AN EXPERIMENTAL TEST OF PREFERENCES FOR THE DISTRIBUTION OF INCOME AND INDIVIDUAL RISK AVERSION

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This study investigates the question of how much income redistribution individuals desire in a society with random differences in individual incomes. The experiments confronted individuals with choices of lotteries determining their own payoffs — to measure individual risk aversion — and with choices of lotteries determining payoffs to everyone in the group — to measure preferences regarding the distribution of income. The subjects were risk averse, but they did not display the extreme risk aversion implied by a Rawlsian maximin rule. The experiments produced little evidence that individuals favor a more equal income distribution than can be explained by individual risk aversion.

INTRODUCTION

Hoffman and Spitzen [1985] have previously reported experimental results on notions of fairness in the distribution of income. Unlike the experiment described here, their study focused on whether differences in income were perceived as “earned” or determined at random. The present study does not distinguish the perceived causes of income inequality but investigates the question of how much income redistribution individuals desire in a society with random differences in individual incomes. In this respect, it is similar to the studies of Frohlich, Oppenheimer, and Rawls [1987a; 1987b]. However, unlike those earlier papers, it compares individual preferences regarding risk with individual preferences regarding the distribution of income in a group.

A variety of reasons have been advanced to explain why individuals would want to give government the constitutional authority to redistribute income at a point in time when the individual does not know whether he will be a recipient of transfers or will be paying taxes to finance such transfers. One rationale for redistribution is the “insurance motive,” which suggests individuals who are uncertain about whether they will be rich or poor would prefer some reduction in inequality even if it reduced the mean expected income. John Rawls [1971] argued that “behind a veil of ignorance” individuals would choose a constitutional rule, the “maximin” or “difference principle,” which allows inequality only if this inequality benefits those worst off. Rawls’s maximin principle can be interpreted as a consequence of extreme risk aversion, but critics have questioned whether individuals behind a veil of ignorance would choose this rule.


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THEORIES OF PREFERENCES FOR THE DISTRIBUTION OF INCOME

Contractarian Theories of Redistribution as Insurance

Rawls's theory of justice is a contractarian theory, in that the criteria for justice are rules which people would hypothetically adopt unanimously in an "original position" in which individuals do not know their own future positions in society. Their ignorance of their own future circumstances is supposed to make individuals impartial, so they will agree to "fair" rules rather than favor rules which might give them some advantage at the expense of other members of the society.

Rawls's derivation of fair rules from the choices individuals would make in his hypothetical original position is similar to justifications of a utilitarian social welfare function by Vickrey [1945; 1960] and Harasanyi [1963; 1965], who had argued that the social welfare function should be impartial. Such preferences would represent the choices that an individual would make in a hypothetical situation in which he had an equal chance of being put in the place of any member of society. Given this equal probability assumption, an individual maximizing expected utility would in effect maximize a social welfare function in which each individual's utility has equal weight. Assuming diminishing marginal utility of individual income, the utilitarian social welfare function implies the desirability of an equal distribution of income, tempered by considerations of the effects redistribution might have on the incentives to produce income.¹

Buchanan and Tullock [1962, 1983] differ from Harasanyi and Vickrey in two respects. First, they avoid the use of a social welfare function. Second, as noted by Rowley [1983, 157] Buchanan and Tullock deal with real rather than hypothetical uncertainty. Whereas Harasanyi and Vickrey base their social welfare function on the hypothetical equal probability assumption, Buchanan and Tullock consider the real uncertainty that people have about their future incomes. Nevertheless, their argument for government redistribution of income is similar to the arguments of

¹ Note that the expected social utility is given by:

\[ U(Y) = \sum_i U_i(Y_i) \]

where \( U_i(Y_i) \) is the utility of individual \( i \) from income \( Y_i \).
Alexander [1974, 611-15] uses an example with individual utility functions of the form

$$U(Y_i) = Y_i^\gamma,$$

where $0 < \gamma < 1$. This is a special form of the utility function in (1) with $A = 0, B = 1 - \varepsilon$ and $\varepsilon < 1$. Alexander uses a more general social welfare function:

$$W = \left[ \sum_i U_i / \gamma \right] \gamma / \gamma,$$

$$= \left[ \sum Y_i / \gamma \right] \gamma / \gamma.$$

This would be identical to the social welfare function in (2) if $\gamma = 1$, but Alexander argues that the sympathetic observer would choose $\gamma < 1$ because some value is placed on the distribution as well as the sum of utilities.

There exists a monotonic transformation of (4) which will give a social welfare function in the form of (2), so the particular mathematical function used by Alexander does not imply an "optimal" income distribution different than that implied by a function such as (2), given the appropriate parameter values. The real difference between the contractarian insurance theories and Alexander's theory is that the former is based on individual choices maximizing only their own expected utility whereas Alexander's theory involves individual preferences about the distribution of utility among all members of society, not just the individual's concern about his own expected utility. According to the contractarian insurance theory, one would expect individuals to make equivalent choices, whether they are choosing a lottery involving only their own income or whether they are choosing a random distribution of income for members of a group. According to Alexander's theory, when choosing a random distribution for a group, individuals would choose a more equal distribution of income than they would when choosing a lottery for themselves.

The Rawlsian Theory

Rawls's theory of justice deals with much more than income distribution. The focus of this paper is on what Rawls calls the "difference principle," also known as the "maximin" rule because it maximizes the benefits of those with the minimum level of primary social goods.

Social and economic inequalities are to be arranged so that they are... to the greatest benefit of the least advantaged... [Rawls, 1971, 83].

This principle refers not simply to differences in income but to differences in an index of "primary social goods" such as "liberty and opportunity, income and wealth, and the bases of self-respect" [ibid., 1971, 62]. Nevertheless, my experiments are concerned with only differences in income.

Given the previous contractarian rationale for income redistribution based on risk aversion, it was natural for economists to view Rawls's theory in these terms (e.g., Musgrave [1974, 625-8] and Arrow [1983, 107-108]). Indeed, the maximin principle can be viewed as a special case of the social welfare functions in which $\omega = \gamma$ in (1) [Atkinson, 1985, 6] or $\rho \rightarrow \infty$ in (4) [Alexander, 1974, 611]. One criticism of Rawls's theory was that there was no reason to assume that individuals have this extreme risk aversion.

Although one interpretation of Rawls is that individuals in the original position choose as if they were extremely risk averse, other justifications of the maximin principle can be given. Arrow (1983, 102) notes that the maximin principle may be justified in making decisions under uncertainty when the probabilities of different outcomes are unknown. Indeed, Rawls describes the original position as a situation in which individuals "have no grounds for relying on one probability distribution over them rather than another" [1974, 649]. In criticizing this aspect of Rawls's argument, Goldman has argued

First we might note that even if it is agreed that the parties must employ some decision rule which takes no account of probabilities, it doesn't follow that they should employ the maximin rule. The maximin rule is only one member of an entire family of decision-principles which take no account of probabilities, and the fact that some member of this family must be used hardly shows that maximin in particular must be... Second, there is something slightly bizarre about Rawls' arguing that the knowledge of the parties in the original position is insufficient to allow them to make probability estimates... this stipulation seems to have no independent rationale. Unlike the stipulation that they possess no knowledge of themselves as individuals, it is not needed to prevent them from "tailoring principles to their own circumstances..."... It does not seem necessary to secure unanimous agreement on principles. Thus its only apparent role is to prevent them from making probability estimates of the various possible outcomes... [1980, 373-75].

Rawls also advances another argument in favor of the difference principle based on "the strains of commitment." In agreeing to the social contract, Rawls [1974, 652] argues that, "since everyone is to give an undertaking in good faith, and not simply to make the same choice, no one is permitted to agree to a principle if they have reason to doubt that they will be able to honor the consequences of its consistent application." According to Rawls, any rule for the distribution of income allowing more inequality than the difference principle would not pass the strains of commitment test because those who found themselves in the least advantaged position might have an incentive to violate the agreement and not to respect the property rights of the more advantaged.
It may be noted that Buchanan [1977, 159] finds this "strains of commitment" argument to be the most compelling defense of the difference principle. However, Alexander [1974, 615-6] raises two points against this argument: (1) It ignores the strains of commitment of the better off who might be forced to sacrifice a large benefit for the sake of the less advantaged. (2) It loses its force if one takes the sympathetic spectator approach rather than the contractarian perspective.

DESCRIPTION OF THE EXPERIMENTS

The experiments that I conducted confront individuals with choices of lotteries determining their own payoffs and with choices of lotteries determining payoffs to everyone in the group. Comparison of the results reveals whether preferences for income redistribution are based solely on an individual "insurance motive" or involve preferences for a more equal distribution of income within the group than is explained by individual risk aversion.

The experiments included a Rawlsian maximin alternative among the choices. However, the experiments departed from the assumptions of Rawls's original position in giving the participants knowledge of the probability distributions of income. In this respect the experiments described in Freibich, Oppenheimer and Evey [1987a, 1987b] and Freibich and Oppenheimer [1990] conform more closely to Rawls's assumptions; these experiments asked the subjects to choose among alternative abstract rules before they knew the actual payoffs and associated probabilities. However, as noted above, ignorance of the probability distribution is not necessary to assure that individuals will choose fair rules; all that is necessary is that individuals know nothing about their own future position that might cause them to choose rules favoring themselves at the expense of others.

A more serious limitation of the experiments is that they do not offer participants opportunities to renege on the agreement, which would make the strains of commitment test relevant.

In the experiments the participants chose among the fifteen alternative income distributions shown in Table 1 in which individuals have a probability of 0.5 of receiving the income given in the column headed X and a probability of 0.5 of receiving the income given in the column headed Y. These payoffs were generated by substituting values of \( t = 0, 0.05, 0.10, 0.15, \ldots, 0.60, 0.65 \) and 0.67552551 in the equations

\[
X = 20(1-t)^6 + 5
\]

\[
Y = 20(1-t)^4 + 4t.
\]

These payoffs could result from a society in which potential earnings are randomly distributed with a probability of 0.5 of an individual having potential earnings equal to 25 and a probability of 0.5 of an individual having potential earnings equal to zero. Taxing the high income individuals at a tax rate \( t \) reduces their actual earnings below their potential earnings while generating revenues to transfer to the low income group. The payoffs to the high-income individuals given by the equation for \( X \) represent their after-tax incomes. The payoffs given by the equation for \( Y \) represent the transfers to each low-income person which are equal to the tax revenues raised from each high-income person. Because of the disincentive effects of taxation, \( (X-Y)<25 \) for \( t<0.2 \), and the equation for \( Y \) describes a "Laffer curve" with a revenue-maximizing rate \( t^* \approx 0.65 \) in this case. A tax rate above \( t^* \) reduces the revenues which are transferred to low-income persons. Distribution \( M \) at which tax revenues are maximized is also Rawls's maximin solution because it maximizes the transfers to low-income persons.

In Table 1 the income distribution with the largest expected-mean income is \( A \), with an expected mean income of $12.50. One would expect risk averse individuals to choose some income distribution with a lower expected mean income but with less inequality. However, only extremely risk averse people would choose the Rawlsian distribution \( M \), which has a mean expected income of $7.20. If the individual is concerned only with the level of income, it would be irrational to choose the more egalitarian distributions, \( N \) and \( O \), although individuals who are concerned about inequality regardless of the level of income — e.g. because of feelings of envy that may be aroused by differences in income — might prefer \( N \) or \( O \) to \( M \) despite the fact that both \( X \) and \( Y \) are greater in \( M \).

In Part A of this experiment, I measured individual risk aversion by offering the subjects a choice of lotteries with probability 0.5 of receiving the payoff \( X \) and probability 0.5 of receiving the payoff \( Y \). To emphasize that this is an individual
choice, the instructions specified that payoffs under this part would be made privately.

In Parts B and C I attempted to determine if preferences regarding differences in income within the group and not just individual risk aversion are part of the motive for favoring income redistribution. Because these parts of the experiment concern preferences about the distribution of income in the group, the instructions specified that payoffs would be made publicly. In Part B subjects were given the same choice of lotteries but with the condition that one of the subjects' choices would be picked at random (without disclosing the name of the person making this choice) and all members of the group would face this same lottery, determining individual payoffs separately. This choice should represent each individual's preferences about the distribution of income.

The procedure in Part C followed the contractarian paradigm more closely; the group was required to agree unanimously on which of the lotteries would determine the payoffs to all individuals in the group. The instructions set a fifteen minute time limit on reaching an agreement, but this constraint did not seem to affect the results because all groups reached agreement in well under the limit.

At the beginning of the experiment subjects were told that payoffs would actually be made for only one of the three parts determined at random. Because the subjects did not know which part of the experiment would actually determine their payoffs, in each part they may be assumed to have chosen as if cash payoffs would be determined by their choices in that part of the experiment. Because actual payoffs were only made for one part of the experiment, the choice in one part should not have been affected by expected payoffs from the other parts. This avoids the problem of intra-experimental income effects which McKee (1989) has found may be significant.

The complete instructions for each part of the experiment are included in an appendix which is available from the author. The subjects were drawn from students in my own economics classes. All of the experiments were conducted before income redistribution was discussed in the course, so students were not influenced by class discussion of theories of income redistribution. However, they may have previously discussed income redistribution theories in other classes.

RESULTS

The experiment was carried out with six groups of students. Group (1) was a public finance class of juniors and seniors. Group (2) was a group of 8 volunteers from a principles class. Groups (3) and (4) were honors classes, almost all not business or economics majors and mostly sophomores. Groups (5) and (6) were principles classes, almost all sophomore business or economics majors. Group (6) economics were stated in terms of "uniform income."

In Part A, most of the subjects displayed some risk aversion in making choices for themselves alone. Only 13 of the 95 students in the experiments chose a value of $t=0.00$, which would have maximized the expected value of the payoff. The mean value of the "tax rate" chosen by all 95 individuals in Part A was 0.2894.

Two of the individual choices in Part A can only be explained as "mistakes." One public administration student in group (2) and one business student in group (5) chose $t=0.6775$. This choice, guaranteeing a certain payoff of $7.08$, is dominated by $t=0.00$, which gives equal chances of receiving $8.20 or $7.20. In Part B choosing an income distribution for the group, a total of 5 students (only 2 of whom were business majors) chose the extreme egalitarian value of $t=0.6775$. Unlike the choice of $t=0.6775$ by two students in Part A, these choices may not be mistakes. As previously noted, an individual might rationally prefer a completely egalitarian distribution of income to the Rawlsian distribution out of concern with feelings of envy arising from inequality. The Rawlsian distribution itself did not attract much support in Part B of the experiments; only one non-business major chose $t=0.60$.  

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>Full Sample</th>
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<td>15</td>
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<td>15</td>
<td>95</td>
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<td>0.3833</td>
<td>0.2875</td>
<td>0.2099</td>
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<td>Standard deviation</td>
<td>0.1571</td>
<td>0.350</td>
<td>0.1014</td>
<td>0.1205</td>
<td>0.2351</td>
<td>0.2139</td>
<td>0.1649</td>
</tr>
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<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
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<td>0</td>
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<td></td>
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<td>Standard deviation</td>
<td>0.1571</td>
<td>0.350</td>
<td>0.1014</td>
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<td>0</td>
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<td>Change from A to B</td>
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<td>0.0188</td>
<td>0.0753</td>
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<td>0.0026</td>
<td>0.0662</td>
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<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>6</td>
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<tr>
<td>Number of decreases</td>
<td>11</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>9</td>
<td>2</td>
<td>11</td>
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<tr>
<td>Part C Unanimous Choice for Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>&quot;tax rate&quot;</td>
<td>0.2894</td>
<td>0.350</td>
<td>0.500</td>
<td>0.250</td>
<td>0.250</td>
<td>0.000</td>
<td>0.2894</td>
</tr>
</tbody>
</table>

Group (1) was a Public Finance class of juniors and seniors. Group (2) was a group of volunteers from a Principles class. Groups (3) and (4) were Honors classes, almost all not business or economics majors and mostly sophomores. Groups (5) and (6) were Principles classes, almost all sophomore business or economics majors. Group (6) economics were stated in terms of "uniform income."
Not only do the results of Part B fail to provide much evidence that individuals would support a Rawlsian or more extreme egalitarian rule for income distribution, but there is little evidence for Alexander's theory that individuals favor a more equal distribution of income than individual risk aversion can explain. The mean value of the "tax rate" chosen by individuals in Part B increased in only three of the six groups, as would be predicted by Alexander's theory. The mean tax rates in the other three groups and for all 85 subjects in the experiments were actually lower than the mean tax rates in Part A, contrary to Alexander's theory. Furthermore, this result cannot be explained by extreme changes on the part of a few individuals; although 24 individuals chose a larger tax rate in Part B than in Part A, 32 people chose lower tax rates in Part B. This result is puzzling, but it certainly does not support Alexander's theory. Perhaps individuals choose an alternative with a higher expected value when making a choice for the group because of a desire to increase the group income.

The results of Part C of the experiments provided no support for Rawls's theory and little support for Alexander's. Consistent with Alexander's theory, groups (2) and (3) did choose a tax rate of 0.50, which was greater than the mean value of the tax rate chosen by individuals in these groups in Part A. However, the other groups chose lower values for the tax rate in Part C than the mean tax rate chosen by individuals in these groups in Part A. Group (6) even chose the risk neutral response, t=0.00, in Part C. Again, the collective choice of an income distribution in Part C with a larger mean but more inequality than the distribution chosen by individuals in Part A may be explained by the desire to increase the group income even if this increases the risk for individuals.

Conclusions based on the results of Part C are probably less reliable than conclusions based on Part B because the choices may have been unduly influenced by the preferences of the more assertive leaders in the groups. For example, one of the honors classes, group (4), unanimously chose t=0.30, the most unequal distribution chosen by any of the groups in part C except for group (6). This choice seemed to result from the influence of one person. The group almost reached agreement on t=0.36, but one holdout persuaded the rest to agree to t=0.20.

The summary of results in Table 2 shows substantial differences among the groups in Parts A and B as well as Part C. In Part A, the greatest risk aversion was in group (3) in which the mean preferred "tax rate" was 0.4111; the least risk averse group was group (6) with a mean preferred "tax rate" of 0.2089. Group (3) also had the highest mean tax rate in Part B, 0.4964. The group with the lowest mean tax rate in Part B, 0.2265, was group (1), the public finance class. In Part C, group (6), which chose the risk neutral alternative, was a principles class which included only business and economics majors. In contrast, group (5), which chose t=0.50 in Part C, was an honors-class with no business or economics majors. Groups (2) and (3) were the smallest groups in the experiments. These observations suggest that non-business majors are more risk averse and prefer a more equal distribution of income for the group than economics and business majors and that smaller groups choose more equal income distributions.
TABLE 3
Seemingly Unrelated Regression Estimates
(std. errors in parentheses)

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Part A</th>
<th>Part B</th>
<th>Part A</th>
<th>Part B</th>
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<tr>
<td>Constant</td>
<td>0.6451 1b</td>
<td>0.6381 1b</td>
<td>0.2541 1b</td>
<td>0.6362 4b</td>
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<tr>
<td></td>
<td>(0.03271)</td>
<td>(0.10668)</td>
<td>(0.03326)</td>
<td>(0.10449)</td>
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<td>ECFIN</td>
<td>-0.00911</td>
<td>-0.10699 8</td>
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<td>0.05199</td>
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<td>(0.04025)</td>
<td>(0.03940)</td>
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<tr>
<td>BUS</td>
<td>-0.10098 6a</td>
<td>-0.10389 8a</td>
<td>0.06229</td>
<td>0.05306</td>
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<td></td>
<td>(0.05900)</td>
<td>(0.05900)</td>
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<td>(0.00025)</td>
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<tr>
<td>F²</td>
<td>0.0038</td>
<td>0.0752</td>
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<tr>
<td>t-statistic for equal coefficients of ECFIN and BUS</td>
<td>0.05063</td>
<td>0.0206</td>
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<tr>
<td>Degrees of freedom</td>
<td>4, 183</td>
<td>4, 183</td>
<td>4, 183</td>
<td>4, 183</td>
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</table>

Indicates significance at the 5 percent level, two-tailed test and 8 indicates significance at the 1 percent level, two-tailed test.

The results of these experiments show that the subjects were risk averse and would therefore favor some income redistribution based on an “insurance motive,” but they did not display the extreme risk aversion implied by a Rawlsian maximin rule. This is consistent with the results of the experiments described in Frohlich, Oppenheimer and Eaves (1987a, 1987b) and Frohlich and Oppenheimer (1990), in which subjects consistently chose a rule maximizing the average income subject to a minimum income constraint in preference to either the Rawlsian rule of maximizing the minimum income or the risk-neutral choice of maximizing the mean income without any constraint.

The experiments produced little evidence that individuals favor a more equal income distribution than can be explained by individual risk aversion. Indeed, the desire to maximize the group’s income may lead individuals to choose a distribution for the group which has a higher expected value and variance than the lottery they would choose for themselves alone. The results also suggest that students majoring in economics or business are less risk averse and less favorable to a more equal income distribution than non-business students.

The experiments described in this paper involved just two income classes, a high income and a low income class. An interesting extension of this research would be to give individuals choices of lotteries each having three or more different payoffs. However, with more than two income classes the relative ranking of income distributions by the degree of inequality becomes ambiguous. In the simple case with only two income classes as in Table 1, income distribution A is clearly more unequal than income distribution B. However, the comparison of two income distributions such as (0, 12, 20) and (4, 5, 26) is not so unambiguous. Atkinson (1980, 16-19) has shown theoretically that in general there is no ranking of the degree of inequality of income distributions independent of the form of the utility function. Amiel and Cowell (1992) found widespread disagreement among respondents to questionnaires asking them to compare the degree of inequality of pairs of hypothetical income distributions. Experiments with monetary payoffs and multiple income classes might shed some light on the form of the utility function people use in judging the inequality of income distributions when confronted with real choices.

NOTES

1. The “optimal income tax” literature demonstrates the tradeoff between a more equal income distribution and incentives to produce income. Cf. Mirrlees [1971].

2. Because the probabilities of the different payoffs are shown to be equal, the experiments make no distinction between the real uncertainty of Bichard and Tullock and the equal probability assumption under Harsanyi and Vickrey’s hypothetical uncertainty.
3. This restriction is supported by the result of an ordinary least squares regression of the "tax rate" chosen in Part A on the independent variables including LOGEE. The estimated coefficient of LOGEE in this equation was much smaller than its coefficient in the equation for Part B and even further from conventional significance levels.

4. The F test for generalized least squares estimates is only asymptotically valid, but Green (1990, 514) suggests that it performs better than the Wald statistic for testing restrictions in a moderately sized sample.

5. This experiment might be criticized because the stakes in the experiment are not as high as in the hypothetical investigative situation in which the choice of a rule may result in a lifetime of poverty. Prosky, Oppenheimer and Savitsky (1987a) and Prosky and Oppenheimer (1986) attempted to make the consequences of choices of rules appear more serious by stating the income distributions in terms of "annual income" in thousands of dollars. To determine whether the outcomes in terms of "annual income" made a difference in the results, Group 2 was given instructions in which outcomes were labeled "annual income" but actual payoffs were "one hour's pay, assuming 2000 hours of work per year." I then estimated another set of regressions including some of the independent variables as a binary variable: ANNUIC was equal to 1 for group (A) and 0 otherwise. The estimated coefficients of ANNUIC were not statistically significant, and when ANNUIC was included the estimated coefficients of the other variables were similar to the estimates in Table 2. Complete regression results including the ANNUIC variable are available from the author.

REFERENCES


