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The Value of Private Risk Versus the Value of Public Risk: An Experimental Analysis of the Johannesson *et al.* Conjecture

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**THE VALUE OF PRIVATE RISK VERSUS THE VALUE OF PUBLIC RISK:
AN EXPERIMENTAL ANALYSIS OF THE JOHANNESSON *et al.* CONJECTURE**

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Abstract: In 1996 Johannesson et al. published a paper in this journal entitled “The Value of Private Safety versus the Value of Public Safety.” Based on preliminary evidence from a hypothetical contingent valuation study, these authors argue that consumers behave as “pure altruists” and reject the notion of paternalistic preferences for safety in a coercive tax setting. These pure altruists consider the cost of a program that might be imposed on other voters when they decide whether to vote for or against public safety programs. The authors conclude that further empirical research in this area is warranted. This paper presents a set of laboratory economics experiments to test Johannesson et al.’s conjecture under controlled conditions in which participants face an actual risk of financial loss. The laboratory results extend those of Johannesson et al., providing strong evidence of pure altruism but limited support for paternalistic altruism for risk.

Keywords: Altruism, risk, voting, public goods

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1. Introduction

In 1996 Johannesson et al. published a paper in this journal entitled “The Value of Private Safety versus the Value of Public Safety.” Their study used hypothetical contingent valuation survey questions about voting for improvements in public transportation safety and purchases of private safety measures to examine the degree of pure altruism and paternalistic altruism in voters’ decisions in a coercive tax setting. The results of their study offer indirect evidence that consumers are “pure altruists” (nonpaternalistic) who take into account the distribution of the costs and net benefits of such a measure to others when choosing whether to vote for an investment in safety that would impose equal costs on all tax payers¹. Their data did not, however, support the existence of paternalistic voters who systematically bias their voting in favor of public safety programs compared to their own selfish interests. Johannesson et al. also concluded that further empirical research was warranted.

This paper presents a set of laboratory economics experiments designed to test the conjecture by Johannesson et al. under controlled conditions in which participants face an actual risk of financial loss rather than a hypothetical risk of loss of life. Note that distinguishing amongst different types of altruism is important because (with some exceptions) economic-theoretic arguments suggest that benefit-cost analyses generally should not incorporate pure altruism in benefit measures (Bergstrom 1982, 2006; Johansson 1992; Milgrom 1993; Flores

¹ In introducing their study Johannesson *et al.* describe their “rough way of handling” the notion that pure altruists with higher (or lower) values for a good might vote no (yes) to a coercive tax referendum that would provide net private benefits (costs) by asking a follow-up to the valuation question “where we inquire whether respondents believe that they are willing to pay more or less than the average car owner.” (p. 266). They do not incorporate this response into the econometric modeling of the dichotomous choice valuation question. Instead, they use the average response to this question in a discussion of why contingent values for a public safety program fell below values for a private safety program of equal magnitude. To wit, “Of our respondents, 33% (24%) believed that their own WTP exceeds (falls short of) the average WTP for the public safety measure, while 43% believed that their WTP is about the same as the average WTP. Thus there is a tendency to overestimate one’s own WTP relative to the WTP of others. This tendency should, *ceteris paribus*, cause the average WTP for the public safety program to fall short of the average WTP for the private safety device if respondents are true altruists” (p. 273).

2002)². Pure altruism occurs when the individual is concerned about the utility of other individuals, irrespective of how the utility is attained. In contrast, from a welfare-theoretic perspective, it has been argued that benefit cost analysis should generally only include paternalistic altruism (Jones-Lee 1991, 1992; Quiggin 1998). Paternalistic altruism occurs when an individual cares only about the level of consumption of a particular commodity by another person, not about the other person's utility or overall well-being.

Most field research that has been done on voter behavior with respect to risk and altruism has examined situations in which altruism is expected to *increase* the proportion of affirmative votes for public welfare measures over what would be anticipated for self-interested participants— i.e. in situations where one would expect paternalistic altruism. This emphasis reflects a prevalent view that is frequently articulated in the value of statistical life literature that accounting for concern about the well-being of others increases aggregate benefits in public benefit-cost analyses (e.g., Jones-Lee 1991, 1992). Empirical testing of this hypothesis with respect to risk improvement has been inconclusive, however; some studies of ballot initiatives have found voting patterns that are consistent with self-interest under a narrow definition (e.g., Deacon and Shapiro 1975) while other research has provided evidence of “public regardingness” in voting behavior (e.g., Holmes 1990; Shabman and Stephenson 1994). To some extent, such

² Bergstrom (1982) provided a neoclassical economic rationale for not accounting for altruism in Kaldor-Hicks welfare tests, leading Johansson (1994) to argue that an appropriate aggregation of valuations for a public good requires that individual, and therefore also aggregate, WTP be conditional on everybody else paying so as to remain at their initial levels of utility. In other words, private WTP values for reducing an individual's own risk are the appropriate values to be aggregated for benefit cost analyses. However, public projects are rarely, if ever, financed under such conditions. Most typically, funding for specific public projects imposes coercive costs that result in utility gains and losses. Moreover, projects that are evaluated tend to be discrete and the initial allocation of public goods is inefficient. Under these conditions, Flores (2002) argued that the extrapolation of Bergstrom's results for marginal changes at the optimum do not carry over to the “more modest problem [of benefit-cost analysis], determining whether a specific project can lead to a Pareto improvement.” Flores further argued that under these more realistic conditions pure altruism should be accounted for in applied welfare analyses. Bergstrom (2006) acknowledges the qualifications raised by Flores, but concludes that “for a broad class of economies, a comparison of the private values to the costs of a projects [remains] the appropriate test for determining whether [a public project] leads to a Pareto improvement” (p. 349).

disparate empirical results might be anticipated because of the inherent incompatibilities of using aggregate voting data as a measure of underlying, but not directly observable, preferences. Thus, by necessity, aggregate modeling approaches rely on indirect proxies for costs (e.g., income for Deacon and Shapiro (1975)), expected risk reduction (e.g., location for Shabman and Stephenson (1994)), and/or altruistic concerns (e.g., political affiliation for Holmes (1990)). Hypothetical contingent valuation research has also been conducted in settings, or using methods, in which willingness to pay for the safety of others is expected to be non-negative (e.g., Viscusi et al. 1988; Araña and León, 2002).

Yet, as conjectured by Johannesson et al. (1996), the coercive nature of voting and taxation also raises another possibility—that some people who are pure altruists will vote “no” on a project that would provide them with private net benefits for risk reduction, narrowly defined, because they are not willing to impose costs on others who will suffer a net loss from the cost versus benefits:

Let us assume that [an individual] is willing to pay \$t for a *ceteris paribus* increase in his own safety. His total WTP for a uniform public risk reduction of the same magnitude will fall short of \$t if he believes that others are willing to pay less than \$t but will still be forced to pay that amount (\$t) for the project. This is because other individuals for whom he cares will experience a lower utility if the program is implemented. In turn, this decrease in the utility of others reduces the pure altruist’s WTP for the public safety project. (p. 264)

In other words, purely altruistic behavior may in some instances *lower* the proportion of affirmative votes relative to a self-interested model. This point was more recently reemphasized by Bergstrom (2006), who notes: “If we are to count the sympathetic gains each obtains from the other’s enjoyment, then we should not forget also to count the sympathetic losses each bears from the share of its cost paid by the other.” (p. 339)

This paper examines the “Johannesson et al. conjecture” that an individual voter will tend to reject projects that impose excessive costs on others while elevating their individual willingness to pay when their decisions are likely to provide positive net benefits to others. We also develop methods to identify and test whether deviations from private, self-interested willingness to pay are driven by paternalistic altruism.

We employ the random-price voting mechanism (RPVM) introduced in Messer et al. (2008), which extends the Becker-DeGroot-Marshack (BDM) mechanism (1964) for private goods to a public-good setting. In that study, subjects were asked to indicate the highest uniform tax they would approve to pay for insurance against a certain loss. The amount of the tax was subsequently determined by a random drawing. If a majority of participants had indicated that they would vote “yes” at the selected tax level or higher, the insurance policy was purchased, the risk of loss was removed, and the tax was collected from all members of the group. If a majority of affirmative votes was not attained, the policy was not implemented and no tax was collected. Because of the voting context, this mechanism is theoretically incentive compatible. Using induced-value experiments, Messer et al. (2008) further demonstrate that the mechanism is demand-revealing in public settings and that the continuous willingness-to-pay (WTP) values correspond to those obtained from referendums involving an analogous dichotomous choice.

In the experiments described here, subjects provided the highest uniform price or tax that they would pay for an insurance policy that would protect them against a probabilistic loss in a private-good ($n=1$) and in a public-good setting ($n=3$, $n=15$). In addition, expected losses were varied across players in a way that allowed us to test for the existence of pure and/or paternalistic altruism. For completeness, we utilized three experimental designs. The first varied the probability of a loss so it most closely followed the survey framework of Johannesson et al.

(1996) while the second varied the loss amount and also explored the possible influence of group size on the public good. Providing a baseline, the third design had the losses occur with certainty analogous to Messer et al. (2008). We note that recent experimental studies have provided considerable support for pure altruism (Charness and Rabin 2002; Engelmann and Strobel 2004; Messer et al. 2008). However, because these studies used induced values under certainty, they could not test for paternalistic altruism, which requires using a commodity. In this study, either privately purchased or publicly provided insurance against risk of loss was the commodity of interest. Further, we couch our analysis in terms of voting decisions for risk reducing public programs.

The paper is organized as follows: Section 2 presents the conceptual foundations and demonstrates how voting behavior can be used to test for the presence of paternalistic versus nonpaternalistic altruism; Section 3 presents the experimental design; Section 4 provides results and statistical tests; and Section 5 provides a summary and discussion of the results.

2. Conceptual Framework

Messer et al. (2008) built upon the “social welfare” preference model of Charness and Rabin (2002) to derive symmetric Bayesian Nash equilibria expectations that are appropriate for the RPVM framework. The conceptual foundations of this study are similar but here we use induced values with public or private insurance against loss in a manner consistent with the framework introduced in Johannesson et al. (1996).

Preferences: Since these experiments were conducted in the laboratory with small stakes, and since there is no generally accepted theoretical model of risk aversion for small stakes, we initially assumed that subjects were not risk averse. As Rabin (2000) points out, the expected

utility model cannot explain the presence of risk aversion in the small since observable levels of risk aversion in the small and large are theoretically inconsistent. Note that the purpose of this study was to examine the nature of altruistic preferences for risk, not to explore risk aversion in the small. Thus, to begin, individual selfish utility was specified as expected payoff or income minus private expected loss:

$$1) \quad U^i = y^i - \rho_{i,s} L_{i,s} \quad i = 1, 2, 3, \dots, n,$$

where y^i denotes the income of participant i and $\rho_{i,s}$ denotes the probability of dollar loss, $L_{i,s}$, in treatment s for participant i in a group of n individuals. An approximate method for dealing with risk aversion is introduced later. In what follows we will use the term “probability-variation” to refer to treatments that vary ρ , and the term “loss-variation” to indicate treatments that vary L .

From equation 1, if a participant cares about the private utility of other participants, then purely altruistic utility, consistent both with Johannesson et al. (1996) and with the efficiency motive of Charness and Rabin (2002), can be specified as

$$2) \quad A^i = U^i + \alpha \sum_{j \neq i} U^j,$$

where α denotes the relative weight placed on the sum of others’ utilities, each denoted j . This is the particular form of pure altruism defined by Johannesson et al. (1996).

Alternatively, in the case of paternalistic preferences for others’ exposure to risk, paternalistic utility can be written as

$$3) \quad P^i = U^i - \beta \sum_{j \neq i} \rho_{j,s} L_{j,s},$$

where participant i loses utility at rate β in the sum of others’ expected losses. Thus, paternalistic preferences imply that individuals care not about others’ utilities but only about the risks they

face. For example, paternalistic altruists might condemn smoking as bad behavior and show interest in helping others quit but may not be interested in other aspects of smokers' well-being.

Equations 1-3 present three models of behavior that can be analyzed in the public-good voting experiments on risk. First, individuals may be solely self-interested and not consider the impact of their vote on others, which is consistent with equation 1. Second, individuals may also show purely altruistic preferences as shown in equation 2 by considering the utilities of others. Or, as shown in equation 3, individuals may have paternalistic preferences and be interested in the risks that others face but not in their overall well-being or utility.

Selfish Preferences: Participants in the experiments were given the opportunity to decide whether to purchase private and public insurance for price c to eliminate a known risk of losing money. The risk-neutral individual will purchase private insurance if the individual utility of accepting the risk is less than or equal to the individual utility of paying c to eliminate the risk:

$$4) \quad y^i - \rho_{i,s} L_{i,s} \leq y^i - c .$$

The maximum price that participant i will pay to eliminate risk when equality holds in (4) is equal to expected value:

$$5) \quad c_{i,s}^{\max} = \rho_{i,s} L_{i,s} .$$

However, if an individual is truly selfish and does not care about the utilities or risks facing others, that individual will vote for public insurance to eliminate risk to his or her voting group if the tax cost to each, t , is such that

$$6) \quad y^i - \rho_{i,s} L_{i,s} \leq y^i - t .$$

In this case, the maximum tax that individual i would pay to eliminate risk for the group is the same as the private value and remains equal to expected value:

$$7) \quad t_{i,s}^{\max} = \rho_{i,s} L_{i,s}, \text{ so } t_{i,s}^{\max} - c_{i,s}^{\max} = 0 .$$

Purely Altruistic Preferences: In the case of pure altruism, individual i will consider the utilities of other individuals, $j \neq i$, in voting on whether to fund a public risk reduction, which eliminates risk to all but imposes a tax cost t on each voter. Thus, individual i will vote affirmatively if

$$8) \quad y^i - \rho_{i,s}L_{i,s} + \alpha \sum_{j \neq i} (y^j - \rho_{j,s}L_{j,s}) \leq y^i - t + \alpha \sum_{j \neq i} (y^j - t)$$

and the maximum tax that i will pay is

$$9) \quad t_{i,s}^{\max} = \rho_{i,s}L_{i,s} + \frac{\alpha}{\alpha + 1} Z_{i,s}, \text{ where}$$

$$10) \quad Z_{i,s} = \frac{\sum_{j \neq i} \rho_{j,s}L_{j,s}}{(n-1)} - \rho_{i,s}L_{i,s}$$

and there are $n > 1$ voters in a voting group. Note that the difference between the maximum uniform tax for reducing risks to all and the own private value that i will pay to reduce risk to herself is determined by $Z_{i,s}$, which compares own risk to the average of others' risks:

$$11) \quad t_{i,s}^{\max} - \rho_{i,s}L_{i,s} \begin{cases} > 0 \text{ for } Z_{i,s} > 0 \\ = 0 \text{ for } Z_{i,s} = 0. \\ < 0 \text{ for } Z_{i,s} < 0 \end{cases}$$

Thus, from (10) and (11), if her risk is greater than the average of others' risks (as measured by expected value), she will pay less than her private value. If her risk is less than the average of others' risks, she will pay more than her private value.

Paternalistic Preferences: An individual with paternalistic preferences will vote in favor of a public risk elimination program if

$$12) \quad y^i - \rho_{i,s}L_{i,s} - \beta X_{i,s} \leq y^i - t,$$

where

$$13) \quad X_{i,s} = \sum_{j \neq i} \rho_{j,s} L_{j,s}$$

and will be willing to vote for a maximum tax of

$$14) \quad t_{i,s}^{\max} = \rho_{i,s} L_{i,s} + \beta X_{i,s}$$

This implies that a paternalist with respect to public risk will always pay more for a successful public risk prevention program than for an identical individual private risk reduction since

$$15) \quad t_{i,s}^{\max} - \rho_{i,s} L_{i,s} \begin{cases} = 0 & \text{for } X_{i,s} = 0 \\ > 0 & \text{for } X_{i,s} > 0 \end{cases} .$$

Treatments and hypotheses drawn from the theory described here are presented in Table 1. The numbers in parentheses are the expected values associated with our specific experimental design.

In addition, since $X_{i,s}$ represents the aggregate expected gains from the insurance policy for all other $n-1$ individuals, $\frac{\partial t_{i,s}^{\max}}{\partial n} > 0$ if the expected losses of other individuals in the group are positive and individuals are paternalistic. Thus, *ceteris paribus*, if paternalistic altruism is present, we would expect higher WTP values for individuals in larger groups. This contrasts with the expectation associated with pure altruism as presented in equation (10), that if additional members are added to the group in a way that does not affect the average expected losses of $j \neq i$, then $\frac{\partial t_{i,s}^{\max}}{\partial n} = 0$ for the pure altruist.

Risk Aversion: As mentioned earlier, given the lack of accepted models of risk aversion in the small, we note that a number of studies have documented systematic deviations from the prediction of expected utility, which implies that risks should be valued at expected values in the laboratory (See, for example, Holt and Laury (2002), Harrison et al. (2005), and Holt and Laury (2005)). However, the potential for risk aversion in the small must be taken into account to avoid

a potential confound. To attempt to capture these deviations, we defined a risk premium $r_{i,s}$ that biases private values such that

$$16) \quad c_{i,s}^{\max} = \rho_{i,s} L_{i,s} + r_{i,s}.$$

Alternatively, $r_{i,s}$ can be interpreted as a systematic error with a positive mean. In either case, we supposed that this risk aversion or positive systematic error could be a function of the experimental parameters of income, probability of loss, and loss, so that

$$17) \quad r_{i,s} = r(y^i, \rho_{i,s}, L_{i,s}) \geq 0.$$

If (16) is used to replace $\rho_{i,s} L_{i,s}$ everywhere in the foregoing analysis except in the definition of X and in the special case in which we assumed that, on average across subjects,

$$\sum_{j \neq i} r_{j,s} / (n - 1) = r_{i,s},$$

so that the average of others' risk premium is the same as own risk premium

over relevant treatments, the predictions of Table 1 do not change. That is, the predicted difference between public and private values (that include risk aversion or systematic error under this special assumption) remain unaltered. However, this requires the assumption that $r_{i,s}$ does not vary systematically with ρ or L so that the average of others' risk premiums is always equal to own risk premium. Note that we assumed that both pure and paternalistic altruist respond not to expected value but to the value of the risk to other individuals. Since the RPVM used in this study obtains private ($n = 1$) and public values ($n = 3, n=15$), the difference between these measures is the value of interest. We can estimate a mixed model with fixed effects to predict this difference as a function of $Z_{i,s}$ and $X_{i,s}$ as competing hypotheses. However, we must use predicted values for $c_{i,s}^{\max}$ in calculating $Z_{i,s}$, which can be obtained using predicted values of $c_{i,s}^{\max}$ obtained from an estimated second-order Taylor-series expansion of (16) after $r_{i,s}$ from (17) has been substituted, as described in section 4 below.

3. Experimental Design

The experiments involved 222 subjects (33 in a baseline treatment with certainty, 87 for the probability-variation risk treatment, and 102 for the loss-amount-variation risk treatment) who volunteered for the experiments in response to recruitment from a variety of undergraduate economics courses. Subjects received written instructions (see Reviewer Appendix) and were permitted to ask questions at the beginning of each part of the experiments. The instructions used language parallel to that commonly found in surveys for referendum voting settings (for example, Carson and Groves (2007)). The instructions directed each subject to *vote* on whether to *fund* an *insurance program* by submitting a *bid* that represented the “highest amount that you would pay and still vote for the insurance program.” We subsequently refer to this as the maximum WTP value.

In the experiments, each subject was seated at an individual computer with a privacy shield and assigned to groups of varying size of either one and three (and also fifteen for the loss-amount-variation treatment). The administrators announced the composition of each group. No communication was allowed. Subjects chose bids that could be anything from zero to the entire initial balance. Using Excel spreadsheets programmed with Visual Basic for Applications, subjects submitted their WTP for insurance to the experiment administrator.

The RPVM operates in much the same way as the traditional private-good BDM mechanism but with several key differences (see Messer et al. (2008) for a complete discussion). In the RPVM, a majority of the bids determines whether the program is funded. Consequently, a treatment in which group size equals one is identical to the private-good BDM mechanism since each subject’s bid constitutes a majority.

In this study, the cost of the program was determined by using a random number table with values from 0 to 2500 that represented the cost in pennies. For example, the number 1529 selected a cost of \$15.29. Consequently, the cost was uniformly distributed between \$0 and \$25 with discrete intervals of \$0.01.

Following procedures developed by Doyle (1997) to help participants understand risk, the probabilistic loss in our study was determined by having volunteer subjects draw ten chips, with replacement, from a bag of 100 chips containing a known number of red and white chips with the proportion reflecting ρ . Each red chip drawn meant that the subject lost a predetermined amount of money (L). The values of ρ and L depended on the experiment design as hereafter described. After the random cost and loss were determined, subjects retrieved this information and their spreadsheets calculated the profits.

All sessions consisted of two parts. The first consisted of ten low-incentive private RPVM rounds in which the subjects received feedback as the cost and losses were determined at the end of each round, giving subjects an opportunity to become familiar with the computer interface and to experience the incentive-compatible characteristics. The second part consisted of high-incentive private and public RPVM treatments in which the one treatment that resulted in cash payments was determined by a random draw at the end of the experiment. Thus, subjects did not receive any feedback during the RPVM treatments, ensuring independence of bids. Subjects were given complete information about the payoffs and risks faced by other subjects. The exchange rate for the second part of the experiment was 40 times greater than the rate for the first part and subjects received an average payoff of \$22 for the 1.5-hour experiment.

We tested our hypotheses by setting an identical level of risk for all of the members of a group (homogeneous treatments)—an expected value of loss of \$2 for one group of voters, \$5 for

another group, and \$8 for a third (see Table 2). In the case of variation in risk (heterogeneous treatments), the voters were assigned one of three different expected value of loss (\$2, \$5, or \$8) so that there was a low-, medium-, and high-risk group of voters. In the groups of three, one subject had each of the expected loss value of \$2, \$5, and \$8, while in the groups of 15, five subjects had each of the expected loss values.

To further explore voting behavior, we used three treatment designs. The probability-variation treatments varied the probability of loss (0.2, 0.5, 0.8) and had a fixed loss value of \$10, corresponding to programs that affect the probability of a particular outcome. These treatments were most similar to the survey design employed by Johannesson et al. (1996), which focused on valuing reductions in the risk of dying in a traffic accident. The loss-variation treatments varied the value of the losses (\$5, \$12.50, \$20) with a fixed probability of 0.4. This corresponds to changing the magnitude of the potential loss. In addition, we included loss-variation treatments that involved groups of fifteen members to test the potential effect of group size on bidding behavior. Finally, in “baseline/calibration” treatments, losses of \$2, \$5, and \$8 occurred with certainty.

4. Results

As previously discussed, a risk-neutral individual’s optimal strategy in the private-good treatments is to submit a bid equal to the expected value of her induced loss.³ In the baseline/calibration experiments, in which losses occurred with certainty, subjects’ average bids were statistically indistinguishable from the induced loss (\$1.92, \$4.85, and \$7.83; one-sample t-test) (Table 3). Such results are consistent with previous research that found that the BDM

³ Due to the discrete costs, another optimal strategy for a risk-neutral person is to submit a bid that is one penny less than the expected value of the induced value.

mechanism in private, induced-value WTP experiments is demand revealing (Irwin et al. 1998). However, in designs in which loss was probabilistic and the potential existed for a greater than expected loss, a subject exhibiting some form of risk aversion might submit a bid that is higher than the expected loss. As shown in Table 3, subjects consistently submitted bids that were higher than expected losses in both the “private” (n=1) probability-variation (\$2.31, \$5.57, and \$8.78) and the loss-variation (\$2.12, \$5.45, and \$8.53) designs using one-sample t-tests. Mean bids were statistically different from expected losses for treatments involving the larger expected losses (\$5 and \$8), suggesting that subjects’ behavior exhibits risk aversion in the small. The fact that the relatively small magnitude of the potential loss rules out the possibility of measurable risk aversion from expected utility (Rabin and Thaler 2001; Rabin 2000), is consistent with these results supporting risk aversion in the small or some other systematic error associated with introducing probabilities. Another possible explanation for the overbidding is bidding error, which would likely raise the bids because the range for them (\$0 to \$25) was asymmetric around the expected losses. However, we note that the certainty baseline does not exhibit overbidding, in fact, the average bids were slightly lower, but not significantly so, than induced value (Table 3). We thus conclude that the elevated average bid relative to the expected value is associated with introducing risk aversion in the small or with the act of introducing risk into our experimental setting.⁴

As in the private treatments, subjects in homogeneous treatments involving a public good submitted bids that were higher than then the expected loss (see Columns 3 and 4 of Table 3).

Consistent with prior research on the RPVM (Messer et al. 2008), subjects’ bids in these

⁴ We note that “trimming” the data by dropping all observations from individuals whose results were two standard deviations away from the mean in the private case resulted in values that were consistent with the predicted values. Thus, the data are also consistent with systematic error. Moreover, the average bids in the homogeneous treatments also were statistically indistinguishable from expected losses once the data were trimmed.

treatments were not statistically different than the subjects' bids in the private treatment, which is consistent with the theoretical predictions from Table 1 for pure altruism but not for paternalistic altruism.

Table 3 shows the effect of shifting from private goods to public goods in both homogeneous and heterogeneous voting settings in its comparisons of the mean bid for each expected loss. In general, as shown in Figures 1 and 2 and Columns 5 and 6 in Table 2, WTP in the heterogeneous voting situation appears to shift upward for subjects with the smallest expected losses (\$2). Such a shift would lend support for the existence of pure altruism—some of those who have the least to gain from the insurance policy are willing to incur a net financial loss for the benefit of others in a coercive public voting situation relative to a like private or homogenous public setting. By itself, such a results would also be consistent with paternalistic altruism. Yet, for subjects with the largest expected loss (\$8), who consequently stand to gain the most from the insurance policy, the WTP distribution shifts downward relative to other treatments in the heterogeneous voting situation. Again this result is consistent with the Johannesson et al. conjecture of pure altruism in a coercive tax setting. But this lowering of willingness to pay values is not consistent with paternalistic altruism. For the middle group (\$5 loss) in the heterogeneous voting situation, there is no consistent directional shift between treatments. This too supports the case for pure altruism (see Table 1) but not paternalistic altruism. Note that, for treatments in which the loss amount varied, there was no systematic difference in WTP between the small groups of three members and the large groups of 15 members (Figure 2 and Table 3, Columns 4 and 6). As such, over the range of group sizes considered, we do not find evidence of paternalistic altruism.

To compare alternative hypotheses regarding the pure altruism measure, Z , and the paternalistic altruism measure, X , as well as to control for the potential impact of risk aversion or systematic error, we used a two-stage random-effect mixed model. As previously described, bids in the first stage in the private treatments were estimated using a Taylor-series expansion of equation 16 such that

$$18) \quad c_{i,s}^{\max} = \beta_0 + \beta_1 y_i + \beta_2 \rho_{i,s} + \beta_3 L_{i,s} + \beta_4 \rho_{i,s} L_{i,s} + \beta_5 \rho_{i,s}^2 + \beta_6 L_{i,s}^2 + \varepsilon_{i,s} + \mu_i.$$

The results show that the constant and the expected loss, ρ^*L , are the only statistically significant variables, suggesting that the observed overbidding may not be due to systematic behavior except as an upward shift in bids (Table 4). Furthermore, tests of the coefficient for ρ^*L failed to reject it as different than 1 ($\chi^2 = 0.12$, $p = 0.7329$). If the insignificant terms are dropped from (18) so that private bids are predicted by a constant and the expected value, ρ^*L , the log likelihood ratio for the model -1345.64 and the constant (equal to 0.069) becomes insignificant but positive ($z=0.43$, $p=0.665$) and the coefficient on the expected value (equal to 1.059) is significant at the 1% level ($z=46.31$, $p=0.000$).⁵

Using $c_{i,s}^{\max}$ predicted from (18), we conducted a second set of random-effect mixed-model regressions, as shown in Table 5, to test the hypotheses outlined in Table 1. To test the potential importance of purely altruistic preferences versus paternalistic preferences, the analysis included both Z (pure altruism) and X (paternalistic altruism) to explain the difference between public and private bids given the different experiments and group sizes. The coefficient on Z was positive and significant at the 1% level for all experiment designs and group sizes, providing evidence of pure altruism. In contrast, the coefficient on X should be positive for paternalistic

⁵ This reduction can be justified given a likelihood ratio test that fails to reject that the two models are different at the 5% level.

altruism but it tended to be small and always insignificant. Thus, we did not find support for paternalistic altruism but did find support for pure altruism.

The estimated coefficient on Z ranged from a low of 0.092 in the loss-amount-variation design when only groups of three were considered to 0.172 in the probability-variation experiment. The overall estimated coefficient for Z was 0.136 and implies a value from α of 0.160. This implies that on average individuals weight their personal utility 6.25 times higher than the utilities of others.

5. Conclusion

There has been longstanding, and continued, interest within welfare economics about the degree and type of altruism that individuals exhibit in public-decision settings and how the effects of altruism should be handled in benefit-cost analyses. Such concerns have also been prominent in literatures on the value of safety and rational voting behavior. Despite this interest, there remains a lack of consensus over whether individuals account for the relative gains and losses of others in coercive voting situations involving risk.

In a departure from previous efforts in this field, this research used experimental economic techniques to investigate directly whether the distribution of expected payoffs affects individual decision-making in a referendum. Consistent with the conjecture by Johannesson et al, we find that individuals with the most to gain from a risk-reducing policy tend to shade their WTP, as expressed in an affirmative vote for a public-good investment, downward. That is, in a heterogeneous public setting they express a maximum WTP that is significantly lower than for an equal reduction in private risk. Similarly, but in another direction, our results suggest that those who derive the least benefit from a public insurance policy tend to have a greater WTP in a

public voting setting than in a private decision-making setting. For a coercive tax setting, this suggests that individuals are willing to incur costs in the form of higher taxes that provide benefits or transfer income to others. In combination, the downward and upward effects are consistent with pure altruism. Finally, little support was found for paternalistic altruism with respect to mitigation of risk in this study. Thus, the results support the types of social preferences for efficiency found in recent studies by Charness and Rabin (2002) and Engelmann and Strobel (2004) found in a voluntary setting. Their results obtained using induced values under certainty, appear to extend to risky situations as well. However, these studies could not realistically examine the possibility of paternalistic altruism because of the use of induced values.

We recognize that the risks investigated here involve much greater probabilities and much smaller losses than the health risk and safety decisions that come before policymakers. Nonetheless, these results provide fodder for the continuing debate concerning altruism in welfare economics. Adopting a controlled experimental economic approach, this research lends additional credence to the Johannesson et al. conjecture regarding pure altruism in coercive tax programs for public risks or safety. These pure altruists consider the cost of a program that might be imposed on other voters when they decide whether to vote for or against public safety programs. Further, this study develops a method that can be used to distinguish between paternalistic and pure altruism in the controlled environment of the experimental economics laboratory. This method can potentially be applied to other commodities that involve or affect risk and that might engender paternalistic preferences, such as healthful versus unhealthful snack foods, alcoholic versus nonalcoholic beverages, and smoking aids such as gum containing nicotine versus cigarettes.

Acknowledgments

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Figure 1. Probability-Variation Design

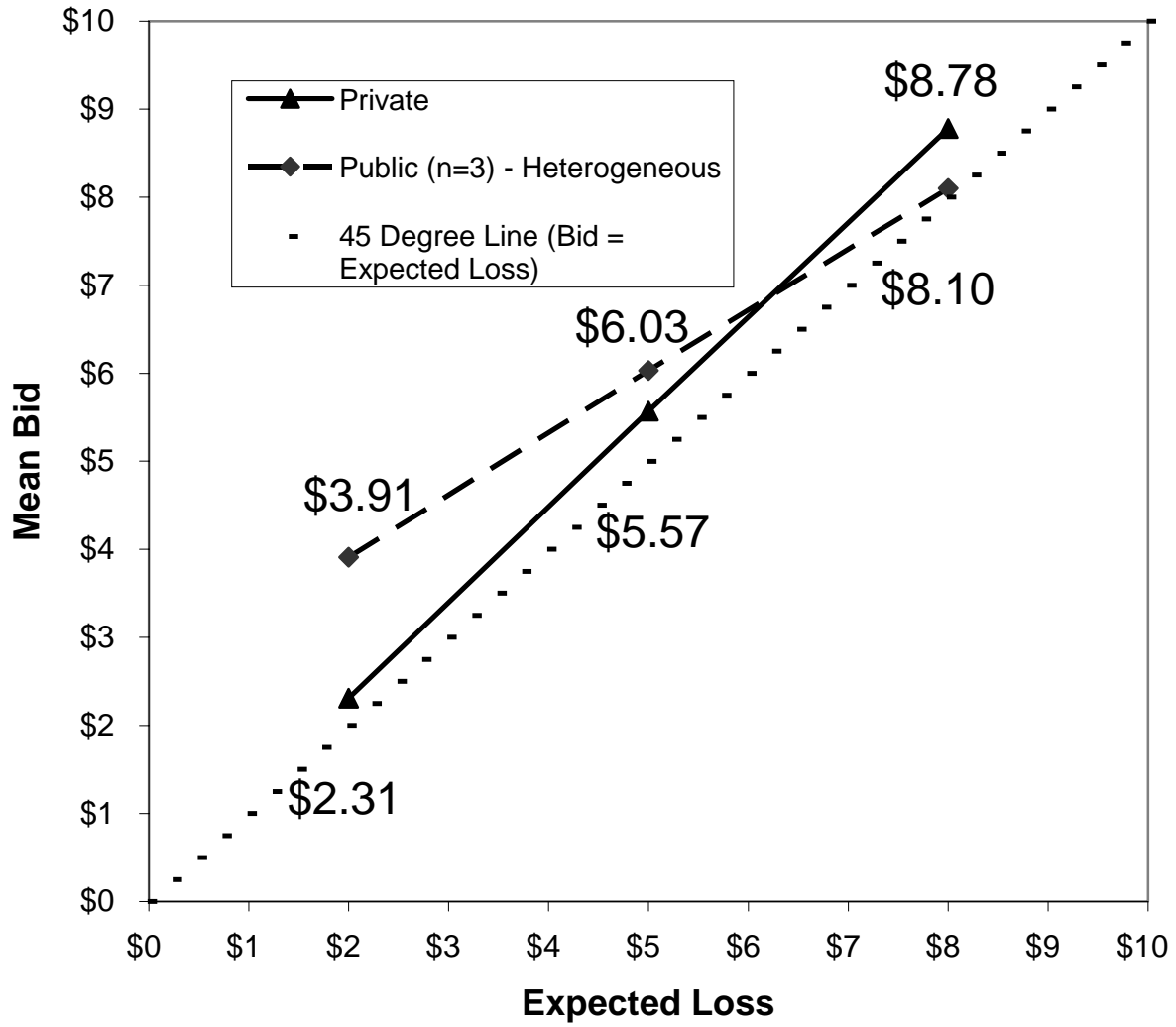


Figure 2. Loss-Variation Design

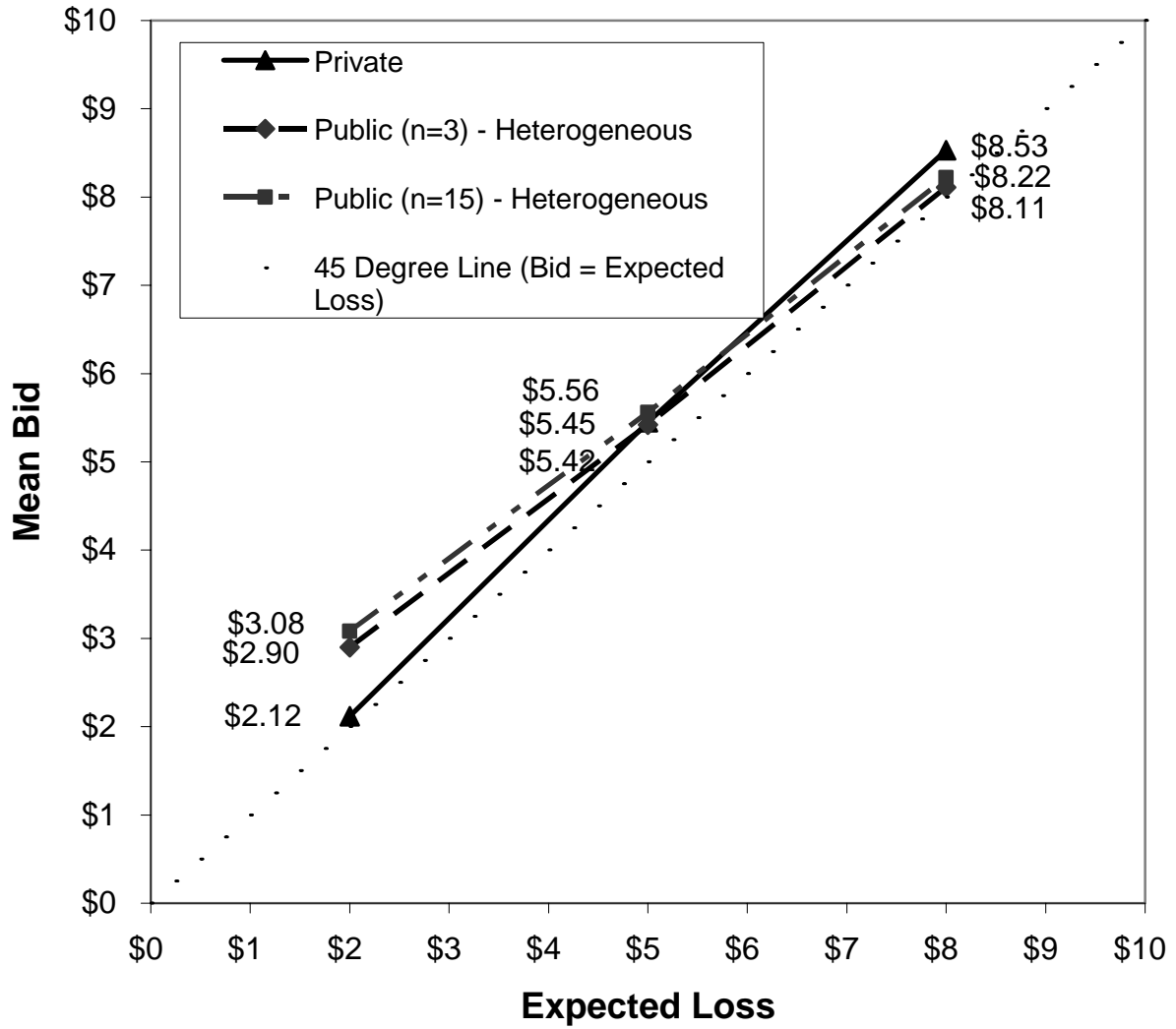


Table 1: Predictions of Public-Private Values

Treatment \ Preferences	Homogeneous Risk						Heterogeneous Risk					
	<i>Probability- Variation</i>			<i>Loss- Variation</i>			<i>Probability- Variation</i>			<i>Loss- Variation</i>		
	Low (\$2)	Average (\$5)	High (\$8)	Low (\$2)	Average (\$5)	High (\$8)	Low (\$2)	Average (\$5)	High (\$8)	Low (\$2)	Average (\$5)	High (\$8)
Selfish	0	0	0	0	0	0	0	0	0	0	0	0
Purely Altruistic Preferences	0	0	0	0	0	0	+	0	-	+	0	-
Paternalistic Preferences	+	+	+	+	+	+	+	+	+	+	+	+

Table 2. Experimental Designs

	Probability (out of ten draws)	Loss Loss	Expected Losses	Expected of Loss	Amount
Loss-Variation	0.4	\$5.00	4	\$2	
	0.4	\$12.50	4	\$5	
	0.4	\$20.00	4	\$8	
Probability-Variation	0.2	\$10	2	\$2	
	0.5	\$10	5	\$5	
	0.8	\$10	8	\$8	
Baseline/Calibration	1.0	\$2	NA	\$2	
	1.0	\$5	NA	\$5	
	1.0	\$8	NA	\$8	

Table 3. Mean Bids for Each Treatment

(1)	Private	Homogeneous		Heterogeneous	
	Group Size = 1	Group Size = 3	Group Size = 15	Group Size = 3	Group Size = 15
	(2) ^a	(3) ^b	(4) ^b	(5) ^b	(6) ^b
Baseline/Calibration (n = 33)					
Expected Loss: \$2	\$1.92	\$2.08		\$2.63 ^b	
Expected Loss: \$5	\$4.85	\$5.06		\$5.07	
Expected Loss: \$8	\$7.83	\$7.99		\$6.97 ^b	
Probability-Variation (n = 87)					
Expected Loss: \$2	\$2.31	\$2.62		\$3.91 ^b	
Expected Loss: \$5	\$5.57 ^a	\$5.75		\$6.03	
Expected Loss: \$8	\$8.78 ^a	\$9.09		\$8.10 ^b	
Loss-Variation (n = 102)					
Expected Loss: \$2	\$2.12	\$2.10	\$2.14	\$2.90 ^b	\$3.08 ^b
Expected Loss: \$5	\$5.45 ^a	\$5.52	\$5.43	\$5.42	\$5.56
Expected Loss: \$8	\$8.53 ^a	\$8.50	\$8.48	\$8.11 ^b	\$8.22

Notes:

Column 2: *a* indicates significantly different from the corresponding expected value at the 5% level.

Columns 3-6: *b* indicates significantly different from the corresponding private value at the 5% level.

Table 4. Random Effects Model for Taylor-Series Expansion for Private Bid

Variable	Coefficient
<i>Constant</i>	-1.1196 (0.9922)
ρ	3.2818 (2.3584)
L	0.1001 (0.1100)
$\rho*L$	0.9609** (0.1147)
ρ^2	-0.0023 (1.5148)
L^2	-0.0023 (0.0029)
Sigma_u	1.4453 (0.0932)
Sigma_e	1.4455 (0.0486)
N	666
Log Likelihood	-1344.24
LR Chi ² =	795.08
Prob > Chi ² =	0.000

Notes: Standard errors in parentheses.

* < 0.05 significance. ** < 0.01 significance.

Table 5. Random Effects Model Results for Public-Private Bids in Public

	Probability- Variation	Loss- Variation	All Data
Constant	0.2679 (0.2988)	0.0657 (0.1114)	0.1999* (0.0888)
Z	0.1722** (0.0295)	0.1160** (0.0228)	0.1362** (0.0180)
X	0.0078 (0.0242)	0.0008 (0.0017)	-0.0001 (0.0016)
Sigma_u	0.9418 (0.1325)	0.6583 (0.0848)	0.7579 (0.0751)
Sigma_e	2.0690 (0.0703)	2.0687 (0.0437)	2.0754 (0.0373)
N	522	1224	1746
Log Likelihood	-1155.4	-2667.1	-3826.7
LR Chi²	32.78	26	56.15
Prob > Chi²	0.0000	0.0000	0.0000

Notes: Standard errors in parentheses

* < 0.05 significance. ** < 0.01 significance.

Reviewer Appendix

Experiment Instructions – Probability-Loss Variation

Instructions (Part A)

This is an experiment in the economics of decision making. In the course of the experiment, you will have opportunities to earn money. Any money earned during this experiment is yours to keep. Please read these instructions carefully and do not communicate with other participants during the experiment.

You will receive a **starting balance** of \$25. At the front of the room are three bags full of one hundred (100) poker chips. The red bag has 20 red chips and 80 white chips. The green bag has 40 red chips and 60 white chips. The blue bag has 80 red chips and 20 white chips. In each round, you will be informed of which bag will be used and ten chips are going to be drawn randomly, and replaced, from this bag by subjects in the experiment. For every white chip drawn, you will have to pay nothing. For every red chip drawn, you will have you pay your **personal loss amount** of \$1.00. For example, if 4 of the 10 chips drawn are red, then you would have to pay \$4 ($\1.00×4) from your starting balance of \$25.

Rather than taking the chance of losing of your personal loss amount for each red chip drawn, you have the option of purchasing an **insurance program** that will remain in effect for the duration of the round of ten chip draws. With an insurance program, you will not owe the personal loss amount in the event that red chips are drawn. But, you will have to pay the experimenter, out of your starting balance, for the insurance program before any chips are drawn that round.

The amount that you indicate as the highest amount that you would pay for the insurance program will become a **vote** in favor or against the program, and will determine whether or not the insurance program is **funded**. Since you are the only voter, your vote will determine whether the insurance program is funded or not.

You will decide the highest amount that you would pay and still vote for this insurance program; we will call this your **bid**. You submit your bid, by typing it into spreadsheet, pressing the “Enter” key, and then clicking on the “Submit” button. For each insurance program, you can bid any amount between \$0 and your initial balance of \$25. Once the administrators receive everyone’s bid, the cost of the insurance program will be determined.

Your bid will be compared to the **cost** of the insurance program, as described below. The cost of the insurance program will be determined by reading off a random number table which has numbers from 0 to 2500. The cost will be determined by dropping a pen onto the random number table. (If more than one mark occurs from the drop, then the one closest to the upper-left corner will be used.) In subsequent programs, the cost will be determined starting from the initial cost and reading from left to right. The number will represent the cost in pennies. For example, the number 790 would represent the cost of \$7.90. Note: since these numbers have been generated by a random number table each cost between \$0 and \$25 is equally likely.

Whether or not the insurance program is funded depends on the amount of your bid and the cost of the program. Note that you will be informed which bag will be used in the round and then you submit your bid *prior* to knowing the cost of the insurance program. It is therefore important that you consider all of the information given to you about the different insurance programs and that you make judicious decisions.

Remember, you have the option of purchasing the insurance program at the beginning of each round and the insurance program will remain in effect or not be in effect for the duration of the round of ten chip draws. There are two possible outcomes for each round:

The insurance program is NOT FUNDED: The insurance program is not funded if your bid is less than the determined cost. For each red chip drawn (on average 20%, 40% or 80% of the time depending upon which bag is used) of the 10, you will pay your personal loss amount from your starting balance.

The insurance program is FUNDED: The insurance program is funded if your bid is equal to or greater than the determined cost. In this case, you are protected from the loss regardless of the color of the chips pulled from the bag. Your cash earnings for the round would be your initial balance (\$25) minus the cost of the insurance program.

Note how your bid is like a vote for or against funding the insurance program. With your bid, you are deciding the highest amount you would pay and still vote for the program. Therefore, your bid is like a vote in favor of the insurance program if your bid turns out to be equal to or greater than the cost. On the other hand, your bid is like a vote against the program if your bid turns out to be less than the cost.

While your bid helps determine whether the insurance program is funded or not, your earnings for a particular program are based on four items: your initial balance, your personal loss amount, the number of red chips drawn, and the determined cost of the insurance program. Consider the case where the insurance program is *not funded*, 2 red chips are drawn (therefore, 8 white chips are drawn) and the determined cost is \$5. In this case, your earnings would be \$23 [$\$25 - (2 \times \$1)$]. However, if the insurance program was *funded*, your earnings would be same regardless of the number of red chips pulled from the bag. In this case your balance would be \$20 ($\$25 - \5). Consider another case where the insurance program is *not funded*, 6 red chips are drawn (therefore, 4 white chips are drawn) and the determined cost is \$5. In this case, your earnings would be \$19 [$\$25 - (6 \times \$1)$]. However, if the insurance program was *funded*, your balance would be \$20 ($\$25 - \5). Note that regardless of whether the program is funded or not we will still conduct the drawing of the ten chips.

Calculation of Your Earnings

Recall that you initially entered your bid into the computer spreadsheet. Once the cost of the insurance program and the number of red chips are determined, the administrator will advise you to click the "Update" button. The computer will automatically indicate whether or not the program was funded, and your earnings will be calculated. Your earnings will be listed in experimental dollars and the exchange ratio for this part of the experiment will be 60 experimental dollars for 1 US dollar. For example, if you earn 30 experimental dollars your payoff would be \$0.50 US. At the end of the experiment, we will audit all of the spreadsheets to ensure accuracy.

*It is important that you clearly understand these instructions.
Please raise your hand if you have any questions.
Please do not talk with other participants in the experiment.*

Instructions (Part B)

For the second part of this experiment, you will now be asked to decide how much you would pay for separate insurance programs. The procedures are similar to those used in the first part of the experiment, except for four important differences.

- 1) For each of the insurance programs, you may be the only voter (as in the first part of the experiment). However, you may also be part of a group of three people whose **votes** will decide whether or not to purchase the insurance program. For programs where the group size is three, which bag will be used for the other voters in your group will be shown to you prior to determining your bid.
- 2) Whether the insurance program is funded or not will be determined by whether the **majority of bids** are greater than or less than the determined cost. If the majority of bids is greater than or equal to the cost, everyone will have to purchase the insurance program at the determined cost. If the majority of bids is lower than the randomly drawn cost, no one will purchase the insurance program.
- 3) Only one of the nine insurance programs will actually be selected and result in cash earnings. Therefore, all bids will be made prior to determination of the cost of the program or the drawing of the chips. After the bids are submitted, we will randomly determine which of the insurance programs will generate cash earnings by drawing from a bag containing nine chips lettered A through I. Each letter corresponds to one of the nine programs.
- 4) The exchange rate has changed. You will now earn two US dollars for every three experimental dollars earned. Thus, if you earn 15 experimental dollars, your payoff would be \$10 US.

For each insurance program, the experiment proceeds as follows:

You will be given a **starting balance** of \$25 and told how much money you and the other members of your group could lose. Once again, the **personal loss amount** per each red chip drawn is \$1.

Whether or not you lose your personal loss amount depends on the ten chips drawn. At the front of the room are three bags full of one hundred (100) poker chips. The red bag has 20 red chips and 80 white chips. The green bag has 40 red chips and 60 white chips. The blue bag has 80 red chips and 20 white chips. One or more bags will be selected and ten chips are going to be drawn randomly, and replaced, from this bag by subjects in the experiment. For every white chip drawn, you will have to pay nothing. For every red chip drawn you will have you pay your **personal loss amount** of \$1 unless your group has purchased an insurance program.

For each program, you will be informed which bag will be used for you and for the other members of your group and you will be asked to decide upon your bid and enter that amount into the second spreadsheet on the computer. Consider all of the information for the insurance program before submitting your bid. For each insurance program, you can bid any amount between \$0 and your initial balance of \$25.

Once everyone has submitted his/her bid for one program, the administrators will show you the information for the next program. After the bids for all the insurance programs have

been entered, we will determine which of the programs will be selected and produce cash earnings.

Next, we will determine the cost of the selected insurance program and whether it will be funded by your group. The cost of the insurance program will be determined in exactly the same manner as before, except that a new random number table with values from 0 to 2,500 will be used. This cost will now be the cost that each person in your group will have to pay if the insurance program is funded. Recall that since these numbers have been generated by a random number table each cost between \$0 and \$25 is equally likely.

Once again, there are two possible outcomes in the round:

The insurance program is NOT FUNDED: The insurance program is not funded if a majority of bids from your group are *less than* the determined cost. For each red chip drawn (on average 20%, 40% or 80% of the time depending upon which bag is selected) of the 10, you and everyone else in your group will pay their personal loss amount from the starting balance.

The insurance program is FUNDED: The insurance program is funded if a majority of bids from your group are *equal to or greater than* the determined cost. In this case, you and everyone else in your group are protected from the loss regardless of the color of the chips pulled from the bag. For you and everyone else in your group, your cash earnings for the round would be your initial balance (\$25) minus the cost of the insurance program. Note that each person in your group will pay the same cost even if the personal loss amounts in your group differed.

The programs, in which you are a group of one, are identical to the insurance programs you experienced in the first part of the experiment. Therefore, the insurance program is not funded if your bid is *less than* the cost determined from the random number table, and program is funded if your bid is *equal to or greater than* the determined cost.

Note once again how your bid is like a vote for or against funding the insurance program. With your bid, you are deciding the highest amount you would pay and still vote for the insurance program. Therefore, your bid is like a vote in favor of the program if your bid turns out to be equal to or greater than the cost. On the other hand, your bid is like a vote against the program if it turns out to be less than the cost. When a majority of bids are equal to or greater than the determined cost, this translates into a majority vote in favor of the insurance program. Similarly, a majority of bids below the cost translates into a majority vote against the program at that cost.

Calculation of Final Earnings

To calculate your earnings from Part B, the administrator will inform you which “Update” button to click. The computer will then calculate your earnings for Part B and add them to your earnings from Part A. We will audit the spreadsheets to ensure accuracy.

Experiment Instructions – Loss-Amount Variation

Instructions (Part A)

This is an experiment in the economics of decision making. In the course of the experiment, you will have opportunities to earn money. Any money earned during this experiment is yours to keep. Please read these instructions carefully and do not communicate with other participants during the experiment.

You will receive a **starting balance** of \$25. At the front of the room is a bag full of one hundred (100) poker chips: 40 red ones and 60 white ones. In each round, ten chips are going to be drawn randomly, and replaced, from the bag by subjects in the experiment. For every white chip drawn, you will have to pay nothing. For every red chip drawn you will have to pay your **personal loss amount**. Your personal loss amount will vary during the course of the experiment. The possible personal loss amounts are -\$0.50, -\$1.25, and -\$2.00. For example, if your personal loss amount is -\$1.25, and 4 of the 10 chips drawn are red, then you would have to pay \$5 ($\1.25×4) from your starting balance of \$25.

Rather than taking the chance of losing of your personal loss amount for each red chip drawn, you have the option of purchasing an **insurance program** that will remain in effect for the duration of the round of ten chip draws. With an insurance program, you will not owe the personal loss amount in the event that red chips are drawn. But, you will have to pay the experimenter, out of your starting balance, for the insurance program before any chips are drawn that round.

The amount that you indicate as the highest amount that you would pay for the insurance program will become a **vote** in favor or against the program, and will determine whether or not the insurance program is **funded**. Since you are the only voter, your vote will determine whether the insurance program is funded or not.

You will decide the highest amount that you would pay and still vote for this insurance program; we will call this your **bid**. You submit your bid, by typing it into spreadsheet, pressing the “Enter” key, and then clicking on the “Submit” button. For each insurance program, you can bid any amount between \$0 and your initial balance of \$25. Once the administrators receive everyone’s bid, the cost of the insurance program will be determined.

The **cost** of the insurance program will be determined by reading off a random number table which has numbers from 0 to 2500. The cost will be determined by dropping a pen onto the random number table. (If more than one mark occurs from the drop, then the one closest to the upper-left corner will be used.) In subsequent programs, the cost will be determined starting from the initial cost and reading from left to right. The number will represent the cost in pennies. For example, the number 790 would represent the cost of \$7.90. Note: since these numbers have been generated by a random number table each cost between \$0 and \$25 is equally likely.

Whether or not the insurance program is funded depends on the amount of your bid and the cost of the program. Note that you submit your bid *prior* to knowing the price of the insurance program. It is therefore important that you consider all of the information given to you about the different insurance programs and that you make judicious decisions.

Remember, you have the option of purchasing the insurance program at the beginning of each round and the insurance program will remain in effect or not be in effect for the duration of the round of ten chip draws. There are two possible outcomes for each round:

The insurance program is NOT FUNDED: The insurance program is not funded if your bid is *less than* the determined cost. For each red chip drawn (on average 40% of the time) of the 10, you will pay your personal loss amount from your starting balance.

The insurance program is FUNDED: The insurance program is funded if your bid is *equal to or greater than* the determined cost. In this case, you are protected from the loss regardless of the color of the chips pulled from the bag. Your cash earnings for the round would be your initial balance (\$25) minus the cost of the insurance program.

Note how your bid is like a vote for or against funding the insurance program. With your bid, you are deciding the highest amount you would pay and still vote for the program. Therefore, your bid is like a vote in favor of the insurance program if your bid turns out to be equal to or greater than the cost. On the other hand, your bid is like a vote against the program if your bid turns out to be less than the cost.

While your bid helps determine whether the insurance program is funded or not, your earnings for a particular program are based on four items: your initial balance, your personal loss amount, the number of red chips drawn, and the determined cost of the insurance program. Consider the case where the insurance program is *not funded*, your personal loss amount is - \$1.25, 2 red chips are drawn (therefore, 8 white chips are drawn) and the determined cost is \$5. In this case, your earnings would be \$22.50 [$\$25 - (2 \times \$1.25)$]. However, if the insurance program was *funded*, your earnings would be same regardless of the number of red chips pulled from the bag. In this case your balance would be \$20 ($\$25 - \5). Consider another case where the insurance program is *not funded*, your personal loss amount is \$1.25, 6 red chips are drawn (therefore, 4 white chips are drawn) and the determined cost is \$5. In this case, your earnings would be \$17.50 [$\$25 - (6 \times \$1.25)$]. However, if the insurance program was *funded*, your balance would be \$20 ($\$25 - \5).

Note that regardless of whether the program is funded or not we will still conduct the drawing of the ten chips.

Calculation of Your Earnings

Recall that you initially entered your bid into the computer spreadsheet. Once the cost of the insurance program and the number of red chips are determined, the administrator will advise you to click the "Update" button. The computer will automatically indicate whether or not the program was funded, and your earnings will be calculated. Your earnings will be listed in experimental dollars and the exchange ratio for this part of the experiment will be 60 experimental dollars for 1 US dollar. For example, if you earn 30 experimental dollars your payoff would be \$0.50 US. At the end of the experiment, we will audit all of the spreadsheets to ensure accuracy.

It is important that you clearly understand these instructions.

Please raise your hand if you have any questions.

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Instructions (Part B)

For the second part of this experiment, you will now be asked to decide how much you would pay for separate insurance programs. The procedures are similar to those used in the first part of the experiment, except for four important differences.

- 1) For each of the insurance programs, you may be the only voter (as in the first part of the experiment). However, you may also be part of a group of 3 or 15 people whose **votes** will decide whether or not to purchase the insurance program. For programs where the group size is 3 or 15, the personal loss amounts of the other voters in your group will be shown to you prior to determining your bid.
- 2) Whether the insurance program is funded or not will be determined by whether the **majority of bids** are greater than or less than the determined cost. If the majority of bids is greater than or equal to the cost, everyone will have to purchase the insurance program at the determined cost. If the majority of bids is lower than the randomly drawn cost, no one will purchase the insurance program.
- 3) Only one of the 15 insurance programs will actually be selected and result in cash earnings. Therefore, all bids will be made prior to determination of the cost of the program or the drawing of the chips. After the bids are submitted, we will randomly determine which of the insurance programs will generate cash earnings by drawing from a bag containing 15 chips lettered A through O. Each letter corresponds to one of the 15 programs.
- 4) The exchange rate has changed. You will now earn two US dollars for every three experimental dollars earned. Thus, if you earn 15 experimental dollars, your payoff would be \$10 US.

For each insurance program, the experiment proceeds as follows:

You will be given a **starting balance** of \$25 and told how much money you and the other members of your group could lose. Once again, the **personal loss amounts** per each red chip drawn are -\$0.50, -\$1.25, and -\$2, and will vary from program to program.

Whether or not you lose your personal loss amount depends on the ten chips drawn. At the front of the room, there is a bag full of one hundred (100) poker chips: 40 red ones and 60 white ones. Ten chips are going to be drawn randomly, and replaced, from the bag in the experiment. For every white chip drawn, you will have to pay nothing. For every red chip drawn you will have you pay your **personal loss amount** unless your group has purchased an insurance program.

For each program, you will be asked to decide upon your bid and enter that amount into the second spreadsheet on the computer. Consider all of the information for the insurance program before submitting your bid. For each insurance program, you can bid any amount between \$0 and your initial balance of \$25.

Once everyone has submitted his/her bid for one program, the administrators will show you the information for the next program. After the bids for all the insurance programs have been entered, we will determine which of the programs will be selected and produce cash earnings.

Next, we will determine the cost of the selected insurance program and whether it will be funded by your group. The cost of the insurance program will be determined in exactly the same manner as before, except that a new random number table with values from 0 to 2,500 will be used. This cost will now be the cost that each person in your group will have to pay if the insurance program is funded. Recall that since these numbers have been generated by a random number table each cost between \$0 and \$25 is equally likely.

Once again, there are two possible outcomes in the round:

The insurance program is NOT FUNDED: The insurance program is not funded if a majority of bids from your group are *less than* the determined cost. For each red chip drawn (on average 40% of the time) of the 10, you and everyone else in your group will pay their personal loss amount from the starting balance.

The insurance program is FUNDED: The insurance program is funded if a majority of bids from your group are *equal to or greater than* the determined cost. In this case, you and everyone else in your group are protected from the loss regardless of the color of the chips pulled from the bag. For you and everyone else in your group, your cash earnings for the **round** would be your initial balance (\$25) minus the cost of the insurance program. Note that each person in your group will pay the same cost even if the personal loss amounts in your group differed.

The programs, in which you are a group of one, are identical to the insurance programs you experienced in the first part of the experiment. Therefore, the insurance program is not funded if your bid is *less than* the cost determined from the random number table, and program is funded if your bid is *equal to or greater than* the determined cost.

Note once again how your bid is like a vote for or against funding the insurance program. With your bid, you are deciding the highest amount you would pay and still vote for the insurance program. Therefore, your bid is like a vote in favor of the program if your bid turns out to be equal to or greater than the cost. On the other hand, your bid is like a vote against the program if it turns out to be less than the cost. When a majority of bids are equal to or greater than the determined cost, this translates into a majority vote in favor of the insurance program. Similarly, a majority of bids below the cost translates into a majority vote against the program at that cost.

Calculation of Final Earnings

To calculate your earnings from Part B, the administrator will inform you which “Update” button to click. The computer will then calculate your earnings for Part B and add them to your earnings from Part A. We will audit the spreadsheets to ensure accuracy.

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