Paying for Confidence: An Experimental Study of the Demand for Non-Instrumental Information*

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Abstract

This paper presents experimental evidence that when individuals are about to make a given decision under risk, they are willing to pay for information on the likelihood that this decision is ex-post optimal, *even if this information will not affect their decision.* Our findings suggest that this demand for non-instrumental information is caused by what we refer to as a "confidence effect": the desire to increase one's posterior belief by ruling out "bad news", even when such news would have no effect on one's decision. We conduct various treatments to show that our subjects' behavior is not likely to be caused by either a preference for early resolution of uncertainty, failure of backward induction or an aversion to contingent planning.

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1 Introduction

The standard view in Economics is that information is deemed valuable if, and only if, it is instrumental for decision-making. However, a growing number of studies in several fields – Economics, Psychology and Medicine – present evidence to the contrary. In Economics, for example, there are experimental studies of social learning in which a significant proportion of subjects purchase non-informative signals (e.g., Kübler and Weizsäcker (2004), Çelen, Choi, and Hyndman (2005) and Goeree and Yariv (2006)).

The most notable evidence from the Psychology literature is provided in a series of studies by Eldar Shafir (Tversky and Shafir (1992), Shafir and Tversky (1992), Bastardi and Shafir (1998) and Redelmeier, Shafir and Aujla, (2001)), of which the most well-known is a joint experiment with Amos Tversky. In this experiment, students were offered a big discount on a holiday resort, provided it was paid for before the date of an important qualifying exam. A majority of students preferred to forgo the discount and delay their decision until information about the exam arrived. After the results of exam were known, however, a majority of students said they would have gone to the holiday resort regardless of whether they passed or failed.

Several studies in Medicine have raised the concern that physicians have the tendency to order too many diagnostic tests beyond the point at which such tests are likely to provide new information (see Allman, Steinberg, Keruly and Dans (1985), Myers and Eisenberg (1985) and Kassirer (1989)) . This concern is best captured by the following quote from the New England Journal of Medicine:

> "We must stop ordering tests that have little chance of changing the scope of diagnostic possibilities. We must become increasingly comfortable with uncertainty; not every diagnosis must be nailed down with the final test...before we embark on a course of therapy." (Putterman and Ben-Chetrit (1995), p.1211)

These studies *seem* to suggest that individuals *may* assign a value to information, which is above and beyond the instrumental benefit it provides. However, it is difficult to asses this hypothesis on the basis of just these studies since there are several factors, not controlled for, which may have contributed towards the decision to acquire "useless" information. For example, subjects in the Economics experiments may not have thought that they were purchasing "useless" information because they either did not update their beliefs according to Bayes rule, or because they did not conform to the equilibrium behavior (and did not expect others to conform). In the Tversky-Shafir experiment subjects might have mistakenly thought that they would choose different actions depending on their grade because they were confused by the fact that there are different reasons to choose the same action – namely, to go on vacation – whether they passed or failed (in one case it's a reward, in another it's a consolation). Finally, there are a host of reasons why physicians may be inclined to subject a patient to more tests than are necessary. The aim of this paper is, therefore, to investigate whether controlling for all these factors, individuals derive an intrinsic demand for non-instrumental information, and if so, what may be the possible sources of this demand.

Both psychologists and economists have offered explanations for why individuals may demand non-instrumental information. Psychologists have argued that a demand for non-instrumental information is irrational in the sense that it is caused by a systematic bias, which can be easily corrected. Tversky and Shafir (1992) (henceforth, TS) called this bias, "The Disjunction Effect", which refers to individuals' tendency not to "think down the decision tree", i.e., not to consider what they would do in each possible contingency. However, this bias can be easily overcome by "forcing" people to do the necessary backward induction.

Economists, on the other hand, have tried to rationalize such a demand by enriching the domain of preferences. In a seminal paper, Kreps and Porteus (1978) (henceforth, KP) have argued that individuals may value information that can only refine their prior beliefs without affecting their decisions simply because such individuals may prefer early resolution of uncertainty. To accommodate such preferences for the temporal resolution of uncertainty, Kreps and Porteus proposed a recursive expected-utility model, which allowed individuals to exhibit intrinsic preferences for more or less information. More recently, Ergin and Sarver (2007) argued that the cognitive effort involved in contingent planning may lead individuals to strictly prefer making a decision, only after they learned the state of nature, over specifying in advance what they would choose in each state. As these authors show, this form of "aversion to contingent planning" can be captured in a model where preferences are defined over *sets of lotteries*.

This paper presents experimental evidence on a demand for non-instrumental information for which the above theories do not provide a satisfactory explanation. We propose an alternative explanation, which is based on the notion that individuals may have an intrinsic preference over the posterior beliefs that they hold when making a given decision. For example, suppose you were faced with a choice between action A and action B, where the outcome depends on an unobservable state of nature. To prefer A over B it is sufficient that according to your current information, there is more than 50% chance that A is ex-post optimal. However, you may "feel more confident" taking action A if you knew that A is ex-post optimal with a probability much higher than 0.5 (say, 0.8). If this could be verified, then you may be willing to pay for such information in order to "raise your confidence" in choosing A. More specifically, we argue that our subjects' behavior is mainly driven by a desire to rule out the worst state of nature before making a decision, even if conditional on knowing this state, they would choose the same decision.

In our experiment subjects were faced with the following simple decision problem. A monetary prize X is hidden in one of two boxes, labeled A and B. The probability that each box contains the prize depends on the state of nature. There are two possible states: *high* and *low.* The probability that box A contains the prize is h in the high state and $l < h$ in the low state, where h and l are *both strictly above* $\frac{1}{2}$. The subject's task is to choose a box If he chooses correctly, he wins the prize. Before he makes his choice, the subject can pay a fee to learn the state of nature. If he chooses not to pay, the subject then must choose a box *without* knowing the state of nature. Whether or not the subject pays the fee, he receives a payment immediately after he makes his choice.

Since a choice of A first-order stochastically dominates a choice of B, knowing the state of nature should not affect one's choice. This is true under any model of decision-making under risk that respects first-order stochastic dominance. It is also independent of the subject's attitude towards risk. Thus, a subject who pays the fee exhibits an intrinsic preferences for non-instrumental information. To determine which of the above three theories best explains these preferences, we ran four experiments, a baseline and two variants:

Treatment 1 (Baseline). Subjects are first asked if they want to pay a fee to learn the state of nature before making their choice. If they answer yes, they are shown the true state and are then asked to choose a box. If they answer no, they are asked to choose a box without any further information.

Treatment 2. Subjects are first asked which box they would hypothetically choose in each of the states. After they submit their answers, subjects are asked if they would like to pay a fee to learn the state. Subjects who answer yes, learn the state and are then asked to choose a box. Subjects who answer no, are asked to choose a box.

Treatment 3. Subjects are first asked to choose a box without knowing the state of nature. *After* they make their choice, but before being paid, they are given the opportunity to pay a fee to learn the state of nature.

Treatment 4. In this treatment there are *three* equally likely states of nature: $h > m > l > \frac{1}{2}$, where $m = \frac{1}{2}(h + l)$. Before choosing a box, subjects are asked if they want to pay a fee for only one of the following pieces of information: (1) whether or not the state is h, (2) whether or not the state is m and (3) whether or not the state is l. If a subject pays the fee for one of the pieces of information, then he is given that information before choosing a box. Otherwise, he chooses a box without any further information. Treatment 4 was run in order to investigate the type of information (i.e., "good news" or "bad news") people are most interested in.

Our findings provide clear evidence that subjects are more than willing to pay for information that will not alter the decision they are about to make. Moreover, our results suggest that this behavior cannot be explained by either the TS disjunction effect nor the KP theory but is consistent with our confidence hypothesis. For example, under TS, a subject who is willing to pay the fee in the Baseline will not be willing to pay the fee in Treatment 2 while under KP, a subject would pay the fee in the Baseline if, and only if, he would pay the fee in Treatment 3. We find that a significant proportion of the subjects are willing to pay a fee both in the Baseline and in the second treatment (in contradiction to TS), but hardly any subject is willing to pay a fee in the third treatment (in contradiction to KP). In particular, for $X = \$20$, $h = 1$ and $l = 0.6$, 18 out of 23 subjects (78%) agreed to pay a fee of \$0.5 in the Baseline, 11 out of 21 subjects (52%) agreed to pay this fee in the Treatment 2 and only one out of 21 (4.7%) agreed to pay in the Treatment 3.

Our fourth treatment presents data that indicates that, by and large, subjects are more willing to pay for information about states of nature that decrease their prior rather than those that increase it even though neither information will alter their decision. In this treatment, information acquired by a decision-maker may either be "good news" - in the sense that the posterior probability that the decision is optimal is *higher* than the prior, or it may be "bad news" - in the sense that this posterior probability is *lower* than the prior. We present evidence suggesting that decision-makers give more weight to bad news than to good news. In particular, we show that most of the subjects, who pay for non-instrumental information, prefer to know whether or not the posterior probability is the lowest it can be than to know whether or not it is the highest it can be.

The remainder of the paper is organized as follows. In Sections 2 through 5 we present both the design of each treatment and our results. For each treatment we discuss whether its results could be explained by the theories we discussed above. Section 6 offers some concluding remarks.

2 The baseline treatment

Experimental design

The entire experiment was conducted in the laboratory of the Center for Experimental Social Science at New York University. Subjects were recruited from the undergraduate population at New York University. A total of 97 subjects participated. In each treatment subjects were handed written instructions, which they first read on their own and was later read out load by one of the authors. Each subject received a show up fee of \$3, which he could keep regardless of the decisions he made in the experiment. Each subject also received an additional amount of \$4, which he could spend during the experiment and keep any amount that was left. Each treatment lasted around 45 minutes and the average payoff was \$20.20. A post experiment questionnaire was administered after the experiment was over asking subjects to explain their actions.

The instructions for the baseline treatment described a situation in which \$20 were to be placed in one of two boxes, labeled A and B, and the task of the subjects was to choose which box contained the money (detailed instructions of Treatment 1 appear in Appendix A). To determine which box would actually contain the \$20, the computer first chose one of two urns, Urn I or Urn II, with equal probability. Each computerized urn contained 100 balls, some marked with the letter A while others were marked with the letter B (all balls had some mark). In all three treatments subjects were given the composition of the two urns (i.e., how many A balls are in each urn) before being asked to choose a box. The computer then drew at random one ball from the chosen urn and placed the \$20 in the box marked on the ball.

The important feature of our design was that the percentage of A balls in Urns I and II, denoted by α and β respectively, was *strictly above* 50, hence, there was a greater chance that box A contained the \$20 no matter which urn was chosen. This was emphasized in bold letters in the instructions (see Appendix A). Thus, choosing A first-order stochastically dominated choosing B.

Subjects were presented with 15 situations that differed in the composition of each urn (see Table 1).[1] The order of these situations was randomly selected for each subject. In each situation, a subject was asked if he would be willing to pay a fee f to see which urn was selected *before choosing a box.* The size of the fee also varied across the situations as may be seen from Table 1. For example, in one situation $\alpha = 1$, $\beta = 0.6$ and $f = \$2.00$. Here, learning that the ball was drawn from Urn I meant that

[1] In Treatment 1, by mistake, Situation 8 that was presented to subjects was identical to Situation 1 (i.e. had the same α, β and f). Hence, there were only 14 non-identical situations presented. Only one subject gave different answers for the two situations, and we did not include him in our data.

A is the correct choice with probability 1, while earning that the ball was drawn from Urn II meant that A is still the correct choice but with a lower probability of 0.6.

After subjects had finished saying yes or no to purchasing information in all 15 situations, one was chosen at random.[2] If for the chosen situation a subject has stated that he would pay to know from which urn the ball was drawn, then that information was revealed to him and he was asked to choose either box A or box B. If the situation chosen for a subject was one for which he decided *not* to pay the fee, then he was asked to choose a box without knowing from which urn the ball was drawn. The outcome - whether or not they chose correctly - was then presented to the subjects and their payoff calculated.

Table 1

Table 1 exhibits a number of important properties of our experimental design. First, in each of the situations there are more than 50 A balls in each urn, hence, choosing A first-order stochastically dominates choosing B *regardless of which urn is used.* Second, the highest fee was \$4, which is precisely the amount that subjects received at the beginning of the experiment *in addition* to their \$3 show-up fee. Thus, even a subject, who paid a fee of \$4 and failed to choose the box with the prize, still walked out of the experiment with the \$3 show-up fee. For example, if the fee was \$2.00 for a particular situation and the subject decided to pay it and then chose a box that contained the \$20, his or her payoff would be

$$\underbrace{\$20}_{\text{prize}} + (\underbrace{\$4}_{\text{initial endowment}} - \underbrace{\$2}_{\text{fee paid}}) + \underbrace{\$3}_{\text{show-up fee}} = \$25$$

If the chosen box contained no money, the subject's payoff would be \$5.

Results

The results of this treatment are presented in Table 2.

Table 2

Note that in some situations, more than 50% of the subjects were willing to pay the fee. In particular, for $\alpha = 1$, $\beta = 0.6$ and $f = \$0.50$, almost 80% of the subjects were willing to do so. Furthermore, when the fee was \$2, or 10% of the prize, about 56% of the subjects agreed to pay the fee when $\alpha = 1$ and $\beta = 0.51$, and about 43% of them

[2] As mentioned in the Introduction, the information that was offered to subjects in Treatment 4 was different from the information offered in the other three treatments. For more details, see Section 5.

agreed to do so when β rose to 0.6.

Table 2 suggests a systematic structure to the data. First, the fraction of subjects who pay the fee decreases with the level of the fee. Consider for example the pair of posteriors $\alpha = 1.0$ and $\beta = 0.51$. While 74% of the subjects paid to find out which of these two posteriors was picked when the fee was \$0.50, about 56% of the subjects paid when the fee was \$2.00 and only 26% paid when the fee was \$4.00. Second, fixing the fee and the probability β, the fraction of paying subjects *increases* with α. For example, when the fee is \$0.50 and $\beta = 0.51$, about 48% of the subjects paid the fee when $\alpha = 0.6$, roughly 65% paid when $\alpha = 0.8$, and approximately 74% paid when $\alpha = 1.0$. In contrast, if we fix the fee and the probability α, the fraction of subjects who pay the fee typically *decreases* with β. For example, when the fee is \$2.00 and $\alpha = 1.0$, the percentage of subjects who pay the fee decreases from 56% to 43% when β increases from 0.51 to 0.60.

To investigate further the correlation between the likelihood of paying the fee and each of the three parameters, α, β and the size of the fee, we ran a simple random effects regression on the pooled data of the baseline treatment. Table 3 summarizes the results of this regression.

Table 3

As evident from Table 3, the coefficient of β and the fee are negative, while the coefficient of α is positive (the estimated values of these coefficients are all significant at the 1% level). This lends further support to our argument in the previous paragraph that our data is has a systematic structure and was not generated by a totally random process. In particular, the results of the baseline treatment suggest that the willingness to pay is positively related to the distance between the low and high posteriors.

In order to interpret the above findings as a demand for non-instrumental information it is important to verify that our subjects respected first-order stochastic dominance. I.e., we need to check that in those situations that were randomly chosen to be played out, our subjects chose box A. Indeed, we find that *all* the subjects in the baseline treatment chose box A.

Some insights into what made subjects pay may be obtained by examining their answers to the post-experiment questionnaire. In this questionnaire, we asked the following: "Knowing that the chance of the \$20 being in box A was always greater than 50%, one could say that Box A was always the 'best' box to choose no matter what you found out after paying the fee. If so, why did you choose to pay the fee when you did? Did you understand that the chances of the money being in Box A was greater than 50%?" Of course, not all of the answers provided are easily interpreted and some may not truely reflect the subjects' state of mind at the point of decision. Still, a general message that comes out of the subset of coherent answers is that on the one hand, the majority of subjects understood that the information offered to them was non-instrumental, but on the other hand they had an intrinsic preference to know the likelihood in which choosing A was the correct decision. For instance, of the subset of coherent answers, a representative sample of responses includes the following:

"I paid the fee to give me confidence in my decision. That's why I would only usually pay it when it was small.";

"Yes, I understood that the chance of the money being in Box A was greater than 50%. But, in paying the inspection fee, what I bought was a sense of security, no matter how false or unnecessary or superfluous that sense was.";

"I did understand the chance that the money was in Box A was greater than 50%. However, I wanted to be positive of my choice and to not be disappointed at myself for not choosing to pay the fee and getting the answer wrong."; and

"Knowing the probability that Box A always had a higher probability was certainly a factor in choosing it, but sometimes you just need a be a bit more certain."

There may be several possible explanations for the results of our baseline treatment. In the next section we investigate the possibility that our results may be driven by a disjunction effect in the sense that our subjects are failing to conduct a one-step backward induction. In Section 4 we ask whether our subjects are simply curious in the sense that they have an intrinsic preference for more information per-se independently of whether or not they are facing a decision. Finally, in Section 5 we ask whether our subjects prefer to make a decision with a particular lottery on their posterior beliefs, which is generated by the information they purchase.

The particular design that we employ may give rise to other potential explanations of our findings. One potential explanation may be an induced demand effect in which the whole setup of the experiment may suggest to subject that the option to acquire information has to be good for something. Consequently, subjects may try out the option particularly in those cases where it is cheap. However, our results show that (i) a significant proportion of subjects paid the fee when it was 10% of the prize (more than 40% when there wer eonly A balls in Urn I), and (ii) subjects paid the fee in seemingly systematic way: their willingness to pay was positively related to the distance between the low and high posteriors. Further evidence against the demand-effect explanation is provided in Treamtnet 3, which we discuss in Section 4.

Another potential explanation of our results may be one of cognitive effort. According to this explanation decision-makers may not be very good at making choices in an environment with uncertainty. Hence, identifying the right decision in state l may be more costly to them (in the sense of spending cognitive resources) than in state h, where the optimal decision may be obvious or at least easier to arrive at. This may make it attractive for them to find out the state, and only incur the cost when it is necessary. Moreover, subjects may believe that conditional on the state, the cost of identifying the optimal decision may be smaller than in the full problem. This idea of costly contemplation is the motivation for Ergin and Sarver's (2007) "aversion to contingent planning": instead of commiting to a contingent plan that specifies an element from each possible choice set, the decision-maker prefers to make a choice only after he learns which is the relevant choice set. We address this potential explanation in our discussion of Treatment 2 and 4 in Sections 3 and 5, respectively.

Finally, the results of Treatment 1 may also be related to the decision theory literature that links the failure to reduce compound lotteries to the uncertainty aversion exhibited in the Ellsberg Paradox. (see Segal (1990) and more recently, Halevy (2007)). This literature argues that most individuals fail to reduce compound lotteries and may therefore prefer one-stage lotteries to compound lotteries, even if they are equivalent in terms of the distribution of final outcomes. Our findings in Treatment 1 suggest that individuals also prefer *menus* of one-stage lotteries to *menus* of two-stage lotteries.

To see why, assume our subjects fail to reduce compound lotteries. A subject who does *not* pay in Treatment 1 is then faced with a choice from a *menu* of two *compound* lotteries: the two-stage lottery associated with a guess of A and the two-stage lottery associated with a choice of B (the two stages consist of first drawing an urn and second, drawing a prize amount). In contrast, a subject who *pays* in Treatment 1 faces a choice from a *menu* of two simple, *one-stage* lotteries. If Urn I is drawn, the first lottery pays \$20 with probability α and the second lottery pays \$20 with probability $1 - \alpha$. If Urn II is drawn, then the probabilities of winning in the two lotteries are β and $1 - \beta$, respectively.

Note, however, that failure to reduce compound lotteries, or Ellsberg-type uncertainty aversion, does not imply whether one type of non-instrumental information is preferred to another (put differently, it does not imply a particular ranking of menus of one-stage lotteries). In particular, it is silent as to whether individuals prefer to know whether or not the *worst* outcome has realized (e.g., a ball was drawn from an urn with the lowest number of A balls) or whether or not the best outcome has realized (a ball was drawn from the urn with the highest number of A balls), in situations where this information is non-instrumental (all urns contain more than 50% A balls). Hence, this theory does not help explain the results reported in Section 5.

3 Treatment 2: "The disjunction effect"

Experimental design

We now turn to investigate whether the demand for non-instrumental information that was obtained in the baseline treatment can *all* be attributed to the disjunction effect. According to TS, the disjunction effect can be undone by having a person ask himself what he would choose under each contingency (selected urn). This implies that if our subjects were forced to think what box they would choose for each choice of urn, then they would stop paying for this information.

To investigate whether this implication would hold in our setup, we modified Treatment 1 as follows. In each of the situations, subjects were asked *three* questions: (1) which box would they choose if they learned that Urn I was used to place the $20? (2) which box would they choose if they learned that it was Urn II? and (3) whether they wanted to pay the fee in this situation. The first two answers were *not* binding, however, they only served to make the subject aware of what he would do in each contingency.[3]

As in Treatment 1, after the subjects answered the above questions in all 15 situations, one situation was drawn at random. If a subject had stated that he wanted to pay the fee for that situation, he was told which urn was selected and then asked to choose a box. If he did not wish to pay the fee for that situation, then he was simply asked to choose a box without knowing the choice of urn. Note that regardless of their answers in the 15 situations, subjects could choose any box they wished for the randomly chosen situation. Thus, the disjunction effect cannot explain the behavior of a subject who chooses to pay the fee after answering that he would choose the same box regardless of the choice of urn. Therefore, subjects who exhibit the disjunction effect, would not pay any fee in Treatment 2, while subjects who exhibit the confidence effect, would behave the same way in Treatments 1 and 2.

Results

Table 4 presents the results of this treatment.

Table 4

[3] Making the answers binding would mean that subjects essentially guess a box *before* they get the chance to learn which urn was drawn. This effect is investigated in Treatment 3.

The first notable feature of the data is that even when subjects were forced to perform backward induction, more than 40% of them paid the \$0.50 fee. In particular, more than 50% paid this fee when $\alpha = 1.0$ and $\beta = 0.6$. Even when the fee was \$2.00, a third of the subjects paid it when the distance between the high and low posterior was the greatest (i.e., when $\alpha = 1.0$ and $\beta = 0.51$). A second feature of the data is the monotonicity with respect to the cost of information: for each (α, β) pair, the fraction of subjects who pay the fee declines as the fee increases. Finally, the positive relation between the fraction of paying subjects and the distance between the low and high posterior is weaker than in the baseline treatment as it is not present across all the situations. For example, consider those situations in which the fee is \$0.50. For $\beta = 0.6$, more subjects pay the fee when $\alpha = 1.0$ than when $\alpha = 0.8$. Similarly, when $\alpha = 0.8$, more subjects pay the fee when $\alpha = 0.51$ than when $\alpha = 0.6$. However, when $\beta = 0.51$, more subjects pay the fee when $\alpha = 0.8$ than when $\alpha = 1.0$. Still, on the aggregate, when the data from all situations is pooled together, there is a positive correlation between the fraction of paying subjects and the distance between the low and high posterior.

Note that Table 4 may be interpreted as some evidence against the cognitive-effort explanation described at the end of the previous section. According to that explanation subjects paid the fee because they were interested in reducing the "cognitive cost" associated with identifying the optimal decision. However, in the present treatment, subjects are forced to incur this cost before they get the opportunity to purchase information. Hence, their decision whether or not to acquire information is independent of this cognitive cost.

Comparing the data in Tables 4 and 2, we observe that in many situations, the proportion of subjects who paid the fee in Treatment 2 is lower than the corresponding proportion in the baseline treatment. This suggests that some - but not all - of the demand for non-instrumental information may be explained by the disjunction effect. To test this hypothesis, we compared the proportion of subjects paying the fee situation-by-situation across treatments using a test of proportions. That is, we took a given situation and looked at the fraction of subjects paying the fee in Treatment 1, compared that number to the fraction paying the fee in Treatment 2, and tested if these proportions are significantly different. Table 5 presents the results of our two-sided test of proportions.

Table 5

Note that in some situations, the proportion of subjects who paid the fee in Treatment 2 were *not lower* than the corresponding proportions in Treatment 1. In fact, there was only one situation (situation 12) where there was a significant difference (at the 5% level) in the proportion of subjects paying the fee between Treatments 1 and 2. We interpret this to mean that in situation 12, only *some* subjects - *but not all* - paid the fee because of a disjunction effect. Hence, Table 5 suggests that subjects' behavior was surprisingly similar across Treatments 1 and 2, despite the fact that in Treatment 2 subjects were asked what box they would choose for each choice of urn. This suggests that the disjunction may not be the sole explanation of our subjects' behavior.

Our interpretation of the data from this treatment rests on the observation that most situations have the following properties. First, most of the subjects who pay the fee state that they would choose Box A whether the ball is drawn from Urn I or II. Second, upon learning which urn was drawn, most subjects choose Box A. For instance, in nine of the 15 situations, at most two subjects said they would choose Box B if Urn II was used. In six of these situations, those who paid, said they would always choose Box A. In particular, when $\alpha = 1.0$, $\beta = 0.6$ and the fee was \$0.50, about 52% of the subjects paid the fee, all of which said they would always choose Box A. In five of the remaining six situations, where more than two subjects said they would choose Box B if Urn II used, at most two such subjects paid the fee. Finally, of the 21 subjects who participated in Treatment 2, only *one* chose box B, and he did so in only *one* situation (Situation 2 where $\alpha = 1$, $\beta = 0.51$ and $f = \$4.00$) where he chose to pay the fee.

4 Treatment 3: Intrinsic preferences for information

Experimental design

Our findings from the second treatment suggests that there remains a significant proportion of subjects who purchase non-instrumental information, even after we control for a possible disjunction effect. In this next treatment we investigate whether the behavior of these subjects may be explained by an intrinsic preference for information per-sé. More specifically, we ask whether the Kreps-Porteus model may rationalize the behavior of our subjects.

All of our treatments have the property that regardless of whether a subject purchased information, he was informed of the outcomes only a few minutes following his choice of a box. This makes it difficult to claim that a subject paid a fee because he was anxious to know whether or not he won the prize when that information was going to be revealed to him almost immediately after his decision.[4] However, since KP are silent about the length of time when they talk about early versus late resolution of uncertainty, this length can, in principle, be extremely short as in our experiment. Moreover, the KP model can also be interpreted as a model of intrinsic preferences for information with no explicit time dimension (see Grant, Kajii and Polak (1998,2000)).

In order to obtain some evidence on whether or not the KP model may explain our results, we ran the following variation of our baseline treatment. In each of the 15 situations, subjects were asked if they were willing to pay a fee to learn the choice of urn *only after* they have chosen a box. According to KP, for a given situation, a subject would pay a fee in Treatment 3 if, and only if, he agreed to do so in Treatment 1, so we would expect approximately the same fraction of subjects to pay the fee in Treatment 3 as did in Treatment 1.

The claim that subjects with KP preferences would choose identically in Treatments 1 and 3 is somewhat subtle so let us pause and explain the reason why this is true. First, fix some situation (α, β, f). Consider Treatment 1 first. In this treatment, a subject can resolve some uncertainty before choosing a box. Hence, we can think of this treatment as consisting of two dates. In date 1 one of the two urns is randomly drawn and the subject decides whether or not he wants to observe the outcome of this draw. In date 2 the subject chooses a box and then a lottery determines whether or not he wins a \$20 prize. For ease of exposition, we shall denote the date-2 lottery by the probability of winning the \$20 dollars (with the understanding that no prize is won with the complementary probability).

From the point of view of the subject, the decision of whether or not to observe the draw of urn has the following implications. Suppose the subject decides to observe the outcome of the draw. If Urn I (Urn II) is drawn, then from the subject's point of view, the date 2 lottery is α (β) if he chooses A, while it is $1-\alpha$ ($1-\beta$) if he chooses B (see Figure $1a$).

$Figure$ $1a$

Suppose next that the subject decides *not* to observe which urn was drawn. Then from his point of view, the date-2 lottery only depends on whether he chooses A or B. If he chooses A, the date-2 lottery is $\frac{1}{2}\alpha + \frac{1}{2}\beta$, while if he chooses B, the date-2 lottery is

[4] Using a similar design, Eliaz and Schotter (2007) find that when there *is* a lag between the time a decision has been made and the time all uncertainty about it is resolved, decision-makers are willing to pay to refine their priors over the residual uncertainty.

$\frac{1}{2}(1-\alpha)+\frac{1}{2}(1-\beta)$ (see Figure 1*b*).

Figure 1*b*

How does a subject with KP preferences decide in date-1 if he should pay to observe the choice of urn? He first observes that regardless of his decision, he should choose box A in date 2 : choosing A leads to a date-2 lottery that first-order stochastically dominates the date-2 lottery that corresponds to a choice of B (this is depicted by the bold lines in Figures 1*a* and 1*b*). This implies that when the subject decides in date 1 to observe the draw of urn, it is *as if* he chooses to execute in date 1 a lottery that randomly draws the date-2 lottery from the pair (α, β). Similarly, when the subject decides *not* to observe the draw of urn, it is as if he chooses a degenerate date-1 lottery that draws the date-2 lottery $\frac{\alpha}{2}+\frac{\beta}{2}$ with probability one.

It follows that the date-1 decision, to observe or not to observe, may be thought of as a choice between two date-1 lotteries over date-2 lotteries. The KP model takes as primitive an individual's preferences over the date-1 lotteries. According to this model, a subject prefers to observe the draw of urn if, and only if, he prefers the date-1 lottery

$$\frac{1}{2}\delta_\alpha+\frac{1}{2}\delta_\beta$$

to the date-1 lottery

$$\delta_{\frac{\alpha}{2}+\frac{\beta}{2}}$$

where δ_p denotes a date-1 lottery that yields the date 2 lottery p with probability one. The above two lotteries are depicted in Figure 2.

Figure 2

Let us now turn to Treatment 3. As in Treatment 1, the subject chooses in date-1 a lottery over date-2 lotteries. The only difference is that now these two dates occur *only after* the subject has chosen a box. Figure 3*a* and 3*b* depict the date-1 lotteries that correspond to the decision to observe the draw of urn and to the decision not to observe it respectively.

Figure 3*a*

Figure 3*b*

As evident from these figures, if a subject always chooses box A (as is optimal), then he should choose to observe the draw of urn if, and only if, he prefers the date-1 lottery

$\frac{1}{2}\delta_\alpha + \frac{1}{2}\delta_\beta$ to the degenerate date-1 lottery $\delta_{\frac{\alpha}{2}+\frac{\beta}{2}}$. But this was also true in Treatment 1. Thus, a subject prefers to pay the fee in Treatment 1 if, and only if, he prefers to do so in Treatment 3.

Note that this conclusion does not require that the subject's preferences over date-1 lotteries (or that his induced preferences over date-2 lotteries) satisfy the standard von Neuman-Morgenstern (vNM) axioms. It only requires that the subject be time consistent and sequentially rational. But these two requirements are also assumed in the various extensions of the KP model that relax the independence axiom of vNM (see Grant, Kajii and Polak (1998,2000)). Hence, Treatment 3 also serves to rule out these extensions.

Note that we have assumed that when subjects do not know which urn was drawn, they reduce the two-stage lottery associated with first drawing an urn and then drawing a ball. This is necessary in order for the KP model to have any bite in Treatment 1. Without this assumption, the date-1 lotteries on date-2 lotteries are the same whether or not the subject pays the fee. If, however, subjects fail to reduce compound lotteries, then whether or not a they pay a fee in Treatment 3, they still face the same, exact compound lotteries. Hence, we should not expect such subjects to pay in the current treatment.

Results

Table 6 and Figure 7 compare the behavior of subjects in Treatments 1 and 3.

Table 6

Figure 7

Note the overwhelming difference in the fraction of subjects paying the fee in Treatments 3 as opposed to Treatments 1 and 2 (see Table 5). For example, while in situations 3, 6 and 12 the proportion of subjects willing to pay the fee in Treatment 3 was 0.047, 0 and 0.047 respectively (out of the 21 subjects who participated in Treatment 3, only one paid in Situations 3 and 12 and none paid in Situation 6), in Treatment 1 these same proportions were 0.782, 0.565 and 0.739, and in Treatment 2 they were 0.524, 0.333 and 0.429 respectively. Applying a test of proportions to the data in comparing behavior in Treatments 1 and 3 , we find that we can reject the null hypothesis of equality in proportions between Treatments 1 and 3 for all situations (see Table 6) in favor of the alternative one-tailed hypothesis that the proportions in Treatments 1 are *greater* than those in Treatment 3 (the same result holds in a comparison of Treatments 2 and 3).

Our results suggest that in contrast to the KP model, our subjects were rarely willing to pay a fee when they had already made their decisions, despite the fact that paying for the fee would resolve some of their uncertainty early rather than later. We interpret these findings as evidence that our subjects' behavior cannot be explained by KP preferences.

In Section 2 we remarked that the structure in our baseline data suggest that this data was not generated by a "demand effect". Treatment 3 provides further evidence against the demand effect hypothesis. To see why, suppose a subject in the baseline treatment suspected that the information offered to him has some value simply because he was being paid money to make 15 choices regarding information aquisition. Then such a subject should have the same suspicion whether he was offered to buy information before or after he made a decision. However, our results clearly indicate the when the information was offered *after* a decision was made, virtually no subject thought that this information may have some value.

We conclude this section by investigating the validity of our assumption that subjects respect first-order stochastic dominance. Recall that we used this assumption to prove that a subject with KP preferences would behave the same in Treatments 1 and 3. To investigate this, we checked the number of subjects who chose Box B in each of the situations. Of the 21 participants, one chose B in Situations 7 ($\alpha = 0.6, \beta = 0.51, \$2$) and 15 ($\alpha = 0.8, \beta = 0.6, \$4$), two chose B in Situations 9 ($\alpha = 0.8, \beta = 0.6, \$0.5$) and 11 ($\alpha = 0.8, \beta = 0.51, \$0.5$), three chose B in Situation 13 ($\alpha = 0.6, \beta = 0.51, \$0.5$) and four chose B in Situation 8 ($\alpha = 0.6, \beta = 0.51, \$4$). However, *only one of these subjects chose to pay the fee.* That subject's decision does not bias the results in our favor since our theory predicts that *no* subject should pay a fee. However, it is not clear whether the four subjects who violated first-order stochastic dominance (by choosing B), chose not to pay because of our proposed theory.

5 Treatment 4: "Good" news vs. "bad" news

Experimental design

The treatments thus far suggest that a significant proportion of our subjects are not indifferent among lotteries on their posterior beliefs even though the posterior beliefs in the support of these lotteries, all induce exactly the same action. To understand the source of these preferences, it is helpful to have more evidence on their structure. The baseline treatment suggests that the subjects' willingness to pay increases with the variance of the lottery (recall that all lotteries are mean preserving spreads of the prior). One interpretation of this relation is that subjects who pay assign a sufficiently high value to making the choice of A with the high posterior that they are willing to risk the possibility of obtaining the low posterior (just as, by analogy, individuals may be willing to pay for a lottery that offers a high monetary prize even at the risk of realizing a loss). Thus, the higher the upper posterior is, the more valuable the information is.

Why would subjects prefer to make the decision with a high posterior? One possible explanation is that they actually derive some intrinsic benefit from making a decision with a "high degree of confidence". An alternative explanation is that of costly contemplation. According to this explanation, subjects may believe that they are not very good at making choices in an environment with a lot of risk. They realize they could probably identify the optimal choice but may have to incur cost for "thinking hard" or possibly making a mistake. Consequently, subjects prefer to make the choice when the posterior belief is high.

A second interpretation may be that subjects are actually averse to making a decision with an upward biased belief that this decision is ex-post optimal (i.e., they prefer *not* to make a decision with a "false sense of confidence"). One possible reason for this might be that individuals want to "prepare themselves" for a situation in which there is still a significant chance (e.g., 49%) that the best ex-ante decision may prove to be ex-post wrong. Consequently, subjects are willing to pay for the information offered to them because they would like to know if the "*bad*" realization (a draw of Urn II) has occured. Therefore, the lower the chances are of drawing the A ball from Urn II, the more valuable the lottery is.

Treatments 1-3 do not allow us to address these different interpretations because there are only two states of nature in these treatments and subjects pay to learn the exact state. Consequently, a subject who wants to know whether or not the information is "bad news" is indistinguishable from a subject who wants to know whether or not it is "good news". We, therefore, ran a fourth treatment where subjects also faced the same 15 situations of Treatments 1-3, but these were presented in a slightly different way. In each situation subjects were told that there were *three* urns used to determine where the $20 prize was to be placed. The percentage of A balls in Urns I, and III where α and β respectively, and the percentage of A balls in Urn II was $\frac{1}{2}(\alpha + \beta)$. Similar to Treatments 1-3, a computer program randomly selected one of the three urns, and from that urn it randomly selected a ball. The $20 was then placed in the Box that corresponded to the letter on the drawn ball. Note that given this procedure, the percentage of A balls in urn II is exactly the prior probability that the $20 will be placed in box A.

For each subject the computer program randomly selected a sequence of the 15 situations. For each situation, subjects were asked if they were willing to pay the fee to learn the answer to one (and only one) of the following questions, and if so, which question they would pay for:

- Question 1 : Was the ball drawn from Urn I ("the high urn")?
- Question 2 : Was the ball drawn from Urn II ("the middle urn")?
- Question 3 : Was the ball drawn from Urn III ("the low urn")?

A subject who pays for an answer to Question 1 (Question 3) is interpreted as a person whose intrinsic benefit from making a decision with the highest posterior is greater (lower) than his loss from making a decision with an upward biased posterior (i.e., with a posterior higher than the true probability). Since Question 2 is totally uninformative, paying for an answer to this question is evidence for some confusion on part of the subject.

Results

Table 7 summarizes the answers to the following questions: How many subjects in total were willing to pay a fee? Conditional on paying the fee, what information were most subjects most interested in?

Table 7

As evident from this table, subjects were again willing to pay a fee in this treatment although not with the same frequency as they did in Treatment 1. For example, while 73% of the subjects in Treatment 1 were willing to pay a fee in Situation 12 ($\alpha = 1, \beta = 0.51, \$0.5$ fee) only 56% were willing to do so in Treatment 4.[5] This percentage is still significantly above zero. The same is true for Situation 3 ($\alpha = 1, \beta = 0.51, \$0.5$ fee) where the percentages are 78% versus 31.3%, respectively when comparing Treatments 1 and 4. These differences in percentages may be explained by the fact that the information sold in Treatment 1 is more precise than the information sold in Treatment 4. In Treatment 1 subject can find out exactly what the probability is of drawing an A ball. However, in Treatment 4 subject can only learn that this probability has two equally likely values.

[5] Note that as we mentioned earlier, in Treatment 4, Urn II in this situation had 52 balls marked by A.

The fractions willing to pay the fee in Treatment 4 in each situation is positively correlated with the fraction paying in Treatment 1 with a correlation coefficient of 0.568, which is significant at the 3% level. Hence, we again see that more subjects are willing to pay the bigger the difference between the high and low urns and the smaller the fee being charged.

We now turn to the question of what subjects are most curious about. Table 7 suggests that more subjects are willing to pay for an answer to Question 3 concerning the low urn rather than to Question1, which concerns the high urn. There exists no situation for which subjects are more likely to seek the answer to Question 1 than they are to Question 3. For example, in Situation 12, 72.2% of subjects who paid a fee, did so to find out the answer to Question 3 rather than Question 1. Similar differences existed in other situations as well. Only in Situation 14 ($\alpha = 1, \beta = 0.6, \$2$ fee) were subjects as curious to find out the answer to Question 1 as they were to Question 3. Finally, note that only five of the 32 subjects paid for an answer to Question 2.

One possible explanation for why Question 3 attracted more buyers is that it is more likely to offer "good news". There is a $\frac{2}{3}$ chance that a subject will *increase* his belief on the good outcome if he pays to find out the answer to Question 3. In contrast, Question 1 offers a $\frac{2}{3}$ chance of *decreasing* one's belief on the good outcome. Thus, if a subject gives greater weight to a decrease his belief on the good outcome, then he may want to shy away from Question 1.

The above findings may be interpreted as evidence against the costly contemplation hypothesis. To see why, suppose most subjects pay for non-instrumental information in Treatment 1 because they prefer to simplify their decision by not contemplating what to do in an irrelevant state. Then it is natural to assume that a choice between A and B is easier to make the higher the posterior that the prize is in A. This suggests that among those subjects who pay, the vast majority would choose to know whether or not the ball was drawn from Urn I. But as Table 7 shows, this is inconsistent with our data.

6 Concluding remarks

This paper attempts to show that people are willing to pay for the opportunity to be more confident in making the right decision. Our findings suggest that decision theory should be enriched to accommodate such preferences. In particular, our findings highlight two behavioral principles that are yet to be captured by any decision-theoretic model: (i) individuals may derive an intrinsic benefit from the posterior beliefs they holds, only if they are about to make a decision, and (*ii*) individuals prefer to know whether or not the worst contingency has occured over knowing whether or not the best contingency has occured.

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Appendix A: **Instructions for Treatment** 1.

This is an experiment in decision making. Various research foundations have supported this research and you will earn money depending upon the decisions you make. You will receive a show up fee of $3, which is yours to keep regardless of the decisions you make in the experiment. When the experiment begins you will also receive an additional amount of $4, which you can spend during the experiment. If you do not spend all of this amount during the experiment, you can keep any amount that is left.

Decision Task:

There are two boxes, labeled A and B. One, and only one, of these boxes contains a prize of $20. The process that determines in which box the $20 will be placed in is as follows. Think of two urns labeled Urn I and Urn II with 100 balls each. In each urn some balls are marked with the letter A and the remaining ones with the letter B so that all balls are marked with one letter. The composition of A and B balls in each urn differs, however.

To determine in which box the $20 is placed, the computer will first choose an urn by flipping a coin with a 50-50 chance of landing heads or tails.

■ If the coin lands *heads* the computer will go to *Urn I* and draw a ball
- If the ball drawn is labeled A, the computer will place $20 in Box A
- If the ball drawn is labeled B, the computer will place $20 in Box B

■ If the coin lands *tails* the computer will go to *Urn II* and draw a ball
- If the ball drawn is labeled A, the computer will place $20 in Box A
- If the ball drawn is labeled B, the computer will place $20 in Box B

For example, suppose that Urn I has 100 A balls and no B balls, while Urn II has 60 A balls and 40 B balls. If the coin lands on heads the $20 will be placed in Box A for sure, while if it lands tails there will only be a 60% chance that the $20 is placed in Box A.

Your task is to choose which of these two boxes to open. If the box you open contains the prize, you will be paid $20.

Before you make your choice we will tell you the composition of the balls in each urn and give you the opportunity to pay a fee to see the result of the coin flip. If you pay the fee, we will tell you whether the coin landed heads or tails so you will know from what urn the ball will be drawn. This means that if you pay the fee you will learn what the chances are that the $20 was placed in Box A.

In the example above, if you pay the fee and learn that the coin landed heads, then you will know that the $20 is in Box A for sure. If you do not pay the fee, then you will be asked to choose a Box without knowing the outcome of the coin flip (that is, you will only know that there is a 50-50 chance that the ball is either drawn from an urn containing 100 A balls, or from an urn containing only 60 A balls).

In the experiment we will present you with 15 situations of the type described above (their order will be picked at random) and ask you if you want to pay the fee in each one. Each situation will be described by a fee and the compositions of Urn I and Urn II. In every situation each urn will always have a 50-50 chance of being selected

It is important to note that in all of the situations **both Urns I and II will contain more than 50 A balls so that there will always be more than a 50% chance that Box A contains the $20.** Paying the fee simply allows you to know what the exact chances are.

After you make your choices for the 15 situations, we will then select one of them at random.

■ If for the chosen situation you decided to see the result of the coin flip, we will then tell you which urn was selected and ask you to choose a box (A or B).

■ If for the chosen situation you decided *not* to see the result of the coin flip, we will let you choose a box without telling you from which urn the ball will be drawn.

Payments:

For each situation your payoff will depend on whether you paid a fee to see the outcome of the coin flip and whether there was $20 in the box you chose. For example, say that fee is $\$X$ and you *choose to pay it.*

■ If you choose a box that has the $20 in it, you will be paid $\$20+(\$4-\$X)+\$3$: the $20 prize, the $4 initial endowment you receive at the beginning of the experiment, minus the $X for learning which urn was chosen, *plus the $3 show-up fee* (or in total $\$27-\$X$).

■ If you do not find the $20, you will be paid $(\$4-\$X)+\$3$: the $4 initial endowment you receive at the beginning of the experiment minus the $X for learning which urn was chosen, *plus the $3 show-up fee* (or in total $\$7-\$X$).

In all the 15 situations you will face, the fee for learning which urn was chosen will not exceed $4, hence you are guaranteed to keep the $3 show-up fee.

Suppose you decide *not* to pay the fee and choose a box *without* seeing the result of the coin flip.

■ If you find the \$20 you will be paid \$20 + \$4 + \$3 : the \$20 prize, plus the \$4 initial endowment, plus the \$3 show-up fee (or in total \$27).

■ If you do not find the \$20, you will be paid \$7 = \$4 + \$3 : the \$4 initial endowment plus the \$3 show-up fee (or in total \$7).

What we ask you to do:

We shall now present you with a list of situations. As we stated above, one and only one of them will be chosen at random and played out for you to determine your payoff.

Appendix B: **Instructions for Treatment** 4.

This is an experiment in decision making. Various research foundations have supported this research and you will earn money depending upon the decisions you make. You will receive a show up fee of \$3, which is yours to keep regardless of the decisions you make in the experiment. When the experiment begins you will also receive an additional amount of \$4, which you can spend during the experiment. If you do not spend all of this amount during the experiment, you can keep any amount that is left.

Decision Task:

There are two boxes, labeled A and B. One, and only one, of these boxes contains a prize of \$20. The process that determines in which box the \$20 will be placed in is as follows. Think of three urns labeled Urn 1, Urn 2 and Urn 3 with 100 balls each. In each urn some balls are marked with the letter A and the remaining ones with the letter B so that all balls are marked with one letter. The composition of A and B balls in each urn differs, however.

To determine in which box the \$20 is placed, the computer will first choose an urn by randomly choosing a whole number from 1 to 3 such that each of the three numbers, 1, 2 and 3, has an equal chance of being selected.

■ If the selected number is 1, the computer will go to *Urn 1* and draw a ball.

■ If the selected number is 2, the computer will go to *Urn 2* and draw a ball.

■ If the selected number is 3, the computer will go to *Urn 3* and draw a ball.

After an urn is chosen the computer will draw a ball from it and if the ball has the letter A written on it it will place \$20 in Box A and if it has the letter B written on it it will place \$20 in Box B.

For example, suppose that Urn 1 (which we will call the "High Urn") has 100 A balls and no B balls, Urn 2 (Which we will call the "Middle Urn") has 80 A balls and 20 B balls and Urn 3 (Which we will call the "Low Urn") has 60 A balls and 40 B balls.

If the randomly selected number is 1, the $20 will be placed in Box A for sure. If the randomly selected number is 2, there will be an 80% chance that the $20 is placed in Box A. Finally, if the randomly selected number is 3, there will only be a 60% chance that the $20 is placed in Box A.

Your task is to choose a box (A or B). If the box you open contains the prize, you will be paid $20. Before you make your choice we will tell you the composition of the balls in each urn and give you the opportunity to pay a fee to learn the answer to one, and only one, of the following questions:

1. Was the ball drawn from Urn 1 (the "High Urn") or was it drawn from either Urn 2 or 3 (the Middle or Low urns)?
2. Was the ball drawn from Urn 2 (the "Middle Urn) or was it drawn from either Urn 1 or 3 (the High or Low urns)?
3. Was the ball drawn from Urn 3 (the "Low Urn) or was it drawn from either Urn 1 or 2 (the High or Middle urns)?

You may also choose *not* to pay for any of the above answers, in which case you would only know that it is equally likely that the ball was drawn from any of the three urns.

In the experiment we will present you with **15** situations, where each situation will be described by a fee and the compositions of Urn 1, Urn 2 and Urn 3 (as in the above example). In every situation each of the three urns will always have an equal chance of being selected. In each situation we shall ask you the following question:

Which of the following options do you want to choose (you may choose only one)?
(*i*) I would like to pay the fee to know whether or not the ball was drawn from Urn 1
(*ii*) I would like to pay the fee to know whether or not the ball was drawn from Urn 2
(*iii*) I would like to pay the fee to know whether or not the ball was drawn from Urn 3
(*vi*) I do not wish to pay for any of the above pieces of information

After you answer the above question for each of the 15 situations, we will then select one of these situations at random.
■ If for the chosen situation you answered that you would pay the fee for one of the three pieces of information (i.e., your answer was either (*i*), (*ii*) or (*iii*)), then we will present you with the information you requested and ask you to choose a box (A or B).
■ If for the chosen situation you answered that you would *not* pay the fee, we will let you choose a box without revealing any additional information.

It is important to note that in all of the situations **all three urns will contain more than 50 A balls so that there will always be more than a 50% chance that**

Box A contains the $20. Paying the fee simply allows you to know more accurately what the actual chances are.

Payments:

For each situation your payoff will depend on whether you paid a fee and whether there was $20 in the box you chose. For example, say that fee is $\$X$ and you *choose to pay it.*

■ If you choose a box that has the $20 in it, you will be paid $\$20+(\$4-\$X)+\$3$: the $20 prize, the $4 initial endowment you receive at the beginning of the experiment, minus the $X fee, *plus the $3 show-up fee* (or in total $\$27-\$X$).
■ If you do not find the $20, you will be paid $(\$4-\$X)+\$3$: the $4 initial endowment you receive at the beginning of the experiment minus the $X fee, *plus the $3 show-up fee* (or in total $\$7-\$X$).

In all the 15 situations you will face, the information fee will not exceed $4, hence you are guaranteed to keep the $3 show-up fee.

Suppose you decide *not* to pay the fee.

■ If you find the $20 you will be paid $\$20+\$4+\$3$: the $20 prize, plus the $4 initial endowment, plus the $3 show-up fee (or in total $27).
■ If you do not find the $20, you will be paid $\$7=\$4+\$3$: the $4 initial endowment plus the $3 show-up fee (or in total $7).

What we ask you to do:

We shall now present you with a list of situations. As we stated above, one and only one of them will be chosen at random and played out for you to determine your payoff.

Table 1

The Situations Used in Treatments 1 and 2

Situation	α	β	Fee
1	1.0	0.60	$4.00
2	1.0	0.51	$4.00
3	1.0	0.60	$0.50
4	0.8	0.60	$2.00
5	0.8	0.51	$4.00
6	1.0	0.51	$2.00
7	0.6	0.51	$2.00
8*	0.6	0.51	$4.00
9	0.8	0.60	$0.50
10	0.8	0.51	$2.00
11	0.8	0.51	$0.50
12	1.0	0.51	$0.50
13	0.6	0.51	$0.50
14	1.0	0.60	$2.00
15	0.8	0.60	$4.00

* This situation was not used in Treatment 1

Table 2:

Baseline Treatment

Fraction of subjects who paid the fee as a function of α, β and the size of the fee[1,2]

Fee:	$0.50		$2.00		$4.00	
	β=0.51	β=0.60	β=0.51	β=0.60	β=0.51	β=0.60
α=1.0	0.739	0.783	0.565	0.435	0.261	0.348
α=0.8	0.652	0.522	0.217	0.217	0.174	0.130
α=0.6	0.478	NA	0.217	NA	NA[2]	NA

[1] A total of 23 subjects participated in this treatment

[2] This is the situation that was not used in Treatment 1.

Table 3

Random Effects Logit: Probability of Paying fee in Treatment 1

Variable	Coefficient	Std. dev.	z	$P > \lvert z \rvert$
fee	-1.172	0.1655	-7.08	0.000
α	8.067	1.525	5.29	0.000
β	-4.048	4.020	-1.01	0.314

Observations = 345
Log likelihood = -139.391
Prob > χ^2 = 0.0000
Wald χ^2 (3) = 53.88

Table 4:

Treatment 2

Fraction of subjects who paid the fee as a function of α, β and the size of the fee[1]

Fee:	$0.50		$2.00		$4.00	
	β=0.51	β=0.60	β=0.51	β=0.60	β=0.51	β=0.60
α=1.0	0.429	0.524	0.333	0.285	0.286	0.190
α=0.8	0.524	0.429	0.238	0.286	0.190	0.190
α=0.6	0.429	NA	0.286	NA	0.143	NA

[1] A total of 21 subjects participated in this treatment

Table 5

Test of Proportions: Treatment 1 (T1) *vs.* Treatment 2 (T2)

Situation	T1 proportion	T2 proportion	t	$P > \|t\|$
1	0.348	0.190	0.8027	0.4270
2	0.261	0.286	-0.1806	0.8575
3	0.783	0.524	1.8369	0.0733
4	0.217	0.286	-0.5123	0.6111
5	0.174	0.190	-0.1390	0.8901
6	0.565	0.333	1.5500	0.1286
7	0.217	0.286	-0.5123	0.6111
8	NA	0.143		
9	0.522	0.429	0.6064	0.5475
10	0.217	0.238	-0.1600	0.8737
11	0.652	0.524	0.8524	0.3988
12	0.739	0.429	2.1547	0.0370
13	0.478	0.429	0.3234	0.7480
14	0.435	0.286	1.0153	0.3158
15	0.130	0.190	-0.5352	0.5967

Table 6: Test of Proportions: Treatment 1 (T1) *vs.* Treatment 3 (T3)

Situation	T1 proportion	T3 proportion	Z*	$P > \lvert z \rvert$
1	0.348	0.000	--	1
2	0.261	0.000	--	1
3	0.783	0.047	15.9	1
4	0.217	0.000	--	1
5	0.174	0.000	--	1
6	0.565	0.000	--	1
7	0.217	0.000	--	1
8	NA	0.047	NA	NA
9	0.522	0.095	6.673	1
10	0.217	0.000	--	1
11	0.652	0.000	--	1
12	0.739	0.047	7.22	1
13	0.478	0.000	--	1
14	0.435	0.000	--	1
15	0.130	0.000	--	1

* Z statistic not calculated when one proportion = 0.

Table 7: Total and Conditional Fraction of Subjects Who Pay Fee for Each Urn[1,2]

Situation	Total (Conditional) Fraction for Urn I		Total (Conditional) Fraction for Urn II		Total (Conditional) Fraction for Urn III		Fraction Paying Fee
1	0.031	(0.250)	0.062	(0.500)	0.031	(0.250)	0.125
2	0.094	(0.500)	0.000	(0.000)	0.094	(0.500)	0.187
3	0.062	(0.200)	0.000	(0.000)	0.250	(0.800)	0.312
4	0.031	(0.125)	0.094	(0.375)	0.125	(0.500)	0.250
5	0.000	(0.000)	0.000	(0.000)	0.125	(1.000)	0.125
6	0.094	(0.333)	0.031	(0.111)	0.156	(0.555)	0.281
7	0.062	(0.286)	0.031	(0.143)	0.125	(0.571)	0.219
8	0.000	(0.000)	0.031	(0.200)	0.125	(0.800)	0.156
9	0.062	(0.167)	0.094	(0.250)	0.219	(0.583)	0.375
10	0.000	(0.000)	0.031	(0.100)	0.281	(0.900)	0.312
11	0.031	(0.071)	0.094	(0.214)	0.312	(0.714)	0.437
12	0.094	(0.167)	0.062	(0.111)	0.406	(0.722)	0.562
13	0.187	(0.461)	0.031	(0.077)	0.187	(0.461)	0.406
14	0.094	(0.333)	0.062	(0.222)	0.125	(0.444)	0.281
15	0.000	(0.000)	0.000	(0.000)	0.094	(1.000)	0.094

[1] Total (Conditional) fraction equals the number of subjects who paid the fee divided by the total number of subjects (number of subjects who paid the fee) in the treatment.
[2] Paying for Urn x (where x=I,II,III) means paying for an answer to Question x.

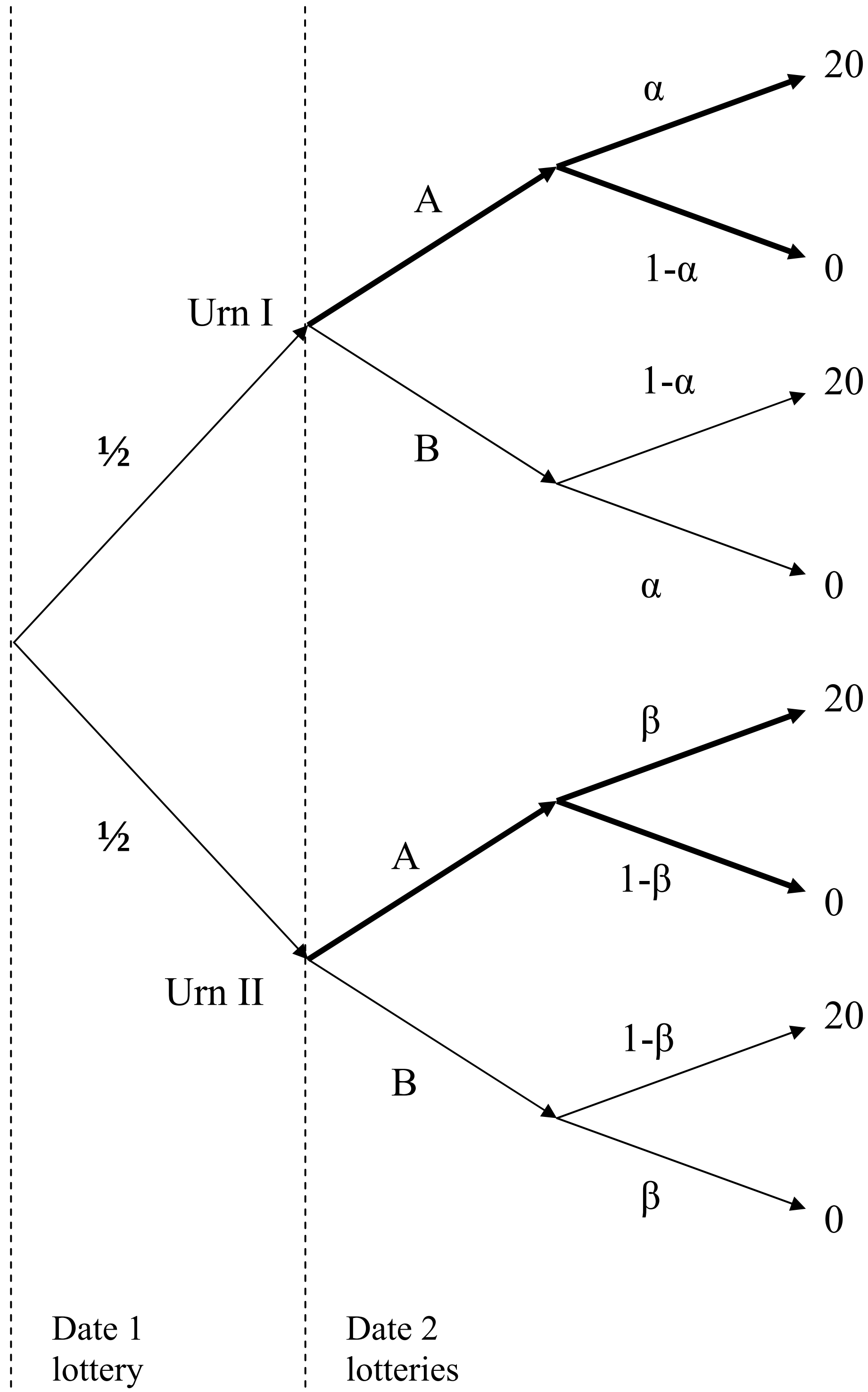


Figure 1a: The decision-tree faced by a subject who decides to pay the fee in Treatment 1.

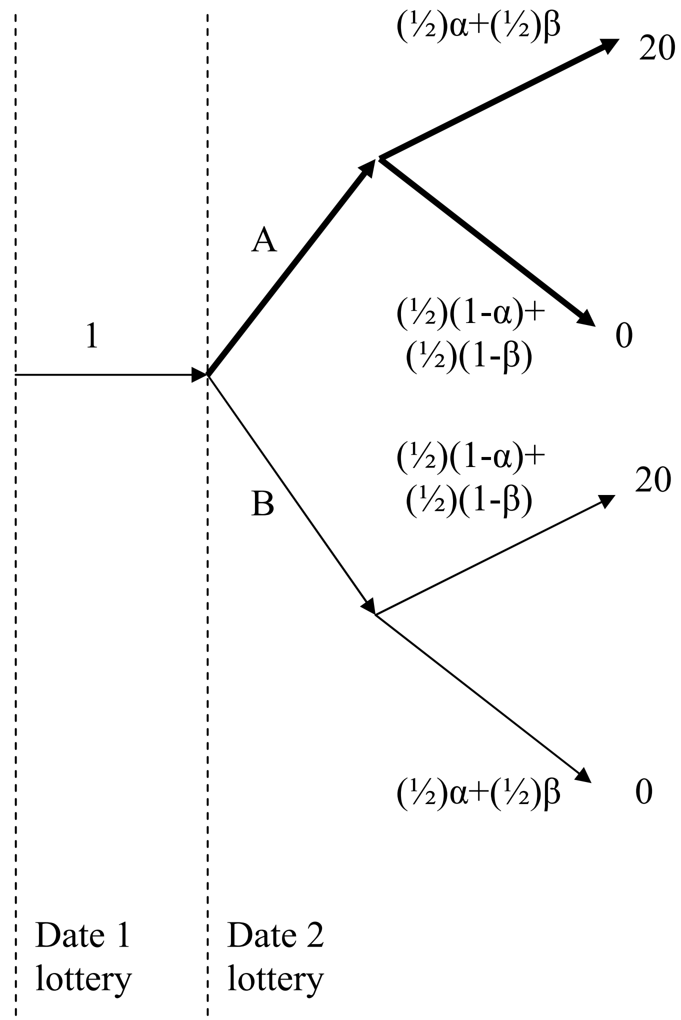


Figure 1b: The decision-tree faced by a subject who decides *not* to pay the fee in Treatment 1.

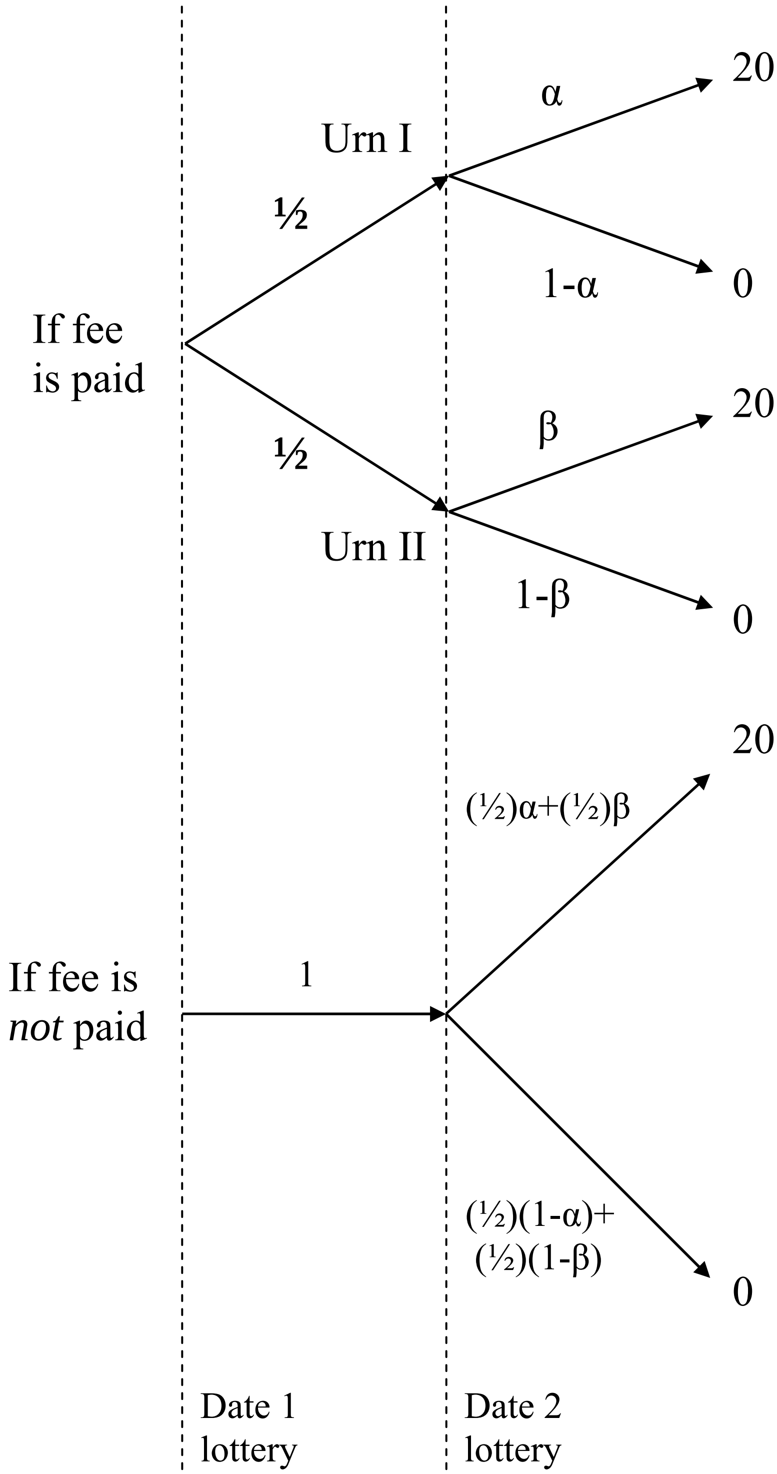


Figure 2: The two date-1 lotteries that corresponds to the decision whether or not to pay the fee in Treatment 1.

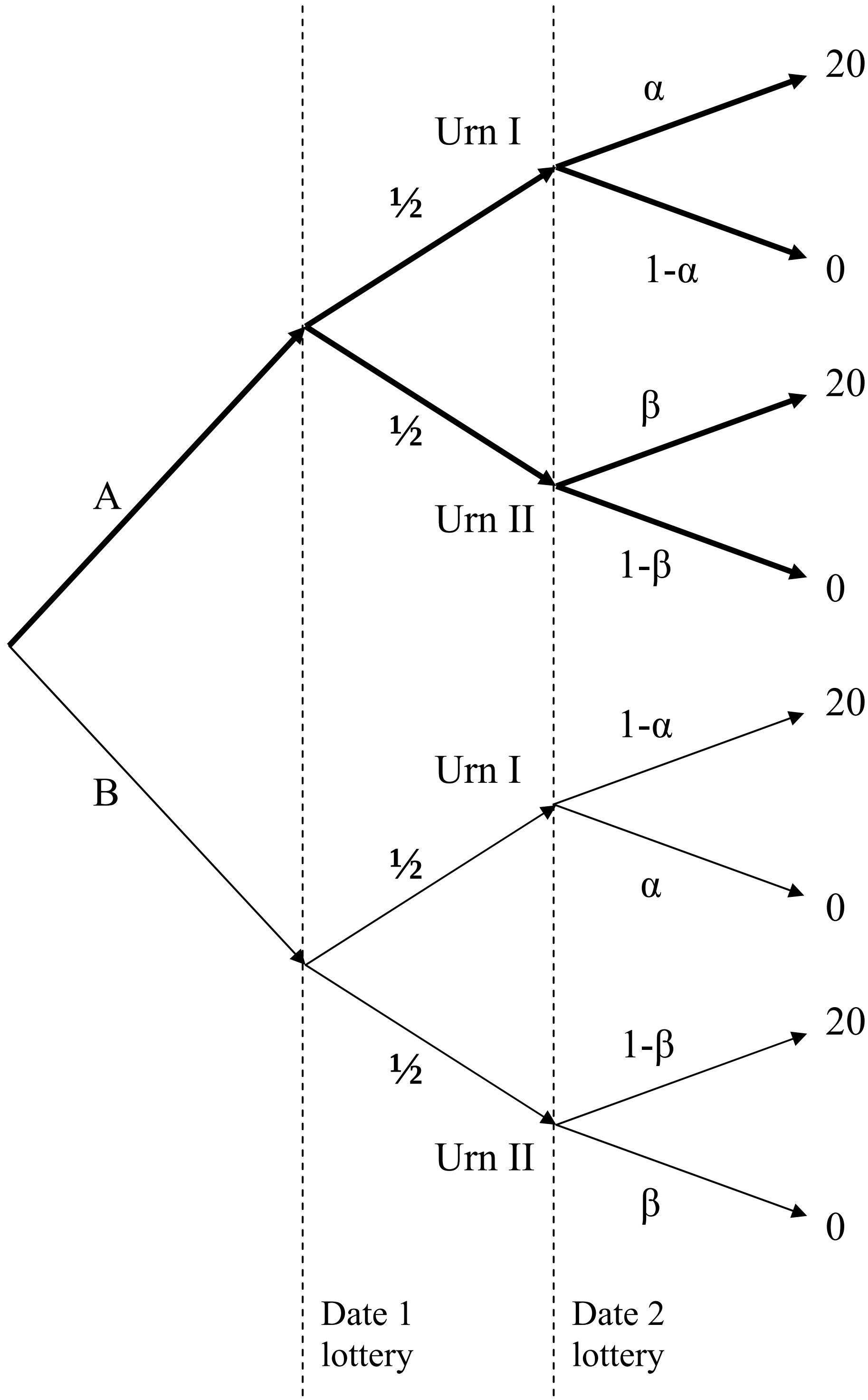


Figure 3a: The decision-tree faced by a subject who decides to pay the fee in Treatment 3.

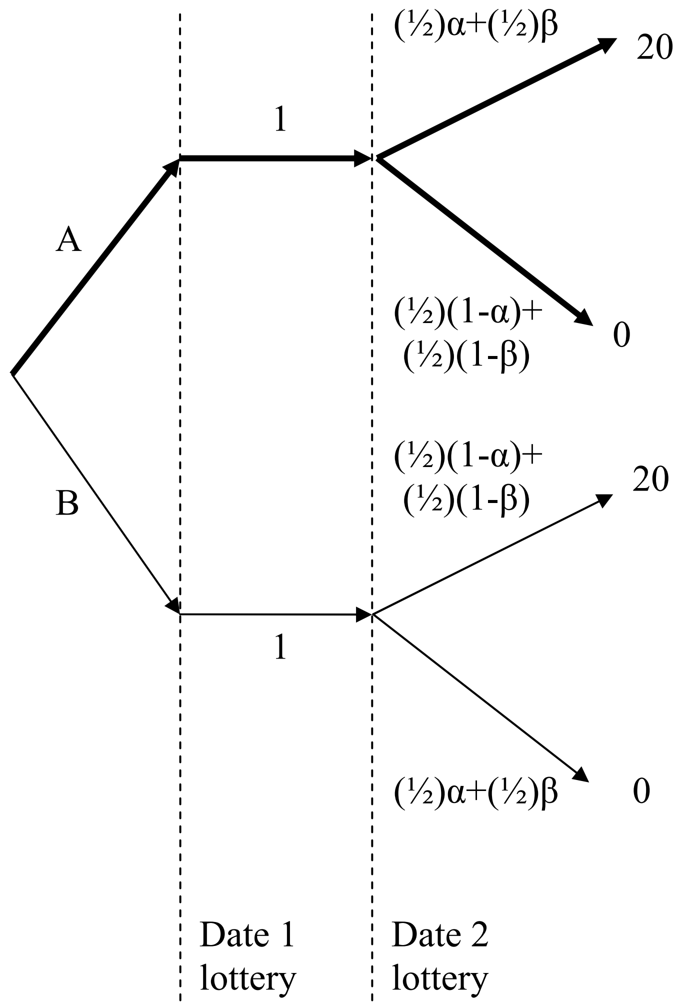


Figure 3b: The decision-tree faced by a subject who decides *not* to pay the fee in Treatment 3.

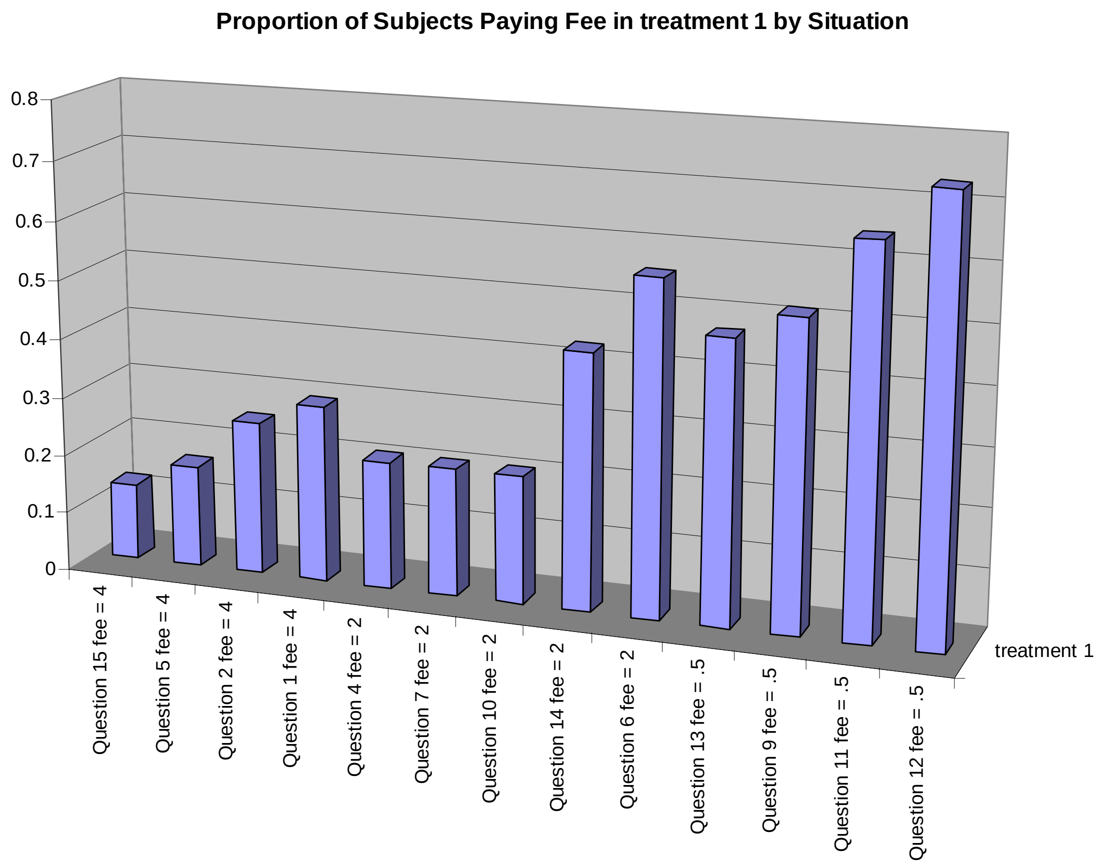
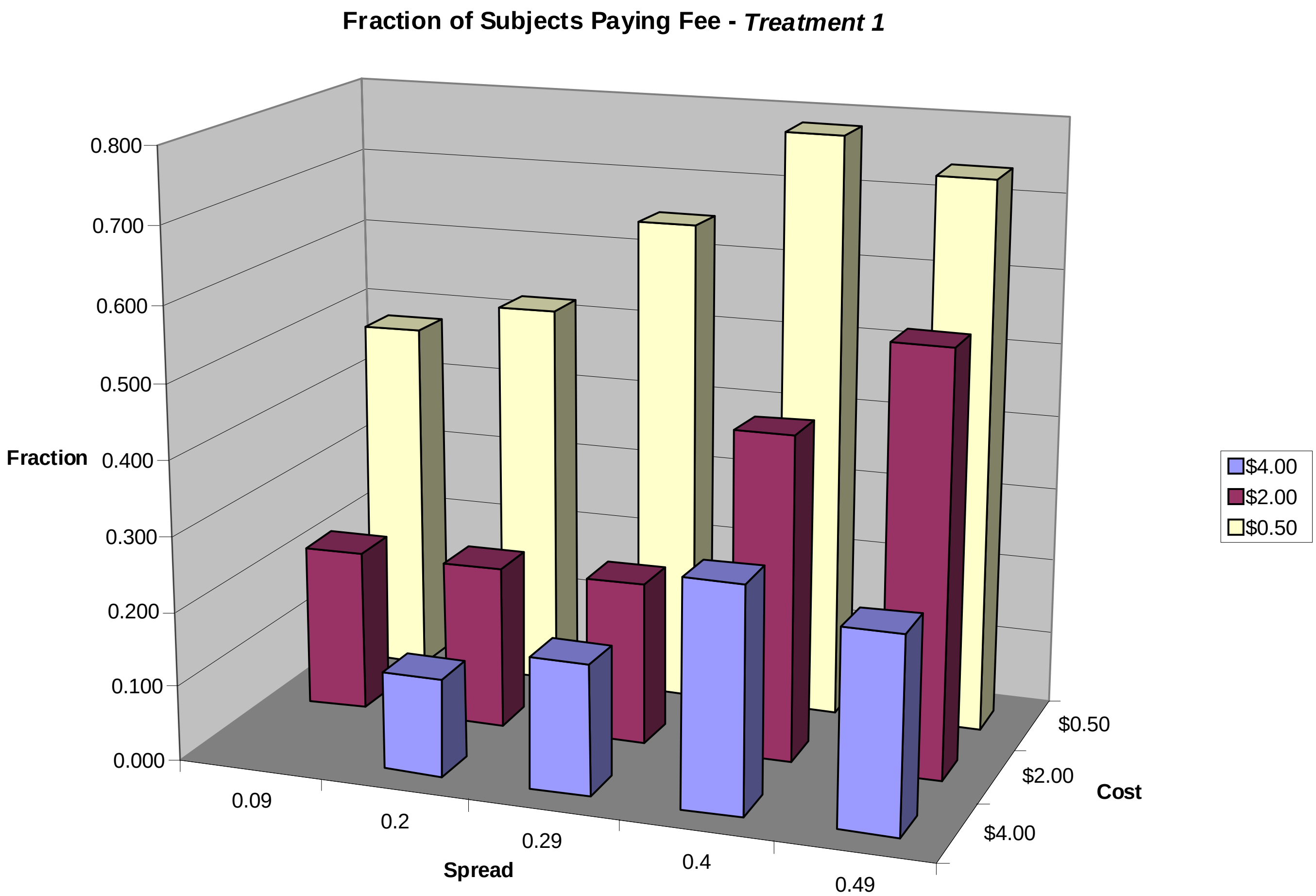
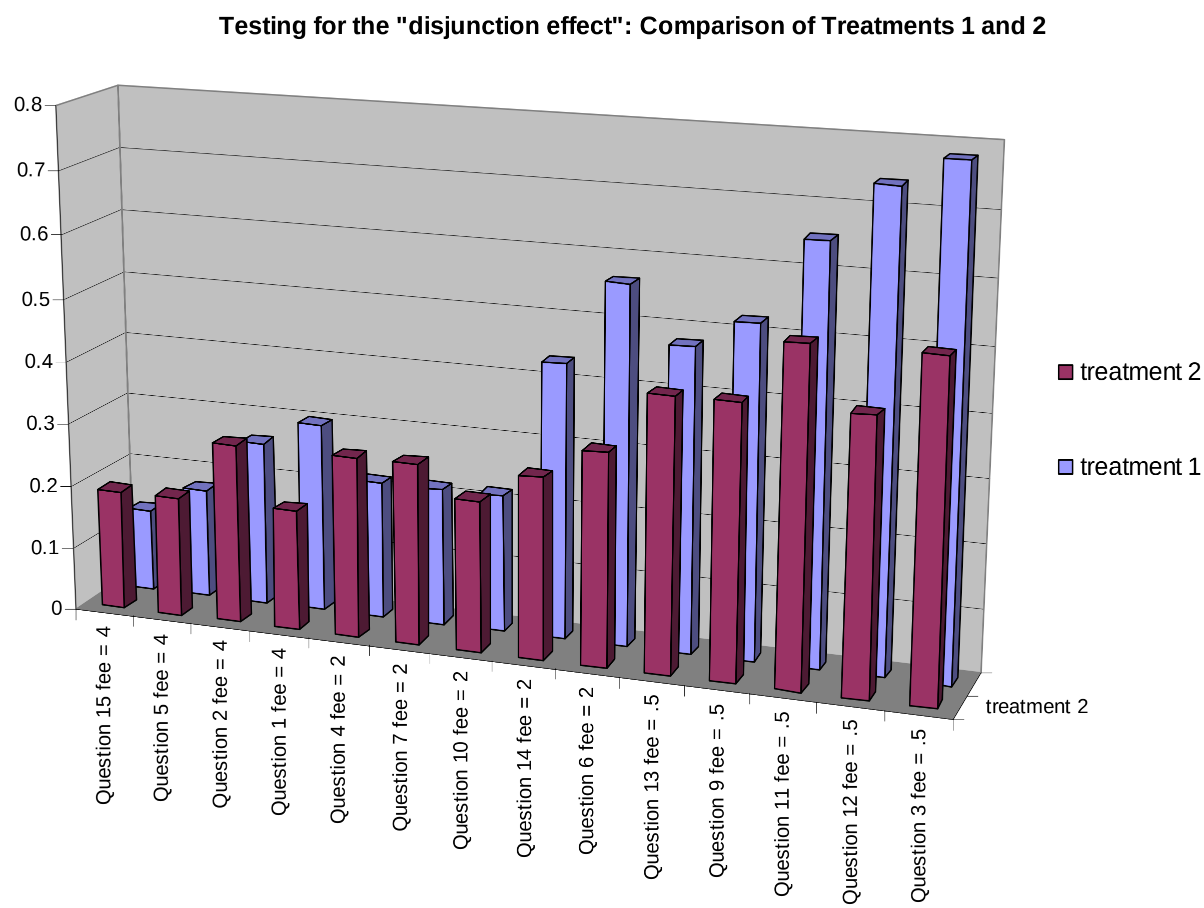

Proportion of Subjects Paying Fee in treatment 1 by Situation
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
treatment 1
Question 15 fee = 4
Question 5 fee = 4
Question 2 fee = 4
Question 1 fee = 4
Question 4 fee = 2
Question 7 fee = 2
Question 10 fee = 2
Question 14 fee = 2
Question 6 fee = 2
Question 13 fee = .5
Question 9 fee = .5
Question 11 fee = .5
Question 12 fee = .5

Figure 4



Fraction of Subjects Paying Fee - *Treatment 1*
Fraction
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.09
0.2
0.29
0.4
0.49
Spread
$0.50
$2.00
$4.00
Cost
$4.00
$2.00
$0.50

Figure 5



Testing for the "disjunction effect": Comparison of Treatments 1 and 2
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
treatment 2
treatment 1
treatment 2
Question 15 fee = 4
Question 5 fee = 4
Question 2 fee = 4
Question 1 fee = 4
Question 4 fee = 2
Question 7 fee = 2
Question 10 fee = 2
Question 14 fee = 2
Question 6 fee = 2
Question 13 fee = .5
Question 9 fee = .5
Question 11 fee = .5
Question 12 fee = .5
Question 3 fee = .5

Figure 6

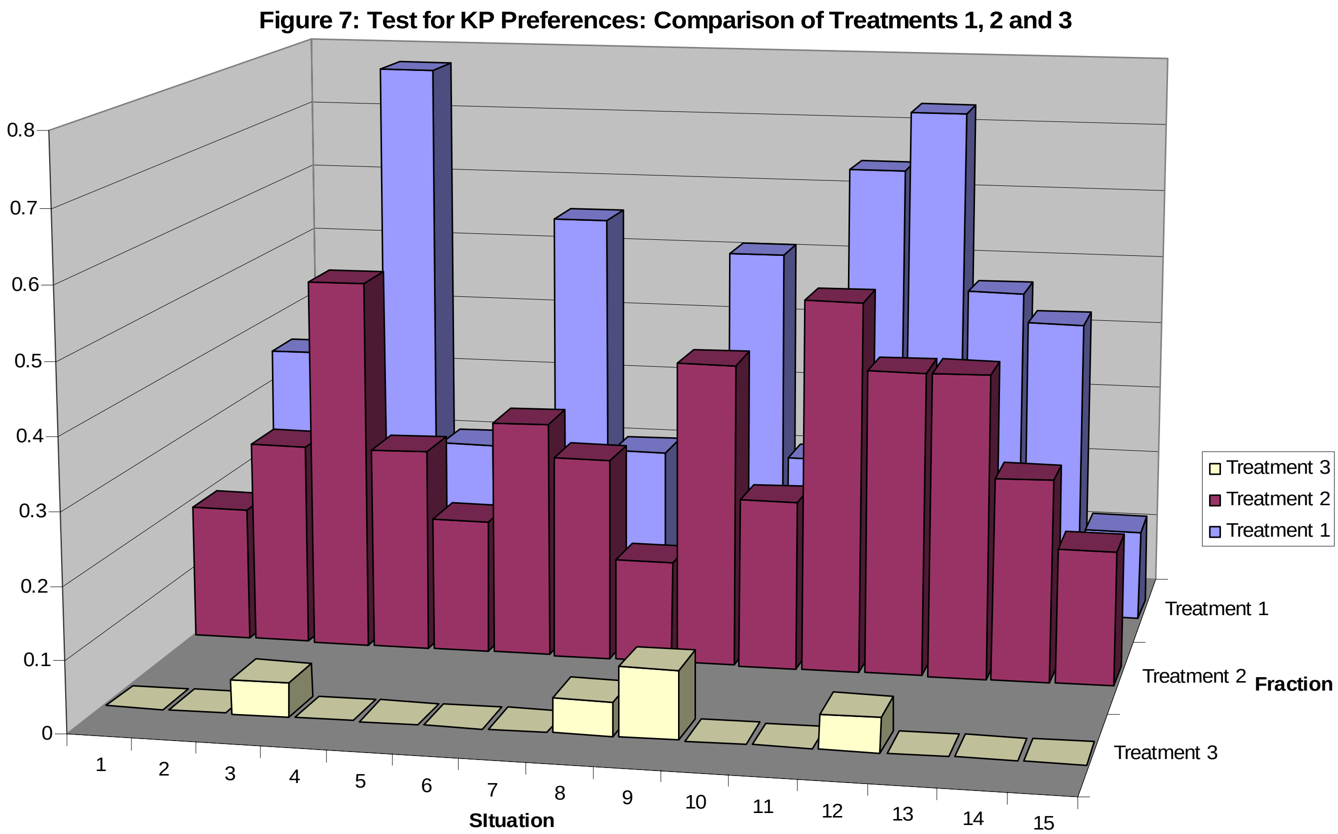


Figure 7: Test for KP Preferences: Comparison of Treatments 1, 2 and 3
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
SItuation
Treatment 1
Treatment 2
Treatment 3
Fraction
Treatment 3
Treatment 2
Treatment 1

Figure 7