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Abstract

Many resource allocation contests have the property that individuals undertake costly actions to appropriate a potentially divisible resource. We design an experiment to compare individuals' decisions across three resource allocation contests which are isomorphic under risk-neutrality. The results indicate that in aggregate the single-prize contest generates lower expenditures than either the proportional-prize or the multi-prize contest. Interestingly, while the aggregate results indicate similar behavior in the proportional-prize and multi-prize contests, individual level analysis indicates that the behavior in the single-prize contest is more similar to the behavior in the multi-prize contest than in the proportional-prize contest. We also elicit preferences toward risk, ambiguity and losses, and find that while such preferences cannot explain individual behavior in the proportional-prize contest, preferences with regard to losses are predictive of behavior in both the single-prize and multiple-prize contests. Therefore, it appears that loss aversion is correlated with behavior in the single-prize and multi-prize contests where losses are likely to occur, but not in the proportional-prize contest where losses are unlikely.

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1. Introduction

Many resource allocation contests have the property that individuals undertake costly actions to appropriate a potentially divisible resource. These actions influence the allocation of the resource depending on the contest in place. In the literature, a common way to classify resource allocation contests is whether the allocation depends probabilistically or deterministically on actions undertaken by individuals.

A common example of a probabilistic resource allocation contest is a raffle, in which a single winning ticket is chosen from among a group of tickets purchased by many individuals. Moving away from this specific application, many economic environments have been modeled as probabilistic allocation contests. These include models of lobbying for government contracts (Krueger, 1974), patent races (Fudenberg et al., 1983), political competitions (Snyder, 1989), and rent-seeking (Tullock, 1980). Common examples of deterministic contests are shared rents (Long and Vousden, 1987), profit sharing and labor productivity (Weitzman and Kruse, 1990), labor contracts (Zheng and Vikuna, 2007), and agricultural innovations (Cason et al., 2010).

In the experimental economics literature there has been extensive investigation of probabilistic allocation contests, particularly single-prize lottery contests; see Dechenaux et al. (2012) for a comprehensive review of the literature.[1] In a single-prize contest individuals can exert expenditures, and an individual's probability of winning the entire resource equals that individual's expenditure in proportion to the total expenditure of all individuals in the contest.[2] In the research

[1] Since the first attempts of Millner and Pratt (1989, 1991), the single-prize contest has been subject to extensive experimental scrutiny (Davis and Reilly, 1998; Potters et al., 1998; Tong and Leung, 2002; Anderson and Stafford, 2003; Herrmann and Orzen, 2008; Nieken and Sliwka, 2010; Sheremeta and Zhang, 2010, Price and Sheremeta, 2011, 2013; Lim et al., 2012; Morgan et al., 2012).

[2] In some contests, such as all-pay auctions (Hillman and Riley, 1989), the individual exerting the highest expenditure wins the entire resource with certainty. Similarly, in the rank-order tournaments (Lazear and Rosen, 1981), the individual with the highest performance, which is the sum of expenditure and a random component, wins the resource with certainty. Dechenaux et al. (2012) provide a comprehensive review of experimental studies of all-pay auctions and rank-order tournaments.

reported here, we build upon the single-prize contest literature, and contrast behavior in this environment with another probabilistic allocation contest, i.e., the multiple-prize contest, and a closely related deterministic contest, i.e., the proportional-prize contest. The multiple-prize contest that we study is similar to the single-prize contest, except the resource is divided into multiple prizes of fixed size, with individuals' expenditures influencing their probability of winning each of the prizes.[3] The proportional-prize contest (isomorphic to the single-prize contest) is a deterministic contest in which each individual's share of the resource (instead of probability of winning the recourse) is equal to that individual's expenditure in proportion to the total expenditures of all individuals in the contest.[4] Under risk-neutrality, the three contests are equivalent and they generate the same equilibrium expenditure level.

The results of the experiment indicate that among the three resource allocation contests the probabilistic single-prize contest generates lower expenditures than either the deterministic proportional-prize or the probabilistic multiple-prize contest. Interestingly, while the aggregate results indicate similar behavior in the proportional-prize and multi-prize contests, individual level analysis indicates that the behavior in the single-prize contest is more similar to the behavior in

[3] Recently, several experimental studies have examined behavior in multiple-prize contests (Müller and Schotter, 2010; Chen et al., 2011; Sheremeta, 2011). However, the main difference of our study is that in our multi-prize contest subjects can win multiple prizes at the same time, whereas they could win only one prize in the previous experiments. Moreover, the design of our multi-prize contest is quite different and under risk-neutrality it is directly comparable to the single-prize contest.

[4] There are several recent experimental studies employing proportional-prize contests. Cason et al. (2010), for example, examine endogenous entry and post entry performance in a real effort proportional-prize contest. Cason et al. (2011) compare the performance of a proportional-prize tournament to a single-prize tournament. Chowdhury et al. (2012), Fallucchi et al. (2012), and Masiliunas et al. (2012), in different parts of their experimental designs, compare proportional-prize contests to single-prize contests. In contrast to our study, all these studies employ between subject design with repeated play, which does not allow to examine individual behavior across different resource allocation contests. The proportional-prize contest is also in some ways similar to the use of individual-specific handicaps to normalize incentives (Dickinson and Isaac, 1998), with the difference that each contestant endogenously competes against the average of all other contestants. Finally, the proportional-prize contest is closely related to a common pool resource extraction game (Gardner et al., 1990; Walker et al., 1990), where individuals receive a return from the resource that is proportionate to their extraction level relative to the total group extraction level. A key difference is that the amount of "prize" is not fixed but endogenously determined.

the multi-prize contest than in the proportional-prize contest. We also elicit preferences toward risk, ambiguity and losses, and find that while such preferences cannot explain individual behavior in the proportional-prize contest, preferences with regard to losses are predictive of behavior in both the single-prize and multiple-prize contests. Therefore, it appears that loss aversion is correlated with behavior in the single-prize and multi-prize contests where losses are likely to occur, but not in the proportional-prize contest where losses are unlikely.

2. Theoretical Models of the Resource Allocation Contests

The single-prize contest model was originally developed by Tullock (1980). In this contest there are n identical players endowed with e who compete for a single prize value v. Player i's expenditure cx_i translates into x_i lottery tickets, with c being marginal cost of each lottery ticket. The probability of player i winning the contest is equal to player i's number of lottery tickets x_i in proportion to the total number of lottery tickets by all players $\sum_{j=1}^{n} x_j$. Thus, the expected utility $EU(x_i, x_{-i})$ of player i is given by

$$EU(x_i, x_{-i}) = \frac{x_i}{\sum_{j=1}^{n} x_j} u_i(e + v - cx_i) + \frac{\sum_{j \neq i}^{n} x_j}{\sum_{j=1}^{n} x_j} u_i(e - cx_i), \qquad (1)$$

where $u_i()$ is the utility function of monetary earnings of player i. If all players are risk-neutral, i.e., $u_i''() = 0$, then the Nash equilibrium number of lottery tickets is $x^* = \frac{n-1}{cn^2} v$.

The multiple-prize contest that we study is similar to the single-prize contest (Berry, 1993; Clark and Riis, 1998).[5] The main difference is that there are m prizes, instead of one, and each

[5] There exists substantial theoretical work on contests with multiple prizes (Berry, 1993; Clark and Riis, 1998; Moldovanu and Sela, 2001; Fu and Lu, 2009). Theoretically, our proportional-prize contest is similar to Berry (1993) and Clark and Riis (1998).

prize is worth $\frac{1}{m}v$. The prizes are awarded by making m draws without replacement from amongst all the lottery tickets purchased by all players. Thus, the expected utility of player i is given by:

$$EU(x_i, x_{-i}) = \sum_{k=0}^{m} \left(\frac{C(x_i,k)C\left(\sum_{j\neq i}^{n} x_j, m-k\right)}{C\left(\sum_{j=1}^{n} x_j, m\right)} \right) u_i \left(e + \frac{k}{m} v - cx_i \right), \tag{2}$$

where $C(a, b)$ is a binomial coefficient representing the number of unordered groups of size b that can be selected from a set of size a. If all players are risk-neutral, (2) simplifies to equation (1) and the equilibrium number of tickets purchased in the multiple-prize contest is the same as in the single-prize contest.[6]

The earlier discussion of the proportionally-prize contest is found in Long and Vousden (1987). In this contest, the prize is divided among the players in amounts proportional to the number of tickets they purchase, i.e., $\frac{x_i}{\sum_{j=1}^{n} x_j}$. The utility $U(x_i, x_{-i})$ of player i is his utility from the endowment plus his share of the prize minus the cost of his tickets.

$$U(x_i, x_{-i}) = u_i \left(e + \frac{x_i}{\sum_{j=1}^{n} x_j} v - cx_i \right). \tag{3}$$

Notice that there is no need to take an expectation, because this contest is deterministic. The equilibrium in the proportional-prize contest is $x^* = \frac{n-1}{cn^2} v$ and it does not depend on risk preferences.

The implications of the three theoretical models, is that if all individuals are risk-neutral expected utility maximizers, and this is common knowledge, then the unique Nash equilibrium in all three resource allocation contests is $x^* = \frac{n-1}{cn^2} v$. However, if individuals are risk-averse, the

[6] Intuitively, the probability of a marginal ticket being selected to win a specific one of the m prizes is $\frac{1}{\sum_{j=1}^{n} x_j}$. Thus, the chance of winning any of the m prizes with a marginal ticket is $\frac{m}{\sum_{j=1}^{n} x_j}$. Therefore, the expected earnings of player i from purchasing that ticket is $\frac{1}{m} v \times \frac{m}{\sum_{j=1}^{n} x_j} = \frac{v}{\sum_{j=1}^{n} x_j}$, which is exact the expected earnings player i would receive by purchasing an extra ticket in the single-prize contest.

direction of the change in equilibrium ticket purchases in contests is ambiguous (Hillman and Katz, 1984; Skaperdas and Gan, 1995; Konrad and Schlesinger, 1997; Cornes and Hartley, 2003). Hillman and Katz (1984) and Skaperdas and Gan (1995), for example, show that risk-averse individuals should be most hesitant to purchase tickets. On the other hand, Konrad and Schlesinger (1997) and Cornes and Hartley (2003), show that the direction of the change in equilibrium ticket purchases caused by an increase in risk aversion may be ambiguous. It is also well recognized in the literature that if individuals have diverse risk preferences and diverse beliefs about others' risk preferences, neither of which can be observed or controlled, then nearly any behavior could be consistent with a Bayesian equilibrium (Ledyard, 1986; Börgers, 1993). Moreover, in addition to risk considerations, individuals may have different attitudes toward losses (caused by the winner-take-all structure of contests) and ambiguity (caused by strategic uncertainty concerning ticket purchases by other individuals in the group).

Given the murky picture painted by the theoretical literature, and the growing prevalence of winner-take-all (Frank and Cook, 1995) and proportional-prize contests (Cason et al., 2010), clarity may best be obtained via empirical evidence as provided by an experimental study and analysis of subjects' behavior in each of the proposed resource allocation contest.

3. Experimental Design and Procedures

To examine the behavior in the described resource allocation contests, we conducted five experimental sessions, with a total of 104 subjects. Two sessions with a total of 44 subjects were conducted at Indiana University-Bloomington and three other sessions with a total of 60 subjects were conducted at Michigan State University. Subjects were recruited from introductory economics classes. Experimental sessions proceeded in four parts.[7] At the beginning of each part subjects were given the instructions, available in the Appendix. Instructions were read by each subject in private and reviewed publicly by the experimenter, using an overhead display.

In the first part of the experiment, subjects were anonymously assigned to four-person groups and they made their decisions simultaneously in the single-prize contest, the multiple-prize contest, and the proportional-prize contest.[8] A single-prize contest was presented as a situation in which one of n = 4 subjects in a group would receive a prize of v = \$72. Each subject was given an endowment of e = \$20 and could affect the likelihood of receiving the prize by purchasing tickets for c = \$0.25 each. The recipient of the \$72 prize was chosen by randomly drawing a ticket from among all of the tickets purchased by a group. It was public information that the prize would be awarded randomly if none of the subjects in a group purchased a ticket, with each subject having an equal chance of receiving the prize.[9] A subject's earnings equaled the \$20 endowment, minus ticket purchase costs, plus \$72 if they were the winner. The procedures for conducting the multiple-prize contest were identical to those for the single-prize contest, except that there were m = 3 prizes, each worth \$24. Each subject could win one, two, or all three prizes. A subject's earnings equaled the \$20 endowment, minus ticket purchase costs, plus \$24 for each of the three prizes they won. Finally, the proportional-prize contest was presented as an opportunity for the subjects within a group to receive a share of a \$72 prize. The share of the prize received by each subject equaled the proportion of his/her tickets relative to those of the entire group. It was public information that if no subject in a group purchased tickets, each received a quarter of the prize. A subject's earnings

[7] The two experimental sessions conducted at Indiana University-Bloomington had only one part.
[8] The three decision situations were presented simultaneously to the subjects as: the first decision situation, the second decision situation, and the third decision situation.
[9] The winning ticket was chosen using the visual tool of a computerized "spinning wheel," where tickets purchased by each subject in a group were numbered, and those numbers were displayed in random order on a wheel. The wheel was programmed to spin for a random duration of time, at which point the winning number was displayed.

equaled the $20 endowment, minus ticket purchase costs, plus his/her share of the $72 prize. One of the contests was randomly selected for payment at the very end of the experiment.

In the second part, we elicited subjects' preferences toward risk from a set of 20 lotteries as in Table 1. In each lottery, similar to Holt and Laury (2002), subjects were asked to state whether they prefer a risky option A or a safe option B. In contrast to Holt and Laury (2002), instead of comparing two different gambles with changing probability distributions, subjects had to compare a fixed gamble ($0.00 or $5.00 with 50% chance each) to a sure amount (increasing monotonically from $0.25 to $5.00).[10] Parameters were set in such a way that more risk-averse subjects would choose more safe options (and switch earlier to a safe option) than less risk-averse subjects. Subjects were not aware of this task until after we elicited and collected their choices from the preceding part. One of the choices was randomly selected for payment at the very end of the experiment.

In the third part, we elicited subjects' preferences toward ambiguity from a set of 20 lotteries as in Table 2. In each lottery, subjects were asked to state whether they prefer an ambiguous option A ($0.00 or $5.00 with unknown chance each) or a safe option B (increasing monotonically from $0.25 to $5.00). Parameters were set in such a way that more ambiguity-averse subjects would choose more safe options (and switch earlier to a safe option) than less ambiguity-averse subjects. Again, subjects were not aware of this task until after we elicited their choices from the preceding part and one of the choices was randomly selected for payment at the very end of the experiment.

Finally, in the fourth part, we elicited subjects' preferences toward losses from a set of 20 lotteries as in Table 3. In each lottery, subjects were asked to state whether they prefer a risky

[10] Our elicitation procedure is more in the spirit of Becker et al. (1964).

option A (50% chance of losing a certain amount between -\$0.50 to -\$10.00) or a safe option B of \$0. Parameters were set in such a way that more loss-averse subjects would choose more safe options (and switch earlier to a safe option) than less loss-averse subjects. As in parts two and three, subjects were not aware of this task until after we elicited their choices from the preceding parts, and only one of the choices was randomly selected for payment at the very end of the experiment.

At the end of the experiment, each subject was paid a \$5 participation fee in addition to their experimental earnings. As noted, subjects were paid based on one randomly selected contest from part one and one randomly selected lottery from each of the remaining three parts. Each session lasted approximately one hour. Subjects' earnings ranged from \$5 to \$94, with a median of \$25.

Before reporting the results, it is important to comment on some elements of our design. First, our experiment uses relatively large stakes, compared to most experiments in the literature. In addition, we investigate behavior in a one-shot interaction, in which decisions for each of the three games are elicited jointly (simultaneously) prior to any outcomes being realized.[11] Not only does this permit within-subjects comparisons, but it may also encourage subjects to consider how their decisions might be affected by the specific features of each of the three contests.[12] We also elicited subjects' preferences toward risk, ambiguity and losses. Obviously, such elicitation procedures may be subject to order effects, so that the behavior in the second part may be

[11] Anderson and Stafford (2003) also use a within-subjects design; however, their focus is on entry into contests and cost heterogeneity.

[12] Of course, this may also come at the cost of forcing subjects to think simultaneously about three contests, which in turn may lead to artificial correlations between expenditures in all three contests. It is also possible that subjects, perceiving some kind of experimenter demand effect, may artificially make different choices in the three treatments. Although both concerns are legitimate, our results indicate that there is strong correlation between the number of tickets purchased in the single-prize and the multi-prize contest, but very weak correlation between the proportional-prize contest and the tickets purchased in the single-prize or the multiple-prize contest.

influenced by the behavior in the first part, etc. However, we find that the behavior in the first part is best correlated with the behavior in the fourth part, and not the behavior in the second or the third part of the experiment.

4. Results

4.1. Summary Observations

We found no significant differences in behavior between the two sessions conducted at Indiana University-Bloomington and three sessions at Michigan State University and thus report the combined results.[13] Figure 1 shows the cumulative frequency of ticket purchases in each of the three resource allocation contests. One immediately apparent observation is that there is considerable variation in the number of tickets purchased in each of the three contests. Ticket purchases vary from 0 to 80 in all three contests, although there are mass points for each contest, such as 20 and 40 tickets.

Another striking feature of the data is that on average the number of purchased tickets is significantly lower than the risk-neutral Nash prediction of 54 tickets (i.e., when n = 4, v = \$72, and c = \$0.25 then $x^* = \frac{n-1}{cn^2}v$ = 54). Specifically, in the single-prize contest subjects purchase on average 39.3 (Wilcoxon signed-rank test, p-value < 0.01, n = 104), in the multiple-prize contest they purchase 43.5 (Wilcoxon signed-rank test, p-value < 0.01, n = 104), and in the proportional-prize contest they purchase 44.3 (Wilcoxon signed-rank test, p-value < 0.01, n = 104). This finding is in stark contrast to the vast majority of studies which document significant over-dissipation in

[13] Comparing the number of purchased tickets at Indiana University-Bloomington and Michigan State University, we find no significant difference in the single-prize contest (Wilcoxon rank-sum test, p-value = 0.70, n_1 = 44, n_2 = 60), in the multi-prize contest (Wilcoxon rank-sum test, p-value = 0.19, n_1 = 44, n_2 = 60), and in the proportional-prize contest (Wilcoxon rank-sum test, p-value = 0.96, n_1 = 44, n_2 = 60).

contests (Dechenaux et al., 2012; Sheremeta, 2013).[14] One possible reason for this finding is that, in contrast to these previous studies, our subjects were given relatively small endowments. Specifically, at the beginning of our experiment subjects were given a budget of $20 and were allowed to bid up to this amount. Although this endowment is not restrictive relatively to Nash equilibrium (54 tickets, equivalent to $13.5), it is much lower than the total prize amount(s) of $72. Based on a quantal response equilibrium model, Sheremeta (2011) and Lim et al. (2012) have shown that when a subject's budget is relatively small compared to the Nash equilibrium then subject's behavior will gravitate toward half of the budget value (i.e., in our case $10 or 40 tickets).

4.2. Comparison of Contests

When examining the averages across the three resource allocation contests, we find that the mean number of tickets purchased is the lowest in the single-prize contest (M = 39.3, SD = 24.6), then in the multiple-prize contest (M = 43.5, SD = 24.0), and then in the proportional-prize contest (M = 44.3, SD = 28.4). The difference between the single-prize and the multi-prize contest is significant (Wilcoxon signed-rank test, p-value = 0.04, n = 104), and the difference between the single-prize and the proportional-prize contest is marginally significant (Wilcoxon signed-rank test, p-value = 0.10, n = 104). On the other hand, the difference between the multi-prize and the proportional-prize contest is not significant (Wilcoxon signed-rank test, p-value = 0.63, n = 104).

Therefore, the results of our experiment indicate that in aggregate the single-prize contest generates significantly lower expenditures than either the proportional-prize or the multi-prize contest, and the proportional-prize and multi-prize contests generate similar expenditures.

[14] Some studies that document significant overbidding in contests are done by Davis and Reilly (1998), Potters et al. (1998), Sheremeta (2010, 2011), Sheremeta and Zhang (2010), Price and Sheremeta (2011, 2013), Cason et al. (2012), Chowdhury et al. (2012), Lim et al. (2012), Mago et al. (2012, 2013), and Savikhin and Sheremeta (2013).

However, it is too early to make any affirmative conclusions since individual behavior may be very different across the three contests.

4.3. Individual Behavior

To examine how individuals view the three resource allocation contests relative to one another, Table 4 classifies subjects based on how their ticket purchases in each contest ranked relative to their purchases in the other contests. The first category (s>m, s>p), in which the subjects purchased more tickets in the single-prize (s) contest than in the multiple-prize (m) contest or the proportional-prize (p) contest, accounts for only 14% of the observations. The second category (m>s, m>p), in which the subjects purchased more tickets in the multiple-prize contest than in the single-prize contest or the proportional-prize contest, accounts for 18% of the observations. The third category (p>s, p>m), in which the subjects purchased more tickets in the proportional-prize contest than in the single-prize contest or multiple-prize contest, accounts for 33% of the observations. The final two categories, corresponding to subjects purchasing the same number of tickets in all three contests (p=m=s) and other rankings, account for 18% and 17% of the observations.

Overall, the classification presented in Table 4 suggests that subjects behave more similarly in the single-prize and multiple-prize contests than in the proportional-prize contest. To further explore whether this is indeed the case, we examine correlations of subjects' ticket purchases between the three resource allocation contests.

4.4. Correlations

Figure 2 displays pairwise correlations of individuals' ticket purchases between contests. The first panel of Figure 2 displays each individual's ticket purchases in the single-prize and multiple-prize contests. A data point represents an individual's ticket purchases in the single-prize contest (x-axis) and the multiple-prize contest (y-axis). Consistent with the apparent correlation in the first panel, the Spearman's correlation coefficient between the single-prize and multiple-prize ticket purchases is $\rho = 0.63$ (p-value < 0.01). The second and the third panels of Figure 2 display the correlation of expenditures between the single-prize and proportional-prize and between the proportional-prize and multi-prize contests. Notice that there appears to be relatively more dispersion away from the forty-five degree line than there is in the first panel. This apparently lower correlation is further evident by lower Spearman's correlation coefficient between the single-prize and proportional-prize ($\rho = 0.27$) and between the multi-prize and proportional-prize contest ($\rho = 0.40$) ticket purchases.

The analysis of correlations suggests that individual behavior in the single-prize and multiple-prize contests is more similar than the behavior in the proportional-prize contest. This makes sense (if subjects are loss-averse) in that both the probabilistic single-prize and multiple-prize contests involve the potential of a net loss given that it is possible to purchase tickets and win nothing, while the deterministic proportional-prize contest guarantees a return as long as tickets are purchased. Of course, this does not mean that there is no risk in the proportional-prize contest – there is still some risk (ambiguity) due to the strategic uncertainty concerning ticket purchases by other subjects in the group, but this type of risk is also equally present in the other two contests.

4.5. Risk, Ambiguity and Loss-Aversion as Determinants of Ticket Purchases

As noted earlier, Figure 1 indicates that there is considerable variation across subjects in the number of tickets purchased in each of the three contests, while the risk-neutral Nash equilibrium prediction is that all subjects should purchase 54 tickets. One explanation is that subjects have different attitudes toward risk, ambiguity and losses which, depending on the contest, may influence individual ticket purchases.[15] To examine this hypothesis we elicited preferences regarding risk, ambiguity and losses in our experiment from 60 subjects using the multiple lottery choice mechanisms presented in Tables 1, 2 and 3 (for more detail see Section 3 and Appendix).[16] Parameters of the elicitation procedure were set in such a way that the more risk-, ambiguity- and loss-averse subject would choose more safe options (and switch earlier to a safe option) than the less risk-, ambiguity- and loss-averse subject. It is often the case that subjects in such tasks do not make consistent choices, i.e., instead of monotonically switching to a safe option at one point, they switch back and forth (Holt and Laury, 2002). For that reason, we have eliminated all subjects with inconsistent choices from the analysis. Table 5 reports that 55, 59 and 60 (out of 60) subjects have consistent preferences toward risk, ambiguity and losses. Although the three elicitation tasks are not directly comparable, in all three tasks, a higher number (of safe options) implies a higher level of aversion toward risk, ambiguity and losses. As such, we perform a simple correlation analysis as shown in Table 5. The correlation results indicate that there is a strong correlation ($\rho = 0.75$) between risk and ambiguity. On the other hand, preferences toward losses are not strongly correlated with risk and ambiguity ($\rho = 0.18$ and 0.11).

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[15] Another explanation for this is that this situation represents disequilibrium. That hypothesis is impossible to reject, given that we cannot observe subjects best response functions.

[16] In the first two sessions (consisting of 44 of the 104 subjects) we did not elicit such preferences.

Table 6 reports the estimation results of simple OLS regressions, where the dependent variable is the number of *tickets* purchased in each of the contests and the independent variables are measures of how *risk-averse*, *ambiguity-averse* and *loss-averse* subjects are. First of all, note that the *ambiguity-averse* variable is not significant in any of the specifications and in any of the contests. The *risk-averse* variable is negative and significant only in specification (1) for the single-prize contest.[17] However, the significance of the *risk-averse* variable disappears once we include the *loss-averse* variable in specification (4). Most importantly, we find that the *loss-averse* variable is negative and significant in specifications (3) and (4) in both the single-prize and the multi-prize contests, suggesting that more loss-averse subjects purchase fewer tickets in the single-prize and the multi-prize contests. This fits nicely with the earlier observation that these two probabilistic contests both involve the potential of a net loss given that it is possible to spend money to purchase tickets and win nothing, while the proportional-prize contest guarantees a return as long as tickets are purchased.

The estimation results presented in Table 6 can explain several phenomena observed in our experiment. First, heterogeneous preferences toward risk and losses can explain heterogeneous behavior of subjects in contests. Moreover, since such preferences play a more important role in the single-prize and the multi-prize contest (explaining 22% and 19% of variation) than in the proportional-prize contest (explaining only 6% of variation), it can also help explain why subjects behave more similarly in the single-prize and multiple-prize contests than in the proportional-prize contest.

[17] This finding is consistent with several other experimental studies documenting negative correlation between risk-aversion and contest expenditures (Millner and Pratt, 1991; Sheremeta and Zhang, 2010; Sheremeta, 2011; Mago et al., 2013). Interestingly, however, this is the opposite to the findings of the first-price auction experiments, where overbidding is usually positively correlated with risk-aversion (Cox et al., 1985; Kirchkamp et al., 2008).

5. Discussion and Conclusions

We investigate the resource allocation properties of three institutions: a probabilistic single-prize contest, a probabilistic multiple-prize contest, and a deterministic proportional-prize contest. In the first two institutions, an individual's probability of receiving a prize is proportional to their contest expenditures relative to the expenditures of other contest subjects. In the third institution, an individual's share of the prize is proportional to their contest expenditures relative to expenditures of other contest subjects. If all subjects are risk-neutral, the predicted level of expenditures is equivalent for all three institutions. In summary, for the experiments reported here, expenditures within each type of contest vary considerably across subjects, on average falling below the predicted level of expenditures for the risk-neutral benchmark. In addition, there is evidence that subjects tend to make lower expenditures in the probabilistic single-prize contest than either the probabilistic multi-prize or the deterministic proportional-prize contest.

Contrasting behavior in probabilistic and deterministic resource allocation contests is of interest to economists and policy makers for several reasons. One interpretation of expenditures in contests of the types investigated in this study is that of rent dissipation (Krueger, 1974; Tullock, 1980; Hillman and Katz, 1984). Subjects may be viewed as competing for an exogenously available resource. In such a case, expenditures used to capture the resource are wasteful from the perspective of the social optimum. On the other hand, contests may be viewed as income generating mechanisms, where expenditures represent revenue (Moldovanu and Sela, 2001; Zheng and Vukina, 2007; Cason et al., 2010). To the extent that the institutional forms of resource allocation contests are endogenously determined, studies of the type presented here provide a testing ground for investigating the allocative and income generating properties of alternative institutions. In this regard, the results reported here suggest that institutions based on deterministic sharing rules or probabilistic sharing rules with a large number of prizes (relative to contestant numbers) may lead to higher rent dissipation, or alternatively, greater revenues to those organizing the contests, than probabilistic sharing rules with a small number of prizes (again relative to contestant numbers) for a given subject pool. However, this interpretation of our results should be taken with caution. First, it is easy to imagine situations in which this result would not hold if individuals were allowed to self-select across the set of potential contests (Cason et al., 2010). Second, a recent experiment by Chowdhury et al. (2012) suggests that in a repeated setting with a sufficiently large endowment, the deterministic proportional-prize contest generates *lower* (not *higher*) rent dissipation than the equivalent single-prize contest.[18] Similar to Chowdhury et al. (2012), the behavior in the proportional-prize contest is closer to the Nash equilibrium than the behavior in other contests. Therefore, combined with the results of Chowdhury et al. (2012), it seems that proportional-prize contests have the effect of moving behavior towards the Nash equilibrium.

Another complication when trying to select among different contests is that individual behavior likely depends on many factors including preferences toward risk, ambiguity and losses. In fact, we find that instead of playing the symmetric risk-neutral Nash solution, subject behavior is very heterogeneous. To potentially explain such heterogeneity, we elicit subjects' preferences toward risk, ambiguity and losses. (We are not aware of any prior studies that elicit preferences toward risk, ambiguity and losses, and examine how such preferences are correlated with behavior in different contests). Interestingly, we find that heterogeneous preferences toward losses (not ambiguity or risk over gains) can best explain the dispersion of ticket purchases in the single-prize and the multiple-prize contests. Somewhat satisfyingly, given that it involves the least risk, none

[18] Fallucchi et al. (2012) and Masiliunas et al. (2012) also document similar patterns.

of the risk preference measures appear to explain individual behavior in the proportional-prize contest. It is important to emphasize that the elicited risk preference measures only explain 19%-22% of variation in the data. This suggests that there may be other important factors which impact individual behavior in contests. For example, subjects may have heterogeneous beliefs about the behavior of others, and such beliefs may influence their decisions in different resource allocation contests. It is also possible that such beliefs may differ across contests, which potentially may account for the observed differences between such contests. We leave these questions for future research.

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Table 1: Elicitation of Risk Preferences

Choice	Option A Risky Option	Option B Safe Option
# 1	$0.00 or $5.00 with 50% chance	$0.25 for sure
# 2	$0.00 or $5.00 with 50% chance	$0.50 for sure
# 3	$0.00 or $5.00 with 50% chance	$0.75 for sure
# 4	$0.00 or $5.00 with 50% chance	$1.00 for sure
# 5	$0.00 or $5.00 with 50% chance	$1.25 for sure
# 6	$0.00 or $5.00 with 50% chance	$1.50 for sure
# 7	$0.00 or $5.00 with 50% chance	$1.75 for sure
# 8	$0.00 or $5.00 with 50% chance	$2.00 for sure
# 9	$0.00 or $5.00 with 50% chance	$2.25 for sure
# 10	$0.00 or $5.00 with 50% chance	$2.50 for sure
# 11	$0.00 or $5.00 with 50% chance	$2.75 for sure
# 12	$0.00 or $5.00 with 50% chance	$3.00 for sure
# 13	$0.00 or $5.00 with 50% chance	$3.25 for sure
# 14	$0.00 or $5.00 with 50% chance	$3.50 for sure
# 15	$0.00 or $5.00 with 50% chance	$3.75 for sure
# 16	$0.00 or $5.00 with 50% chance	$4.00 for sure
# 17	$0.00 or $5.00 with 50% chance	$4.25 for sure
# 18	$0.00 or $5.00 with 50% chance	$4.50 for sure
# 19	$0.00 or $5.00 with 50% chance	$4.75 for sure
# 20	$0.00 or $5.00 with 50% chance	$5.00 for sure

Subjects choose between a risky Option A ($0.00 or $5.00 with 50% chance) or a safe Option B (a certain amount for sure).

Table 2: Elicitation of Ambiguity Aversion Preferences

Choice	Option A Ambiguous Option	Option B Safe Option
# 1	$0.00 or $5.00 with unknown chance	$0.25 for sure
# 2	$0.00 or $5.00 with unknown chance	$0.50 for sure
# 3	$0.00 or $5.00 with unknown chance	$0.75 for sure
# 4	$0.00 or $5.00 with unknown chance	$1.00 for sure
# 5	$0.00 or $5.00 with unknown chance	$1.25 for sure
# 6	$0.00 or $5.00 with unknown chance	$1.50 for sure
# 7	$0.00 or $5.00 with unknown chance	$1.75 for sure
# 8	$0.00 or $5.00 with unknown chance	$2.00 for sure
# 9	$0.00 or $5.00 with unknown chance	$2.25 for sure
# 10	$0.00 or $5.00 with unknown chance	$2.50 for sure
# 11	$0.00 or $5.00 with unknown chance	$2.75 for sure
# 12	$0.00 or $5.00 with unknown chance	$3.00 for sure
# 13	$0.00 or $5.00 with unknown chance	$3.25 for sure
# 14	$0.00 or $5.00 with unknown chance	$3.50 for sure
# 15	$0.00 or $5.00 with unknown chance	$3.75 for sure
# 16	$0.00 or $5.00 with unknown chance	$4.00 for sure
# 17	$0.00 or $5.00 with unknown chance	$4.25 for sure
# 18	$0.00 or $5.00 with unknown chance	$4.50 for sure
# 19	$0.00 or $5.00 with unknown chance	$4.75 for sure
# 20	$0.00 or $5.00 with unknown chance	$5.00 for sure

Subjects choose between an ambiguous Option A ($0.00 or $5.00 with unknown chance) or a safe Option B (a certain amount for sure).

Table 3: Elicitation of Loss Aversion Preferences

Choice	Option A Risky Option	Option B Safe Option
# 1	-$0.50 or $5.00 with 50% chance	$0.00 for sure
# 2	-$1.00 or $5.00 with 50% chance	$0.00 for sure
# 3	-$1.50 or $5.00 with 50% chance	$0.00 for sure
# 4	-$2.00 or $5.00 with 50% chance	$0.00 for sure
# 5	-$2.50 or $5.00 with 50% chance	$0.00 for sure
# 6	-$3.00 or $5.00 with 50% chance	$0.00 for sure
# 7	-$3.50 or $5.00 with 50% chance	$0.00 for sure
# 8	-$4.00 or $5.00 with 50% chance	$0.00 for sure
# 9	-$4.50 or $5.00 with 50% chance	$0.00 for sure
# 10	-$5.00 or $5.00 with 50% chance	$0.00 for sure
# 11	-$5.50 or $5.00 with 50% chance	$0.00 for sure
# 12	-$6.00 or $5.00 with 50% chance	$0.00 for sure
# 13	-$6.50 or $5.00 with 50% chance	$0.00 for sure
# 14	-$7.00 or $5.00 with 50% chance	$0.00 for sure
# 15	-$7.50 or $5.00 with 50% chance	$0.00 for sure
# 16	-$8.00 or $5.00 with 50% chance	$0.00 for sure
# 17	-$8.50 or $5.00 with 50% chance	$0.00 for sure
# 18	-$9.00 or $5.00 with 50% chance	$0.00 for sure
# 19	-$9.50 or $5.00 with 50% chance	$0.00 for sure
# 20	-$10.00 or $5.00 with 50% chance	$0.00 for sure

Subjects choose between a risky Option A (which has 50% chance of losing certain amount) or a safe Option B ($0.00 for sure).

Table 4: Rankings of Individuals' Ticket Purchases Between Contests

Ranking of Ticket Purchases	Percent of Subjects
Single-Prize (s>m, s>p)	14%
Multiple-Prize (m>s, m>p)	18%
Proportional-Prize (p>s, p>m)	33%
Equal (p=m=s)	18%
Other	17%

p = proportional-prize contest
m = multiple-prize contest
s = single-prize contest

Table 5: Correlation between Risk, Ambiguity and Loss-Aversion

Variable	Observations	Mean	Correlations		
			risk-averse	*ambiguity-averse*	*loss-averse*
risk-averse	55	9.16	1		
[# safe choices]		(0.44)			
ambiguity-averse	59	10.24	0.75	1	
[# safe choices]		(0.45)			
loss-averse	60	12.72	0.18	0.11	1
[# safe choices]		(0.51)			

The standard errors are in parentheses.

Table 6: Risk, Ambiguity and Loss-Aversion as Determinants of Ticket Purchases

Specification	(1)	(2)	(3)	(4)
Dependent variable	*tickets*	*tickets*	*tickets*	*tickets*
	Single-Prize Contest			
risk-averse	-2.86**			-2.70
[# safe choices]	(1.04)			(1.55)
ambiguity-averse		-1.57		0.39
[# safe choices]		(0.97)		(1.45)
loss-averse			-2.27**	-2.13*
[# safe choices]			(0.81)	(0.85)
constant	67.05**	56.14**	69.37**	88.43**
	(10.16)	(10.45)	(10.79)	(14.17)
	Multi-Prize Contest			
risk-averse	-1.68			0.16
[# safe choices]	(1.03)			(1.50)
ambiguity-averse		-1.41		-1.68
[# safe choices]		(0.94)		(1.41)
loss-averse			-2.51**	-2.31**
[# safe choices]			(0.76)	(0.82)
constant	62.69**	60.83**	78.29**	92.39**
	(10.04)	(10.12)	(10.15)	(13.69)
	Proportional-Prize Contest			
risk-averse	-0.71			-1.43
[# safe choices]	(1.27)			(1.94)
ambiguity-averse		0.12		1.37
[# safe choices]		(1.17)		(1.83)
loss-averse			-1.70	-1.68
[# safe choices]			(0.99)	(1.07)
constant	50.71**	43.30**	65.73**	64.24**
	(12.39)	(12.61)	(13.23)	(17.80)
Observations	55	59	60	55

* significant at 5%; ** significant at 1%. The standard errors are in parentheses.

Figure 1: Cumulative Frequency of Ticket Purchases by Subjects

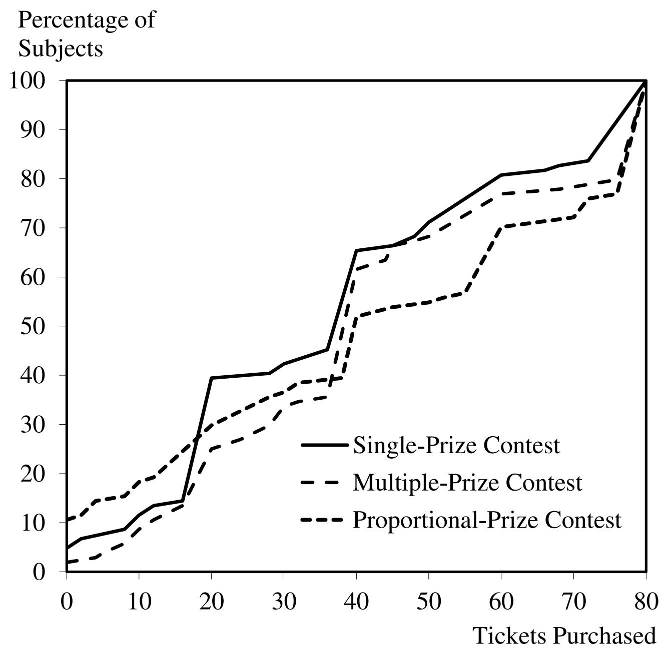
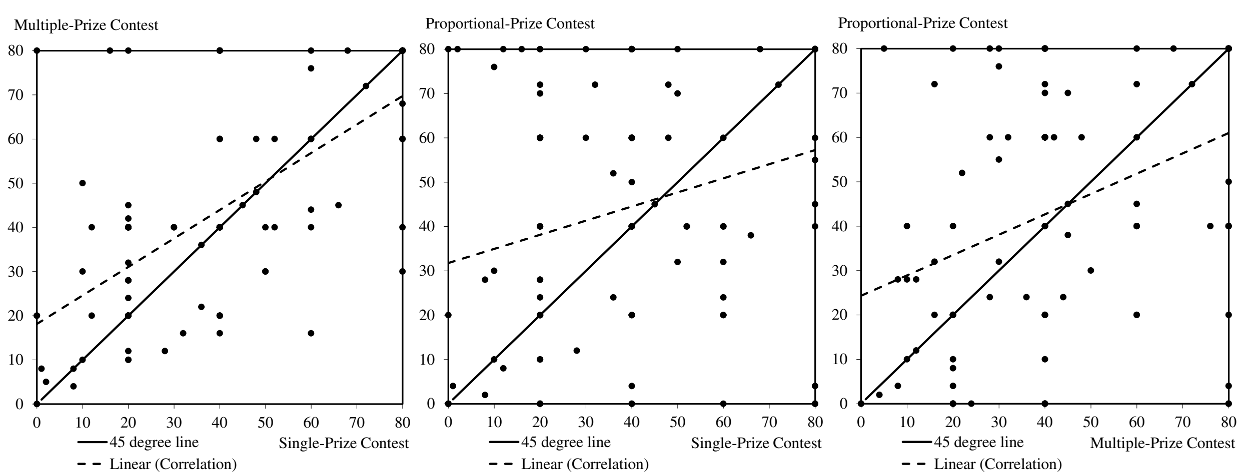


Figure 2: Correlation of Individuals' Ticket Purchases Across Contests



Appendix (Not for Publication) – Experiment Instructions

PART 1

In this experiment, you will make choices in three different decision situations. You have been randomly assigned to a group consisting of you and three other participants. Your earnings will depend upon your decision and the decisions of the other three participants who are in your group. All decisions will be anonymous. Further, you will never know the identities of any of the participants with whom you are matched in any decision situation. Below we describe the six steps for the experiment.

1. You will receive instructions for the first decision situation that will explain the type of decision you will make. Then, you will be given time to make your decision in that situation.
2. We will then proceed to the instructions for the second decision situation, and you will again be given time to make your decision for the second situation.
3. Finally, we will proceed to the third decision situation, where you will be given instructions and time to make a decision.
4. Before we collect your decisions, you will be given time to go back and change any of your decisions in the three decision situations.
5. After all participants have had time to finalize their decisions, we will collect the decisions.
6. For each group, we will randomly pick one of the three decision situations. Participants in that group will receive earnings based only on the outcome of the randomly chosen decision situation.
7. At the end of the experiment, you will receive your $5 show-up fee, plus your earnings from the decision situation that was selected for your group.

Your participant number for all three decision situations is: _______
You are in group ____

Instructions for First Decision Situation

The instructions below are written to describe the way earnings will be determined if this decision situation is the one that is randomly selected for your group. In this decision situation, one of the four participants in each group will receive a monetary prize of $72. Your chance of receiving the prize in your group depends on your decision and the decisions of the three other participants in your group.

You can affect your likelihood of receiving the prize by purchasing tickets, which you can think of as raffle tickets for the purposes of this decision situation. Your likelihood of receiving the prize also depends on the number of tickets purchased by the three other participants in your group. Prior to your decision about how many tickets you wish to purchase, you will not be able to observe the number of tickets the other participants purchase. We will begin the decision situation by giving you $20. You can keep as much of this $20 as you like, or you can use some, or all of it, to purchase tickets.

Rules of this decision situation

You and the other participants in your group will have the opportunity to buy tickets. Each ticket will cost 25¢. Since each ticket costs 25¢, and you have $20 with which to purchase tickets, you will be able to buy up to 80 tickets. In your group, the recipient of the $72 prize will be chosen by randomly drawing a ticket from among all of the tickets purchased by participants in your group. The probability that you receive the prize can be calculated as follows:

$$\text{Probability of you receiving the prize} = \frac{\text{(Number of tickets you buy)}}{\text{(Total number of tickets bought by your group)}}$$

If none of the players in your group buys a ticket, the prize will be awarded randomly, with each player having an equal chance of receiving the prize.

Earnings

Your earnings in this decision situation will be that part of your $20 which you do not spend on tickets, plus the $72 prize, if you receive the prize.

Demonstration

Before making a decision below, wait for the experimenter to demonstrate how this decision situation will be conducted.

Your decision

Indicate your decision in the area below:

Number of tickets I wish to purchase:	_________	(0 to 80)
Total cost of my tickets:	_________	(Number of tickets bought times $0.25)
Portion of my $20 not spent on tickets:	_________	($20 minus total cost of your tickets)

Instructions for Second Decision Situation

The instructions below are written to describe the way earnings will be determined if this decision situation is the one that is randomly selected for your group. In this decision situation, there will be three prizes of $24 in each group. It is possible for any individual to receive zero, one, two, or all three prizes. Your chance of receiving any one of the prizes in your group depends on your decision and the decisions of the three other participants in your group.

You can affect your likelihood of receiving a prize by purchasing tickets, which you can think of as raffle tickets for the purposes of this decision situation. Your likelihood of receiving a prize also depends on the number of tickets purchased by the three other participants in your group. Prior to your decision about how many tickets you wish to purchase, you will not be able to observe the number of tickets the other participants purchase. We will begin the decision situation by giving you $20. You can keep as much of this $20 as you like, or you can use some, or all of it, to purchase tickets.

Rules of this decision situation

You and the other participants in your group will have the opportunity to buy tickets. Each ticket will cost 25¢. Since each ticket costs 25¢, and you have $20 with which to purchase tickets, you will be able to buy up to 80 tickets.

In your group, the recipient or recipients of the three $24 prizes will be chosen by randomly drawing three tickets from among all of the tickets purchased by participants in your group. The probability that you receive any one of the prizes can be calculated as follows:

$$\text{Probability of you receiving any one of the prizes} = \frac{\text{(Number of tickets you buy)}}{\text{(Total number of tickets bought by your group)}}$$

If none of the players in your group buys a ticket, the prizes will be awarded randomly, with each player having an equal chance of receiving each prize.

Earnings

Your earnings in this decision situation will be that part of your $20 which you do not spend on tickets, plus $24 for any of the prizes you receive.

Demonstration

Before making a decision below, wait for the experimenter to demonstrate how this decision situation will be conducted.

Your decision

Indicate your decision in the area below:

Number of tickets I wish to purchase:	_________	(0 to 80)
Total cost of my tickets:	_________	(Number of tickets bought times $0.25)
Portion of my $20 not spent on tickets:	_________	($20 minus total cost of your tickets)

Instructions for Third Decision Situation

The instructions below are written to describe the way earnings will be determined if this decision situation is the one that is randomly selected for your group. In this decision situation, the four participants in your group will each receive some part of a monetary prize of $72. The share of the $72 you receive depends only on your decision and the decisions of the three other participants in your group.

You can affect your share of the prize by purchasing tickets. Your share of the prize in your group also depends on the number of tickets purchased by the three other participants in your group. Prior to your decision about how many tickets you wish to purchase, you will not be able to observe the number of tickets the other participants purchase. We will begin the decision situation by giving you $20. You can keep as much of this $20 as you like, or you can use some or all of it to purchase tickets.

Rules of this decision situation
You and the other participants in your group will have the opportunity to buy tickets. Each ticket will cost 25¢. Since each ticket costs 25¢, and you have $20 with which to purchase tickets, you will be able to buy up to 80 tickets.
In your group, each participant's share, or proportion, of the $72 prize will be determined by the number of tickets they purchased divided by the total number of tickets purchased in their four participant group.

$$\text{Share of the prize that you will receive} = \frac{\text{(Number of tickets you buy)}}{\text{(Total number of tickets bought by your group)}}$$

If none of the players in your group buys a ticket, each participant will receive a one-fourth share of the prize.

Earnings
Your earnings in this decision situation will be that part of your $20 which you do not spend on tickets, plus the share of the $72 prize you receive.

Demonstration
Before making a decision below, wait for the experimenter to demonstrate how this decision situation will be conducted.

Your decision
Indicate your decision in the area below:

Number of tickets I wish to purchase:	_________	(0 to 80)
Total cost of my tickets:	_________	(Number of tickets bought times $0.25)
Portion of my $20 not spent on tickets:	_________	($20 minus total cost of your tickets)

PART 2
In this part of the experiment, you will be asked to make a series of choices in decision problems. How much you receive will depend partly on chance and partly on the choices you make.

Decision
For each line in the table below, please state whether you prefer option A or option B. Notice that there are a total of 20 lines in the table – you should think of each line as a separate decision you need to make. At the end of the experiment only one line will be randomly selected to be the "line that counts". Each line is equally likely to be selected, and you do not know which line will be selected when you make your choices. Hence you should pay attention to the choice you make in every line. The point where you switch from option A to option B normally lies somewhere between the first and the last line. After you have completed all your choices we will randomly select one line (using a 20-sided die) which will be the "line that counts." You will be paid depending on the decision you made in that line.

Earnings
Your earnings for the selected line depend on which option you chose: If you chose option B in that line, you will receive an amount of money specified by option B – between $0.25 and $5, depending on the line. If you chose option A in that line, you will receive either $5 or $0. To determine your earnings in the case you chose option A we will randomly draw a ball from a bag containing twenty balls. There are ten orange and ten white balls in the bag. That means that when we draw a ball, there is a 50% chance that it is white and a 50% chance that it is orange. Before you draw the ball you choose a color. For example, suppose that you choose white. If the drawn ball is really white, you will receive $5. If the drawn ball is orange, you will receive $0.
The actual earnings for this part of the experiment will be determined at the end of the experiment, and will not depend on any other parts of the experiment.

Decision Number	Option A		Option B	Choose A or B
1	**$5.00** with 50% chance	**$0.00** with 50% chance	**$0.25** for sure	
2	**$5.00** with 50% chance	**$0.00** with 50% chance	**$0.50** for sure	
3	**$5.00** with 50% chance	**$0.00** with 50% chance	**$0.75** for sure	
4	**$5.00** with 50% chance	**$0.00** with 50% chance	**$1.00** for sure	
5	**$5.00** with 50% chance	**$0.00** with 50% chance	**$1.25** for sure	
6	**$5.00** with 50% chance	**$0.00** with 50% chance	**$1.50** for sure	
7	**$5.00** with 50% chance	**$0.00** with 50% chance	**$1.75** for sure	
8	**$5.00** with 50% chance	**$0.00** with 50% chance	**$2.00** for sure	
9	**$5.00** with 50% chance	**$0.00** with 50% chance	**$2.25** for sure	
10	**$5.00** with 50% chance	**$0.00** with 50% chance	**$2.50** for sure	
11	**$5.00** with 50% chance	**$0.00** with 50% chance	**$2.75** for sure	
12	**$5.00** with 50% chance	**$0.00** with 50% chance	**$3.00** for sure	
13	**$5.00** with 50% chance	**$0.00** with 50% chance	**$3.25** for sure	
14	**$5.00** with 50% chance	**$0.00** with 50% chance	**$3.50** for sure	
15	**$5.00** with 50% chance	**$0.00** with 50% chance	**$3.75** for sure	
16	**$5.00** with 50% chance	**$0.00** with 50% chance	**$4.00** for sure	
17	**$5.00** with 50% chance	**$0.00** with 50% chance	**$4.25** for sure	
18	**$5.00** with 50% chance	**$0.00** with 50% chance	**$4.50** for sure	
19	**$5.00** with 50% chance	**$0.00** with 50% chance	**$4.75** for sure	
20	**$5.00** with 50% chance	**$0.00** with 50% chance	**$5.00** for sure	

PART 3

In this Part of the experiment, you will again be asked to make a series of choices in decision problems. How much you receive will depend partly on chance and partly on the choices you make.

Decision

For each line in the table, please state whether you prefer option A or option B. Notice that there are a total of 20 lines in the table – you should think of each line as a separate decision you need to make. At the end of the experiment only one line will be randomly selected to be the "line that counts". Each line is equally likely to be selected, and you do not know which line will be selected when you make your choices. Hence you should pay attention to the choice you make in every line. The point where you switch from option A to option B normally lies somewhere between the first and the last line. After you have completed all your choices we will randomly select one line (using a 20-sided die) which will be the "line that counts." You will be paid depending on the decision you made in that line.

Earnings

Your earnings for the selected line depend on which option you chose: If you chose option B in that line, you will receive an amount of money specified by option B – between $0.25 and $5, depending on the line. If you chose option A in that line, you will receive either $5 or $0. To determine your earnings in the case you chose option A we will randomly draw a ball from a bag containing twenty balls. The balls are either white or orange, but you do not know the exact number of white and orange balls before you make your decision. Before we draw the ball you choose a color. For example, suppose that you choose white. If the drawn ball is really white, you will receive $5. If the drawn ball is orange, you will receive $0.

The actual earnings for this part of the experiment will be determined at the end of the experiment, and will be independent of other parts of the experiment.

Decision Number	Option A		Option B	Choose A or B
1	**$5.00** with unknown chance	**$0.00** with unknown chance	**$0.25** for sure	
2	**$5.00** with unknown chance	**$0.00** with unknown chance	**$0.50** for sure	
3	**$5.00** with unknown chance	**$0.00** with unknown chance	**$0.75** for sure	
4	**$5.00** with unknown chance	**$0.00** with unknown chance	**$1.00** for sure	
5	**$5.00** with unknown chance	**$0.00** with unknown chance	**$1.25** for sure	
6	**$5.00** with unknown chance	**$0.00** with unknown chance	**$1.50** for sure	
7	**$5.00** with unknown chance	**$0.00** with unknown chance	**$1.75** for sure	
8	**$5.00** with unknown chance	**$0.00** with unknown chance	**$2.00** for sure	
9	**$5.00** with unknown chance	**$0.00** with unknown chance	**$2.25** for sure	
10	**$5.00** with unknown chance	**$0.00** with unknown chance	**$2.50** for sure	
11	**$5.00** with unknown chance	**$0.00** with unknown chance	**$2.75** for sure	
12	**$5.00** with unknown chance	**$0.00** with unknown chance	**$3.00** for sure	
13	**$5.00** with unknown chance	**$0.00** with unknown chance	**$3.25** for sure	
14	**$5.00** with unknown chance	**$0.00** with unknown chance	**$3.50** for sure	
15	**$5.00** with unknown chance	**$0.00** with unknown chance	**$3.75** for sure	
16	**$5.00** with unknown chance	**$0.00** with unknown chance	**$4.00** for sure	
17	**$5.00** with unknown chance	**$0.00** with unknown chance	**$4.25** for sure	
18	**$5.00** with unknown chance	**$0.00** with unknown chance	**$4.50** for sure	
19	**$5.00** with unknown chance	**$0.00** with unknown chance	**$4.75** for sure	
20	**$5.00** with unknown chance	**$0.00** with unknown chance	**$5.00** for sure	

PART 4

In this part of the experiment, you will be asked to make a series of choices in decision problems. How much you receive will depend partly on chance and partly on the choices you make.

Decision

For each line in the table below, please state whether you prefer option A or option B. Notice that there are a total of 20 lines in the table – you should think of each line as a separate decision you need to make. At the end of the experiment only one line will be randomly selected to be the "line that counts". Each line is equally likely to be selected, and you do not know which line will be selected when you make your choices. Hence you should pay attention to the choice you make in every line. The point where you switch from option A to option B normally lies somewhere between the first and the last line. After you have completed all your choices we will randomly select one line (using a 20-sided die) which will be the "line that counts." You will be paid depending on the decision you made in that line.

Earnings

Your earnings for the selected line depend on which option you chose: If you chose option B in that line, you will receive $0. If you chose option A in that line, you can receive either a loss between -$.50 and -$10, depending on the line, or a gain of $5. To determine your earnings in the case you chose option A we will randomly draw a ball from a bag containing twenty balls. There are ten orange and ten white balls in the bag. That means that when we draw a ball, there is a 50% chance that it is white and a 50% chance that it is orange. Before you draw the ball you choose a color. For example, suppose that you choose white. If the drawn ball is really white, you will receive -$x (the exact amount depends on the line chosen). If the drawn ball is orange, you will receive $5.

The actual earnings for this part of the experiment will be determined at the end of the experiment, and will not depend on any other parts of the experiment.

Decision Number	Option A		Option B	Choose A or B
1	**-$.50** with 50% chance	**$5.00** with 50% chance	**$0.00** for sure	
2	**-$1.00** with 50% chance	**$5.00** with 50% chance	**$0.00** for sure	
3	**-$1.50** with 50% chance	**$5.00** with 50% chance	**$0.00** for sure	
4	**-$2.00** with 50% chance	**$5.00** with 50% chance	**$0.00** for sure	
5	**-$2.50** with 50% chance	**$5.00** with 50% chance	**$0.00** for sure	
6	**-$3.00** with 50% chance	**$5.00** with 50% chance	**$0.00** for sure	
7	**-$3.50** with 50% chance	**$5.00** with 50% chance	**$0.00** for sure	
8	**-$4.00** with 50% chance	**$5.00** with 50% chance	**$0.00** for sure	
9	**-$4.50** with 50% chance	**$5.00** with 50% chance	**$0.00** for sure	
10	**-$5.00** with 50% chance	**$5.00** with 50% chance	**$0.00** for sure	
11	**-$5.50** with 50% chance	**$5.00** with 50% chance	**$0.00** for sure	
12	**-$6.00** with 50% chance	**$5.00** with 50% chance	**$0.00** for sure	
13	**-$6.50** with 50% chance	**$5.00** with 50% chance	**$0.00** for sure	
14	**-$7.00** with 50% chance	**$5.00** with 50% chance	**$0.00** for sure	
15	**-$7.50** with 50% chance	**$5.00** with 50% chance	**$0.00** for sure	
16	**-$8.00** with 50% chance	**$5.00** with 50% chance	**$0.00** for sure	
17	**-$8.50** with 50% chance	**$5.00** with 50% chance	**$0.00** for sure	
18	**-$9.00** with 50% chance	**$5.00** with 50% chance	**$0.00** for sure	
19	**-$9.50** with 50% chance	**$5.00** with 50% chance	**$0.00** for sure	
20	**-$10.00** with 50% chance	**$5.00** with 50% chance	**$0.00** for sure	