Preferences for Redistribution and Perception of Fairness: An Experimental Study*

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ABSTRACT

We conduct a laboratory experiment to study how demand for redistribution of income depends on self-interest, insurance motives, and social concerns relating to inequality and efficiency. Our choice environments feature large groups of subjects and real world framing, and differ with respect to the source of inequality (earned or arbitrary), the cost of taxation to the decision maker, the dead-weight loss of taxation, uncertainty about own pre-tax income, and whether the decision-maker is affected by redistribution. We estimate utility weights for the different sources of demand for redistribution, with the potential to inform modeling in macroeconomics and political economy.

JEL codes: D31, P16, H24, C91

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1. Introduction

Redistribution of income through taxes and transfers has long been normal practice in advanced democracies. Numbers taken by Milanovic (2000) from the Luxembourg Income Study on seventeen OECD countries for the early 1990s, indicate that the income share of the bottom 40% of households was, on average, 14.1 percentage points higher when measured on a post-tax-and-transfer than on a pre-tax-and-transfer basis. Even in the U.S., the least redistributive of the countries surveyed, this share was 7.6 percentage points higher in the post- than in the pre-tax-and-transfer distribution.

Three main factors can explain support for redistribution in democracies: 1) income maximization, 2) risk aversion, and 3) social preferences. First, with right-skewed income distributions, a majority of voters can potentially benefit from redistributing from the richest towards themselves. Second, if there is some degree of uncertainty about agents' future income and if tax regimes are sufficiently persistent, risk-averse individuals may support redistribution as a form of insurance against negative shocks. Third, individuals may favor redistribution to reduce inequalities that they judge to be unfair, while concerns for efficiency losses arising from taxation may reduce the demand for redistribution. Although there is an active debate on the relative importance of each of these factors for real-word redistributive outcomes (see for instance Alesina and Giuliano (2010) and Bénabou and Tirole (2006)), it is generally difficult to address this question using aggregate data or field evidence.

In this paper we elicit demands for redistribution from a large number of subjects under a variety of experimental conditions in the lab. This allows us to control for various potential confounds and analyze the impact of different motives for redistribution. While we build on a large experimental literature on social preferences (Fehr and Schmidt, 1999; Charness and Rabin, 2002), our design has features that resemble the macroeconomy (Ackert, Martinez-Vazquez, and Rider, 2007; Krawczyk, 2010), and our findings are potentially informative for modeling in public finance and macroeconomics.

Each experimental session involves a group of twenty-one subjects who are assigned unequal initial earnings calibrated to proportionally reproduce the actual U.S. pre-tax income distribution. Subjects are asked to choose a proportional tax rate - 0%, 10%, ... 100% - to be applied to the initial earnings distribution with equal division of the proceeds. There is no voting: each subject knows that, at the end of the experiment, her tax choice could be randomly selected and implemented.

We elicit subjects' tax choices under various conditions: 1) different direct cost (ranging from 0% to approximately 5% of average experimental income), 2) different dead-weight losses (0% to 25% of tax revenue), 3) different methods to assign pre-tax earnings (randomly, based on income of the place of origin, based on performance on a quiz, or in a game of skill), and 4) different degrees of involvement and information of the decision-maker (as an unaffected observer, as an affected party uncertain of her pre-tax income, as an affected party certain about her pre-tax income).

We find that each of the three motives for redistribution matters in our experiment. First, in line with income maximization, we find that a higher direct tax cost and a higher expected pre-tax income depress demand for redistribution. Furthermore, when uncertainty about income is resolved, subjects show a strong tendency to select the level of redistribution that maximizes their own post-tax earnings, although social concerns continue to matter. Second, we find that subjects who are more confident about their performance, thus facing a lower (perceived) income risk, specify a lower tax rate. Third, we find that social concerns matter: an increase in the efficiency loss reduces average tax rates, even for a disinterested observer, and most subjects are willing to pay to reduce income inequality among others.

Utility estimates of the underlying motives of the subjects mirror these results. These estimates put about 81% weight on own income level, 15% weight on the standard deviation of own income, 3% weight on distributive fairness (represented by the income of the lowest earner), and 1% weight on efficiency (as represented by aggregate earnings). If only decisions about redistribution of “arbitrarily" determined incomes are considered, the weight on own income is a smaller 73% and that on distributive fairness rises to 10%. On the basis of the utility function, we calculate that our average subject is willing to trade about 0.4% of his own expected payoff for a 10% reduction in inequality (defined as the difference between the lowest and the average income), 2% for a 10% reduction in the standard deviation of her own expected income, slightly over 2% for a 10% increase in the group's aggregate earnings, and to accept a 1.8% decrease in aggregate earnings in exchange for a 10% decrease in inequality. Overall, our subjects redistribute 45% of pre-tax income, reducing the distribution's Gini coefficient from 0.51 to 0.28.

Assuming that our subjects' preferences resemble those of citizens of real world industrialized democracies, our results suggest that self-interest, risk-avoidance, and social concerns, including both concern for fairness and dislike of inefficiency, all play non-negligible roles in supporting mildly redistributive public policies. These findings extend the results of a small but growing number of incentivized lab experiments on redistribution and taxation. Studies in this literature universally find an important role for self-interest, and some show that risk aversion is an important motive for redistribution (Beck, 1994; Schildberg-Hörisch, 2010). There is less consensus about preferences for equality, with some studies finding support for such preferences (Tyran and Sausgruber, 2006; Ackert, Martinez-Vazquez, and Rider, 2007; Schildberg-Hörisch, 2010), while others do not (Beck, 1994; Beckman, Formby, and Smith, 2004; Krawczyk, 2010). With respect to efficiency motives, Krawczyk (2010) and Beckman, Formby, and Smith (2004) find evidence for small efficiency concerns in a leaky-bucket set-up. Krawczyk (2010) and Fong and Luttmer

(2011) also find the source of inequality (deserved or not) to be important. Our experiment shows that all of these concerns play a significant role in large groups featuring 'real world' income inequalities.

In the broader debate on the nature of social preferences, our finding that people care about the poor but are also willing to make modest sacrifices for the sake of efficiency is in line with Charness and Rabin (2002) and Engelmann and Strobel (2004). Indeed, one of our main contributions is to show that social preference models like Charness and Rabin's are applicable to more complex and larger-scale settings.

The remainder of the paper is organized as follows. Section 2 describes the design and rationale of our experiments. Section 3 provides a theoretical framework for predicting and interpreting the results. In Section 4 we illustrate and discuss our main results. Section 5 concludes and discusses the application of the results.

2. Experimental Design

Experimental sessions were conducted in a computer lab at Brown University. Each session involved 21 subjects and lasted about 90 minutes. Overall, we conducted 16 sessions involving a total of 336 undergraduate students from a wide range of disciplines. Sessions began with a set of instructions that appeared on participants' computer screen and were simultaneously read aloud by the experimenter. Subjects were informed they would receive a \$5 show-up fee plus an additional payoff that would depend on the outcome of the experiment. The core of the experiment consisted of two parts, which we will refer to as "Part 1" and "Part 2". In each part, participants chose four tax rates that could affect their own and others' payoffs. Near the end of the experiment, one of the two parts was randomly selected for payment. If Part 2 was selected, subjects were invited to reconsider their decisions, generating a third set of tax choices we call "Part 3".

We started by telling subjects that each of them would be assigned one of twenty possible provisional payoffs, ranging from \$0.11 to \$100, that proportionally reproduced the pre-tax income distribution in the United States. Online appendix Table S.1 (where throughout the paper the prefix S. refers to material in the Online Appendix), shown on subjects' computer screens, illustrated the distribution of experimental payoffs and income vigintiles.[1] We then explained that provisional earnings could be assigned to subjects in four possible ways: 1) randomly, 2) in proportion to their socio-economic background (proxied by the average income of the area where

[1] Table S.1's reference to income distribution in the U.S. was partly intended as a framing device, to give decisions a real world macro-economic reference. However, we attempted to steer a middle course, never telling subjects, for example, that "this is an experiment to study your views about the distribution of income," never using words like "just" or "fair," etc. Compare, for example, Frohlich and Oppenheimer (1992) or Johansson-Stenman, Carlsson, and Daruvala (2002).

their family resided during high-school[2]), 3) on the basis of their relative performance in a general knowledge quiz, or 4) in a computer-based skill game (Tetris). Which method would actually be used to assign payoffs to subjects would be determined by a random draw at the end of the session. The four methods (which we will henceforth refer to as respectively as "Random", "Where From", "Quiz" and "Tetris") were designed to mimic various determinants of economic success in real life (i.e. luck, family background, acquired knowledge, ability) with the purpose of assessing differences in agents' attitude toward redistribution relative to their perception of entitlement. We told subjects they would be able to alter the initial distribution by taxing earnings and redistributing the proceeds equally among all; in particular they would be asked to choose a proportional tax rate ranging from 0% to 100% in increments of 10%. We illustrated the effect of taxation on earnings verbally, graphically, by means of a formula and of a table so that both more and less mathematically inclined subjects could understand. The table is reproduced in Table S.2.

In Part 1, subjects had the role of a "disinterested" decision-maker. Each subject chose a tax rate for each income determination method knowing that, at the end of the session, one randomly chosen "decisive" subject's choice would be applied to the pre-tax earnings distribution of the other twenty subjects to determine their final payoff. The payoff of the decisive individual would be randomly drawn from the interval \$19.80-\$21.80 and would not be directly affected by the redistributive process.[3] We also informed subjects that, when making their tax choices, they would face two additional parameters: a "tax cost", which measured the direct cost of each additional 10% tax to the decisive individual (similar to Andreoni and Miller, 2008), and an "efficiency loss" which measured the percentage loss in total tax revenue associated with each additional 10% tax (in line with Okun (1975)'s "leaky bucket" argument). These treatment variables, which varied only across sessions, were designed to assess subjects' willingness to pay for a more equal distribution and their concern for aggregate efficiency.[4]

Formally, letting y_i^0 be the pre-tax payoff of a non-decisive individual i, t the tax rate, and e

[2] Information on the zip code of subjects' area of origin was collected in the sign-in procedure before subjects had learned anything about the experiment. For non-US students we use the average income of their country of origin (source: World Bank, 2001) since assembling income data for small jurisdictions for a large set of countries was impracticable.

[3] We adopted a random payoff to prevent subjects from learning if they were chosen as "decisive individual" at their session's conclusion, and the potential associated social discomfort. The expected payoff is close to but slightly above the average (\$19.80) so as to balance potential feelings of jealousy (with respect to high earners), feelings of guilt (with respect to low earners), and resentment of assignment to the decision-maker role. How successful our design choice was in this regard cannot be determined without additional experiments which lie beyond the scope of the paper.

[4] The tax cost parameter could take one of four values: \$0, \$0.25, \$0.5 or \$1 per 10% tax. A \$1 tax cost means that specifying a 100% tax rate costs \$10, or about half the earnings of an average subject. The efficiency loss parameter could take one of three values: 0%, 12.5%, and 25% per 10% tax. We varied tax cost and efficiency loss across rather than within sessions out of concern that, combined with the tasks and the wide range of conditions already proposed to subjects, exposure to additional sources of within-session variation would increase the probability of less well-considered choices.

the efficiency loss parameter, i's post-tax earnings in Part 1 can be written as

$$y_i = (1-t)y_i^0 + t(1-e)\frac{1}{20}\sum_{j=1}^{20} y_j^0. \tag{1}$$

Similarly, letting c be the tax cost parameter and $y_d^0 \backsim U(19.8, 21.8)$ the decisive individual d's base payoff, d's Part 1 post-tax earnings can be written as: $y_d = y_d^0 - c \cdot 10 \cdot t$.

Once the first set of instructions was completed, subjects were invited to ask questions and performed a brief comprehension test before proceeding to the actual decision stage. The purpose of Part 1 was to elicit subjects' preferences about redistribution in the micro community of participants under a condition that mirrors Adam Smith's "impartial observer" who, in the interpretation of Konow (2009), "is not now and has no expectation of ever being implicated in the situation being evaluated."

After subjects had submitted their preferred Part 1 tax rate for each of the four methods, instructions for Part 2 were spelled out. We now explained that Part 2 would be analogous to Part 1 except that the earnings of the randomly selected decisive individual would be affected by her chosen tax and would be determined in the same way as those of the other subjects. Thus, the decisive individual's post-tax pay-off in Part 2 can be written formally as

$$y_d = (1-t)y_i^0 + t(1-e)\frac{1}{20}\sum_{j=1}^{20} y_j^0 - c \cdot 10 \cdot t. \tag{2}$$

In Part 2, one of the twenty non-decisive subjects would be randomly chosen to receive an amount between \$19.80 and \$21.80 unaffected by the chosen tax rate. Tax cost and efficiency loss parameters were held constant in a given session, so the same applied to Part 1 and Part 2. At the end of the instructions, subjects completed a comprehension test and were asked to predict their relative ranking (in one of 7 ranges[5]) in each of the three non-random methods. In addition subjects indicated whether they were "very confident", "somewhat confident" or "not confident at all" about their predictions.

Subjects then submitted their four Part 2 tax choices, after which they moved on to perform the Quiz and the Tetris tasks. Part 2 - which we will refer as the "involved decision-maker" scenario- was designed to put each subject in the position of a hypothetical decision-maker behind a veil of ignorance (Harsanyi, 1979) with imperfect or no information about her future position in the earnings distribution.

Once the Quiz and Tetris tasks were completed, the experimenter publicly tossed a coin to determine whether Part 1 or Part 2 would determine earnings. If Part 1 was selected, the core

[5] Ranges grouped together ranks 1-2, 3-5, 6-8, 9-11, 12-14, 15-17, 18-20.

of the experiment ended. If instead Part 2 was selected, subjects were told their ranking in each of the four earnings determination methods and were offered the opportunity to revise any or all of their Part 2 tax choices. Hence, without prior announcement, Part 2 decisions were rendered non-binding and each subject made an additional tax choice for each method in the position of an "involved decision-maker" without uncertainty (we will refer to this scenario as "Part 3").[6] The same tax cost and efficiency loss parameter would apply to Part 3 as well.

After subjects had revised their tax choices, one method was selected to determine pre-tax earnings. Participants were then invited to participate in an incentivized task consisting of five choices between a certain payment and a lottery (described in Table S.3) designed to elicit risk attitudes using the "multiple price list" method introduced by Harrison and Rutström (2008), and to answer a background survey including a series of questions on personal characteristics and attitudes. Finally, one subject was randomly selected to be the decisive individual, her preferred tax rate for the relevant part and method was announced, and final payoffs were computed and delivered to participants in closed envelops. The identity of the decisive individual was never revealed to subjects. Figure 1 summarizes the timing of the experimental session, while Table 1 reports a summary of the treatment variables with indication of the respective source of variation (between- or within-subject) and a preview of the main qualitative results. All the instructions are available at: www.brown.edu/Research/IDE/walkthrough.

The order in which our subjects made their disinterested tax choices and their interested tax choices with and without uncertainty was governed by several considerations. It seemed to us subjects could think most clearly about the disinterested choice before the prospect of making a similar choice as an involved party had been mentioned to them, so we placed that decision first. In the interested condition, there were obvious reasons to start with the uncertain choices, and then lift uncertainty.[7] Unfortunately, we cannot rule out order effects. For example, subjects who gave weight to their social convictions in the disinterested condition may have tried to appear consistent when self-interest dictated otherwise in the interested ones; or subjects may have felt more free to choose selfishly after first demonstrating some altruism or social concern, which might have the opposite effect. This should be kept in mind when comparing results from different parts of the experiment.

[6] In sessions where earnings depended on Part 1 choices, letting subjects revise their decisions after knowing their pre-tax earnings rank could inadvertently reveal to a subject her identity as decisive individual (for instance a subject whose rank would have yielded her \$0.11 with 0% tax rate and who, choosing 0% tax rate, had instead received \$19.80, would know she had been selected as the decisive individual). Not only did we not want others to be able to identify the decisive individual at the end of the session, but we also wanted no subject to be certain of her own status, to make sure that tax choices were not made with immediate social discomfort at the session's end in mind.

[7] In principle, for the Random, Tetris and Quiz methods, order could be reversed if a new random draw were made and a new quiz and Tetris game played, but uncertainty would be attenuated for the latter methods by experience.

Overall, participants appeared to have no difficulty understanding the instructions and answering the comprehension questions. All subjects made tax choices for each of the four methods both in Part 1 and 2 as well as in Part 3 when this occurred (in 7 out of 16 sessions), and all but one also completed the risk aversion test and the background survey. The subject pool was fairly representative of the overall student population with regard to gender, ethnic background, socio-economic status, political ideology and area of study. The distribution of participants by personal characteristics is reported in Table S.4.

3. Hypotheses and Predictions

This paper aims to investigate the impact of social motivations on redistributive decisions. Political economy models of redistribution do not provide much guidance in this endeavor since they focus on the self-interest motive and typically abstract from concerns for fairness or equality Meltzer and Richard (1981). By contrast, the literature on social preferences has produced several models that rationalize 'other regarding' behavior in laboratory experiments. In this section we apply this kind of model to our experiment and bridge these two streams of literature.

The most cited social preference models are due to Fehr and Schmidt (1999, henceforth FS) and Charness and Rabin (2002, henceforth CR). The FS model assumes that agents are inequality averse, and as a consequence place negative weight on the payoffs of those who have more than they do, and positive weight on the payoffs of those who have less. The CR model assumes less structure on the weight placed on the payoffs of other people. Specifically, it allows for the possibility that agents may care positively about the payoffs of those who have more than they do, consistent with a preference for aggregate payoffs or efficiency, which have been found to be important in redistribution problems (Charness and Rabin, 2002; Engelmann and Strobel, 2004). In addition, the multi-player version of CR (outlined in the appendix of their paper) allows for concerns for inequality amongst people other than the decision maker, which have no place in the FS model. For these reasons, we concentrate on the CR multi-player model. We discuss the application of the FS model to our experiment in the Online Appendix, where we also provide estimates of its parameters.

The original CR model does not incorporate risk considerations; this aspect limits its direct applicability to our analysis since uncertainty and risk play an important role in Part 2 of our experiment. To address this issue, while keeping the model simple and easy to interpret, we augment the model with a preference over the riskiness of income. The resulting utility function is:

$$V_i = (1-\lambda)\left[(1-\gamma)Ey_i + \gamma(-\sigma_{y_i})\right] + \lambda\left[\delta y^{min} + (1-\delta)\sum_j y_j\right] \tag{3}$$

where y denotes the post-tax income. The model includes four variables referring to different aspects of the post-tax payoffs; parameters λ, γ and δ denote the utility weights on these variables.

The first two variables are the expectation of own income Ey_i, and its standard deviation σ_{y_i}; together they form the 'self-interested' component of the utility function, and have a joint relative weight of $1-\lambda$. The parameter γ can be interpreted as the importance of income risk relative to the level of income. The last two variables represent the 'other-regarding' (or social) component of the utility function and λ their corresponding weight relative to the self-interested component. The term y^{min} indicates the lowest income in the group and is a measure of inequality, whereas the variable $\sum_j y_j$ refers to the group's aggregate payoff and thus captures overall efficiency.[8] The parameter δ measures the relative importance of inequality and efficiency concerns. In Section 4 we produce estimates for these parameters.

Thus, the modified CR model incorporates all three motivations for redistribution that we mentioned in the introduction: 1) income maximization, 2) risk aversion and 3) social preferences. On the basis of these three motivations, we can generate testable predictions for our experiment (the derivations are shown in the Online Appendix A).[9] First, for subjects who care about their expected income ($\lambda, \gamma < 1$), the utility from redistribution decreases with (expected or announced) income in Part 2 and 3 of the experiment. The reason is that the gains (losses) from redistribution are lower (higher) for a subject with higher pre-tax earnings. Similarly, a higher personal cost of taxation c to the decision maker raises the price of redistribution and reduces demand.

HYPOTHESIS 1:

a. *In Part 2 and 3, the average tax rate decreases with own (expected or actual) pre-tax income.*

b. *In all Parts (1, 2, and 3), the average tax rate declines with the tax cost.*

Second, in Part 2, where there is uncertainty about pre-tax income and the decision maker is affected by redistribution, higher taxes reduce the post-redistribution standard deviation of income, increasing utility for risk averse decision makers ($\gamma > 0$). Thus the model predicts that

HYPOTHESIS 2: *In Part 2, the average tax rate increases with the (perceived) standard deviation of own pre-tax income.*[10]

8 Whether the concern motivating a preference for redistribution in the real world is better captured by a Rawlsian formulation or by a more general measure of the variation of incomes is an important question but must remain beyond our scope.

9 Note that since the model is linear in the tax rate, it predicts that individuals will only choose corner solutions ($t = 0$ or $t = 1$). Since observed decisions are not in fact bunched at 0% and 100%, the model can make predictions on the average tax rate but not necessarily on an individual level. In addition, the comparative statics depend on the assumption that there exist marginal individuals, which is satisfied if there is sufficient heterogeneity in the preference parameters λ, γ and δ.

10 The perceived standard deviation is higher, for instance, when one's pre-tax income is determined randomly, and is also higher for those who are less confident in predicting their rankings on the non-random criteria.

Note that if we model risk aversion as a separate weight on the standard deviation of income (in addition to γ), the optimal tax rate in Part 2 increases for agents with higher risk aversion.

Finally, an increase in the efficiency loss reduces utility from redistribution for individuals with social concerns ($\lambda > 0$), since taxes reduce aggregate income and are less effective at raising the income of the poorest. In addition, the model predicts that those who care enough about the minimum payoff (i.e. with a high δ and λ) are willing to pay a positive tax cost in the role of disinterested observer in order to reduce inequality in the population.

HYPOTHESIS 3:

a. In all Parts (1, 2, and 3), the average tax rate declines with the efficiency loss.

b. In Part 1, the average tax rate is positive even when the tax cost is positive.

The model does not include a process-based theory of fairness, so it cannot provide hypotheses regarding the impact of different income determination methods. One could, however, let the model's parameters vary depending on the source of the original inequalities. If one conjectures that inequality concerns δ will be stronger under 'arbitrary' pre-tax income assignment (Random and Where-From) than under 'earned' pre-tax income assignment (Tetris and Quiz), this implies higher optimal tax rates under the former methods. In the following section we test these predictions.

4. RESULTS

In this section, we first investigate the effect of our experimental manipulations and range of individual attributes on the distribution of tax choices. Second, we estimate the parameters of the structural model of Section 3, in order to uncover the motivations underlying redistributive decisions.

4.1. TREATMENT EFFECTS AND SUBJECT CHARACTERISTICS

We first discuss the impact of the treatments and subjects' characteristics in each of the three parts of the experiment: i) disinterested decision-maker (Part 1), ii) interested decision-maker with uncertainty (Part 2), iii) interested decision-maker without uncertainty (Part 3).

Part 1. Figure 2 reports subjects' average tax choice. For each part of the experiment, average tax choices are grouped by tax cost (top panel) and efficiency loss (bottom panel). The first notable finding is that subjects tend to support fairly high levels of redistribution, although they are not affected by it and despite the direct cost of taxation to themselves. In fact, considering all sessions together, subjects chose a positive tax in 76.4%, a tax of 50% or higher in 44.2%, and full equalization of earnings in 14% of Part 1 tax choices. Even focusing only on sessions with positive tax cost (12 out of 16), we see that in line with Hypothesis 3b, subjects choose a positive tax rate in 75.4% of the cases. On average, the subjects in these sessions sacrifice \$2.25 - just over 10% of their expected payoff - to reduce inequality among others by 41.4%.

While support for redistribution is relatively unresponsive to the direct cost of taxation for values of \$0, \$0.25 and \$0.50 per 10% (with average tax rates of 45.3%, 45.7%, and 44.8% respectively), average tax drops significantly when tax cost is \$1 per 10% (33.7%), consistent with subjects' demand curve for redistribution being downward sloping. A series of Mann-Whitney tests finds the distributions of tax choices to be significantly different at \$1 tax cost than at lower levels (all significant at the 5% level), confirming the rather non-linear nature of the relationship.[11]

A similar pattern is observed with respect to efficiency loss: while the average Part 1 tax rate is similar in sessions with 0% and 12.5% efficiency loss (44.7% and 43.6% respectively), subjects chose significantly lower tax rates in sessions in which redistribution is associated with a 25% loss in tax revenue (36.3%). A series of Mann-Whitney tests confirms this finding, showing no significant difference between the distribution of preferred tax between sessions with 0% and 12.5% efficiency loss. In line with Hypothesis 3a however, there is a significant difference in the distribution of tax choices in sessions with 25% efficiency loss compared to sessions with 12.5% and 0% efficiency loss (significant at the 5% and 10% level respectively). Since efficiency loss has no impact on the earnings of the decision maker, this result suggests the existence of a trade-off between concerns for equality and concern for others' aggregate earnings.

With regard to the determinants of pre-tax earnings, Figure 3 reports the average tax rate for each of the four income determination methods respectively in Part 1, 2 and 3 (while Table S.5 reports the complete distribution of tax choices for the three parts, for all methods combined and separately for each method). Looking at Part 1, we see that subjects tend to support more redistribution when initial earnings are "arbitrary" - Random (49.3%) and Where From (45.1%) - than when they are "earned" - Tetris (37.7%) and Quiz (37.3%). This pattern is confirmed by a series of Wilcoxon matched pair tests for within-subject comparisons: subjects choose higher taxes under the Random than under the Where From method (significant at the 5% level), higher taxes under the Random and Where From methods than under the Quiz and Tetris ones (all four comparisons yield significance at the 1% level), while there is no evidence of significant differences between

[11] Since exploring the nature of this non-linearity goes beyond the scope of our investigation, in the econometric analysis that follows opt for a linear specification in both tax cost and efficiency loss.

tax choices under the Tetris and the Quiz method (p-value: .276).[12]

To further test the impact of tax cost, efficiency loss and income determination methods on redistributive choices in the disinterested decision-maker condition, in Table 2 we estimate a set of multivariate regressions with Part 1 tax as dependent variable. We use Tobit regressions censored at 0 and 1 to address the possibility that, if allowed, some subjects would have chosen a tax rate lower than 0% or higher than 100%.[13]

In column 1 we regress Part 1 tax choices on the tax cost and efficiency loss parameters. Both variables display a negative and significant coefficient, confirming the pattern observed in Figure 2. With regard to the magnitude of the marginal effects, a one standard deviation increase in tax cost corresponds to a 4.5-percentage points decrease in preferred tax, while a one standard deviation increase in efficiency loss corresponds to a 3.3-percentage points decrease in preferred tax (in both cases evaluated around the mean of both dependent and independent variables).

These results remain largely unchanged in column 2 when the following individual controls are included in the regression: gender, ethnic dummies, self-reported political ideology (from less to more liberal), average income of the place of origin (log), risk aversion index (1-5), and number of economics courses taken.[14] To test how tax choices respond to the perceived causes of inequality, the specification shown in column 2 also includes a dummy variable for each income determination method (Random being the omitted category). While the *Where From* dummy has a negative marginal effect of 4.2 percentage points (significant at the 5% level), the *Tetris* and the *Quiz* dummy display negative marginal effects of 11.6 and 11.4 percentage points respectively (both significant at the 1% level). These results confirm the considerable impact of the perception of fairness and entitlement on subjects' redistributive attitudes.

Part 2. In Part 2, subjects knew they would be affected by redistribution but were uncertain about their relative position in the pre-tax distribution. As displayed in the first panel of Figure 2, Part 2 tax choices were similar to Part 1, although the average tax was somewhat higher. As in Part 1, subjects tended to choose lower tax rates for higher levels of both tax cost and efficiency

[12] Interestingly, the sensitivity of the demand for redistribution to income determination methods turns out to be stronger for men than for women. In Part 1, male subjects tend to choose significantly higher tax rates for the Random and Where From methods (47.5% and 40.3% respectively) than for Tetris and Quiz methods (29.9% and 28.9% respectively). This difference is much less pronounced for female subjects (51.6% for Random, 51.0% for Where From, 47.1% for Tetris and 47.5% for Quiz).

[13] We also estimate all regressions using ordinary least squares (OLS) obtaining very similar results. In what follows we report the Tobit results.

[14] With regard to the effect of personal characteristics on support for redistribution, the coefficients on the individual controls - not reported in Table 2 to save space, but shown in Online appendix Table S.6 - suggest that female subjects and subjects with more liberal views tend to choose significantly higher taxes. Both these effects are quite large: the female dummy displays an 11.3 percentage point marginal effect, while a one standard deviation change in the Conservative-Liberal ideological scale corresponds to a 4.6 percentage point increase in preferred tax. In contrast, ethnicity, home area income and risk aversion appear to have no significant impact.

loss; a partial exception is represented by sessions with \$0 tax cost which display a *lower* average tax rate than sessions with \$0.25 and \$0.5: 43.6% compared to 48.2% (p-value: 0.044) and 47.8% (p-value: 0.061) respectively. As shown in Figure 3, Part 2 and Part 1 tax choices also display similar differences with regard to income determination methods - significantly higher for Random and WF than for Tetris and Quiz methods - the main difference being the higher tax rate for the Random method in Part 2, about 5 percentage points higher than in Part 1 (p-value: 0.027). This last difference is consistent with risk aversion and the insurance motive playing a role when the decision-maker will occupy one of the twenty income ranks but is uncertain which it will be. The similarities with Part 1 are confirmed by the regression results presented in columns 3 and 4 of Table 2 in which Part 2 tax choices for all methods are pooled together.

To test Hypothesis 1a, we investigate how subjects' expectations about their position in the pre-tax distribution affect their tax choices in Part 2. To do so, we use information on subjects' self-reported expectation of how they will rank in each of the three non-random methods, and their self-reported level of confidence in their own guess. The first two panels of Figure 4 report the average tax rate separately for each of seven expected rank range (1^{st}-2^{nd}, 3^{rd}-5^{th}, 6^{th}-8^{th}, 9^{th}-11^{th}, 12^{th}-14^{th}, 15^{th}-17^{th}, 18^{th}-20^{th}), and two levels of confidence (where "Confidence Level (high/low)" is a dummy variable which is 1 for subjects who reported being very confident in their guess and 0 otherwise).[15] In line with Hypothesis 1a, subjects expecting to be ranked better supported lower taxes for any level of confidence (ranging from 3.3% for subjects expecting to be ranked 1^{st} or 2^{nd} to 76.4% for those expecting to be ranked 18^{th} to 20^{th}). Furthermore, tax choices are more polarized for high-confidence subjects (ranging from 1.6% to 81.9 %) than for low-confidence ones (ranging from 6.19% to 65.4 %).[16]

To further corroborate these findings, in column 5 of Table 2 we focus on the non-random methods and extend the base specification to include the expected rank variable, the confidence level, and the interaction between the two. Both expected rank and its interaction with the confidence level display a positive coefficient significant at the 1% and 10% level respectively, indicating that the more certain they are of a high (low) income, the lower (higher) the chosen tax rate.[17] Both effects are rather sizeable: a one rank class change in expectation (e.g. from 1^{st}-2^{nd} to 3^{rd}-5^{th}) corresponds to a 3.4 percentage point increase in tax rate, which rises to 4.6 percentage point for subjects very confident in their prediction.

The sum of the coefficients of "Confidence Level" and "Confidence Level*Expected Rank"

[15] Higher rank categories correspond to lower pre-tax payoff with subjects selecting 1^{st}-2^{nd} expecting to receive the highest pre-tax payoff and subjects selecting 18^{th}-20^{th} the lowest.

[16] Interestingly, even when very confident about their prediction, most subjects expecting to be ranked high (low) refrained from choosing zero (full) redistribution, perhaps due to a lingering concern for the unlikely possibility of ending up in the low (high) part of the payoff distribution

[17] When including these variables in the regression, the Pseudo-R^2 rises to 0.231 from 0.092 of an analogous regression on the sample of tax choices for non-random methods only.

measures the effect of confidence and provides confirmative evidence for Hypothesis 2. Note that a direct test of this hypothesis is difficult since it involves changing the riskiness of income while holding expected income constant. It seems reasonable to assume that a decrease in confidence by subjects who expect to be in the middle of the income distribution reflects a higher perceived income risk without a large shift in expected income. From the estimates in column 5 it is easy to compute that for all those who expect to have a rank from 5 to 15, higher confidence translates into a lower demand for redistribution, in line with Hypothesis 2. The fact that average tax rates are highest under the Random method, which is likely to have the highest perceived income risk, provides further support for Hypothesis 2.

Finally, note that if subjects were self-interested and accurate in their expectations of their pre-tax ranks, Part 2 tax choices should have exceeded those of Part 3 assuming risk aversion, due to the uncertainty in Part 2. The fact that this is not the case (see below), suggests a tendency towards overconfidence in the formation of expectations. A check of the data confirms this conjecture. The expected range of pre-tax income ranks selected by subjects before making their Part 2 tax choice was too optimistic in 49.5% of cases, too pessimistic in 30.5% of cases and correct in 20% of cases. On average, expectations were 1.5 (out of twenty) ranks too optimistic. Such overconfidence is a general finding (Moore and Healy, 2008), and may go some way to explaining why the average chosen tax level is lower in Part 2 than in Part 3[18].

Part 3. In Part 3, subjects learned their rank in the distribution of pre-tax payoffs and were given the opportunity to revise their chosen tax rates. As is evident from Figure 2, subjects tend to choose considerably higher tax rates in Part 3 than in Parts 1 and 2. The tax cost parameter seems to have little effect on tax choices, which is not so surprising given that it is generally smaller than the direct loss (or benefit) from redistribution for most pre-tax income levels. In line with the results from Parts 1 and 2, high efficiency loss is associated with lower tax choices in Part 3 (with a drop of about 6 percentage points in sessions with 25% efficiency loss relative to sessions with lower values).

The absence of uncertainty in Part 3 implies that insurance motives should play no role, and one would expect a greater tendency for subjects to select the tax rate that maximizes their post-

[18] To corroborate this conjecture, we pool observations for Parts 2 and 3 for the set of subjects having performed tax choices in both parts, and focus on the non-random income determination methods, for which expected rank in Part 2 was elicited (882 observations: 147 subjects x 3 methods x 2 parts). On this sample we first estimate a Tobit regression of tax rate on a dummy variable for Part 3 - including all the controls used in our baseline specification, and clustering standard errors at the individual level - and find that the Part 3 dummy displays a positive and significant coefficient (marginal effect: 0.135 significant at the 1% level), consistent with the difference in average tax between Part 3 and Part 2 depicted in Figure 2. However, when including in the specification a variable rank (equal to expected rank for Part 2 and to actual rank for Part 3), the coefficient on the Part 3 dummy becomes much smaller (marginal effect: 0.045) and statistically insignificant.

tax earnings. A look at the distribution of Part 3 tax choices by rank class (right panel of Figure 4) supports this conjecture: the resolution of uncertainty determines a greater polarization in tax choices between high- and low-ranked subjects than in Part 2, with an average tax rate of 20.7% for subjects ranked in the top ten positions and of 83.1% for the others.

In light of the relevance of self-interest considerations, one may wonder whether other factors - i.e. perception of entitlement, social preferences for redistribution - had any impact on Part 3 tax choices. With regard to the perception of entitlement, unlike in Parts 1 and 2, we observe no systematic difference in average tax rates between “earned” and “unearned” income determination methods in Part 3 (Figure 3). Turning to the role of a subject’s social preferences, one can assume that they are reflected in the tax rate chosen in the “disinterested decision-maker” condition (Part 1), which can be used as a proxy. Therefore, in Figure 5 we report the average tax rate by rank separately for subjects having chosen above- and below-median tax rate in Part 1 for the same income determination method. The figure shows that those who specified a high tax rate in Part 1 also choose higher taxes in Part 3 (p-value: 0.000). This can be interpreted as a sign that social preferences continue to matter in Part 3. Another indicator of the relevance of social preferences is that of the subjects whose income maximizing tax rate was 0%, roughly a third (31.5%) selected a positive tax rate.

In the last three columns of Table 2 we investigate the determinants of Part 3 tax choices more systematically. In column 6 we regress Part 3 tax choices on efficiency loss and rank-specific tax cost; the latter captures the cost of a 10% tax increase both in terms of foregone earnings given the subject’s rank and the session-specific tax cost parameter. The rank-specific tax cost displays a negative, large and highly significant coefficient, further corroborating Hypothesis 1a. In contrast, efficiency loss has virtually no effect. Since the rank-specific tax cost also accounts for the effect of efficiency loss on the gain (loss) from redistribution, this result suggests that subjects’ concern for aggregate efficiency may have been dominated by other considerations in Part 3.

In column 7 we include the baseline individual controls and dummies for the various income determination methods; the latter do not display any significant effect (see column 4 of Table S.6).[19] Finally, in column 8, we also include Part 1 tax choice in the specification. In line with the graphical evidence presented in Figure 5, Part 1 tax displays a positive and highly significant coefficient suggesting that those subjects that preferred higher redistribution in the “disinterested decision-maker” scenario did so also when acting as “interested decision-maker" with full information. Note that the effect is rather small, and explained variance rises by only 2% when the

[19] The only exception is the number of economics courses taken; its initially counter-intuitive positive sign may simply reflect more self-interested choices, since 100% tax maximized own payoff for a majority of subjects. Indeed, when estimating the same specification on the sample of subjects that benefit from 100% tax (318 out of 588 observations), the coefficient on "Number of Economics Courses Taken" is larger and more significant than for the overall sample (marginal effect 0.037, significant at the 1% level vs. 0.020 significant at the 5% level).

variable is included in the regression.

In sum, the data are supportive of the hypotheses in Section 3. We see that a higher (expected) own income and tax cost decrease the chosen tax rate. A higher perceived income risk increases the chosen tax rate in Part 2. The negative effect of the efficiency loss on tax rates in Part 1 and 2 of the experiment indicates a concern for aggregate income. The willingness to pay for redistribution in Part 1 as well as in the higher demand for redistribution in the 'arbitrary' income methods indicates a concern for equality.

4.2. Motives for redistribution

To understand the motives behind redistribution, we estimate the parameters of the structural model discussed in Section 3. In the Online Appendix we conduct a similar exercise for the parameters of the Fehr-Schmidt model.

Estimation method. To obtain the structural estimates, we follow the methodology used in CR and employ McFadden's conditional logit model (McFadden, 1973). This model assumes that people make choices to maximize a utility function, but do so with error. If the errors satisfy a particular (type I extreme value) distribution, it can be shown that the probability of choosing a certain tax rate $\tau \in \{0, 0.1, .., 1\}$ is given by

$$P(t_i = \tau) = \frac{e^{u_{i\tau}}}{\sum_{k=0}^{1} e^{u_{ik}}} \tag{4}$$

where the utility function u_{it} is given by (3), and is estimated as

$$u_{it} = \beta_1 E y_{it} + \beta_2 \sigma_{y_{it}} + \beta_3 y_t^{min} + \beta_4 \sum_j y_{jt}. \tag{5}$$

This model is used to construct a likelihood function, which in turn is maximized with respect to the parameters $\beta_1, ..., \beta_4$. These parameters can then be transformed into the CR utility weights, given in equation (3).

In our estimation we pool the data for Part 1, 2 and 3 and cluster standard errors for each individual. For each tax rate and individual we compute the associated post-redistribution value of each term in the utility function.[20] Here, the expected own payoff Ey_{it} is simply the expected payoff (in Part 1), the payoff associated with the subject's expected rank in the income distribution (in

[20] The estimation method entails constructing an observation for each possible tax rate $\{0, 0.1, ..., 1\}$ for each individual and income determination method, rather than using as an observation only the tax rate which the subject selected.

Part 2), or the subject's actual payoff (Part 3). The standard deviation $\sigma_{y_{it}}$ is simply the standard deviation of after-tax payoffs. The minimum $y_t^{min} = \min\{y_{1t}, y_{2t}, ..., y_{20t}\}$ is the after-tax payoff of the lowest-earning subject and the aggregate income $\sum_j y_{jt}$ is the after-tax total group payoff, taking into account the efficiency loss in the calculation of both variables.[21] Note that the estimated parameters represent broad patterns in the data, but do not reflect the degree of heterogeneity between subjects. In the Online Appendix, we use the individual answers to the questionnaires to incorporate heterogeneity in the estimates.

Results. We present our estimates in Table 3, with the upper part showing the coefficients of equation (5) and the lower parts the parameters of the modified CR utility function given by (3).[22] We present estimates based on the data for all income methods together (All Methods), and estimates for the data of the 'arbitrary' (Random - Where From (WF)) and 'earned' (Tetris - Quiz) pre-tax income determination methods taken separately.

Looking at the first three columns of Table 3, we see that the coefficient on 'expected income' is positive and highly significant in all cases, that the coefficient on 'standard deviation of income' has varying signs and is most significant in column 2. The coefficient on 'minimum income' is positive and highly significant for the observations from the arbitrary methods (column 2), insignificant and small for those from the earned methods (column 3), and positive and marginally significant for the pooled data (column 1). The coefficient on 'aggregate income' is consistently positive but insignificant and small. The small coefficients can be explained partly by the fact that changes in the aggregate income of twenty subjects across tax rates and treatments are large (in absolute terms) relative to changes in the individual-level variables, so even a small coefficient may reflect an non-negligible impact of aggregate income on choice behavior.

The results for the parameters of (5) map into estimates of the utility parameters. The social concern - λ - is highly significant for the arbitrary method observations, marginally significant for the pooled specification and not significant for the earned income methods, indicating a greater

[21] The minimum and aggregate income do not vary between individuals in the same session, but do vary between individuals in different sessions who may face different values of the efficiency loss. In the calculations of the sum, we abstract from income of the 21st subject who is randomly selected to get an income in the range of \$19.80 - \$21.80 and whose income is not affected by the tax rate. In Part 1, by construction, this leaves the income of the decision maker out of the sum.

[22] The CR parameters are calculated from the estimated coefficients as follows $\lambda = \frac{\beta_3+\beta_4}{\beta_1+\beta_2+\beta_3+\beta_4}$, $\gamma = \frac{\beta_2}{\beta_1+\beta_2}$ and $\delta = \frac{\beta_3}{\beta_3+\beta_4}$. We report both the β's and the CR parameters because information about the sign of the β coefficients may get lost in this conversion. Note that where the coefficients have a sign that is different than anticipated in equation 3, the utility parameters need not be between zero and one and lose their interpretation as relative weights. This is occurs for example for the estimate of δ in column 6.

focus on own payoffs for those methods.[23] For both the combined and the arbitrary method data, we find significant estimates of δ, indicating that subjects show more concern about the lowest earner's income than about the aggregate earnings of all subjects. The weight on the standard deviation of income - γ - is significant in columns 2 and 3, although in column 3, somewhat surprisingly, it implies risk loving.

In the estimates discussed thus far, we assumed that subjects perceive the standard deviation of their income in Part 2 to be the same regardless of the confidence in their guess of their income rank under the various income methods. However, consider a subject who is unsure of her comparative performance on an as-yet-unseen general knowledge quiz, but quite sure that her family's location or her own game playing skill will yield either a high or low income rank. Such a subject would perceive a greater income risk under the Quiz than under the Where From or Tetris methods, and greater risk still under the Random method. Such differences in perception can be expected to affect the choice of risk-reducing taxes. To address this issue and obtain more precise estimates of the concern subjects have with the standard deviation of own income, we make use of each subject's self-reported confidence in own guess of income rank. We construct $Uncertain_{im} = \frac{4-c_{im}}{4}$, where $c_{im} \in \{1,2,3\}$ indicates i's self-reported confidence in her guess of the pre-tax income rank under method m.[24] $Uncertain_{im}$ ranges from 0.25 for those most sure of their standing on a given method to 0.75 for those least sure. For the Random income determination method we set $Uncertain_{im}$ to 1. We then perform new estimates where we replace the $\sigma_{y_{it}}$ of the previous estimates with 'Perceived st. dev. of income', calculated as $Uncertain_{im} * \sigma_{y_{it}}$.

The resulting estimates, reported in column 4-6 of Table 3, yield more significant coefficients for the standard deviation in the overall sample, now more strongly suggestive of risk aversion, with the positive coefficient for the earned methods observations becoming insignificant. Estimates are roughly similar with respect to the remaining three variables, except that the coefficient indicating concern for the minimum earner loses its significance in the pooled specification (column 4) and becomes negative (but insignificant) for the earned specification. These changes are reflected in the structural parameters, shown in the lower portion of columns 4-6; estimated utility functions now accord significant weight to lowering the standard deviations of their incomes in all but the earned income methods.

[23] These results are confirmed by a Wald test of the hypothesis that coefficients of both the aggregate and the minimum income are equal to zero. The test yields a clear rejection ($\chi^2 = 11.70$, $p = 0.003$) for the arbitrary income methods (column 2), while we cannot reject it for the combined ($\chi^2 = 3.01$, $p = 0.222$) and earned income methods ($\chi^2 = 1.01$, $p = 0.605$).

[24] We set $c_{im} = 1$ if the subject answered the question: "How confident do you feel about your estimate?" by "Not confident at all." We set $c_{im} = 2$ if the subject answered "Somewhat confident" and $c_{im} = 3$ if she answered "Very confident".

COMPARISON TO CHARNESS AND RABIN AND MARGINAL RATES OF SUBSITUTION

The comparison of our utility parameter estimates to those of CR is complicated by the fact that their estimates refer to a two-player model. However, we can provide some approximate quantitative comparisons. In the appendix to their paper, CR show that one can convert the parameters of the multiplayer model to the two-player model used in the main text of the paper, if the former is applied to a two player setting (CR, p. 852). Thus, if we assume that the utility weights of our model continue to be relevant in a two player setting, we can forge a comparison with the relevant estimates in CR, which are are obtained from the bottom row of table VI (CR, p. 840). The first is $\rho = 0.424$, which measures the utility weight of the richest player on the income of the poorest player. The second is $\sigma = 0.023$, which measures the utility weight of the poorest player on the income of the richest player.

The conversion of our estimates yields values of $\rho' = 0.044$ and $\sigma' = 0.009$ for all income methods (column 4) and $\rho' = 0.109$ and $\sigma' = 0.005$ for the arbitrary income methods (column 5). Thus, as CR, our estimates of both equality and efficiency concerns have a positive sign. However, we find lower values for both utility weights, where the absolute difference with CR is largest for ρ, the weight on the income of the poorest group member. This is perhaps not so surprising, since the poorest group member is likely to be a more salient figure in a two-player game than in a group of 21.

We can also make comparisons by calculating marginal rates of substitution between the different sources of utility. Based on the utility estimates in column 4-6 of Table 3, Table 4 shows the resulting willingness to give up own income to reduce the standard deviation of income, raise the aggregate payoff, or reduce inequality (which is measured as the difference between the minimum and the average income). The numbers in brackets indicate the willingness to pay as a percentage of expected income in the experiment, which was \$19.80. We can perform a comparison of these numbers with CR, by calculating from their estimates the marginal rates of substitution akin to those just reported. First, the richest player's willingness to pay to raise the payoff of the poorest in CR can be compared to the average subject's willingness to pay to raise the minimum income in our experiment. Similarly, the poorest player's willingness to pay to raise the income of the richest player in CR, can be compared to the average subject's willingness to pay for aggregate payoffs in our experiment.[25] The results, given in the final column of Table 4, show that the willingness to pay to raise the aggregate and the minimum payoff are both higher in CR, with the difference being larger for the minimum payoff.

In sum, we find that people are concerned about their own income and its riskiness, but also care about helping those who are less well off when income inequality results from an arbitrary

[25] In the calculation of the willingness to pay in the CR model, we assumed that reciprocity plays no role, i.e. $q = 0$. Thus, the entry in the first column is computed as $\frac{\rho}{1-\rho}$, and that in the second column as $\frac{\sigma}{1-\sigma}$.

process.[26] As in CR, we find that subjects seem to be willing to make modest sacrifices to raise aggregate payoffs.[27] Furthermore, the structural estimates of the FS model, provided in the Online Appendix, show no evidence that people are envious and use taxes to reduce the payoffs of those who have more than they do.

5. Conclusion

We identified three likely determinants of public demands to redistribute income from richer to poorer citizens: the general self-interest of those in lower income brackets, the insurance motive, and social preferences. The latter can be divided into assistance to the poor or dislike of undeserved inequalities, and reluctance to shrink the social piece.

To investigate the relative importance of these potentially competing factors, we conducted sixteen experimental sessions in each of which twenty-one subjects were confronted with an array of earnings mirroring the U.S. pre-tax income distribution. Subjects had to state their preferred tax rates in a linear tax-and-transfer scheme, facing both earned and unearned inequality, from the standpoint of a disinterested observer as well as an interested observer, the latter both under the veil of ignorance and after the resolution of uncertainty. Our experiment is distinctive in its 'realistic' features such as large groups, macro framing, decision-making under multiple conditions, and variation of both direct cost to decision-maker and efficiency cost of redistribution.

Not surprisingly, self-interest stands out as the dominant motive in the involved conditions. However, self-interest cannot explain the willingness of a large majority of subjects to sacrifice some earnings to increase equality of earnings among others in the disinterested decision-maker condition, nor can it explain greater reluctance to redistribute when aggregate earnings must be sacrificed, and likewise sensitivity to whether pre-tax incomes are "arbitrary" or "earned." Moreover, our best-fitting estimates of a modified Charness-Rabin social preference model suggest social concerns matter, and that laboratory results on fairness and social preferences "scale up" to settings with larger groups, and perhaps even to the macroeconomic realm. The concern for the poorest subject seems to be somewhat smaller than in typical experiments on social preferences, but this strikes us as plausible given the large-group setup.

Assuming the decisions taken by our subjects reflect the views that influence political de-

[26] Although not shown to conserve space, we performed separate structural estimates using only the male and only the female subject observations. The resulting estimates show that the utility weight on the minimum income is higher for women than for men, while the reverse is true for the weights on own income and aggregate payoffs.

[27] Although the coefficients on aggregate payoffs in our Table 3 are not statistically significant, we do not view this as decisive evidence against the existence of efficiency concerns. These coefficients are somewhat imprecisely estimated, because the only treatment variation in aggregate income stems from the efficiency loss, which affects both the minimum and the aggregate income. We view the highly significant effect of efficiency loss on tax choice in our earlier Tobit regressions and the consistent positive signs on aggregate income in Table 2 as indicative of an efficiency concern.

cisions in industrialized countries, our utility estimates can be used by scholars in the field of macroeconomics and political economy to construct more realistic utility and social welfare functions. Combined with a model of taxes and transfer payments, this may improve estimations of the socially optimal tax rate. For instance, if citizens care about the income of the least well-off, a standard model with selfish agents will underestimate the welfare benefits of redistributive policies. The weight placed on efficiency, on the other hand, will lower optimal redistribution to the extent that there is an efficiency loss associated with taxation.

It is important to remember that the utility weights are estimated for the average subject. There are indications of considerable variation in preferences, with more politically liberal subjects favoring more redistribution, and with female subjects tending to make less distinction between "arbitrary" and "earned" pre-tax incomes. Such heterogeneity within our subject pool may well extend to cross-country differences. Specifically, greater concern for the poorest under the "arbitrary" methods, in our data, is consistent with theories suggesting that redistribution varies among countries due to different perceptions of the role played by luck versus effort in determining economic outcomes (Alesina and Angeletos, 2005). Conducting experiments like ours using different country subject pools would be a valuable next step.

There are many reasons for caution in extrapolating our results to the real world economy. These include that our experimental stakes were a small fraction of annual incomes, that decisions made for a population of twenty may or may not translate well into decisions made for millions, that subjects do not learn the redistribution attitudes of others, that we abstract from incentive effects and do not consider pre-tax income differences due to different effort/leisure choices or willingness to take risks. On the other hand, alternative data sources have their own drawbacks: field experiments where actual incomes are altered are costly and difficult to design, answers to hypothetical scenario questions raise cheap-talk concerns, and polling data cannot provide us with such a large set of costly decisions in such diverse conditions. Therefore, we believe our results should at least be drawn upon as a complement to inferences obtained by other methods.

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Table 1: Description of treatment variables

Treatment variable	Description	Values	Source of variation	Main findings
Tax cost	Cost of a 10% tax increase to the decisive individual (DI)	\$0, \$0.25, \$0.5, \$1	Between-subject	Tax rate decreases as tax cost goes up
Efficiency loss	Share of tax revenue lost	0%, 12.5%, 25%	Between-subject	Tax rate decreases as efficiency loss goes up
Income determination method	Method used to assign individuals to pre-tax payoffs	Random, WF, Tetris, Quiz	Within-subject	Lower tax rate for methods involving effort/ability
Involvement	DI's position as affected or unaffected party in redistributive decision	Part 1: Unaffected Part 2 & 3: Affected	Within-subject	Higher tax rate when DI is affected by taxes and redistribution
Uncertainty	DI's information on own position in pre-tax payoff distribution when choosing tax	Part 2: Uncertain Part 3: Certain	Within-subject	Own payoff influences tax choice more when uncertainty is resolved; regression evidence of risk aversion

All income determination methods and involvement conditions were implemented in all experimental sessions (16 sessions involving 335 subjects). While the uncertainty condition was implemented in all experimental sessions, only in seven randomly selected sessions (involving 147 subjects) participants were given the possibility to choose a tax rate after learning their ranking in the pre-tax distribution. Finally, different experimental sessions were characterized by a different combination of "tax cost" and "efficiency loss": efficiency loss 0%, two sessions for each of the four tax costs (8 sessions, 168 subjects); efficiency loss 12.5%, one session for each of the four tax costs (4 sessions, 83 subjects); efficiency loss 25%, one session for each of the four tax costs (4 sessions, 84 subjects).

Table 2: Tobit regressions for Part 1 (disinterested decision-maker), Part 2 (involved decision-maker with uncertainty), and Part 3 (involved decision-maker without uncertainty)

Dependent variable: Tax choice (0-1)

	Part 1 All	Part 1 All	Part 2 All	Part 2 All	Part 2 Non-random	Part 3 All	Part 3 All	Part 3 All
Tax Cost	-0.122***	-0.121***	-0.088**	-0.093**	-0.083**			
	(0.039)	(0.039)	(0.038)	(0.037)	(0.038)			
Efficiency Loss	-0.319**	-0.260*	-0.413***	-0.359***	-0.302**	0.028	0.059	0.106
	(0.153)	(0.151)	(0.134)	(0.131)	(0.137)	(0.215)	(0.219)	(0.216)
Where From		-0.042**		-0.103***			0.008	0.029
		(0.021)		(0.024)			(0.048)	(0.049)
Tetris		-0.116***		-0.182***	-0.067***		0.035	0.076
		(0.018)		(0.020)	(0.021)		(0.045)	(0.047)
Quiz		-0.114***		-0.146***	-0.042**		0.008	0.048
		(0.019)		(0.020)	(0.021)		(0.046)	(0.048)
Expected Rank (1-20)					0.034***			
					(0.004)			
Confidence Level (Low/High)					-0.179***			
					(0.053)			
Confidence*Expected Rank					0.012*			
					(0.006)			
Rank-Specific Tax Cost						-0.224***	-0.222***	-0.222***
						(0.041)	(0.041)	(0.039)
Part 1 Tax Choice (0-1)								0.344***
								(0.070)
Individual controls	NO	YES	NO	YES	YES	NO	YES	YES
Observations	1,340	1,340	1,340	1,340	1,005	588	588	588
Uncensored observations	837	837	868	868	651	149	149	149
Left-censored observations	316	316	281	281	237	197	197	197
Right-censored observations	187	187	191	191	117	242	242	242
Log-likelihood	-1159	-1099	-1128	-1051	-645.2	-486.6	-480.7	-465.2
Pseudo-R^2	0.0140	0.0647	0.0135	0.0806	0.231	0.233	0.242	0.267

Individual controls include: gender, ethnic background dummies (Caucasian, Asian, African-American, Hispanic, Other), home area income (log), risk aversion index, self-reported political ideology and the number of economics courses taken. An extended version of the table reporting the coefficients on the individual controls is included in the Appendix. The Random income determination method is the baseline in all columns except in column (5) where only observations for non-random methods are used and the baseline is the "Where From" method. "Rank-Specific Tax Cost" includes the direct tax cost of taxation (as in parts 1 and 2) as well as the cost (or benefit) of taxation to the decision maker given his/her pre-tax earnings rank under the income determination method in question. "Part 1 Tax (0-1)" represents the tax rate (between 0 and 1) chosen by the same individual under the same income determination method in the "disinterested decision-maker" condition. Coefficients shown are marginal effects. Robust standard errors clustered by individual in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Estimates of Utility Function Parameters From Equation 5

Dep. Var.: Tax Rate	(1) All Methods	(2) Random - WF	(3) Tetris - Quiz	(4) All Methods	(5) Random - WF	(6) Tetris - Quiz
Expected income	0.223***	0.233***	0.230***	0.227***	0.239***	0.230***
	(0.018)	(0.023)	(0.021)	(0.018)	(0.024)	(0.020)
Standard dev. of income	-0.006	-0.029***	0.017**			
	(0.005)	(0.007)	(0.007)			
Perceived st. dev. of income				-0.041***	-0.052***	0.022
				(0.007)	(0.008)	(0.013)
Minimum Income	0.0185*	0.0387***	0.0003	0.010	0.034***	-0.002
	(0.011)	(0.012)	(0.012)	(0.011)	(0.012)	(0.012)
Aggregate income	0.002	0.002	0.003	0.003	0.002	0.003
	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)
λ	0.084*	0.134***	0.015	0.044	0.110***	0.003
	(.047)	(0.042)	(0.063)	(0.043)	(0.040)	(0.067)
γ	0.027	0.110***	-0.080**	0.153***	0.179***	-0.103
	(0.023)	(0.023)	(0.035)	(0.024)	(0.023)	(0.069)
δ	0.881***	0.958***	0.093	0.785***	0.952***	-4.000
	(0.106)	(0.078)	(3.203)	(0.174)	(0.086)	(111.4)
Observations	3268	1634	1634	3268	1634	1634

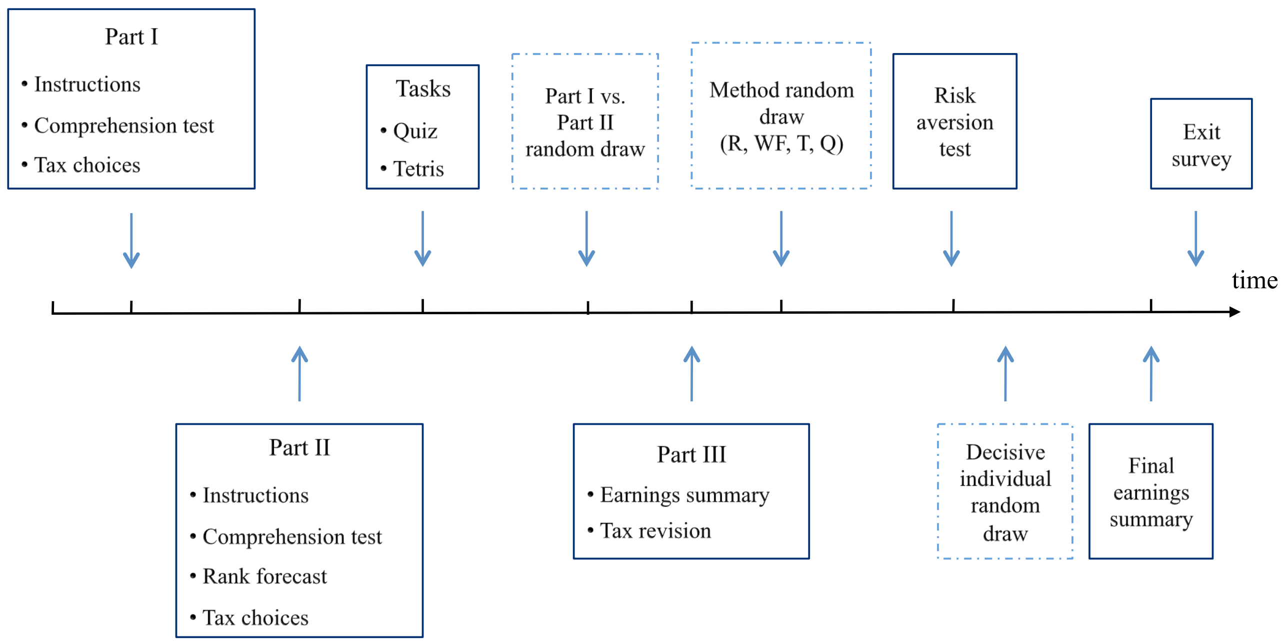
Standard errors clustered by individual reported in parentheses. Standard errors for the parameters in the lower part of the table are obtained by employing the delta method. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Willingness to Pay to Increase Minimum Income, Aggregate Payoffs and the Standard Deviation of Income

Willingness to pay to:	All methods	Random-WF	Tetris-Quiz	CR
reduce st. dev. of income by $1	$ 0.180 (0.91%)	$ 0.218 (1.10%)	-$ 0.093 (-0.47%)	
reduce st. dev. of income by 10%	$ 0.404 (2.04%)	$ 0.489 (2.47%)	-$ 0.209 (-1.06%)	
raise the minimum income by $ 1	$ 0.043 (0.22%)	$ 0.143 (0.73%)	-$ 0.011 (-0.05%)	$0.74 (3.73%)
lower inequality by 10%	$ 0.084 (0.43%)	$ 0.282 (1.42%)	-$ 0.022 (-0.11%)	
raise aggregate income by $1	$ 0.012 (0.06%)	$ 0.007 (0.04%)	$ 0.013 (0.07%)	$0.024 (0.12%)
raise aggregate income by 10%	$ 0.458 (2.31%)	$ 0.281 (1.42%)	$ 0.535 (2.68%)	

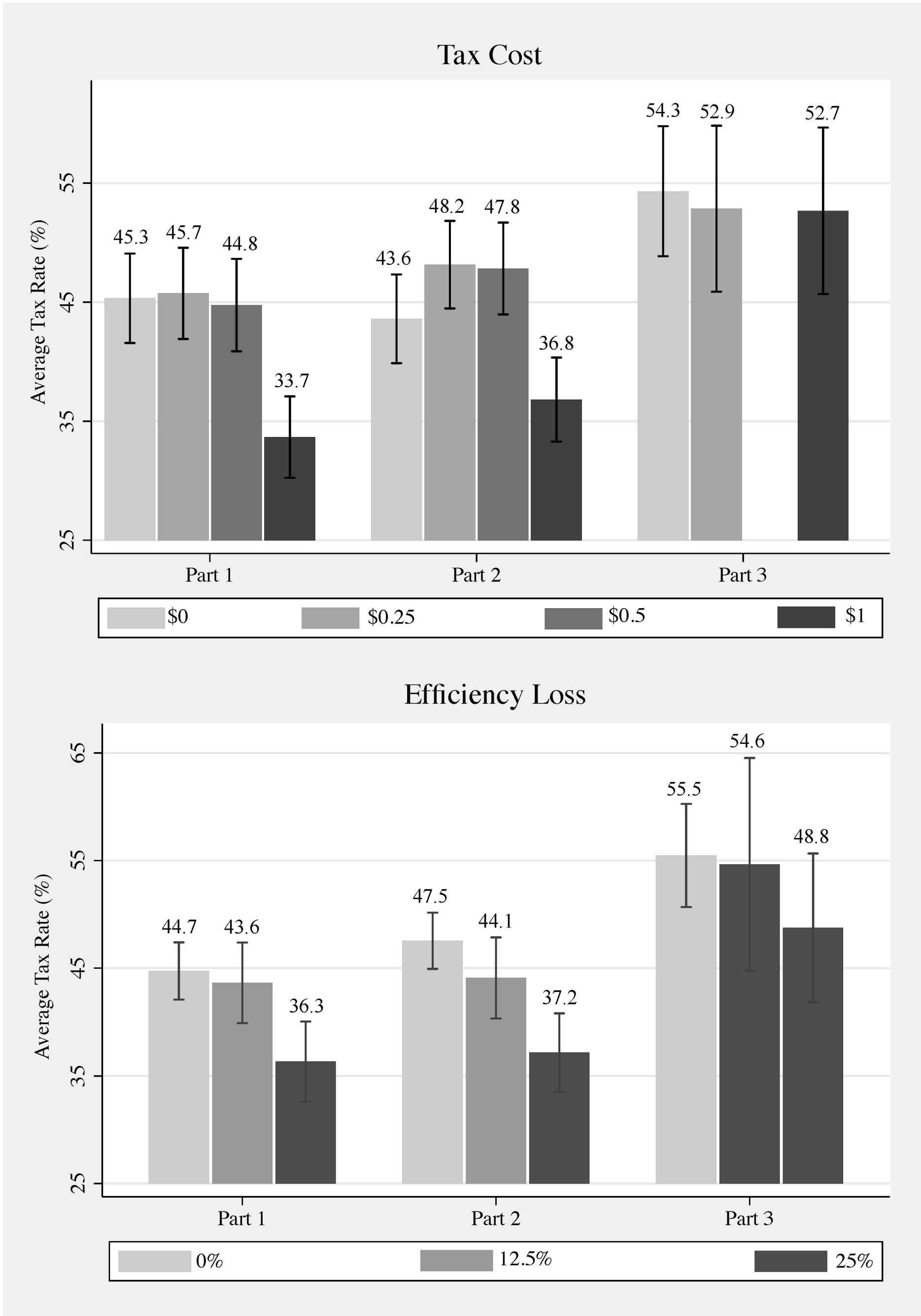
WTP is based on the estimates in columns 4-6 of Table 3. Numbers in parentheses express the willingness to pay as a percentages of average expected pre-tax own income in this experiment ($19.80). In the second row, the 10% reduction in the standard deviation of pre-tax income is taken in the random treatment, where the standard deviation of pre-tax income is 22.47. In the fourth row, inequality is defined as the difference between the pre-tax income of the poorest ($0.11) and the pre-tax average income ($19.80). In the final row, the 10% increase of aggregate income is taken over aggregate group income, which equals 396.

Figure 1: Sequence of the Experimental Session



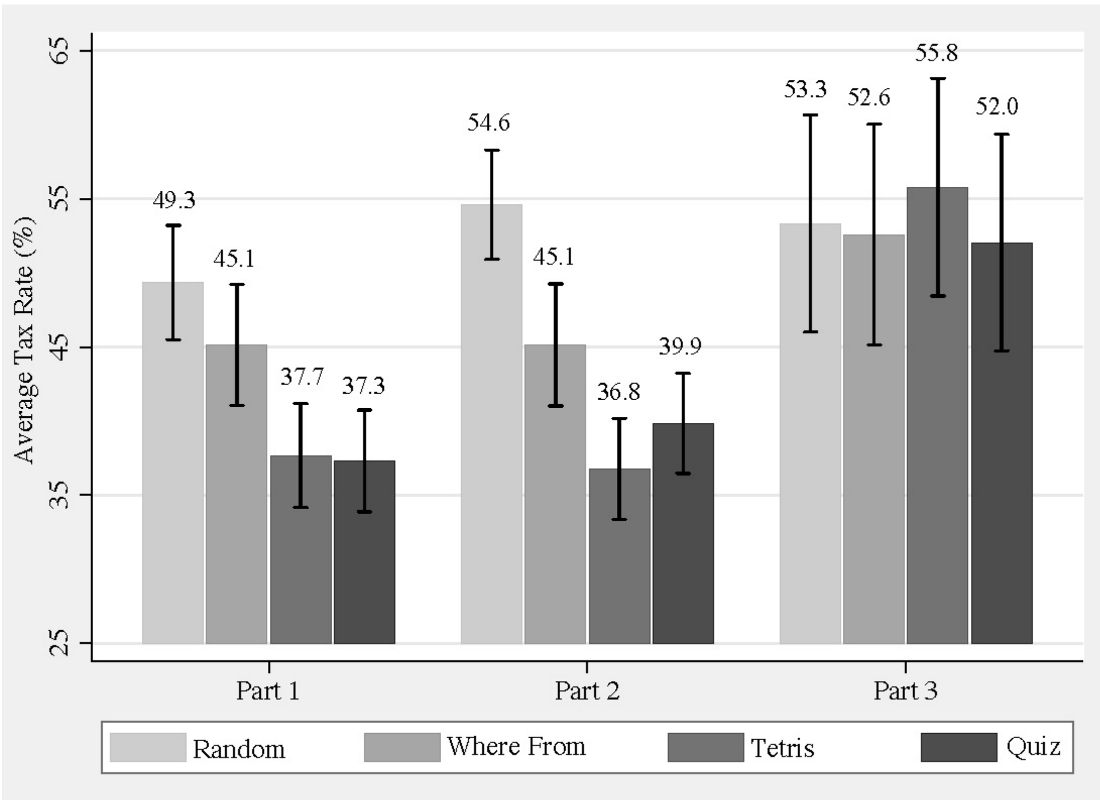
The dashed boxes indicate the randomization in the determination of payoffs.

Figure 2: Average Tax Choice by Tax Cost and Efficiency Loss



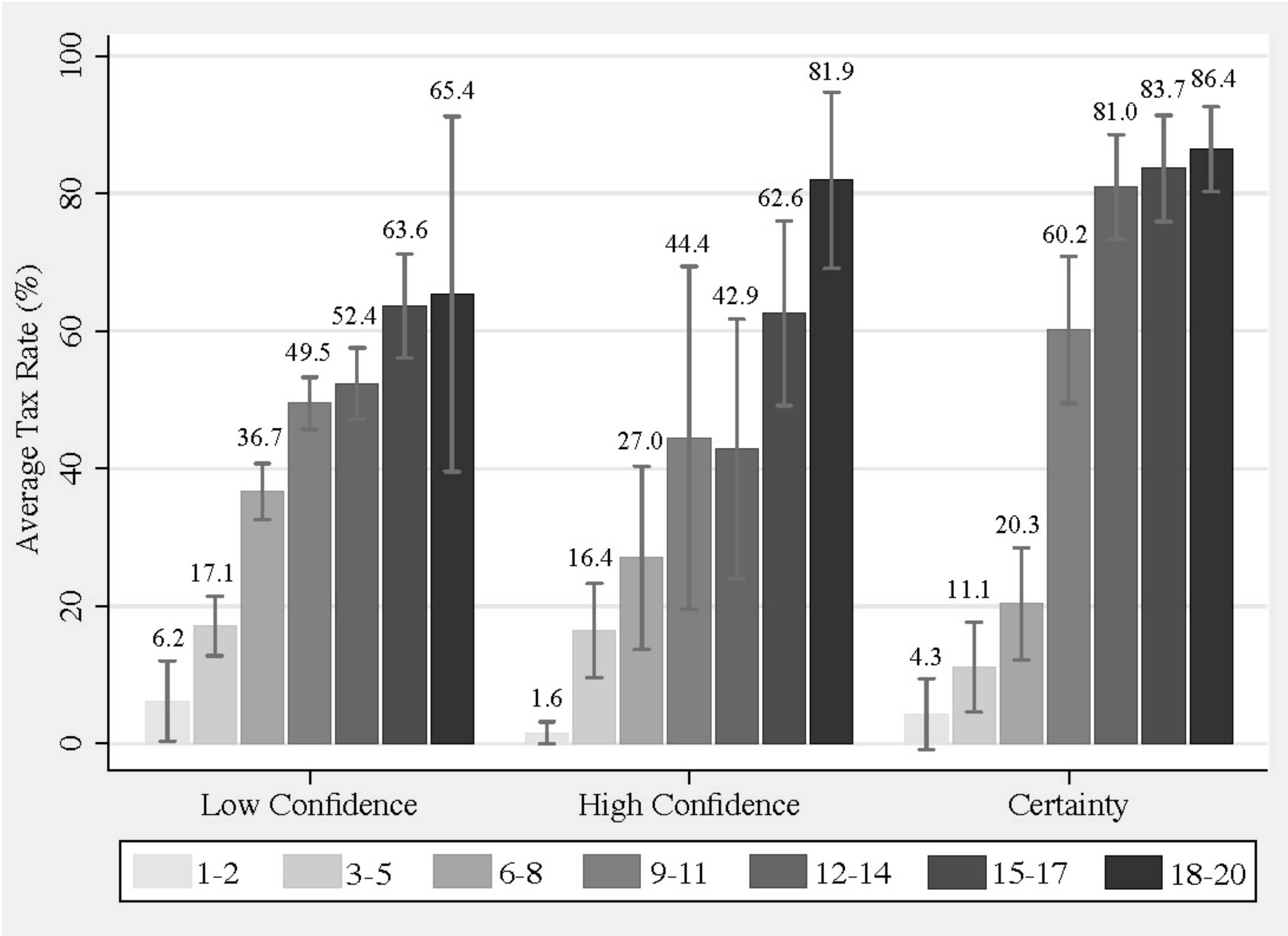
The figure reports the average tax rate (and 95%-confidence interval) chosen by subjects under each of the three conditions - "disinterested decision-maker" (Part 1), "interested decision-maker with uncertainty" (Part 2), "interested decision-maker without uncertainty" (Part 3) - for different values of the *Tax Cost* and *Efficiency Loss* treatment variables. While *Tax Cost* represents the direct cost to the decision-maker of an additional 10% tax, *Efficiency Loss* represents the percentage loss in total earnings associated with taxation. Part 3 was implemented only when Part 2 was randomly selected to determine pay-offs, which occurred in 7 out of 16 experimental sessions; since none of these sessions was characterized by a $0.5 tax cost, no observation is available for this value for Part 3.

Figure 3: Average Tax Choice by Method



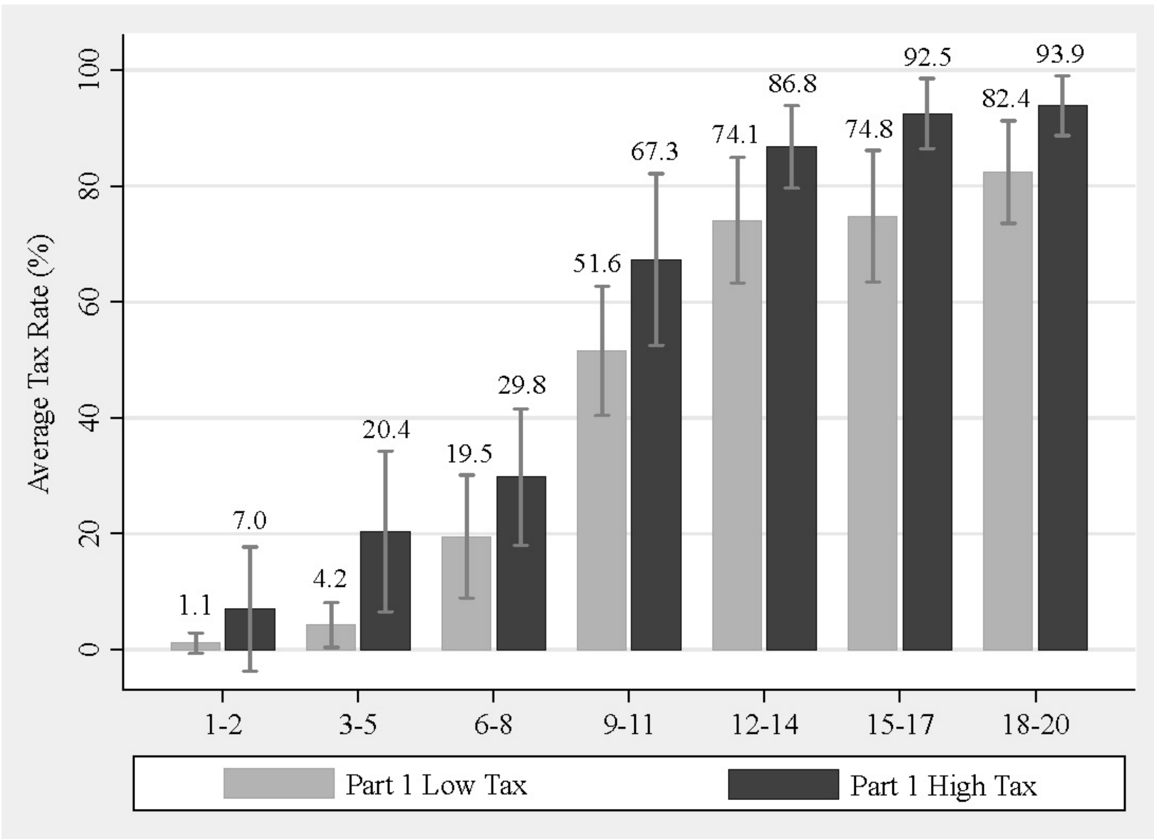
The figure reports the average tax rate (and 95%-confidence interval) chosen by subjects under each of the three conditions - "disinterested decision-maker" (Part 1), "interested decision-maker with uncertainty" (Part 2), "interested decision-maker without uncertainty" (Part 3) - for each of the four income determination methods: *Random*, *Where From*, *Quiz* and *Tetris*. The last three methods are meant to reflect socio-economic background, knowledge, and skill, respectively.

Figure 4: Average Tax Choice by Rank Category and Confidence Level under the "Interested Decision-maker" condition (Parts 2 and 3)



The figure reports the average tax rate (and 95%-confidence interval) chosen by subjects under the "interested decision-maker" condition with and without uncertainty (Parts 2 and 3) separately by rank category in the pre-tax payoff distribution (expected in Part 2 and actual in Part 3), and by the degree of uncertainty (low and high confidence in Part 2, certainty in Part 3).

Figure 5: Average Tax Choice under the “Interested Decision-maker without Uncertainty” condition (Part 3) by Rank Category and Part 1 Tax Choice



The figure reports the average tax rate (and 95%-confidence interval) chosen in the “interested decision-maker without uncertainty” condition (Part 3) by subjects with different rank in the pre-tax payoff distribution. We distinguish between those subjects who chose a high and a low tax rate in Part 1 (the “ disinterested decision-maker” condition). A subject’s Part 1 tax choice for a given pre-tax income determination method is considered low (high) if it is below or equal to (above) the median Part 1 tax choice for that method in sessions with the same Tax Cost and Efficiency Loss parameters.

Material for Supplementary Online Appendix

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Table S.1: U.S. Individual Income Distribution and Possible Experimental Earnings

Twentieth/Rank	Income	Earnings
1	$157,423	$100.00
2	$72,488	$46.05
3	$57,538	$36.55
4	$48,516	$30.82
5	$41,776	$26.54
6	$36,697	$23.31
7	$32,458	$20.62
8	$28,991	$18.42
9	$25,637	$16.29
10	$22,795	$14.48
11	$20,028	$12.72
12	$17,525	$11.13
13	$15,052	$9.56
14	$12,818	$8.14
15	$10,715	$6.81
16	$8,699	$5.53
17	$6,792	$4.31
18	$4,878	$3.10
19	$2,383	$1.51
20	$166	$0.11

Source: U.S. Census Bureau (2001)

Table S.2: Earnings Distribution under Different Tax Rates

Ranking	t = 0%	t = 10%	t = 20%	t = 30%	t = 40%	t = 50%	t = 60%	t = 70%	t = 80%	t = 90%	t = 100%
1	100.0	92.0	84.0	75.9	67.9	59.9	51.9	43.9	35.8	27.8	19.8
2	46.1	43.4	40.8	38.2	35.6	32.9	30.3	27.7	25.1	22.4	19.8
3	36.6	34.9	33.2	31.5	29.9	28.2	26.5	24.8	23.2	21.5	19.8
4	30.8	29.7	28.6	27.5	26.4	25.3	24.2	23.1	22.0	20.9	19.8
5	26.5	25.9	25.2	24.5	23.8	23.2	22.5	21.8	21.2	20.5	19.8
6	23.3	23.0	22.6	22.3	21.9	21.6	21.2	20.9	20.5	20.2	19.8
7	20.6	20.5	20.5	20.4	20.3	20.2	20.1	20.1	20.0	19.9	19.8
8	18.4	18.6	18.7	18.8	19.0	19.1	19.3	19.4	19.5	19.7	19.8
9	16.3	16.6	17.0	17.3	17.7	18.0	18.4	18.8	19.1	19.5	19.8
10	14.5	15.0	15.5	16.1	16.6	17.1	17.7	18.2	18.7	19.3	19.8
11	12.7	13.4	14.1	14.9	15.6	16.3	17.0	17.7	18.4	19.1	19.8
12	11.1	12.0	12.9	13.7	14.6	15.5	16.3	17.2	18.1	18.9	19.8
13	9.6	10.6	11.6	12.6	13.7	14.7	15.7	16.7	17.8	18.8	19.8
14	8.1	9.3	10.5	11.6	12.8	14.0	15.1	16.3	17.5	18.6	19.8
15	6.8	8.1	9.4	10.7	12.0	13.3	14.6	15.9	17.2	18.5	19.8
16	5.5	7.0	8.4	9.8	11.2	12.7	14.1	15.5	17.0	18.4	19.8
17	4.3	5.9	7.4	9.0	10.5	12.1	13.6	15.2	16.7	18.3	19.8
18	3.1	4.8	6.4	8.1	9.8	11.5	13.1	14.8	16.5	18.1	19.8
19	1.5	3.3	5.2	7.0	8.8	10.7	12.5	14.3	16.1	18.0	19.8
20	0.1	2.1	4.0	6.0	8.0	10.0	11.9	13.9	15.9	17.8	19.8

The table reported above refers to a session with 0% efficiency loss, that is, with no loss in tax revenue associated with taxation. In sessions with positive values of efficiency loss (12.5%, 25%), the earnings reported in the table shown to participants would reflect the corresponding loss in tax revenue associated with taxation.

Table S.3: Test for the Assessment of Risk Aversion

1) Please indicate whether you would like to receive \$1 or would prefer to let the computer randomly select for you either \$0 or \$1.80 (each with a 50% probability). ☐ Guaranteed \$1 ☐ Random Selection between \$0 and \$1.80
2) Please indicate whether you would like to receive \$1 or would prefer to let the computer randomly select for you either \$0 or \$2 (each with a 50% probability). ☐ Guaranteed \$1 ☐ Random Selection between \$0 and \$2
3) Please indicate whether you would like to receive \$1 or would prefer to let the computer randomly select for you either \$0 or \$2.33 (each with a 50% probability). ☐ Guaranteed \$1 ☐ Random Selection between \$0 and \$2.33
4) Please indicate whether you would like to receive \$1 or would prefer to let the computer randomly select for you either \$0 or \$2.67 (each with a 50% probability). ☐ Guaranteed \$1 ☐ Random Selection between \$0 and \$2.67
5) Please indicate whether you would like to receive \$1 or would prefer to let the computer randomly select for you either \$0 or \$3 (each with a 50% probability). ☐ Guaranteed \$1 ☐ Random Selection between \$0 and \$3

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B: Distribution of Participants' Characteristics and Choices

Table S.4: Distribution of Participants by Personal Characteristics. For reasons of space we have merged some of the categories.

		Subjects	% Subjects
Gender	Female	151	45.1%
	Male	184	54.9%
Ethnic background	White	213	63.6%
	African-American	25	7.5%
	Asian	58	17.3%
	Hispanic	21	6.3%
Home Area Income	< $ 20,000	65	19.4%
	$ 20,000 - $ 40,000	176	52.5%
	$ 40,000 - $ 60,000	67	20.0%
	> $ 60,000	27	8.1%
Political Self-Identification	Liberal	247	73.7%
	Moderate	50	14.9%
	Conservative	38	11.3%
Economics Courses	2 or less	283	84.5%
	More than 2	52	15.5%

Table S.5: Distribution of Tax Choices by Part and by Method

Part 1 (335 subjects, 1340 choices)					
	All	Random	WF	Tetris	Quiz
t=0%	23.6%	20.0%	24.5%	25.7%	24.2%
t=10%	6.2%	3.9%	8.1%	5.7%	7.2%
t=20%	6.6%	5.1%	5.7%	8.4%	7.5%
t=30%	11.0%	8.1%	9.3%	13.4%	13.1%
t=40%	8.4%	8.1%	5.1%	9.3%	11.3%
t=50%	10.2%	14.6%	7.5%	8.4%	10.5%
t=60%	5.5%	5.4%	4.8%	6.6%	5.1%
t=70%	5.8%	5.1%	6.6%	5.7%	6.0%
t=80%	5.2%	5.7%	5.1%	5.4%	4.5%
t=90%	3.6%	5.1%	4.5%	3.3%	1.5%
t=100%	14.0%	19.1%	19.1%	8.4%	9.3%
Part 2 (335 subjects, 1340 choices)					
	All	Random	WF	Tetris	Quiz
t=0%	21.0%	13.1%	26.0%	25.1%	19.7%
t=10%	6.0%	3.6%	7.5%	6.3%	6.9%
t=20%	7.2%	5.4%	5.4%	9.3%	8.7%
t=30%	11.2%	8.7%	9.6%	13.1%	13.4%
t=40%	8.2%	8.1%	3.6%	10.2%	11.0%
t=50%	10.5%	16.1%	5.7%	8.7%	11.3%
t=60%	5.8%	4.8%	6.3%	5.1%	7.2%
t=70%	6.8%	7.5%	7.5%	6.9%	5.4%
t=80%	5.1%	5.7%	5.4%	5.1%	4.2%
t=90%	4.0%	5.1%	3.9%	3.9%	3.3%
t=100%	14.3%	22.1%	19.4%	6.6%	9.0%
Part 3 (147 subjects, 588 choices)					
	All	Random	WF	Tetris	Quiz
t=0%	33.5%	35.4%	34.7%	30.6%	33.3%
t=10%	3.9%	0.7%	5.4%	4.8%	4.8%
t=20%	1.5%	1.4%	0.7%	3.4%	0.7%
t=30%	3.1%	3.4%	3.4%	2.7%	2.7%
t=40%	3.1%	2.7%	1.4%	0.7%	7.5%
t=50%	3.7%	6.8%	3.4%	2.7%	2.0%
t=60%	2.0%	2.0%	2.0%	1.4%	2.7%
t=70%	3.2%	3.4%	2.0%	4.8%	2.7%
t=80%	2.0%	0.7%	3.4%	2.7%	1.4%
t=90%	2.7%	2.0%	2.7%	4.1%	2.0%
t=100%	41.2%	41.5%	40.8%	42.2%	40.1%

C: DERIVATION OF THE HYPOTHESES

We have the following modified Charness-Rabin utility function

$$V_i = (1-\lambda)\left[(1-\gamma)Ey_i + \gamma(-\sigma_{y_i}))\right] + \lambda\left[\delta y^{min} + (1-\delta)\sum_j y_j\right] \tag{A.1}$$

where Ey_i is individual i's expected post-tax payoff, σ_{y_i} is the standard deviation of this payoff, y^{min} is the minimum of the post-tax group payoffs and $\sum_j y_j$ is the sum of these group payoffs.

We rewrite the elements of the utility function as a function of tax rates, pre-tax wealth levels, and individual beliefs. Let super-script ^{0} denote the pre-tax wealth levels, e the efficiency loss, c the tax cost, N the number of subjects in the pool, $\bar{y}$ the average payoff of the group, and p_{ij} the (subjective) probability of individual i that wealth position j will obtain. The four components of the utility function can then be written as:

$$\begin{aligned}
E[y_i(t)] &= E_i[(1-t)y^0] + \bar{y}^0 t(1-e) - tc,\\
&= \sum_j p_{ij} y_j^0 (1-t) + \bar{y}^0 t(1-e) - tc,\\
\sigma_{y_i}(t) &= \sqrt{E_i[y_i(t)^2] - E_i[y_i(t)]^2}\\
&= \sqrt{\sum_j p_{ij}(y_j^0(1-t))^2 - \left(\sum_j p_{ij} y_j^0 (1-t)\right)^2}\\
&= (1-t)\sigma_{y_i}^0,\\
\sum_j y_j &= N\bar{y}^0(1-et),\\
y^{min}(t) &= y_{min}^0(1-t) + \bar{y}^0 t(1-e),
\end{aligned}$$

where y^0 is a random variable with support on the j initial wealth positions, $E_i y^0$ is the expected pre-tax income of individual i according to the beliefs of individual i, and $\sigma_{y_i}^0$ is the standard deviation of pre-tax income y^0, again according to the beliefs of individual i.

To derive predictions for our experiment, we use an approximation of the model to a continuous tax choice, that allows us to take derivatives. We look at the different parts of the experiment separately

Part 1. In Part 1, the tax does not influence own payoffs (except via the tax cost) and $\sigma_{y_i}^0$ is independent of the tax rate. The derivative with respect to t is

$$\frac{dV_i}{dt} = -(1-\lambda)(1-\gamma)c + \lambda\delta(\bar{y}^0 - y_{min}^0) - \lambda(\delta + N(1-\delta))\bar{y}^0 e.$$

Part 2. In Part 2, tax influences both expected income and the standard deviation of income. The first order condition becomes

$$\frac{dV_i}{dt} = (1-\lambda)(1-\gamma)(\bar{y}^0 - E_i y^0 - c) + \gamma(1-\lambda)\sigma^0_{y_i} + \lambda\delta(\bar{y}^0 - y^0_{min}) - (\lambda\delta + N\lambda(1-\delta) + (1-\lambda)(1-\gamma))e\bar{y}^0.$$

Part 3. In Part 3, there is no income risk and so $\sigma^0_{y_i} = 0$. The first order condition is

$$\frac{dV_i}{dt} = (1-\lambda)(1-\gamma)(\bar{y}^0 - E_i y^0 - c) + \lambda\delta(\bar{y}^0 - y^0_{min}) - (\lambda\delta + N\lambda(1-\delta) + (1-\lambda)(1-\gamma))\bar{y}^0 e.$$

Note that in each case, since the utility function is linear in the tax rate, the tax rate drops out of the first order condition. Thus, the model predicts only corner solutions: if the derivative is positive, an individual will want to set the maximal rate ($t = 1$). If it is negative, she will want to set the minimum rate ($t = 0$). The sign of the derivative depends on the experimental parameters e and c (whereas $\bar{y}^0$ and y^0_{min} are fixed in the experiment), as well as on the individual preference parameters λ, δ and γ. To allow comparative statics with respect to the average tax rate, one needs sufficient heterogeneity in preferences. A sufficient (but not necessary) condition that the joint distribution of λ, δ and γ has full support on $[0,1]^3$; this guarantees the existence of a marginal individual for whom the first order condition is exactly zero.

First, it is easy to see that in Part 2 and 3, the derivative decreases in the expectation of own income. Moreover, in each part of the experiment, the first order condition is decreasing in the tax cost c. This yields our first hypothesis. Second, Hypothesis 2 follows because in Part 2 the first order condition increases in the standard deviation of income $\sigma^0_{y_i}$ (i.e. the subjective uncertainty about the pre-tax income). Third, in each part of the experiment, the first order condition decreases in the efficiency loss e, yielding Hypothesis 3a). Hypothesis 3b) follows because the first order condition in Part 1 will be positive for individuals with a high λ and high δ.

Finally, one can show that in all Parts of the experiment, an increase in δ will always (weakly) raise the optimal average tax rate. An increase in λ will do so if δ is sufficiently large. Thus, we conjecture that in the 'arbitrary' inequality income methods (Random and Where-From), where λ and δ are likely to be higher, tax rates will be higher than in the Tetris and Quiz methods.

Table S.6: Tobit Regressions with Coefficients on Individual Controls

Dependent variable: Tax rate (0-1)

	Part 1 All	Part 2 All	Part 2 Non-random	Part 3 All	Part 3 All
Tax Cost	-0.121*** (0.039)	-0.093** (0.037)	-0.083** (0.038)		
Efficiency Loss	-0.260* (0.151)	-0.359*** (0.131)	-0.302** (0.137)	0.059 (0.219)	0.106 (0.216)
Where From	-0.042** (0.021)	-0.103*** (0.024)		0.008 (0.048)	0.029 (0.049)
Tetris	-0.116*** (0.018)	-0.182*** (0.020)	-0.067*** (0.021)	0.035 (0.045)	0.076 (0.047)
Quiz	-0.114*** (0.019)	-0.146*** (0.020)	-0.042** (0.021)	0.008 (0.046)	0.048 (0.048)
Expected Rank (1-20)			0.034*** (0.004)		
Confidence Level (Low/High)			-0.179*** (0.053)		
Confidence*Expected Rank			0.012* (0.006)		
Rank-Specific Tax Cost				-0.222*** (0.041)	-0.222*** (0.039)
Part 1 Tax Choice					0.003*** (0.001)
Female	0.113*** (0.032)	0.113*** (0.027)	0.090*** (0.029)	0.015 (0.053)	-0.011 (0.052)
African-American	-0.043 (0.065)	0.038 (0.061)	0.049 (0.062)	0.020 (0.093)	0.057 (0.093)
Asian	0.016 (0.044)	0.022 (0.037)	0.006 (0.039)	0.090 (0.072)	0.092 (0.069)
Hispanic	0.001 (0.053)	0.032 (0.056)	0.054 (0.062)	0.167 (0.104)	0.196* (0.100)
Other	0.061 (0.064)	0.009 (0.055)	0.064 (0.059)	0.030 (0.146)	-0.016 (0.132)
Home area income (log)	-0.036 (0.025)	-0.064*** (0.024)	-0.038 (0.027)	-0.023 (0.036)	-0.022 (0.038)
Risk Aversion Index (1-5)	0.006 (0.004)	0.006* (0.003)	0.004 (0.004)	0.000 (0.006)	-0.002 (0.006)
Politically Liberal (1-7)	0.035*** (0.012)	0.030*** (0.010)	0.021** (0.011)	0.022 (0.019)	0.009 (0.020)
# Economics Courses Taken		-0.008 (0.006)	-0.003 (0.007)	0.021** (0.010)	0.021* (0.011)
Observations	1,340	1,340	1,005	588	588
Log-likelihood	-1099	-1051	-645.2	-480.7	-465.2
Pseudo-R^2	0.0647	0.0806	0.231	0.242	0.267

The table reports the results in columns 2, 4, 5, 7 and 8 of Table 2 displaying the coefficients of the following individual controls: a dummy for female subjects; ethnic background dummies (African-American, Asian, Hispanic, other ethnic background; baseline: Caucasian); log of home area income (calculated from subjects' zip code or country of origin); risk aversion index (on a 1-5 scale from less to more risk averse, based on subjects' choices in the task reproduced in Table S.3); self-reported political ideology (on a 1-7 scale from less to more Liberal); number of economics courses taken. See Table 2 for a description of the other variables. Robust standard errors clustered by individual in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

E: Using Questionnaire Evidence to Incorporate Preference Heterogeneity

The utility estimates from our conditional logit model are not individual specific, and do not tell us anything about the heterogeneity between subjects. To take into account variation in preferences between the subjects and provide a robustness check on our results, we use the heterogeneity in the questionnaire responses. In particular, we assume that the intensity of individual preferences is measured by the survey responses, and use these responses as interaction terms on the regressors. Letting ω_i denote the interaction term for subject i, the utility function to be estimated is

$$u_{it} = \beta_1 \cdot Ey_{it} + \beta_2 \cdot \omega_i^{sd} \cdot \sigma_{y_{it}} + \beta_3 \cdot \omega_i^{min} \cdot y_t^{min} + \beta_4 \cdot \omega_i^{sum} \cdot \sum_j y_{jt}. \tag{A.2}$$

Although the model still provides us only with a common estimate of $\beta_1 - \beta_4$, the utility weights that individuals place on the arguments $\sigma_{y_{it}}$, y_t^{min} and $\sum_j y_{jt}$ now vary (for example, i's utility rises by $\beta_3 \cdot \omega_i^{min}$ when y_t^{min} rises by one unit).

Note that our aim is not to quantify the heterogeneity in the estimates. This would require including the direct effects in the model, which does not fit well with the interpretation of utility estimates. Rather, we use the heterogeneity that we have found in Section 4.1 as a robustness check on our estimates. Of course, in adopting this model, we assume that coefficients on the variables and their importance in the utility function differ among individuals in a manner proportionate to their questionnaire responses. Moreover, we assume that the preference heterogeneity captured in the ω_i term influences utility only through the corresponding preference term in the utility function.

We construct the ω_i terms as follows.

Results

The results are reported in the upper part of Table S.7, where we pool the data from Part 1, 2 and 3 of the experiment. Standard errors are clustered by individual. The first column combines all income methods, the second and third columns split the result between the 'arbitrary'

[28] On the basis of the lottery task we constructed two measures of risk aversion. Let $i \in \{1,2,3,4,5\}$ be the number of the respective question in the task. The first measure attaches a value $i-1$ to a subject who switches from the sure outcome to the lottery in the ith question, and 5 if the individual always chose the sure outcome. Thus, the measure had a range from 0 to 5. 27 Subjects did not have an unique switching point, and could thus not be evaluated with this measure. To avoid throwing away these data, we constructed a second measure that we used in our calculations. This measure is the sum of those questions i where the subject chose the sure outcome, and has a range from 0 to 15. For example, if the subject chose the sure outcome in question 1, 3 and 4, the measure would be $1+3+4=8$. Although we used this second measure in our calculations, all our results would hold if use the first measure instead.

Standard deviation (ω_i^{sd})	We construct a measure of risk aversion on the basis of the risk elicitation task presented in Section A of this appendix.[28] In order to avoid extreme values of the weights we took the square root of this measure, and normalized by the sample mean so that the average was equal to 1.
Minimum (ω_i^{min})	We use the answer to the question "Which of the following best describes your political philosophy (ideology), on a scale of 1 (Very Conservative) to 7 (Very Liberal)?". The score was normalized by dividing each individual's response by the sample mean.
Aggregate income (ω_i^{sum})	We use the number of economics courses the subject reports having taken. The number of courses was normalized by dividing each individual's response by the sample mean. This variable was quite right-skewed, i.e. there are many people with no courses and few people with many courses. To avoid very extreme values we took the square root as our interaction term, again correcting to make sure that the mean is equal to 1.

and 'earned' inequality treatments. As in Table 3 in the main text, the last three columns report the results of the model when we use the perceived standard deviation of income (which takes into account differences in confidence about estimated own rank by individual and income method).

The results are very much in line with those reported in the main text. The coefficient for expected income is significant and positive in any specification. The coefficient for the standard deviation of income is negative in the pooled and arbitrary income methods and very significantly so when we use the perceived income risk (columns 4 and 5). The coefficient for minimum income is positive and significant in the arbitrary income methods, and to a lesser degree in the pooled specification. The significance level and size of this coefficient are now somewhat higher than that in the main text. Perhaps the most important difference with the main text is that the utility weight estimate for aggregate income is now higher than before and significant in the pooled specification (column 4). Reflecting these last two observations, the weight on social concerns λ is now higher in the pooled specification.

Table S.7: Standardized Estimates of Utility Function Parameters From the Model A.2

Dep. Var.: Tax Rate	(1) All Methods	(2) Random - WF	(3) Tetris - Quiz	(4) All Methods	(5) Random - WF	(6) Tetris - Quiz
Expected income	0.227***	0.237***	0.233***	0.229***	0.241***	0.233***
	(0.018)	(0.023)	(0.021)	(0.018)	(0.024)	(0.021)
ω_i^{sd}* St. dev. of income	-0.005	-0.021***	0.010			
	(0.006)	(0.007)	(0.007)			
ω_i^{var}* Perceived st. dev. of income				-0.030***	-0.038***	0.013
				(0.008)	(0.009)	(0.012)
ω_i^{min} * Minimum income	0.027***	0.053***	0.003	0.022**	0.050***	0.002
	(0.010)	(0.012)	(0.011)	(0.010)	(0.012)	(0.011)
ω_i^{sum} * Aggregate income	0.005	0.005	0.004	0.005*	0.005	0.004
	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
λ	0.120***	0.183***	0.030	0.092**	0.165***	0.025
	(0.038)	(0.036)	(0.052)	(0.036)	(0.034)	(0.054)
γ	0.023	0.083***	-0.046	0.114***	0.137***	-0.062
	(0.025)	(0.025)	(0.032)	(0.028)	(0.026)	(0.061)
δ	0.858***	0.917***	0.460	0.821***	0.911***	0.317
	(0.066)	(0.0454)	(0.736)	(0.078)	(0.047)	(1.205)
Observations	3268	1634	1634	3268	1634	1634

Standard errors in parentheses. Standard errors clustered by individual. * p<0.10, ** p<0.05, *** p<0.01

F: THE FEHR-SCHMIDT (1999) MODEL

The most cited model in the field of social preference research is due to Fehr and Schmidt (1999, henceforth FS). In this Section we investigate the predictions of this model in our experiment and perform an estimation of its parameters using our experimental data.

Since the FS model does not account for risk, we augment the FS model with risk preferences (as we did with the Charness-Rabin model), which yields the following utility function:

$$u_i = E_i y_i - \gamma \sigma_{y_i} - \frac{\alpha_i}{n-1} \sum_{j \neq i} \max\{y_j - y_i, 0\} - \frac{\beta_i}{n-1} \sum_{j \neq i} \max\{y_i - y_j, 0\}. \tag{D.1}$$

In words, utility is increasing in own income, and decreasing in the standard deviation of own income, as well as in the inequality between the decision maker and the other players. Specifically, α measures the strength of aversion towards disadvantageous inequality (other people having more), and β measures the strength of the aversion towards advantageous inequality (other people having less).

We generate some predictions for the behavior in our experiment (the computations are available on request):

a. The average tax rate declines with (expected) own income and with the tax cost.

b. The average tax rate decreases in the efficiency loss in Part 2 and 3, but increases in the efficiency loss in Part 1.

These predictions are rather intuitive, except for the fact that in Part 1 the optimal tax rate increases with the efficiency loss. The reason for this surprising result is that the FS model does not explicitly account for efficiency considerations, and the efficiency loss interacts with the assumption of inequality aversion in a counterintuitive way. A decision maker who cares about disadvantageous inequality will want to reduce the incomes of the richest people in the sample and a higher efficiency loss means taxes are a more effective tool to do so. One can show that under the values for α and β found in FS, this effect outweighs the countervailing motive to avoid advantageous inequality, and therefore a higher efficiency loss implies a higher optimal tax rate.

Two caveats are worth noticing. In the first part of the experiment, the decision maker is an outsider who does not benefit from redistribution. It is therefore unclear whether she would take the self-centered view that the FS model assumes. Put differently, our experiment is predicated on the possibility that people care about the degree of inequality in society somewhat independently of their own standing, but such concerns are not modeled by FS. Furthermore, in the Part 3 sessions where the tax cost is low, the model only predicts corner solutions. Taxes do not change the income rank of the decision maker, and the model is linear. Thus, a decision maker will either choose 100% redistribution or no redistribution, depending how much she cares about inequality.[29] Therefore, the model can predict intermediate tax choices only as a matter of averages (i.e., the proportion of 0% versus 100% tax choices).

As we see in the main text, the Tobit regressions do corroborate the results of the first hypothesis and the first part of the second hypothesis. However, they falsify the second part of the second hypothesis. In order to get more evidence for the model, we try to estimate its structural parameters.

Structural Estimates

We use the methodology of Section 4.2 to get structural estimates for the parameters in the FS model. That is, we employ McFadden's conditional logit model, where own income and the standard deviation of income are computed as described in the main text. Advantageous and disadvantageous income inequality is computed for each possible tax level (i.e., the eleven possible values of t), income method, part of the experiment and individual. The utility function u_{it} to be estimated is given by

$$u_{it} = \beta_1 y_{it} + \beta_2 \sigma_{it} + \beta_3 \frac{1}{n-1} \sum_{j \neq i} \max\{y_{jt} - y_{it}, 0\} + \beta_4 \frac{1}{n-1} \sum_{j \neq i} \max\{y_{it} - y_{jt}, 0\}. \qquad \text{(D.2)}$$

The results are reported in the upper part of Table S.8, where we pool the data from Part 1, 2 and 3 of the experiment and standard errors are clustered by individual. The first column combines all income methods, the second and third columns split the result between the 'arbitrary' and 'earned' inequality methods. As in Table 3 in the main text, the last three columns report the results of the model when we use the perceived standard deviation of income, which takes into account differences in the confidence with which individual subjects believe they can estimate their pre-tax earnings under different income determination methods.

The coefficient for 'expected income' is positive and highly significant in all specifications. Furthermore, the coefficient for 'standard deviation of income' has a negative sign in all specifications and is significant in most specifications. The size of these coefficients is comparable to those of the CR model in the main text. The coefficient for 'Disadvantageous inequality' is positive and significant except in the arbitrary income treatments. This is consistent with the greater acceptance of 'earned' inequalities on which we comment in the main text of the paper. The coefficient for 'Advantageous inequality' is negative in most specifications and is never significant.

The bottom part of Table S.8 presents the estimates for α and β, obtained by normalizing

[29] Mathematically speaking, the tax rate drops out of the first order condition, yielding a corner solution for the optimal tax rate. The same happens in the CR model for Part 1.

the coefficients so that the coefficient for ‘Expected income’ equals 1. Standard errors are calculated by the delta method. The results provide at most mixed evidence for the existence of inequality aversion. On the one hand, a Wald test rejects the hypothesis that *both* inequality parameters are equal to zero for the pooled specification (column 4, $\chi^2 = 10.59$, $p = 0.005$) and the earned income methods (column 6, $\chi^2 = 21.29$, $p = 0.000$) . On the other hand, contrary to both the theory and the results presented in Fehr and Schmidt (1999), the estimate for α has a negative sign, indicating that subjects like disadvantageous inequality. The estimates for β are of the hypothesized sign, but insignificant. Overall, the results do not lend support to the idea that subjects use taxes as an instrument to bring down the income of the highest earners out of envy.[30]

[30] To be sure, heterogeneity of preferences among individuals plays an important role in Fehr and Schmidt's (1999) paper and subsequent discussions. An analysis along the lines of Section E, above, might accordingly be of interest.

Table S.8: Estimated (standardized) utility weights for the Fehr-Schmidt (1999) model

Dep. Var.: Tax Rate	(1) All Methods	(2) Random - WF	(3) Tetris - Quiz	(4) All Methods	(5) Random - WF	(6) Tetris - Quiz
Expected income	0.217***	0.217***	0.244***	0.229***	0.233***	0.244***
	(0.030)	(0.032)	(0.041)	(0.031)	(0.034)	(0.041)
Standard dev. of income	-0.031***	-0.053***	-0.009			
	(0.006)	(0.008)	(0.007)			
Perceived st. dev. of income				-0.070***	-0.077***	-0.024*
				(0.008)	(0.010)	(0.013)
Disadvantageous inequality	0.055*	0.007	0.116***	0.074**	0.018	0.120***
	(0.032)	(0.038)	(0.041)	(0.032)	(0.038)	(0.041)
Advantageous inequality	0.004	-0.006	-0.004	-0.0007	-0.016	-0.004
	(0.033)	(0.038)	(0.046)	(0.035)	(0.039)	(0.045)
α	-0.254**	-0.032	-0.477***	- 0.323**	-0.077	-0.491***
	(0.130)	(0.173)	(0.125)	(0.118)	(0.156)	(0.123)
β	-0.018	0.027	0.017	0.003	0.068	0.016
	(0.156)	(0.172)	(0.184)	(0.151)	(0.160)	(0.184)
Observations	3268	1634	1634	3268	1634	1634

Standard errors in parentheses, clustered by individual. *** p<0.01, ** p<0.05, * p<0.1.