does not decrease the profit unless 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"* (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 (2007) 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

[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)).

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.

3 Design and Experimental Procedure

3.1 Design

In the study participants were potential buyers of a hypothetical airline ticket. Depending on the treatment participants had different options for purchasing it. One option was an NYOP-option which was available in all six treatments. To use it participants needed to submit a bid for the ticket and if the submitted bid was above the threshold the subject would win the ticket. The participant's payoff would be $v_t - b_t$, where v_t is the participant's value of the acquired ticket in round t and b_t is the participant's bid. If the bid is below the threshold then the participant does not win the item and he is not allowed to use the NYOP in that round again. Another option that was available in some but not all treatments was the posted price option. Participants would observe the posted price and could simply decide whether they are willing to pay that price for a particular ticket or not. If they use the posted price option then their payoff would be $v_t - p_t$, where p_t is the posted price in period t.

Treatments also 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 are six different treatments, three of which are one-value treatments and the other three of which are two-value treatments. For each number of values 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. These treatments enabled us to compare the outcome in the case when only the NYOP is available versus an outcome when only posted-price is available. 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* available option to purchase the ticket. The purpose of making the list price available was 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.

In treatments with an available posted price participants had the same information as in the treatments with a known posted price. The difference was that they *could* purchase the ticket at the list price if they chose to do so. Participants were informed that if they chose the list price they would acquire the ticket, pay the list price, and the round would end. Alternatively, 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 $U1$ and $U2$ were the two treatments with <u>u</u>nknown posted price; treatments $K1$ and $K2$ were the two treatments with <u>k</u>nown posted price and finally, A1 and A2 were the two treatments where the posted price option was <u>a</u>vailable.

	Posted Price		
	Unknown	Known	Available
One Value	U1	K1	A1
Two Values	U2	K2	A2

Table 1: Ticket values and information conditions in each of the six treatments.

Although the primary focus of the paper is how the NYOP mechanism compares to the posted price mechanism in terms of generating profit, no treatments were conducted where *only* the posted price was available. Instead we used a computer to generate the posted-price outcome using a procedure that is described at the end of Section 3.3. There are two reasons for not conducting a treatment with only the posted-price. The first is that subjects are already participating in six different treatments. The second is that subjects may find the simple task uninteresting and lose focus throughout the remaining treatments of the experiment. We present results in section 4.1 that show that subject behavior conforms well to the basic rationality assumptions we use when generating the posted-price only outcomes.

3.2 Experimental Procedure

Each session consisted of all 6 treatments with 12 rounds per treatment for a total of 72 rounds. To control for potential order effects of the treatments, 4 different orders were used. In all orderings either all three one-value treatments were run first or all three two-value treatments were run first. The two orderings when the one-value treatments were run first were $U1, K1, A1, U2, K2, A2$ and $A1, K1, U1, A2, K2, U2$. When the two-value treatments were run first the orderings were $U2, K2, A2, U1, K1, A1$ and $A2, K2, U2, A1, K1, U1$. Note that 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 $A1$).

All sessions were conducted at UNC Charlotte between April 2007 and September 2007. The subject pool consisted mainly of UNC Charlotte undergraduate students. A total of 64 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 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.

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

[8] About half of the 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.

[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.

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 rotated among participants in the following manner. Values were initially generated for all 12 rounds and 16 participants in the $U2$ treatments. That is participant i in period t would have two values: $(v_{i,t}, w_{i,t})$. For the 12 rounds of the $K2$ treatment, participant 2 simply received participant 1's value 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: $(v_{i-1,t}, w_{i-1,t})$. 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 component of the (v, w) vector. This way, in aggregate, for a given round t all treatments use the same values, however, each specific participant would receive different values in different treatments.

As mentioned earlier we did not conduct the benchmark treatment with only the posted-price available. Instead we used the computer to generate the data. For round t of the benchmark we took the values generated for round t of $U2$[10] treatment: $\{(v_{i,t}, w_{i,t})\}_{i=1}^{16}$. In the one-value treatments we assumed that everyone with $v_{i,t} \geq p_t$ would purchase the ticket. In the two-value treatments we assumed that everyone with $\max\{v_{i,t}, w_{i,t}\} \geq p_t$ would purchase the ticket and that the ticket with the highest value would be purchased. Using this procedure we calculate consumer, producer and social surpluses for the posted-price scenario and compare it with outcomes in the conducted treatments.

A final yet important remark is that when comparing the benchmark with the $A1$ 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. Hopefully the results from these experiments 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 that is beyond the scope of the current paper.

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 $[0, 400]$. 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 benchmark. In our analysis here we will only look at $A1$ and $A2$ treatments. The reason is that all

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

	First treatment seen			
	$U1$	$A1$	$U2$	$A2$
$A1$: Fail to buy if $value > PP$	1	4	1	0
$A2$: Fail to buy if $value > PP$	2	2	11	4
$A2$: Buy w/PP but buy low value item	2	3	7	11
$A1$: Buy w/PP when $PP > value$	6	10	8	14
$A2$: Buy w/PP when $PP > high\ value$	3	4	11	30
$A1$: $Bid > PP$	7	2	7	4
$A2$: $Bid > PP$	11	3	6	8
$K1$: $Bid > PP$	36	13	26	27
$K2$: $Bid > PP$	19	13	29	27

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.

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]

For the $A1$ and $A2$ treatments we determine (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 purchase the item when their value was greater than the posted-price, and (3) how often participants submitted bids above the posted-price. For the $A2$ treatments we examine how often participants used the posted-price to purchase the lower valued object. Finally, although it is not a check on basic rationality, we also include how many participants bid above the posted-price in the $K1$ and $K2$ treatments. This final question is of interest to see if participant beliefs about where the threshold lies were different in different orderings. Table 2 provides a breakdown of each of these occurrences by treatment ordering.

Most cells when the one-value treatments were seen first contain less than 5% violations,[12] 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 initially available. On an individual level, most participants commit a violation zero or one times and two or three participants (out of 64) are responsible for the bulk of violations. For example, in the $A1$ treatment there were 38 instances when subjects purchased the object when the posted price was above their values. On an individual level, 16 participants did this one time, 5 participants did this twice, and 3 participants were responsible for the remaining 12 occurrences. These results suggest that participants tend to conform to the basic rationality assumptions used to create the benchmark level.

The last two rows of Table 2 show how participants' perceptions of the posted-price in the K treatments changed with different orderings. There was little difference between the treatments where $U2$ and $A2$ were seen first. However, the treatment where $A1$ was seen first shows a large decline in the number of times

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

[12] In each cell of Table 2 there are 192 observations, so that cells with a count greater than 10 violate the basic rationality assumptions at more than 5%.

participants bid above the known posted-price. Thus, when $A1$ was the first treatment seen it seems to have decreased bids in the $K1$ treatment, at least relative to the posted-price.

4.2 Individual Behavior

In this section we analyze participants' bidding. The average and median normalized bids across treatments are presented in Table 3. 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	80.81	118.14	100.92	107.55	124.44	91.59
Median	106.00	146.00	126.00	107.50	136.00	107.00

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 $K2$.

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
$v_{1,t}$	0.922	0.000	0.680	0.000	0.497	0.000	0.402	0.000
p_t	−0.007	0.849	0.302	0.000	−0.008	0.739	0.237	0.000
$Profit_{t-1}$	−0.510	0.000	0.081	0.209	−0.034	0.282	−0.022	0.398
Won_{t-1}	20.115	0.097	−9.136	0.279	−7.139	0.118	−4.086	0.313
$v_{2,t}$	*	*	*	*	0.491	0.000	0.353	0.000
$\|v_{1,t} - v_{2,t}\|$	*	*	*	*	−0.351	0.000	−0.247	0.000
$Constant$	−10.353	0.382	−57.009	0.000	−17.924	0.002	−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 $U1$ where $Profit_{t-1}$ is significantly negative. This is in contrast to Ding et al. (2005) who find that previous period outcomes impact bidding behavior. The likely reason for the difference between our study and Ding, et. al. is that values were changing throughout our study.

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 78 times out of 768 in $A1$ (10.1%) and 128 times out of 768 in $A2$ (16.67%). 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 it more profitable than a purchase 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.

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 288 (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
$v_{1,t} - a_t$	0.017	0.000	0.006	0.000
p_t	-0.001	0.188	-0.001	0.013
$v_{2,t} - a_t$	$*$	$*$	0.004	0.003
$\|v_{1,t} - v_{2,t}\|$	$*$	$*$	0.004	0.012

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 over 10% of the 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
$v_{1,t}$	0.718	0.000	0.390	0.000
p_t	0.251	0.001	0.331	0.000
$Profit_{t-1}$	-0.068	0.450	-0.108	0.028
Won_{t-1}	1.131	0.887	-3.436	0.716
$Bought_{t-1}$	-16.592	0.222	-15.575	0.068
$Nobid_{t-1}$	27.059	0.040	26.634	0.022
$v_{2,t}$	*	*	0.252	0.000
$\|v_{1,t} - v_{2,t}\|$	*	*	-0.247	0.000
Const	-37.615	0.006	-10.471	0.450

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 argued in the end of Section 3.3 the assumption that posted prices in the $A1$ and $A2$ treatments are the same as in the benchmark may be inaccurate. We use it for two reasons. First, due to a lack of theoretical guidance this assumption is no worse than any other. Second, even if this assumption is incorrect the results still can be informative. This is because the profit values reported in this section represent the lower bound for the optimal profit level. Consequently, 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 make our conclusions stronger.

Table 7 shows the average profit earned by the seller in each of the treatments as well as the benchmark profit that the seller would earn using only the posted price. Rows 3 and 4 show the number of times the good is purchased using the NYOP and PP (i.e. posted-price) options, respectively. Rows 5 and 6 show the total number of purchases in the corresponding treatment and the total number of purchases in the posted-price benchmark. The percentage in parenthesis is a percentage from the total number of observations which was equal to 768.

	U1	K1	A1	U2	K2	A2
Average Profit						
Profit	103.216	106.255	120.327	96.361	100.934	147.677
Benchmark	100	100	100	153.125	153.125	153.125
Number of Transactions						
NYOP	405 (53%)	477 (62%)	368 (48%)	415 (54%)	466 (61%)	329 (43%)
Posted Price	*	*	180 (23%)	*	*	328 (43%)
Total	405 (53%)	477 (62%)	548 (71%)	415 (54%)	466 (61%)	657 (86%)
Benchmark	384 (50%)	384 (50%)	384 (50%)	588 (77%)	588 (77%)	588 (77%)

Table 7: Profit and Number of Transactions.

The profit in the $U1$ and $K1$ treatments is slightly higher than the posted-price benchmark profit and it is considerably higher in the $A1$ treatment. A t-test shows that the difference in profit is significant between the $K1$ and the benchmark (p-value is 0.025) and between $A1$ and the benchmark (p-value is 0.000) but not between the $U1$ treatment and the benchmark (p-value is 0.305).

The profit increase in the $A1$ treatment as compared to the posted-price benchmark is surprising at first. One would expect that since tickets purchased using the NYOP-option and using the PP-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. 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. 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 $v_{1,t} > p_t$ whose bid was accepted. However, given that the number of sales in $A1$ increased to 71% from the 50% of the benchmark, this source of the profit loss was overcome by an increase in a number of sales.

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 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 $\max\{v_{1,t}, v_{2,t}\} > p$ 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 bid was 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 the benchmark profit and the difference is significant (p-value of t-test is 0.0395). Our preliminary result is that introducing the NYOP option with the opaque feature leads to a decrease in profit.

Result 5. *Introducing the NYOP option with the opaque feature leads to a statistically significant decrease in profit. The difference from the A1 treatment 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.

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.[13] 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 8 we show how seller profit varies for different threshold levels in the $A1$ and $A2$ treatments.

As one would expect as the threshold level decreases in both the $A1$ and $A2$ treatments the total number of transactions together with the total number of accepted bids is, in general, increasing. As for profit, in $A1$ it is always strictly above the benchmark profit. In $A2$ the relationship 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. For some threshold levels $A2$ leads to even a slightly higher profit

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

	Transactions			**Profit**		**Transactions**			**Profit**	
Threshold	A2	**B2**	Acc-ed Bids	A2	**B2**	A1	**B1**	Acc-ed Bids	A1	**B1**
192	51	**52**	3	159.63	**162.50**	46	**40**	4	146.27	**125.00**
189	52	**52**	5	169.27	**162.50**	38	**28**	2	122.83	**87.50**
159	50	**48**	11	155.59	**150.00**	33	**28**	12	99.89	**87.50**
123	52	**52**	19	152.80	**162.50**	38	**32**	29	106.34	**100.00**
99	55	**48**	29	151.50	**150.00**	45	**32**	33	118.98	**100.00**
85	56	**48**	37	152.77	**150.00**	44	**32**	40	112.19	**100.00**
81	52	**44**	34	136.84	**137.50**	41	**24**	33	107.41	**75.00**
60	57	**52**	21	158.11	**162.50**	53	**36**	45	127.88	**112.50**
32	55	**48**	35	134.91	**150.00**	43	**28**	27	108.13	**87.50**
25	56	**44**	49	124.73	**137.50**	60	**36**	52	143.97	**112.50**
24	59	**44**	42	134.66	**137.50**	50	**32**	40	116.28	**100.00**
9	62	**56**	44	141.33	**175.00**	57	**36**	51	133.77	**112.50**

Table 8: Profit by (normalized) threshold values. B1 and B2 are one-value and two-value benchmark outcomes. Each cell for a number of transactions and accepted bids is out of 64 observations.

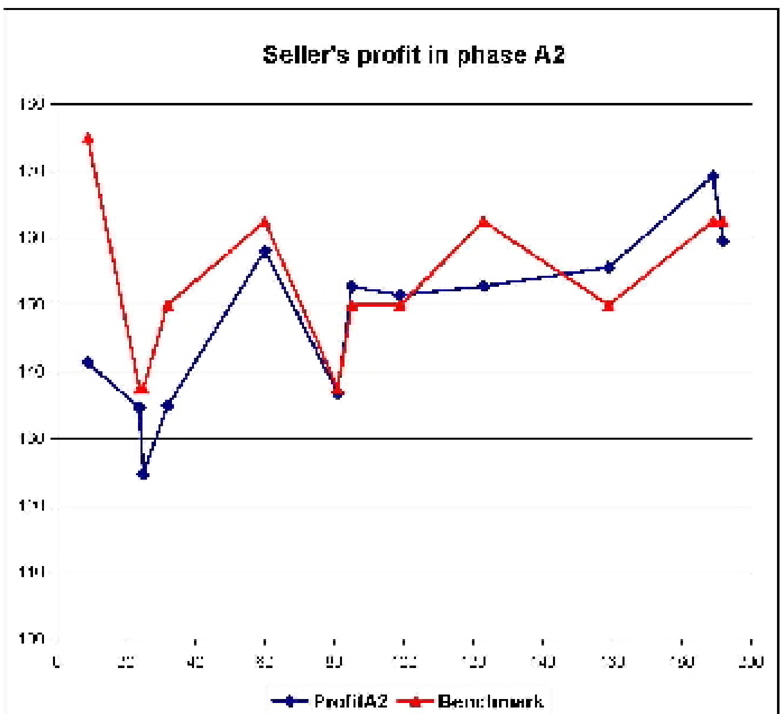

Figure 1: Comparison of benchmark and experimental profit in A2 by threshold

Conducting t-tests for each threshold level we have that the only levels that lead to a significant difference in profits are 9, 25 and 32 with p-values being 0.0005, 0.0952 and 0.0317 respectively. The alternative hypothesis for the t-test was that the benchmark average profit is higher than the $A2$ average profit. The result suggests that $A2$ is significantly less profitable than the posted price benchmark 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 a threshold level of 9 then the difference in profits is also insignificant with the p-value of 0.1453.[14]

Result 6. *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.*

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 9 shows, in the one-value treatments consumer surplus is lower than the benchmark in $U1$ but higher than the benchmark in $A1$. As it was already discussed previously this occurs because in $U1$ the only piece of information available for consumers is the value. Consequently, many consumers were bidding too low and as a result they would not purchase the good and receive zero surplus. In $A1$ the main gain in surplus comes from the fact that more customers were served than in the benchmark and many of them were able to purchase the good at a (cheaper) NYOP price.

	U1	K1	A1	U2	K2	A2
Surplus	35.440	*48.621*	53.378	35.194	39.965	68.979
Benchmark	46.88	*46.88*	46.88	80.16	80.16	80.16
Profit	*103.216*	106.255	120.327	96.361	100.934	147.677
Benchmark	*100*	100	100	153.125	153.125	153.125
Welfare	138.656	154.876	173.704	131.555	140.898	216.656
Benchmark	146.880	146.880	146.880	233.287	233.287	233.287

Table 9: Average Consumer Surplus, Seller Profit and Social Welfare. Numbers are in italic when the difference is insignificant.

In the two-value treatments the consumer surplus is lower than the benchmark in all three treatments. The main source of the decrease is the mismatch that occurs when the consumer with a higher value for an AM flight receives a PM ticket and vice versa. In contrast, in the posted price environment the consumer would always purchase the good that he values most. The surplus gap is consistently the smallest in $A2$ where many participants purchased the good at posted price thereby decreasing the number of mismatches.

The difference in social welfare is similar to differences in consumer's surplus. In all treatments but $K1$ and $A1$ the social welfare is significantly decreased. The increase in $K1$ and $A1$ treatments comes from the fact that more participants were served than in the benchmark (see Table 7). The decrease in social welfare in the two-value treatments comes from the aforementioned mismatch and also from participants' lower willingness to pay for the NYOP product which reduced sellers' profit. When the posted price option is available in $A2$ the decrease in welfare is the smallest among the two-value treatments though still significant.

An important observation is that in two-value treatments Table 9 shows the ex-post consumer surplus and social welfare. That means that when we calculate consumer surplus we calculate after it has been

[14] That does not produce the sample selection problem since the threshold was exogenously determined.

determined the ticket type that the consumer receives. At the ex-ante level at least in the $A2$ treatment 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. Given that ex-post $A2$ 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.

Result 7: *Introducing the NYOP channel without hiding any information is beneficial both for consumers and producers. Introducing the NYOP channel and concealing the product information is detrimental for consumers because of the mismatch. The producers on the other hand do not experience a significant difference unless the threshold level is set too low (see Result 6).*

5 Concluding remarks

In this paper we experimentally study the effect of the NYOP pricing mechanism on the seller's profit, consumers' surplus and the social welfare. In particular, we show that without the opaque feature, the NYOP mechanisms coupled with the posted-price mechanisms provide a benefit to both consumers AND producers. However, if the NYOP agency is opaque then the combination of the NYOP and the posted-price mechanisms appears to lead to little to no change in seller's profit but a sizable reduction in consumer surplus, measured in terms of observable payoff and not utility. The bulk of the reduction in consumer surplus stems from the mismatch that occurs when consumers receive their low-valued item. In general, our results underestimate the profitability of this combination because one might expect that the posted price would change after the introduction of the NYOP mechanism. Given a lack of formal theories on the subject we ignore this effect which means that there could exist a posted-price that leads to a higher profit.

On one hand the result that even with the opaque feature the $NYOP+PP$ 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. 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.

Overall, in our experiment the NYOP pricing mechanism performed relatively well compared to the posted-price benchmark. In almost all cases it either produced the same profit as the benchmark or significantly higher. The only exception is in the $A2$ treatment where the threshold levels were set too low. This contributes to understanding properties of the NYOP mechanism and helps to explain why many sellers are willing to use the NYOP channels.

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Appendix A: Instructions

Here is a copy of the instructions for the U1, K1, A1, U2, K2, A2 treatment.

Welcome to a decision-making study!

Introduction

Thank you for participating in today's experiment in economic decision-making. These instructions describe the details of the experiment, so please read them carefully. If you have any questions while these instructions are being read, please raise your hand.
At this time I ask that you refrain from talking to any of the other participants.

General Description

In the experiment you will be asked to make a decision regarding purchasing a hypothetical airline ticket. The ticket can be purchased from two (hypothetical) travel agencies. At different phases of the experiment, there will be different sets of rules and options available to you. The specifics of each phase will be clearly explained to you before the phase begins. In total there will be six phases. Each phase consists of 12 rounds. *This part of the instructions describe the initial 3 phases.*

In every round of the first three phases you will know your valuation *V* of the ticket and it will differ from round to round. If in a particular round you purchase the ticket and pay price *p* then your net gain in that round is *V-p*. If you do not purchase the ticket your net gain is 0. Net gains that you earn each round will determine your cash payoffs as described at the end of the instructions. Please note that ALL the monetary values are denominated in CENTS, so that 500 is 500 cents (=$5).

Example 1: Your valuation for the flight is 500. You purchased the ticket at a price of 200. Your net gain in this round is 300.

Travel Agencies

There are two ticket agencies: Agency 1 and Agency 2. Depending on the phase of the experiment you will either be able to use only one of them or you will have a choice of which one to use.

If you use Agency 1 to purchase the ticket you see the price of the ticket and you need to decide whether you are willing to pay the list price for this ticket or not. You can make this decision by pressing either the "Reject List Price" or "Accept List Price" button.

If you use Agency 2 to purchase the ticket you will have to name the price that you would like to pay. You "name" this price by typing it into a text box and then pressing the button that reads "Submit Price". Agency 2 has a threshold price that it received from a hypothetical airline. Agency 2 will compare your price with its threshold price. If your price is higher you purchase the ticket and pay the price that you named. Otherwise, the ticket is not purchased.

Threshold prices that Agency 2 uses were generated by the computer for all 72 rounds before the beginning of this study and are unknown to you. You can only learn whether your price is higher or lower than the threshold and only AFTER you have submitted your price.

Example 2: Assume you play round 5 of the phase where only Agency 2 is available. Your valuation for the ticket in round 5 is 800. Your decision is what price to submit to Agency 2. Say you submit price p. If p is higher than the threshold of Agency 2 then the ticket is sold to you and your net gain is $800 - p$. If p is less than the threshold price the ticket is not sold to you, your net gain is 0. Note that your net gain will be NEGATIVE if your bid is greater than your value AND you win the item.

Cash Payments

Your cash payments will be determined in the following way. Recall that the experiment consists of 6 phases with 12 rounds in each phase. At the end of the experiment, your total earnings for each phase will be summed up. ONE of the six phases will be chosen at random and all participants will be paid their earnings in cash for the chosen phase of the experiment. To choose the phase, one of the participants will pull a number out of a hat.

Description of Phases 1–3.

Following is a description of the phases that you will see in the first half of the study. Similar descriptions will be also available on the computer screen.

Phase 1

In this phase only Agency 2 is available. You are in the situation described by **Example 2.**

Phase 2

In this phase only Agency 2 is available. However, you know the price charged by Agency 1 even though you **CANNOT** use Agency 1 to purchase tickets.

Phase 3

Both agencies are available. You can either pay Agency 1's price or you can submit your price to Agency 2. If Agency 2 rejects your price you are allowed to use Agency 1 if you wish to do so.

Example 3: Assume you play round 5 of the phase where both Agencies are available. Your valuation for the ticket is 700. Assume that the price of Agency 1 is 600. In this phase you are free to use either Agency. In particular, you can go ahead and pay 600 for the ticket to Agency 1. Alternatively, you could submit price *p* to Agency 2. **Importantly,** if your price is rejected by Agency 2 you are still allowed to purchase the ticket from Agency 1. However, if you initially choose to Accept or Reject the list price, then you will **NOT** be able to name your own price for that round.

Description of Phases 4 through 6

This set of instructions describes phases 4, 5, and 6. Most of the instructions are similar to the first 3 phases but there are differences between the first 3 phases and these 3 phases. It is asked that you please follow closely to ensure that you understand these differences.

In this part of the experiment you will be asked to make a decision regarding purchasing a hypothetical airline ticket. You can either purchase the ticket for a **morning** flight or for an **evening** flight. The ticket can be purchased from two (hypothetical) travel agencies.

In every round of the last three phases you will know your valuation M for the **morning flight** and your valuation E for the **evening flight**. If in a particular round you purchase the ticket for a morning flight and pay price p then your net gain in that round is M-p. Similarly, if you buy the ticket for the evening flight and pay price p then your net gain is E-p. If you do not purchase any flight your net gain is 0. Net gains that you earn in each round will determine your cash payoffs as was already described.

Example 1: Your valuation for the morning flight is 500. You purchased the ticket at a price of 200. Your net gain in this round is 300.

Travel Agencies

There are two ticket agencies: Agency 1 and Agency 2. Depending on the phase of the experiment you will either be able to use only one of them or you will have a choice of which one to use.

If you use Agency 1 to purchase the ticket you see the price of the morning and evening flights. Your decision is which flight, if any, to buy.

Example 2: Assume you play round 5 of the phase where Agency 1 is available. Your valuation for the morning flight in round 5 is 1000 and your valuation for the evening flight is 900. The price for either flight is 800. Your decision is whether to purchase the ticket and for which flight. If you purchase the morning flight your net gain in round 5 is 1000– 800 = 200.

Agency 2 is different from Agency 1. First of all, if you buy tickets from Agency 2 you will **NOT** know whether this is a morning or an evening flight ticket until you pay for it. Second, if you use Agency 2 to purchase the ticket *you* name the price that you would like to pay. These two things together mean that at the moment when you submit the price you do not know whether you are purchasing the morning or the evening flight. And you will NOT know until you pay for the ticket.

Whether Agency 2 sells you a ticket and whether this will be a morning or an evening flight is determined as follows. In every round Agency 2 has a threshold price. If the price that you submit is higher than the threshold price then Agency 2 sells you a ticket and you pay your price. Otherwise, the ticket is not sold. The time of the flight is determined randomly. Think of it that if your price is accepted Agency 2 flips a coin and if it is heads you get a morning flight and if it is tails you get an evening flight.

Threshold prices that Agency 2 uses were generated by the computer for all 72 rounds before the beginning of this study and are unknown to you. You can only learn whether your price is higher or lower than the threshold and only AFTER you have submitted your price.

Example 3: Assume you play round 5 of the phase where only Agency 2 is available. Your valuation for the morning flight is 1000 and your valuation for the evening flight is 1100. Your decision is what price to submit to Agency 2. Say you submit price *p*. If *p* is higher than the threshold price of Agency 2 the ticket is sold to you. If this is the morning ticket your net gain is 1000-*p*. If it is the evening ticket your net gain is 1100–*p*. If *p* is less than the threshold price the ticket is not sold to you, your net gain is 0. Note that your net gain will be NEGATIVE if you win the item AND your price is greater than your value for that item. Any negative amounts will be subtracted from your earnings for this phase.

Phases 4–6

Following is a description of the phases that you will see in the first half of the study. Similar descriptions will be also available on the computer screen.

Phase 4

In this phase only Agency 2 is available. You are in the situation described by **Example 3.**

Phase 5

In this phase only Agency 2 is available. However, you know the prices charged by Agency 1 even though you **CANNOT** use Agency 1 to purchase tickets.

Phase 6

Both agencies are available. You can either pay Agency 1's price or you can submit your price to Agency 2. If Agency 2 rejects your price you are allowed to use Agency 1 if you wish to do so. If you purchase the ticket from Agency 2 the round ends.

Example 4: Assume you play round 5 of the phase where both Agencies are available. Your valuation for the morning flight is 700. Your valuation for the evening flight is 600. Assume that the price of Agency 1 is 500 for both flights. In this phase you are free to use either Agency. In particular, you can pay 500 for either morning or evening ticket to Agency 1. Alternatively, you could submit price *p* to Agency 2. **Importantly,** if your price is rejected by Agency 2 you are still allowed to purchase the ticket from Agency 1. However, if you initially choose to Accept or Reject the list price, then you will **NOT** be able to name your own price for that round.

Appendix B: Screenshot of the A2 treatment