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Lucy F. Ackert
Ann Gillette
Jorge Matinez-Vazquez
Mark Rider

Georgia State University

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Lucy F. Ackert
Ann Gillette
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Michael McKee

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International Studies Program
Andrew Young School of Policy Studies
Georgia State University
Atlanta, Georgia 30303
United States of America

Phone: (404) 651-1144
Fax: (404) 651-4449
Email: ispaysps@gsu.edu
Internet: http://isp-aysps.gsu.edu

International Studies Program
Andrew Young School of Policy Studies

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Experimental Evidence for Tax Policy Design

Lucy F. Ackert, Ann Gillette
Kennesaw State University and Federal Reserve Bank of Atlanta

and

Jorge Martinez-Vazquez and Mark Rider
Andrew Young School of Policy Studies, Georgia State University

Abstrat:

In this paper we build on the work of Engelmann and Strobel (2004) and Ackert, Martinez-Vazquez, and Rider (2005) to examine the potential role of social preferences in tax policy design. We randomly assign each of the twenty participants in a session to one of four groups. The payoffs to each participant are determined by majority vote of the participants in a given group. We randomly assign each participant a pre-tax income which remains the same throughout the experiment to control for the potential confounding effect of risk pooling equilibria. Based on statistical analysis of the data generated by these experiments, we find support for the hypothesis that minimax preferences of Rawls (1971) or the inequality aversion model of Fehr and Schmidt (1999) can account for individual choices over alternative tax structures.

Keywords: Equity, Social preferences, Inequity aversion, Optimal taxation

JEL Classification numbers : C91, C92, D63, H21

1. Introduction and Review of the Literature

Since the classic writings of Ramsey (1927), Mirrlees (1971), and Diamond and Mirrlees (1971), economists have expended considerable effort on deriving rules for optimal tax design. Even though the rules describe theoretically optimal tax policies, they are not in a practical, political sense implementable because they tend to be widely unpopular with the public.[1] If, however, individual utilities are correctly specified and the social welfare function properly accounts for distributional concerns then optimal tax policy prescriptions should be popular with the public rather than unpopular.

Ackert, Martinez-Vazquez, and Rider (AMR (2004)) contend that a potential explanation for this paradox may be that individual utilities are not properly specified as purely selfish, that is, depending exclusively on one's own payoff. AMR provide evidence that in the context of selecting a tax regime people care not only about their own payoff, but also about the payoffs of others, i.e., in selecting a tax regime people appear to have social preferences. These findings build on those of an increasingly large literature that provides evidence of social preferences influencing individual decision-making in a variety of contexts (see, for example, Frohlich and Oppenheimer (1992), Ledyard (1995), Camerer (1997), Bolton and Ockenfels (2000), and Charness and Rabin (2002), among others).

From the perspective of tax policy design, the significance of such findings is that optimal tax policy prescriptions that account for social preferences may be quite different from traditional prescriptions. If people care about the distributional consequences of taxation, then tax structures that are perceived to result in an unfair distribution of after-tax incomes may not be optimal. Rather, optimal tax rules will require balancing individually held concerns for distributional equity and minimizing conventional excess burdens of distortionary taxation.

Two recent papers, Engelmann and Strobel (ES (2004)) and AMR (2004), use experimental methods to examine the role of social preferences in optimal tax policy design. ES find support for a model of social preferences in which people care about their own payoff, the payoff of the worst off particicipant (Rawls (1971)), and efficiency or the sum of individual payoffs (Harsanyi (1955)). However, ES use one shot experiments and only elicit the preferences of the median income participant. Furthermore, the after-tax payoff of this participant is the same under both income distributions. Therefore no sacrifice in terms of own payoff is called for in voting for equity or efficiency in their experimental design. We believe that a decision reflects a preference for fairness only when the chosen outcome requires a sacrifice by the decision-maker in the form of a reduced after-tax payoff in order to achieve a more equitable distribution of payoffs among the participants.

In contrast, AMR (2004) look for evidence of social preferences in selecting tax structures by requiring that all the participants in the experiment vote in repeated rounds. Before each round, the participants are randomly assigned pre-tax incomes. The payoff to each participant is determined by the choice of the majority. Earnings are determined by randomly selecting one of the rounds. This experimental design provides information on the preferences of all the participants. Furthermore, in this design voting for social preferences may require a sacrifice in terms of reduced own payoff. This allows the investigator to gauge whether and how much participants are willing to sacrifice in terms of a smaller after-tax payoff in order to reduce payoff inequality. In AMR's experimental design, the participants are re-assigned pre-tax incomes before each round. Therefore the results of their experiments may be confounding risk pooling equilibria, which is a purely selfish motive, with the influence of social preferences on individual choices. Another potential issue with AMR's approach is that the participants are

seated around a table facing each other as they vote, so some may be voting for the redistributive tax structure in response to perceived social pressure rather than a genuine desire to reduce payoff inequality.

In this paper we build on the previous literature to examine social preferences as a potential explanation of the paradox of optimal tax theory. To control for the potential issues in AMR identified above, we randomly assign each of the twenty participants in a session to one of four groups. As in AMR, the payoffs to each participant are determined by majority vote of the participants in a given group. In contrast to their design, the participants do not know the identity of the other members of their group. By providing for anonymity in this fashion, we hope to mitigate the potential influence of social pressure. Further, we randomly assign each participant a pre-tax income which remains the same throughout the experiment to control for the potential confounding effect of risk pooling. There are six experimental sessions with 13 different decisions on pairs of tax structures for a total of 110 participants and 1,430 decisions. Based on statistical analysis of the data generated by these experiments, we find support for the hypothesis that social preferences influence individual choices over alternative tax structures.

This paper proceeds as follows. Section Two describes our experimental design. Section Three discusses the empirical model and the results. Section Four offers some concluding comments.

2. Experimental Design and Method

The primary objective of this paper is to evaluate the ability of alternative characterizations of social preferences to predict individual choices among alternative tax structures in a group context. The experiment includes six sessions. In each session participants

were asked to make 13 paired comparisons.[2] Two participant pools were used. Four sessions included students at a large urban university, and two sessions included foreign nationals who were in the United States to study tax policy. The average age of the 110 participants is 30.8; 65 percent are male; 66 percent are self-supporting; and 36 percent earn more than $50,000 per year.[3] Table 1 reports average monetary earnings in the experiment and number of participants per session.[4] Observation of participants during the experiment indicated that the monetary rewards were motivating. Instructions are provided in Appendix A.

At the beginning of each experimental session, participants were randomly spread out in a large classroom to maintain privacy. The instructions were handed out prior to the distribution of the accompanying thirteen tax decision choice sheets. An experimenter read the instructions aloud and encouraged participants to ask any clarifying questions. Each of the 13 decisions is a paired choice between "Tax 1" and "Tax 2" which determines the tax and consequently after-tax income and potential earnings for each member of a five person group. In all sessions but one, there were twenty participants and thus four different groups per decision.[5] The members of a group for each decision were anonymous and pre-randomized. Each member within a group had a different pre-tax income level. In all thirteen decision pairs, Tax 1 is always a flat $5 tax for each member of the group. The paired Tax 2 distributions were chosen, given our time and attention limits, to minimize collinearity among the alternative measures of social preferences employed in this study. Participants were told that the tax they paid would be chosen by majority vote, and that they were not allowed to confer with other participants at any time in making their decision. They were also told that one of the thirteen decisions would be randomly chosen to determine participant earnings.

The pre-tax income for each participant was determined by drawing a card from a set of twenty (or ten) cards, one for each participant. In the set of cards there were four (two) cards for each of the five pre-tax income levels: $10, $20, $30, $40, and $50. Participants were told to keep their income card private information and that they would have this same pre-tax income throughout all thirteen decisions. As the cards were drawn, a monitor recorded the pre-tax income level by participant number which facilitated the pre-randomization of groups. Participants were informed that the groups had been randomized in such a way that there was always one member with each of the five pre-tax income levels. To establish a common knowledge benchmark, they were also told that the total income in each group was $150, and the average income $30.

After the pre-tax income level cards were drawn, the thirteen decision sheets were distributed. Participants had 30 minutes to complete the thirteen decisions, and time was never a binding constraint. After all decision sheets had been collected, a monitor tallied the votes by decision for each group and the tally was publicly displayed on a screen using a projector during the earnings determination section.

Given the focus of this paper, the instructions were purposefully framed in the language of pre-tax and after-tax income because of experimental evidence that context matters in certain circumstances. Both the after-tax income distribution and taxes paid by each group member were presented in table form next to the pre-tax income levels for each tax distribution choice, and at the bottom of each distribution the total group tax and after-tax income were reported. Although one piece of information can easily be calculated from the other, we presented both pieces of information to eliminate possible framing biases across individuals. Furthermore, the design considerations of group anonymity and the reporting of majority votes after all decisions had

been made, eliminates possible visually-related personal biases, controls for wealth effects between decisions, and maintains stationarity of population expectations across the thirteen decisions. Importantly, there is no motivation for risk sharing for the following reasons: (1) pre-tax income level and rank for each participant is held constant throughout the experiment, (2) group membership is anonymous, and (3) groups are re-randomized after each of the thirteen decisions.

3. Statistical Model and Results

The main objective of this paper is to evaluate the ability of different behavioral hypotheses to predict voting behavior in our experimental environment. In addition to the purely selfish hypothesis of conventional economic theory, we evaluate three social preference hypotheses frequently discussed in the literature, namely efficiency, Rawls, and disadvantageous and advantageous inequality aversion. According to the efficiency hypothesis, people seek to maximize the sum of individual payoffs, and according to the Rawls (1971) hypothesis people seek to maximize the payoff of the worst off individual. Finally, according to the disadvantageous (advantageous) inequality aversion hypothesis, people are averse to differences in income with respect to people with incomes greater (less) than their own (Fehr and Schmidt (1999)).

To make matters more concrete, the upper panel of Table 2 summarizes for decision 8 the basic information for the twenty-two participants assigned the $10 pre-tax income. We choose this table and income level simply for illustrative purposes. The after-tax payoff is $5 with Tax 1 and $4 with Tax 2 for the $10 pre-tax income participant under decision 8. According to the selfishness hypothesis, the net-benefit from Tax 2 (ΔS) is the difference in own after-tax payoffs

or -$1 (= $4 - $5). According to the efficiency hypothesis, the net-benefit of Tax 2 (ΔE) is the difference in the sums of the payoffs or -$5 [= ($120 - $125) = ($4 + $17 + $30 + $25 + $44) - ($5 + $15 + $25 + $35 + $45)], and the net-benefit from Tax 2 (ΔR) according to the Rawls hypothesis is the difference in the minimum payoffs or -$1 (= $4 - $5). Calculating the net-benefit (ΔD) according to the disadvantageous inequality hypothesis is slightly more complicated. For the participant assigned a pre-tax income of $10, all the other participants have greater after-tax incomes. Therefore, the net-benefit from Tax 2 according to the disadvantageous hypothesis is $0 or [= ($100 - $100) = ($17 - $4) + ($30 - $4) + ($25 - $4) + ($44 - $4) - ($15 - $5) + ($25 - $5) + ($35 - $5) + ($45 - $5)]. Since no one has less after-tax income than the $10 pre-tax income participant, advantageous income inequality (ΔA) is $0 by definition. For the reader's convenience, the net-benefits of Tax 2 for decision 8 are reported in the respective rows of the middle panel of Table 2.

With this information in hand, it is a simple matter to use each hypothesis to predict the $10 pre-tax income participant's preferred tax. According to the selfishness, efficiency, and Rawls hypotheses, if the net-benefit is positive then the participant should vote for Tax 2, otherwise not. Since participants are presumed to be averse to advantageous and disadvantageous inequality, the participant should vote for Tax 1 if the net-benefit from Tax 2 is positive. If the net-benefit according to a particular hypothesis is $0 then the respective hypothesis cannot predict a participant's choice. The lower panel of Table 2 shows the number of observed votes by the $10 pre-tax income participants *correctly* predicted by each hypothesis. In the case of decision 8, 16 participants voted for Tax 1. Therefore, the selfishness, efficiency, and Rawls hypotheses correctly predicted 16 out of 22 votes or approximately 73 percent. Since the net-

benefit of the advantageous and disadvantageous inequality hypotheses are equal to $0, they cannot predict observed votes.

Using similar calculations for all 1,430 decisions across all thirteen decision tables, we find that the selfishness hypothesis correctly predicts approximately 80 percent of the observed votes. In other words, the selfishness hypothesis goes a long way in predicting individual behavior in the game under investigation. However, the selfishness hypothesis alone cannot explain the observed choices in the remaining 20 percent of decisions. It is noteworthy that the votes of only 5 participants (4.5%) consistently reflect purely selfish motives across all thirteen decisions. Therefore, we investigate whether social preferences can improve the predictive power of the conventional model of purely selfish preferences.

Table 3 provides descriptive statistics for the five explanatory variables used in this study and calculated in the manner described above. The minimum difference in own payoffs is -$43, the maximum difference is $30, and the average difference is -$1.076. In other words, it can be quite costly to vote against your own self interest.

From previous research (AMR (2004)), we know that there is a potential problem with collinearity among these variables. While estimated coefficients are consistent in the presence of near perfect collinearity, collinearity increases the size of the standard errors. Table 4 reports the correlation matrix for participants' votes and the five explanatory variables described above: difference in own payoff (ΔS), difference in total payoff (ΔE), difference in minimum payoff (ΔR), the difference in disadvantageous index (ΔD), and the difference in advantageous index (ΔA). Although harmful collinearity is in the eye of the beholder, most of the correlation coefficients appear to be reasonably small. However, there is greater collinearity among the difference in own payoff (ΔS), the difference in disadvantageous inequality (ΔD), and the

difference in advantageous inequality (ΔA). The potential implications of this finding are discussed below.

We begin this investigation by estimating a model that accounts solely for the difference in own payoffs or the selfishness hypothesis, which we refer to as the S-model for ease of reference. The S-model serves as a benchmark against which to gauge the marginal contribution of alternative theories of social preferences.

The S-model may be represented as follows:

$$y_i^* = \left(B_0 + \alpha_i^*\right) + B_2 \Delta\pi_i + \varepsilon_{i1}$$

In this model, y_i^* is a latent-continuous-random-variable representing the change in utility induced by the choice of Tax 2 versus Tax 1, which is a $5 head tax on each participant in the group regardless of the assigned pre-tax income. The change in utility of a particular tax structure cannot be observed, but we can observe the individual's vote. We assume that the individual always votes in favor of the tax structure that maximizes her own utility, and

$$Vote_i = \begin{cases} 1 \; if \;\; y_i^* > 0. \\ 0 \; if \;\; y_i^* \leq 0. \end{cases}$$

In other words, y_i^* takes the value of 1 when a subject prefers Tax 2; and 0 otherwise. To infer an individual's preferences from their observed vote presumes that the participants are truthfully revealing their preferred tax structure. We believe that this assumption is a reasonable assumption in this experiment because voting in binary decisions is incentive compatible and strategy proof.

Initially, we assume that i's utility depends on the difference in own payoffs or $\Delta\pi_i$. Previous experimental results, particularly from ultimatum games and the like, indicate that approximately 20 percent of the population can be modeled as purely selfish; another 20 percent

of the population appears to exhibit social preferences; and the remainding 60 percent of the population appears to be conditional cooperators who can go either way depending on the observed behavior of others. In other words, there is evidence of unobserved heterogeneity in tastes for fairness in the population. To account for such heterogeneity among the subjects, we include a latent random variable (α_i^*) that reflects unobserved idiosyncratic tastes for fairness. We control for random-effects in our empirical approach to control for this source of unobserved heterogeneity in our sample. Finally, the random error of the structural model is given by ε_{i1}.

First, we estimate the S-model by assuming the random error term follows a logistic distribution. Table 5 reports the results from estimating a Random-Effects Logistic Regression.[6] The estimates of the S-model are reported in the column of Table 5 labeled accordingly. The estimated coefficient of the difference in own payoffs is positive and statistically significant at conventional levels. This means that the larger the own payoff from Tax 2 relative to Tax 1, the more likely it is that a participant votes for Tax 2, and vice versa. The marginal effect of the difference in own payoffs is around 0.03, which means that for each dollar increase in own payoff the probability of voting for Tax 2 increases by 3 percentage points.[7] Such voting behavior is consistent with the predictions of the S-model in which the individual only cares about maximizing her own after-tax payoff. To investigate the robustness of these results to alternative distributional assumptions, we also estimate the S-model assuming the error term is normally distributed. Accordingly, we report the results of Random-Effects Probit Regressions in Table 6. The results are very similar to those obtained from the Random-Effects Logistic Regression: the estimated coefficient of the difference in own payoff is positive and statistically significant at conventional levels and the size of the marginal effect is approximately the same.

Next, we estimate a version of the model that allows us to investigate whether individual concerns for efficiency influence voting in this experiment. In this specification, we augment the S-model by including the difference in total payoffs between the two tax structures or $\Delta\Sigma\pi_j$, which is a measure of the difference in aggregate efficiency between the two tax systems. For ease of reference, we refer to this hypothesis as the E-model, which is given by the following equation:

$$y_i^* = \left(B_0 + \alpha_i^*\right) + B_2\Delta\pi_i + B_3\Delta\sum_{j=1}^{5}\pi_j + \varepsilon_{i2}$$

The estimated coefficients of the E-model are reported in Tables 5 and 6 in the columns labeled accordingly. As in the case of the S-model, the estimated coefficient of the difference in own payoffs is positive and statistically significant at conventional levels. However, the difference in total payoffs is not significantly positive which is inconsistent with the efficiency hypothesis wherein people are concerned with maximizing total after-tax payoffs. By comparing the estimates in Table 5 (Logistic results) with those in Table 6 (Probit results), we see that this conclusion is not particularly sensitive to assumptions about the distribution of the error term.

We extend the S-model in a third direction by estimating a specification that accounts for distributional equity as described by the Rawls hypothesis: people prefer the distribution that maximizes the payoff of the worst off individual or max min ($\pi_1, \ldots, \pi_5$). We refer to this specification as the R-model, which is given by the following equation:

$$y_i^* = \left(B_0 + \alpha_i^*\right) + B_2\Delta\pi_i + B_3\Delta\text{maxmin}(\pi_j) + \varepsilon_{i3}$$

The estimates of the R-model are reported in Tables 5 and 6 in the columns labeled accordingly. Consistent with the results obtained from the S- and E-models, the estimated coefficient on the difference in own payoffs is positive and statistically significant at

conventional levels. Further, the estimated coefficient on the difference in the minimum payoff is positive and statistically significant at conventional levels irrespective of the distributional assumption. This result is consistent with the Rawls hypothesis that predicts concern with the income of the worst off individual, which is a type of social preferences. Note that the marginal effect of the difference in minimum payoffs is relatively small vis-à-vis that for the difference in own-payoffs. For each one-dollar increase in the former, the probability of voting for Tax 2 increases by half a percentage point. Of course, economic theory predicts that concern for own payoff would be weighted more heavily than a concern for others.

Finally, we turn to the Fehr and Schmidt (1999) model in which people care about their own payoff and are averse to disadvantageous and advantageous inequality as defined above. We measure the difference in disadvantageous and advantageous inequality among the two tax structures by $\Delta\Sigma\max(\pi_j - \pi_i, 0)$ and $\Delta\Sigma\max(\pi_i - \pi_j, 0)$, respectively. We refer to this variant as the FS-model which is given by the following equation:

$$y_i^* = \left(B_0 + \alpha_i^*\right) + B_2\Delta\pi_i + B_3\Delta\sum_{i\neq j}\max\left\{\pi_j - \pi_i, 0\right\} + B_4\Delta\sum_{i\neq j}\max\left\{\pi_i - \pi_j, 0\right\} + \varepsilon_{i4}$$

The estimates of the FS-model are reported in Tables 5 and 6 in the columns labeled accordingly. Again, the estimated coefficient on the difference in own payoff is positive and statistically significant at conventional levels. The estimated coefficient on the difference in disadvantageous inequality is negative and statistically significant at conventional levels. In other words, as disadvantageous inequality increases under Tax 2 relative to Tax 1, a participant is less likely to vote for Tax 2. This is consistent with the hypothesis that people are averse to disadvantageous income inequality. The estimated coefficient on the difference in advantageous inequality is also negative, but it is marginally insignificant at conventional levels (p-value = 0.171). These findings provide some support for the hypothesis that people are averse to income

inequality. Note that the estimates obtained with the FS-model do not appear to be sensitive to the assumed distribution of the error term. Consistent with the predictions of the FS-model, the estimated marginal effects for both types of inequality aversion are substantially smaller, in absolute value than that of the difference in own payoffs. Specifically, for each one dollar increase in disadvantageous (advantageous) inequality, the probability of voting for Tax 2 decreases by somewhat less than 0.1 percentage points; whereas a dollar increase in the difference in own payoffs results in a 3 percentage point increase in the probability of voting for Tax 2.

Finally, Tables 5 and 6 report the results of regressions that include all five potential influences on voting behavior: the difference in own payoff (selfishness), difference in total payoff (efficiency), difference in minimum payoff (Rawlsian), the difference in disadvantageous index, and the difference in advantageous index (inequity aversion). Again we find own payoff is an important determinant of behavior. However, as perhaps might be expected given the correlations reported in Table 4, no other influence is significant. We are unable to separate the effects in a multivariate model, possibly due to high standard errors resulting from multicollinearity.

Focusing on the entire set of estimates, it is reassuring to observe that the estimated coefficient on the difference in own payoffs is remarkably stable across the five specifications reported in Tables 5 and 6. There is little doubt that concern with own payoff influences participant votes among tax structures. However, we also find evidence that social preferences influence participant votes: they are willing to sacrifice in the form of a reduced own payoff to support tax structures where either the minimum payoff is maximized (Rawls hypothesis) or advantageous and disadvantageous inequalities are reduced. Social preferences are stable across

the two subject pools included in our experiment. We re-estimated all regressions reported in this paper with a dummy variable taking the value of 1 (0) for the tax policy (traditional) participants. The estimated dummy variable was insignificant in all regressions.

Like Frohlich and Oppenheimer (FO, 1992) and ES, we find support for the R-model. Following FO and ES, We also estimate a specification which accounts for selfishness (difference in own payoff), efficiency (difference in total payoffs), and Rawls (difference in minimum payoffs), which we refer to as the SER-model. The estimated coefficients of the SER-model from a Random-Effects Logistic Regression are 0.069 (p-value = 0.000), 0.009 (p-value = 0.12), and -0.005 (p-value = 0.29), respectively. The estimated coefficients of the difference in own and minimum payoffs have the correct signs, but the estimated coefficient on the difference in total payoffs has the wrong sign and is not statistically different from zero at conventional significance levels (p-value = 0.29).[8] In contrast to the findings reported by FO and ES, we do not find strong evidence in favor of the SER-model. Rather, the findings of this paper provide further support for the findings of AMR in favor of the FS-model. It is noteworthy that the findings in AMR are obtained with a different experimental methodology and subject population.

4. Conclusion

The primary objective of this paper is to shed light on the way social preferences relate to individual choices among alternative tax structures in a group context. We report results from an experiment with two participant pools: one drawn from students at a large urban university and the other drawn from foreign nationals who were in the United States to study tax policy. The experiment includes six experimental sessions in which participants are asked to make thirteeen choices among pairs of tax structures.

The results of our experiments are consistent with the conjecture that social preferences influence the choice of tax structures. The data strongly support the conventional understanding that subjects vote selfishly for the tax structures that maximize their own payoffs, but we also find evidence that some subjects exhibit social preferences. In other words, many, but certainly not all, are willing to take a reduced own payoff and support tax structures where either the minimum payoff is increased or advantageous and disadvantageous income inequality are reduced.

Further investigation of the role of social preferences on decision-making in groups is warranted. Better insight into individual preferences for redistributive taxation will improve optimal tax design and, perhaps, bring optimal tax theory and politically feasible tax structures into greater accord than currently is the case. Tax policy designs that fails to consider the importance of social preferences will not be optimal because people care about individual *and* distributional consequences.

APPENDIX

Instructions

This section of the experiment consists of a series of thirteen decisions. You will not find out how much you have earned until you have completed all thirteen decisions. You will be given a maximum of 30 minutes to complete this section of the experiment.

For each of the thirteen decisions, your earnings will be determined by your pre-tax income and the tax chosen by your group. There will be five members in each group and the **majority vote** will determine the tax for all members of your group. **For each of the thirteen decisions you are re-randomized into a different group.** The members of your group will be **anonymous** to you. None of you will know the identity of your group members.

Your pre-tax income in this section of the experiment will be determined by drawing a card from a set of five cards. The pre-tax incomes recorded on the five cards are as follows: $10, $20, $30, $40, and $50. Your income card is **private information** and you should **not** disclose it to other participants **at any time**.

[*Stop for the drawing of your pre-tax income card*].

Note that in each group there will be one member with each pre-tax income level. Thus, before taxes are paid the total income in each group is $150 and the average income of the group is $30. Each of you will keep this **same pre-tax** income for **all thirteen decisions** in this section of the experiment.

Whether you pay Tax 1 or Tax 2 on your pre-tax income depends on the majority vote of your group. For each of the thirteen decisions you will be given a *Tax Table* that summarizes the tax that is paid by each member of your group and the resulting after-tax income.

Your **Section 3 Record Sheet** shows thirteen decisions. Each decision is a paired choice between "Tax 1" and "Tax 2". You will record your group number for each decision in the second column and your tax choice in the third column. Only one of the thirteen choices will be used to determine your earnings for this section. Next I will explain how these choices affect your earnings for this section of the experiment.

A set of thirteen cards labeled 1 through 13 will be used to determine payoffs. After all participants have made their choices, one of the participants will be selected to draw a card to determine which one of the thirteen decisions will be used. Again, even though you make thirteen decisions, **only one** of these decides your earnings, but you do not know in advance which decision will be used. **Note that each decision has an equal chance of determining your earnings for this section.** Your after-tax income from the binding decision is yours to keep and will be paid to you in cash.

You **may not confer** with other participants in making your decisions at any time. When all participants have recorded their votes for the taxes they prefer on both their Section 3 Record

Sheets and their thirteen Decision Sheets, a monitor will come by and check that the votes are correctly recorded on the Record and Decision Sheets. A monitor will tally the votes for each group and record the outcome of each group's majority vote on an overhead transparency. The outcome will be displayed to everyone **only after** all participants have recorded their decisions.

This is the end of the instructions for this section, if you have any questions on this section of the instructions please ask them now. An experimenter will distribute the Tax Tables for the thirteen decisions at this time. When you have made your thirteen choices, please turn your Record and Decisions Sheets face down so that an experimenter may collect them. You have 30 minutes to complete the thirteen decisions.

[New page]

Group Number _____ Participant ID _____

Decision 1

Tax Table

The tax you pay on your pre-tax income will be one of two types. The following table summarizes the tax that is paid for each income level.

Pre-tax Income	Tax 1		Tax 2	
	Tax	After-Tax Income	Tax	After-Tax Income
$10.00	$5.00	$5.00	$1.00	$9.00
$20.00	$5.00	$15.00	$6.00	$14.00
$30.00	$5.00	$25.00	$6.00	$24.00
$40.00	$5.00	$35.00	$6.00	$34.00
$50.00	$5.00	$45.00	$6.00	$44.00
Total	$25.00	$125.00	$25.00	$125.00

Your Vote

Circle one of the following: Tax 1 or Tax 2

[New page]

Decision 2
Tax Table

The tax you pay on your pre-tax income will be one of two types. The following table summarizes the tax that is paid for each income level.

Pre-tax Income	Tax 1		Tax 2	
	Tax	After-Tax Income	Tax	After-Tax Income
$10.00	$5.00	$5.00	$8.00	$2.00
$20.00	$5.00	$15.00	$15.00	$5.00
$30.00	$5.00	$25.00	-$7.00	$37.00
$40.00	$5.00	$35.00	$5.00	$35.00
$50.00	$5.00	$45.00	$4.00	$46.00
Total	$25.00	$125.00	$25.00	$125.00

Your Vote

Circle one of the following: Tax 1 or Tax 2

[New page]

Decision 3
Tax Table

The tax you pay on your pre-tax income will be one of two types. The following table summarizes the tax that is paid for each income level.

Pre-tax Income	Tax 1		Tax 2	
	Tax	After-Tax Income	Tax	After-Tax Income
$10.00	$5.00	$5.00	-$15.00	$25.00
$20.00	$5.00	$15.00	$3.00	$17.00
$30.00	$5.00	$25.00	$7.00	$23.00
$40.00	$5.00	$35.00	$11.00	$29.00
$50.00	$5.00	$45.00	$25.00	$25.00
Total	$25.00	$125.00	$31.00	$119.00

Your Vote

Circle one of the following: Tax 1 or Tax 2

[New page]

Decision 4

Tax Table

The tax you pay on your pre-tax income will be one of two types. The following table summarizes the tax that is paid for each income level.

Pre-tax Income	Tax 1		Tax 2	
	Tax	After-Tax Income	Tax	After-Tax Income
$10.00	$5.00	$5.00	$8.00	$2.00
$20.00	$5.00	$15.00	$4.00	$16.00
$30.00	$5.00	$25.00	-$9.00	$39.00
$40.00	$5.00	$35.00	$8.00	$32.00
$50.00	$5.00	$45.00	$1.00	$49.00
Total	$25.00	$125.00	$12.00	$138.00

Your Vote

Circle one of the following: Tax 1 or Tax 2

[New page]

Decision 5
Tax Table

The tax you pay on your pre-tax income will be one of two types. The following table summarizes the tax that is paid for each income level.

Pre-tax Income	Tax 1		Tax 2	
	Tax	After-Tax Income	Tax	After-Tax Income
$10.00	$5.00	$5.00	-$17.00	$27.00
$20.00	$5.00	$15.00	-$4.00	$24.00
$30.00	$5.00	$25.00	-$2.00	$32.00
$40.00	$5.00	$35.00	$38.00	$2.00
$50.00	$5.00	$45.00	$20.00	$30.00
Total	$25.00	$125.00	$35.00	$115.00

Your Vote

Circle one of the following: Tax 1 or Tax 2

[New page]

Decision 6

Tax Table

The tax you pay on your pre-tax income will be one of two types. The following table summarizes the tax that is paid for each income level.

Pre-tax Income	Tax 1		Tax 2	
	Tax	After-Tax Income	Tax	After-Tax Income
$10.00	$5.00	$5.00	$6.00	$4.00
$20.00	$5.00	$15.00	$6.00	$14.00
$30.00	$5.00	$25.00	$6.00	$24.00
$40.00	$5.00	$35.00	$6.00	$34.00
$50.00	$5.00	$45.00	$6.00	$44.00
Total	$25.00	$125.00	$30.00	$120.00

Your Vote

Circle one of the following: Tax 1 or Tax 2

[New page]

Decision 7

Tax Table

The tax you pay on your pre-tax income will be one of two types. The following table summarizes the tax that is paid for each income level.

Pre-tax Income	Tax 1		Tax 2	
	Tax	After-Tax Income	Tax	After-Tax Income
$10.00	$5.00	$5.00	$1.00	$9.00
$20.00	$5.00	$15.00	$12.00	$8.00
$30.00	$5.00	$25.00	$14.00	$16.00
$40.00	$5.00	$35.00	$0.00	$40.00
$50.00	$5.00	$45.00	$6.00	$44.00
Total	$25.00	$125.00	$33.00	$117.00

Your Vote

Circle one of the following: Tax 1 or Tax 2

[New page]

Decision 8

Tax Table

The tax you pay on your pre-tax income will be one of two types. The following table summarizes the tax that is paid for each income level.

Pre-tax Income	Tax 1		Tax 2	
	Tax	After-Tax Income	Tax	After-Tax Income
$10.00	$5.00	$5.00	$6.00	$4.00
$20.00	$5.00	$15.00	$3.00	$17.00
$30.00	$5.00	$25.00	$0.00	$30.00
$40.00	$5.00	$35.00	$15.00	$25.00
$50.00	$5.00	$45.00	$6.00	$44.00
Total	$25.00	$125.00	$30.00	$120.00

Your Vote

Circle one of the following: Tax 1 or Tax 2

[New page]

Decision 9

Tax Table

The tax you pay on your pre-tax income will be one of two types. The following table summarizes the tax that is paid for each income level.

Pre-tax Income	Tax 1		Tax 2	
	Tax	After-Tax Income	Tax	After-Tax Income
$10.00	$5.00	$5.00	-$25.00	$35.00
$20.00	$5.00	$15.00	-$10.00	$30.00
$30.00	$5.00	$25.00	$1.00	$29.00
$40.00	$5.00	$35.00	$11.00	$29.00
$50.00	$5.00	$45.00	$48.00	$2.00
Total	$25.00	$125.00	$25.00	$125.00

Your Vote

Circle one of the following: Tax 1 or Tax 2

[New page]

Decision 10

Tax Table

The tax you pay on your pre-tax income will be one of two types. The following table summarizes the tax that is paid for each income level.

Pre-tax Income	Tax 1		Tax 2	
	Tax	After-Tax Income	Tax	After-Tax Income
$10.00	$5.00	$5.00	-$13.00	$23.00
$20.00	$5.00	$15.00	-$4.00	$24.00
$30.00	$5.00	$25.00	$28.00	$2.00
$40.00	$5.00	$35.00	$9.00	$31.00
$50.00	$5.00	$45.00	$17.00	$23.00
Total	$25.00	$125.00	$37.00	$103.00

Your Vote

Circle one of the following: Tax 1 or Tax 2

[New page]

Decision 11

Tax Table

The tax you pay on your pre-tax income will be one of two types. The following table summarizes the tax that is paid for each income level.

Pre-tax Income	Tax 1		Tax 2	
	Tax	After-Tax Income	Tax	After-Tax Income
$10.00	$5.00	$5.00	-$15.00	$25.00
$20.00	$5.00	$15.00	-$5.00	$25.00
$30.00	$5.00	$25.00	$5.00	$25.00
$40.00	$5.00	$35.00	$15.00	$25.00
$50.00	$5.00	$45.00	$25.00	$25.00
Total	$25.00	$125.00	$25.00	$125.00

Your Vote

Circle one of the following: Tax 1 or Tax 2

[New page]

Decision 12

Tax Table

The tax you pay on your pre-tax income will be one of two types. The following table summarizes the tax that is paid for each income level.

Pre-tax Income	Tax 1		Tax 2	
	Tax	After-Tax Income	Tax	After-Tax Income
$10.00	$5.00	$5.00	-$10.00	$20.00
$20.00	$5.00	$15.00	$0.00	$20.00
$30.00	$5.00	$25.00	$10.00	$20.00
$40.00	$5.00	$35.00	$20.00	$20.00
$50.00	$5.00	$45.00	$30.00	$20.00
Total	$25.00	$125.00	$50.00	$100.00

Your Vote

Circle one of the following: Tax 1 or Tax 2

[New page]

Decision 13

Tax Table

The tax you pay on your pre-tax income will be one of two types. The following table summarizes the tax that is paid for each income level.

Pre-tax Income	Tax 1		Tax 2	
	Tax	**After-Tax Income**	**Tax**	**After-Tax Income**
$10.00	$5.00	$5.00	-$1.00	$11.00
$20.00	$5.00	$15.00	$9.00	$11.00
$30.00	$5.00	$25.00	$9.00	$21.00
$40.00	$5.00	$35.00	$9.00	$31.00
$50.00	$5.00	$45.00	$9.00	$41.00
Total	$25.00	$125.00	$35.00	$115.00

Your Vote

Circle one of the following: Tax 1 or Tax 2

[New page]

Participant ID _____

Section 3 Record Sheet

Decision	Group Number	Your Vote (Tax 1 or Tax 2)	Group Majority Vote (Tax 1 or Tax 2)	Your Pre-tax Income (income card)	Your Taxes Paid*	Your After-tax Income
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						

* The amount you pay in taxes is determined by your income level and the majority vote for Tax 1or Tax 2.

[New page]

Earnings Determination

Section 3 Earnings:

Note the randomized groups on the overhead for each Tax Table Decision and each group's majority vote. Please verify that your recorded group number for each decision corresponds to that on the overhead. At this time, a card will be randomly chosen that will designate which of the thirteen decisions will determine your earnings. [*Stop for drawing of the card and calculation of the majority vote for the binding Tax Table decision*.] Please record on your cumulative record sheet the binding Tax Table Decision number chosen and your group's majority vote. Please calculate your earnings and a monitor will come by to check your calculations.

Notes

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1. These optimal tax policy prescriptions are typically derived from the maximization of a social welfare function composed of individual utilities subject to a tax revenue constraint
2. Each experimental session includes two additional sections in which we measure risk preferences in monetary gambles and altruism in a two-person context. Future research will investigate how risk preferences and altruism relate to social preferences in the larger group context investigated in this paper.
3. Responses on the post-experiment questionnaire indicated some demographic differences across the two subject pools. Perhaps most notably, relative to the traditional students the foreign nationals were older, with average age of the policy (traditional) participants of 38.6 (26.4). Despite the demographic variation across the two subject pools, we find no significant differences in behavior across the participants, as reported later in Section III.
4. In recruiting for the experiment, we required an even number of participants and groups consisting of five participants. Although our goal was sessions of size 20, we ran one session with ten participants because we were unable to recruit 20.
5. In one session there were 10 participants, giving two groups of five.

6. Although we do not report standard errors for the marginal effects, there is no change in significance for any of the variables in any of the regressions.
7. Note that the marginal effects reported here are not directly comparable to those reported by AMR (2004) due to different empirical specifications. Directional expectations, however, are the same.
8. The results from estimating this model by Random-Effects Probit are nearly identical in every respect.

TABLE 1: Brief Summary of Experiment

The table reports the subject pool, number of participants, and average earnings for the six sessions included in the experiment.

Experiment Session	Participants	Number of Participants	Average Participant Earnings per Session [a]
1	Traditional Students	20	$23.49
2	Traditional Students	20	$21.55
3	Policy Students	20	$24.99
4	Policy Students	20	$21.35
5	Traditional Students	10	$26.40
6	Traditional Students	20	$25.00

NOTE:

a. Average participant earnings do not include earnings in other sections of the experiment (see footnote 2), the show-up payment ($4 per participant), or the payment for completing a post-experiment questionnaire ($4 per participant).

TABLE 2: Comparing the Voting Behaior in Decision 1
For the Participants Randomly Assigned a Pre-Tax Income of $10

This table reports the income distributions and tax choices for Decision 8. Then the table reports the net benefit of voting for Tax 2 for the 22 participants assigned a pre-tax income of $10. The third panel of the table reports the number of the 22 votes correctly predicted by the five hypotheses. The final two hypotheses cannot predict observed votes because the net benefit of Tax 2 is zero under both hypotheses.

Pre-Tax Income	After-Tax Income 1	After-Tax Income 2
10	5	4
20	15	17
30	25	30
40	35	25
50	45	44
Total Income	$125.00	$120.00

Net Benefit from Voting for After-Tax Income 2 According to

Maximize Own-Payoff Hypothesis	-1
Maximize Sum of Payoffs Hypothesis	-5
Maximize Minimum Payoff Hypothesis	-1
Minimize Disadvantageous Inequality Hypothesis	0
Minimize Advantageous Inequality Hypothesis	0

Numbers of Votes Correctly Predicted by

Maximize Own-Payoff Hypothesis	16
Maximize Sum of Payoffs Hypothesis	16
Maximize Minimum Payoff Hypothesis	16
Minimize Disadvantageous Inequality Hypothesis	0
Minimize Advantageous Inequality Hypothesis	0

TABLE 3: Descriptive Statistics for all 13 Decisions

This table reports summary statistics for all 1,430 choices across 13 tax decisions.

Variable	Mean (Standard Errors)	Minimum (Maximum)
Difference in own-payoffs (ΔS)	-1.076 (12.44)	-43 (30)
Difference in total payoffs (ΔE)	-6.00 (9.45)	-25 (13)
Difference in minimum payoffs (ΔR)	3.31 (7.52)	-3 (20)
Difference in disadvantageous inequality indices (ΔD)	5.07 (48.48)	-100 (142)
Difference in advantageous inequality indices (ΔA)	-30.95 (36.06)	-100 (50)

TABLE 4: Correlation Matrix for All 1,430 Decisions Made by the 110 Participants

This table reports the correlation between participants' votes and and five explanatory variables included in subsequent analysis: difference in own payoff (ΔS), difference in total payoff (ΔE), difference in minimum payoff (ΔR), the difference in disadvantageous inequality index (ΔD), and the difference in advantageous inequality index (ΔA).

Variable	Vote	ΔS	ΔE	ΔR	ΔD	ΔA
Vote	1.00					
ΔS	0.47	1.00				
ΔE	0.03	0.15	1.00			
ΔR	0.02	-0.03	-0.22	1.00		
ΔD	-0.35	-0.68	0.01	-0.33	1.00	
ΔA	0.26	0.59	0.22	-0.31	-0.32	1.00

TABLE 5: Random-Effects Logistic Regression

This table reports the results of several Random-Effects Logistic Regressions where the dependent variable takes the value of 1 when a participant votes for Tax 2. Underneath the estimated coefficients are standard errors in parentheses ( ) and corresponding marginal effects in brackets [ ]. This table also reports the number of observations, a χ^2 test of the significance of the regression, the estimated value of the log-likelihood function, and McFadden's Adjusted Pseudo-$R^2 = 1 - \left(\frac{\ln \hat{L} - K}{\ln L_0} \right)$; where $\ln[L_0]$ is the maximized value of the log-likelihood function computed with only a constant term; $\ln[\hat{L}]$ is the maximized value of the log-likelihood function for the model, and K is the number of regressors.

Variable	S-Model[1]	E-Model	R-Model	FS-Model	Full Model
Constant	-0.442*** (0.088)	-0.492*** (0.095)	-0.505*** (0.093)	-0.533*** (0.123)	-0.552*** (0.000)
Difference in own-payoffs	0.127*** (0.009) [0.029]	0.128*** (0.009) [0.030]	0.129*** (0.009) [0.030]	0.125*** (0.011) [0.029]	0.126*** (0.000) [0.029]
Difference in total payoffs	-	-0.010 (0.007) [-0.002]	-	-	-0.006 (0.421) [-0.001]
Difference in minimum payoffs	-	-	0.021** (0.009) [0.005]	-	0.009 (0.445) [0.002]
Difference in disadvantageous inequality	-	-	-	-0.004** (0.002) [-0.0009]	-0.003 (0.178) [-0.001]
Difference in advantageous inequality	-	-	-	-0.003 (0.002) [-0.0009]	-0.002 (0.443) [-0.001]
Number of observations	1,430	1,430	1,430	1,430	1,430
χ^2 test of the significance of the regression	20.47***	20.30***	20.55***	17.80***	18.18***
Estimated value of the log-likelihood	-756.53	-755.54	-754.06	-753.40	-752.61
McFadden's Adjusted Pseudo-R^2	0.175	0.176	0.178	0.178	0.179

NOTE:

a. A single asterisk (*) indicates that the estimate is significant at the 10-percent level, a double asterisk (**) indicates significance at the 5-percent level, and a triple asterisk (***) indicates significance at the 1-percent level.

TABLE 6: Random-Effects Probit Regression

This table reports the results of several Random-Effects Probit Regressions where the dependent variable takes the value of 1 when a participant votes for Tax 2. Underneath the estimated coefficients are standard errors in parentheses ( ) and corresponding marginal effects in brackets [ ]. This Table also reports the number of observations, a χ^2 test of the significance of the regression, the estimated value of the log-likelihood funciton, and McFadden's Adjusted Pseudo-R^2 $= 1-\left(\frac{\ln \hat{L} - K}{\ln L_0}\right)$; where $\ln[L_0]$ is the maximized value of the log-likelihood function computed with only a constant term; $\ln\left[\hat{L}\right]$ is the maximized value of the log-likelihood function for the model, and K is the number of regressors.

Variable	S-Model [a]	E-Model	R-Model	FS-Model	Full Model
Constant	-0.254*** (0.054)	-0.286*** (0.058)	-0.285*** (0.057)	-0.279*** (0.074)	-0.292*** (0.000)
Difference in own-payoffs	0.068*** (0.004) [0.026]	0.069*** (0.004) [0.026]	0.069*** (0.004) [0.026]	0.066*** (0.006) [0.025]	0.066*** (0.000) [0.025]
Difference in total payoffs	-	-0.006 (0.004) [-0.002]	-	-	-0.005 (0.286) [-0.002]
Difference in minimum payoffs	-	-	0.010* (0.005) [0.004]	-	0.005 (0.436) [0.002]
Difference in disadvantageous inequality	-	-	-	-0.002* (0.001) [-0.0007]	-0.001 (0.287) [-0.001]
Difference in advantageous inequality	-	-	-	-0.001 (0.002) [-0.004]	-0.0002 (0.927) [-0.0001]
Number of observations	1,430	1,430	1,430	1,430	1,430
χ^2 test of the significance of the regression	30.45***	30.01***	30.27***	27.79***	28.25***
Estimated value of the log-likelihood	-756.90	-762.78	-762.10	-762.02	-760.97
McFadden's Adjusted Pseudo-R^2	0.167	0.168	0.169	0.169	0.170

NOTE:

a. A single asterisk (*) indicates that the estimate is significant at the 10-percent level, a double asterisk (**) indicates significance at the 5-percent level, and a triple asterisk (***) indicates significance at the 1-percent level.

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