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Aspirations of the middle class: Voting on redistribution and status concerns

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Abstract

Aspirations of the Middle Class:
Voting on Redistribution and Status Concerns

Kai A. Konrad and Florian Morath[*]

This paper analyzes the role of narrowly selfish and other-regarding preferences for the median voter in a Meltzer-Richard (1981) framework. We use computerized and real human co-players to distinguish between these sets of motivations. Redistribution to real co-players has a negative effect on the median voter's tax rate choice. Further, perceived income mobility decreases the desired amount of redistribution. Our results suggest the importance of concerns about own mobility as well as status concerns of the median voter who tends to keep distance to the low-income group, whereas inequity aversion does not play a role in the political economy context.

Keywords: Redistribution, other-regarding preferences, median voter, experiments

JEL classification: C91, D03, D72, D78, H20

1 Introduction

Individuals care about the distribution of income and its redistribution. They may care because they have genuine other-regarding preferences. Alternatively, a desire for (re-)distribution may be purely instrumental and caused by motivations that are genuinely fully selfish. This paper provides experimental evidence for genuinely selfish motives for redistribution and own income mobility to be the more important drivers for redistributional preferences.

Genuine other-regarding preferences may be based on several considerations. Individuals could dislike highly asymmetric outcomes because they find them unfair and feel better if the distribution is more even. Likewise, individuals may feel sorry for the ones having less and suffer from others having more than themselves.[1] Alternatively, individuals may genuinely like it if others gain -whether or not these others are rich or poor- because they feel altruism or compassion. Or they may dislike this, because they are spiteful or envious, or because they have a genuine concern for status and a desire for high own relative standing. Such feelings may have developed through an indirect evolutionary approach by which types and mutations of types are described by their preferences.[2] Adam Smith (1759) described such preferences and claimed their existence in the very first paragraph of *The Theory of Moral Sentiments*:

> How selfish soever man may be supposed, there are evidently
> some principles in his nature, which interest him in the fortune
> of others, and render their happiness necessary to him, though
> he derives nothing from it except the pleasure of seeing it. Of

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[1]This assumption underlies an important and most influential line of research that started with Bolton and Ockenfels (2000) and Fehr and Schmidt (1999), who show that a large set of experimental results is consistent with optimizing behavior if individuals maximize payoff functions that are characterized by inequity aversion.

[2]For some examples of other-regarding preferences that can be founded by an evolutionary approach, see Güth and Yaari (1992), Bester and Güth (1998), Huck and Oechssler (1999), Konrad (2004).

> this kind is pity or compassion, the emotion which we feel for the
> misery of others, when we either see it, or are made to conceive
> it in a very lively manner.

Rather differently, redistributional preferences may follow purely instrumental motives. For instance, individuals may prefer stable institutions and may find the commitment of a society for some amount of redistribution desirable, because their own income position may be subject to negative or positive shocks, and they enjoy the insurance aspect of governmental redistribution.[3] This insurance motive may then be larger or smaller, depending on the individual's perceptions about the likelihood of own upward (downward) mobility.[4] Moreover, individuals may care about their income position relative to others, because relatively high income is a signal of future high income, or because it grants access to absolutely scarce goods and opportunities, including improved prospects in the marriage market.[5]

Which of these reasons applies or is the more important cause of distributional preferences is relevant both for a theory of economic behavior and for welfare considerations. It is not easy to discriminate between these theories empirically. In the experimental laboratory, however, we can discriminate between some classes of these theories. In particular, we can test whether or not a preference for more redistribution is driven by the existence of a given reference group; hence, whether individuals genuinely care about the co-players with whom they interact, and whether they prefer the payoffs of their co-players to be closer to their own payoff. For this purpose we consider individuals in several treatments that are variants of the well-known Meltzer-Richard (1981) framework, which is the benchmark model for describing the political economy process of redistribution. In this framework individuals

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[3] This insurance motive has been analyzed formally by Varian (1980).

[4] This motivation is considered by Bénabou and Ok (2001).

[5] This latter consideration is prominent in Hirsch (1976), but also in formal theories of relative standing comparisons such as those posited by Frank (1984, 1985), Cole et al. (1992), Glazer and Konrad (1996), and Corneo (2000).

know the general distribution of abilities and their own ability. They then choose their preferred proportional income tax. The median voter preference is implemented, and individuals choose their labor effort, followed by taxation of gross incomes and lump-sum per-capita redistribution. We consider several variants of this framework, where the co-players are real subjects in some treatments and where there are no human co-players in some other treatments.

More specifically, we consider a 2 x 2 design. The treatments differ along two dimensions. One dimension introduces or removes a human reference group: in two of the treatments the individuals interact with players that are simulated by computers, and each individual knows that any redistribution is between himself/herself and the computer. In two other treatments the individuals choose their favorite amount of income redistribution, knowing that their co-players are real human beings and anticipating the resulting distribution of incomes after redistribution. Genuine preferences for equity should materialize in the treatments with real co-players, but not in the treatments with computer-simulated co-players. For the player who has the median position in the society, this suggests more redistribution if the player interacts with real players than if the player interacts with a computer.

The second dimension distinguishes between two types of income mobility across a series of independent but identical games. In one type of games, the individual keeps his/her gross wage and position in the income hierarchy throughout all games. In the second type of games, the individual is assigned different positions in the income distribution throughout the rounds. Such income mobility throughout the (independent) rounds of the experiment may affect the individuals' perception of efficiency and tax distortion as well as their comparison to the reference group. By a random-matching design we eliminate possible (quasi) repeated game effects in all treatments.

We find that, in the absence of own income mobility and when removing the reference group, players maximize their own material payoff. They be-

have closely in line with the theoretical predictions of the Meltzer-Richard (1981) framework. Interaction with real players yields a (weakly significant) deviation from the Meltzer-Richard predictions, but this deviation is in the opposite direction of what would be predicted by a theory of inequity aversion: individuals choose *less* redistribution in the presence of a reference group than when they interact with computers. Compared to the prediction from maximizing material payoff, median voters adjust the income distribution in favor of the rich, at the expense of both the poor and themselves. One possible explanation is that the presence of real co-players makes median voters care more about overall efficiency and total payoffs. Also, if individuals have status concerns, median voters may try to distinguish themselves more clearly from the poor, rather than trying to be closer to the rich. By choosing lower tax rates, the median voter can keep a larger distance to the group of low-productivity individuals.[6]

We also find that income mobility across formally independent rounds has a significant impact on median tax rates. It makes individuals choose lower redistributive taxes than with fixed productivities, and this effect is large and statistically significant when players interact with computers. A reason for this result might be that the individuals develop a stronger sense for efficiency when experiencing different roles during the experiment. The redistribution-decreasing effect of own income mobility across rounds is smaller and insignificant when players interact with real players. Moreover, the effect from introducing real co-players is not significant in the treatments with income mobility.

If individuals choose lower tax rates than predicted because they care about overall efficiency, such considerations should be more pronounced in the treatment with fluctuating productivities where income positions are changing during the experiment. The size of the effect of a reference group,

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[6]This explanation based on relative standing comparisons is very much in line with the theory predictions in Corneo and Grüner (2000).

however, is smaller (although not significantly different) in the treatment with fluctuating productivities than in the treatment with fixed productivities. This suggests that status concerns vis-à-vis the poor are the more consistent explanation for the observed choices on redistribution. Such status concerns could also explain why the effect of the reference group becomes insignificant when income positions are changing during the experiment and hence, on average, differences across individuals are equalized.

The work by Meltzer and Richard (1981) has stimulated a large empirical literature focusing on the relation between income and preferences for redistribution; these studies, however, have led to mixed results.[7] In the experimental laboratory, the many additional aspects that determine preferences for redistribution and interact with the benchmark effects can be removed or controlled for. The theory of inequity aversion developed by Bolton and Ockenfels (2000) and Fehr and Schmidt (1999) has generated considerable debate and has played a dominant role in many areas of economics more recently. Whether or not inequity aversion is at work in the context of political decision-making on income distribution is, hence, a question of major importance.[8] While we are not aware of any experiment that analyzes other-regarding preferences in a framework that incorporates the Meltzer-Richard theory, existing experimental evidence mainly supports the importance of social preferences for choices of redistribution, but also the im-

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[7]Neustadt and Zweifel (2009) find that Swiss citizens' demand for redistribution increases with income and higher self-positioning, which they interpret as being in contradiction with the Meltzer-Richard (1981) model. Corneo and Grüner (2002) find a negative impact of higher income for individuals' desire for more income redistribution, but they also show that social rivalry and social norms are relevant determinants. Krusell and Ríos-Rull (1999) argue that their calibration model of a dynamic Meltzer-Richard framework predicts transfers that are "quite close" to empirical data. Moene and Wallerstein (2001) show that deviations from the Meltzer-Richard prediction on the impact of inequality can be explained by distinguishing among different categories of welfare spending. Ravallion and Lokshin (2000) find evidence for a strong relationship between own earnings prospects and attitudes towards redistribution for Russia.

[8]Excellent surveys of the theories of other-regarding preferences and experimental results are, for instance, Fehr and Schmidt (2006) and Cooper and Kagel (2009).

pact of efficiency considerations. Tyran and Sausgruber (2006) analyze a case where subjects endowed with different income levels vote on a fixed amount of redistribution. They find that Fehr-Schmidt-type inequity aversion may explain their experimental results on voting on redistribution. Engelmann and Strobel (2004) challenge the role of inequity aversion, asking whether efficiency considerations and maximin preferences could be a more compelling explanation for experimental findings. In their experiment, subjects choose between different income allocations. By varying total and relative payoffs, Engelmann and Strobel explain the observed choices as being driven by selfishness together with efficiency concerns and maximin preferences, rather than inequality aversion. Durante and Putterman (2009) focus on the role of self-interest, risk aversion, and fairness considerations in a framework with redistributional taxes; their results mainly provide support for the importance of self-interest. Krawczyk (2010) analyzes preferences for redistribution of randomly generated income and distinguishes whether the probabilities of winning a high income are randomly assigned or result from individual effort/ability. Similarly, Esarey, Salmon and Barrilleaux (2010) use a laboratory experiment to measure the role of left-wing or right-wing ideology for redistributive preferences. In our analysis, we consider preferences for redistribution in an institutional framework where individuals choose both income-generating effort and a redistributive tax rate, and where taxation involves incentive costs. By establishing a benchmark for redistributional choices in the absence of a reference group, we find deviations from material payoff maximization, but the evidence suggests that these deviations must be attributed to theories other than genuine other-regarding preferences.

In the next section, we describe the theoretical political economy framework, the experimental set-up, and the theory predictions. The main experimental results are in Section 3. Section 4 concludes.

2 The formal setup

2.1 A Meltzer-Richard framework

Our experiment is based on the framework by Meltzer and Richard (1981) (MR). We consider an economy that consists of three individuals. Individual $i \in \{1, 2, 3\}$ has a commonly known productivity (wage) w_i where $w_1 < w_2 < w_3$ and is a player in a two-stage game.

In STAGE 1, each individual i states a proportional tax rate $\tau_i \in [0, 1]$ which he/she would like to implement in the economy. The mechanism that determines the tax rate selected and implemented for the economy is a short-cut of the median voter theory (as employed in MR): we simply assume that the median choice of the three preferred tax rates is selected and implemented.

In STAGE 2, each individual i knows the implemented tax rate τ and chooses a work effort $x_i \in \mathbb{R}_+$. The individual wage is equal to the output it generates. Given the tax rate τ and all three individuals' effort choices, individual payoff equals

$$\pi_i = (1 - \tau) w_i x_i - \frac{x_i^2}{2} + \frac{1}{2} \sum_{j \neq i} \tau w_j x_j. \tag{1}$$

This payoff consists of the following components. The own effort choice together with the individual productivity determines an individual's gross income as $w_i x_i$. This gross income is taxed at the tax rate τ. Moreover, there is a disutility from work effort which is assumed to be equal to $x_i^2/2$. Finally, the tax revenue is used solely for lump-sum redistribution. If there are n individuals, each individual obtains the same share $1/(n-1)$ of the tax payments of the other $(n-1)$ individuals in the economy, where here $n = 3$. This constitutes the last term in (1). Hence, as in the case with infinitely many individuals, individuals correctly anticipate that their own tax payment has a zero impact on the redistributive transfer they obtain.

To solve for the subgame perfect equilibrium, we first determine the optimal effort choice given the tax rate τ. Differentiating (1) with respect to x_i yields an optimal effort choice which is equal to

$$x_i^* = (1 - \tau) w_i. \tag{2}$$

Hence, individual i's effort is equal to the own net wage rate. Note that it is independent of the choices and productivities of the other individuals.

Inserting this effort choice for individuals $1, 2, 3$ into individual i's payoff function (1) yields a payoff of

$$\pi_i(\tau) = \frac{1}{2}(1 - \tau)^2 w_i^2 + \frac{1}{2}\tau(1 - \tau) \sum_{j \neq i} w_j^2. \tag{3}$$

If each voter chooses the tax rate that maximizes his own payoff, given that this tax rate is implemented and given that this induces all other individuals to choose their payoff maximizing work effort, the first-order condition with respect to τ transforms into

$$\tau(w_i) = \frac{w_i^2 - \frac{1}{2}\sum_{j \neq i} w_j^2}{w_i^2 - \sum_{j \neq i} w_j^2}. \tag{4}$$

Examining the second-order condition shows that the individual with the highest wage w_3 prefers a tax rate of zero,

$$\tau(w_3) = 0. \tag{5}$$

Individual 1 with the lowest productivity prefers a strictly positive tax rate which is given in (4). The optimal tax rate choice of individual 2 with the median productivity is equal to

$$\tau(w_2) = \begin{cases} \frac{w_2^2 - \frac{1}{2}w_1^2 - \frac{1}{2}w_3^2}{w_2^2 - w_1^2 - w_3^2} & \text{if } w_2^2 < \frac{1}{3}\sum_i w_i^2 \\ 0 & \text{otherwise} \end{cases}. \tag{6}$$

The median voter prefers a strictly positive tax rate whenever w_2 is sufficiently small such that he benefits from redistribution.

2.2 Experimental design and hypotheses

Design The experiment maps a Meltzer-Richard framework in which a trade-off between efficiency and equity exists. The general research question is how individuals vote on redistribution if redistributive taxation is distortive and individuals vote on a tax rate as well as generate income to which the tax rate is applied. More specifically, we consider four treatments which are designed to answer two sets of questions. First, how do individuals vote on redistribution between themselves and real players in a reference group, compared to a situation in which there is no reference group? An answer to this question yields insights about whether other-regarding preferences are genuine, or derived by genuinely selfish motives. Second, how do tax rate choices within one round change when the individual productivity can change between (independent) rounds? How do such fluctuations of productivity influence the median voters' preference for redistribution?

In order to isolate the additional effects of other-regarding preferences and of varying productivities, we use a 2×2 between-subjects design. Our first question is on the impact of other-regarding preferences on the individuals' preferred tax rates. Here, we contrast a setup where participants are grouped into economies consisting of three 'real individuals' (*real co-players*) with a treatment where a participant's co-players were simulated by computers (*simulated co-players*). In the treatments with real co-players, the participants were told that, in each round, they would be grouped into economies of three participants, one with a low productivity, one with a medium productivity, and one with a high productivity. The same applied to the treatments with simulated co-players, but here, the participants were informed that only one player per group would be a 'real participant' and that the other two individuals in this economy would be replaced by com-

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	Fixed productivity	Fluctuating productivity
Simulated co-players	"FIXEDSIM" # participants: 24 # economies per round: 24	"FLUCTSIM" # participants: 24 # economies per round: 24
Real co-players	"FIXEDREAL" # participants: 72 # economies per round: 24	"FLUCTREAL" # participants: 72 # economies per round: 24

Table 1: Overview of the experimental design

puters - hence, their co-players would be computers. It was stated in the instructions that the computer would choose tax rates and work effort so as to achieve the highest payoff for the respective simulated player. All other aspects of the experiment remained exactly the same in the treatments with real and with simulated co-players.

Changes of productivities throughout the rounds of the experiment can have important effects on preferred tax rates, as we will discuss in greater detail when we state our main hypotheses. Changing the participants' roles (individual with low, medium, or high productivity) during the experiment could affect their perception of tax distortion effects, could lead to stronger empathy with the other individuals, and may change the notion of a 'fair' tax rate. We distinguish two setups. In the treatments with *fixed productivity*, the participants kept their role/productivity throughout all rounds of the experiment. They were told that, at the beginning of the experiment, their productivity would be randomly assigned and that they would keep this productivity in all rounds of the experiment. In contrast, in the treatments with *fluctuating productivity*, the participants were informed that their productivity would be newly assigned in each round with equal probability of obtaining one of the productivities. Each single round, however, was com-

pletely identical to the treatments with fixed productivity, since the current productivity was announced at the beginning of each round. Table 1 summarizes the four treatments: "FIXEDSIM" and "FIXEDREAL" on the one hand, and "FLUCTSIM" and "FLUCTREAL" on the other hand.

In each of the four treatments, the two-stage game described in the previous section was played 12 times. The participants of the experiments were students from different fields of study.[9] In each session, after the instructions had been read, the participants had to answer questions regarding their understanding of the experiment. By answering these questions, the participants earned their endowment in the experiment. After the 12 rounds, the participants had to fill in a questionnaire with statistical information. Finally, the participants were paid in private. One session lasted about 75 minutes, and, on average, a participant earned 14 euros, plus a show-up fee.

In each round, individuals were grouped into sets of three players. In the treatments where co-players were simulated, this was revealed to the participants. The productivities used in all treatments were equal to

$$w_1 = 0, \ w_2 = 3, \ \text{and} \ w_3 = 6.$$

Thus, in each group consisting of three players (either three real players or one real and two simulated players), there was one player with a productivity of 0, one with a productivity of 3, and one with a productivity of 6. If players choose their work effort according to the theory prediction given in (2), payoff-maximizing tax rate choices are

$$\tau(w_1) = 50\%, \ \tau(w_2) = 33\%, \ \text{and} \ \tau(w_3) = 0\%, \tag{7}$$

dependent on the individual productivity $w_i \in \{0, 3, 6\}$ (compare (4)-(6)).

The sequence of actions per round was as follows. At the beginning of each

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[9]The experiment was programmed and conducted with the experiment software z-Tree (Fischbacher 2007) and run at the MELESSA lab of the University of Munich. The participants were recruited using the software ORSEE (Greiner 2004).

round, the participants were displayed their productivity and had to state the tax rate (as an integer between 0 and 100) they would want to implement in their economy. The computer selected the median tax rate within an economy (consisting of 3 players), which was implemented in this economy and round.[10] The implemented tax rate was displayed on the computer screen, and then the participants had to choose their work effort as a non-negative real number.[11] At the end of each round, participants were displayed their own choices and their own payoff.

In the treatments with simulated co-players, once the tax rate was implemented, the computer chose the payoff-maximizing work effort (as in (2)) for the simulated players, which is independent of the other players' decisions. The simulated players' preferred tax rate depends on work effort choices in stage 2. We let the computer choose the simulated players' preferred tax rate as if work effort choices are in line with the theory prediction. Of course, we do not use these choices as observations. Our analysis uses the real players' choices of their preferred tax rates as observations, and these are independent of the tax rates the computer would choose for the simulated players.

In the instructions, the participants were told that, in each round of the experiment, they would be randomly re-matched with two other participants to form a group. In fact, in the experiment, without being precise about that, we used matching groups of 9 participants to randomly be divided into three 'economies' to obtain a larger number of independent observations. In the treatments with simulated co-players, a matching group consists of only one 'real participant'.

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[10]To be precise, only with probability 0.8 did the computer select the median tax rate; with the remaining probability, either the lowest or the highest of the three proposed tax rates was selected. This deviation from the median voter theory was used to incentivize players with low or high productivity to state their preferred tax rate, and it was made common knowledge. It does, however, not change each player's optimal tax rate choice.

[11]There was an upper bound for this choice equal to 6, which would be the optimal choice of the individual with the high productivity if the tax rate were zero.

Predictions The treatments with simulated co-players constitute an important benchmark when determining preferences for redistribution in a framework with distortionary redistributive taxation. Here, we can examine whether subjects understand the disincentive effect of higher tax rates for work effort and the implication for redistributive taxes. The median tax rate in the FIXEDSIM treatment establishes the median voter's preferred tax rate in a framework where (i) other-regarding preferences and similar considerations can be excluded as potential factors that shape redistributional preferences and (ii) the individuals' balancing of tax distortion effects versus redistribution is undisturbed by fluctuations of individual productivity.

Using the observed choices in the FIXEDSIM treatment as the baseline for a comparison, we are able isolate the effect of other-regarding preferences on the preferred amount of redistribution. We compare a) tax rate choices in FIXEDSIM treatment to choices in the FIXEDREAL treatment, and b) tax rates in FLUCTSIM treatment to those in the FLUCTREAL treatment. Let $\hat{\tau}^m$ denote the average of the empirically observed median tax rates (the preferred tax rates of the individuals with median productivity). If individuals have only self-regarding preferences, maximization of own monetary payoff leads to the first main hypothesis.

Hypothesis 1 *a) In the treatments with fixed productivity, median tax rates are the same with real co-players as with simulated co-players:*

$$\hat{\tau}^m \left(\text{FIXEDREAL} \right) = \hat{\tau}^m \left(\text{FIXEDSIM} \right).$$

b) In the treatments with fluctuating productivity, median tax rates are the same with real co-players as with simulated co-players:

$$\hat{\tau}^m \left(\text{FLUCTREAL} \right) = \hat{\tau}^m \left(\text{FLUCTSIM} \right).$$

If other-regarding preferences affect the median voter's preferred tax rate and individuals have inequity aversion, we should observe median tax rates

in the treatments with real co-players that are higher than in the treatments with simulated co-players:

$$\hat{\tau}^m \left(\text{FIXEDREAL} \right) \;\; > \;\; \hat{\tau}^m \left(\text{FIXEDSIM} \right)$$

$$\hat{\tau}^m \left(\text{FLUCTREAL} \right) \;\; > \;\; \hat{\tau}^m \left(\text{FLUCTSIM} \right)$$

Intuitively, by choosing a higher tax rate, the median voter increases the income of the poor individual in the society, and at the same time, he decreases the distance between his income and the income of the rich individual. Hence, the median voter's preference for redistribution should be stronger when individuals care about equity.

Then, we analyze how changes in productivity affect median tax rates. Since rounds are completely independent and there is no uncertainty about the productivity in each single round, standard economic theory predicts that fluctuations of individual productivity do not change the median tax rates compared to the case of fixed productivities.

Hypothesis 2 *a) In the treatments with simulated co-players, median tax rates are the same with fluctuating productivity as with fixed productivity:*

$$\hat{\tau}^m \left(\text{FLUCTSIM} \right) = \hat{\tau}^m \left(\text{FIXEDSIM} \right).$$

b) In the treatments with real co-players, median tax rates are the same with fluctuating productivity as with fixed productivity:

$$\hat{\tau}^m \left(\text{FLUCTREAL} \right) = \hat{\tau}^m \left(\text{FIXEDREAL} \right).$$

If fluctuations of individual productivity during the experiment lead to median tax rates that differ from those observed with fixed productivity, there are several possible explanations for such a change in behavior. First, when productivity changes during the experiment, individuals may perceive productivities as being random even in the actual round and therefore de-

velop a stronger sense of efficiency. They may take the tax distortion effect better into account and adapt their tax rate choice accordingly. This would lead to median tax rates being *lower* with fluctuating productivity than with fixed productivity. Second, when individuals experience different productivity levels, in the treatments with real co-players this may increase their empathy for the different productivity types; the additional effect on median tax rates, however, is ambiguous.[12] Third, when individuals care about the other individuals' total payoff in the experiment, then the effect of other-regarding preferences should be weaker with fluctuating productivities than with fixed productivities, because total payoffs are equalized in the treatments with fluctuating productivities. In the case of real co-players, this should lead to lower median tax rates with fluctuating productivity than with fixed productivity.

In the treatments with simulated co-players, the second and third effects of fluctuating productivities are excluded by construction: since co-players are simulated by computers, we do not expect empathy for other individuals or other-regarding preferences to play any role. Thus, if median tax rates in the FLUCTSIM treatment differ from those in the FIXEDSIM treatment, we would expect median tax rates to be lower in the FLUCTSIM treatment. Other-regarding preferences could not explain such deviations from the theory prediction; a difference would have to be attributed to the fact that individuals perceive productivities as random and changing over time and therefore choose tax rates that are less distortive. Comparing the treatment effects of fluctuating productivities in the cases of simulated and real co-players, we can shed light on the question of how other-regarding preferences interact with fluctuations of productivity, in addition to the change in the perception of efficiency.

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[12]The individual history in the experiment may help to identify effects of increased empathy for the poor versus the rich individual.

3 Results

This section discusses the main results of our study. Before turning to the tax rate choices, we will examine how the participants adjusted their work effort in reaction to the implemented tax rate. Finding out whether tax distortion of work effort is in line with the theory prediction and whether there are differences between treatments is an important building block for the analysis of preferred tax rates.

We estimate work effort as a function of the net wage,

$$x_{ikt} = f\left((1 - \tau_{kt}) w_{ikt}\right),$$

where w_{ikt} is the productivity/wage rate of individual i in group k and round t and τ_{kt} is the tax rate valid in group k and round t. According to the theory prediction, the slope of the function f should be equal to 1 since predicted work effort is equal to the net wage (see (2)). To allow for different slopes in the different treatments, we interact the net wage with dummy variables FLUCT, REAL, and FLUCTREAL=FLUCT×REAL, included in a vector TR. The variable FLUCT (REAL) is equal to one if the observation comes from a treatment with fluctuating productivity (real co-players), and zero otherwise. In the same way, we allow for treatment-specific intercepts. We estimate a linear regression of the form

$$x_{ikt} = \alpha_0 + \boldsymbol{\alpha} \times TR + \beta_0 \left(1 - \tau_{kt}\right) w_{ikt} + \boldsymbol{\beta} \left(1 - \tau_{kt}\right) w_{ikt} \times TR + \varepsilon_{it}.$$

The estimation results are shown in Table 2.[13]

The most important coefficient is β_0, which estimates the marginal impact of the net wage on effort choices; the estimated coefficient is equal to 1.002 and therefore perfectly in line with the theoretical prediction. Moreover, the

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[13]In the estimation, standard errors are clustered at the level of a matching group (groups of 9 participants in the treatments with real co-players and one participant in the treatments with simulated co-players).

Work effort	
Estimated equation	
$x_{ikt} = \alpha_0 + \boldsymbol{\alpha} \times TR + \beta_0(1 - \tau_{kt})w_{ikt} + \boldsymbol{\beta}(1 - \tau_{kt})w_{ikt} \times TR + \varepsilon_{it}$	
Estimation results	
α_0 (CONSTANT)	0.177
	(0.107)
α_1 (FLUCT)	0.134
	(0.160)
α_2 (REAL)	0.079
	(0.123)
α_3 (FLUCT$\times$REAL)	0.005
	(0.186)
β_0 $((1 - \tau_{it})w_{it})$	1.002***
	(0.021)
β_1 $((1 - \tau_{it})w_{it} \times$FLUCT$)$	0.017
	(0.037)
β_2 $((1 - \tau_{it})w_{it} \times$REAL$)$	-0.021
	(0.028)
β_3 $((1 - \tau_{it})w_{it} \times$FLUCT$\times$REAL$)$	-0.060
	(0.046)
R^2 (overall)	0.821
N	2304

Note: *** significant at 1%. Standard errors in parentheses (clustered at the level of matching groups).

Table 2: Estimation results for choices of work effort.

estimated coefficients β_1 to β_3 are not significantly different from zero.[14]

As a first main result, we find that individuals behave almost perfectly in line with the theory prediction when choosing their work effort, and they behave very similarly across treatments, in particular when we consider only rounds where the participants have already become familiar with the framework. Thus, the individuals understand the disincentive effect that higher taxes have for choices of effort, and they choose their effort so as to maximize their monetary payoff. In turn, they were also able to anticipate the tax distortion effects when stating their preferred tax rate. The fact that individuals understand the trade-off between more redistribution and stronger distortions of effort choices is an important prerequisite for the following analysis of preferred tax rates.

Now we turn to the main part of our paper and analyze tax rate choices. Our estimations will focus on median tax rates and test Hypotheses 1 and 2 on equality of median tax rates across treatments. To start with, we give an overview of tax rate choices; Figure 1 plots the average preferred tax rates in each round, separated by treatment and productivity level.

First, as it becomes obvious in Figure 1, in all treatments preferred tax rates are lower the higher one's own productivity. Hence, independent of the nature of the co-players and productivity changes, own material interest seems to be a strong driving force of tax rate choices. Second, tax rate choices of voters with high productivity are on average $5 - 6\%$ in all treatments and therefore close to the theory prediction of 0%. Tax rate choices of low-productivity voters show more variance, both over time and across treatments (treatment averages are between 57.9% and 73.4%); moreover, they

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[14]There is a significant treatment effect if we compare the FLUCTREAL treatment to the FLUCTSIM treatment. This effect is measured by comparing β_1 (FLUCT) to $\beta_1 + \beta_2 + \beta_3$ (FLUCT+REAL+FLUCTREAL); we can reject at the 5%-level that $\beta_2 + \beta_3 = 0$. This treatment effect becomes non-significant if we drop the observations from early rounds (the first two rounds) and hence account for learning effects. The other treatment effects (β_1, β_2, $\beta_1 + \beta_2$) are non-significant. See Figure 2 for a graphical illustration of the treatment effects in the context of median tax rates.
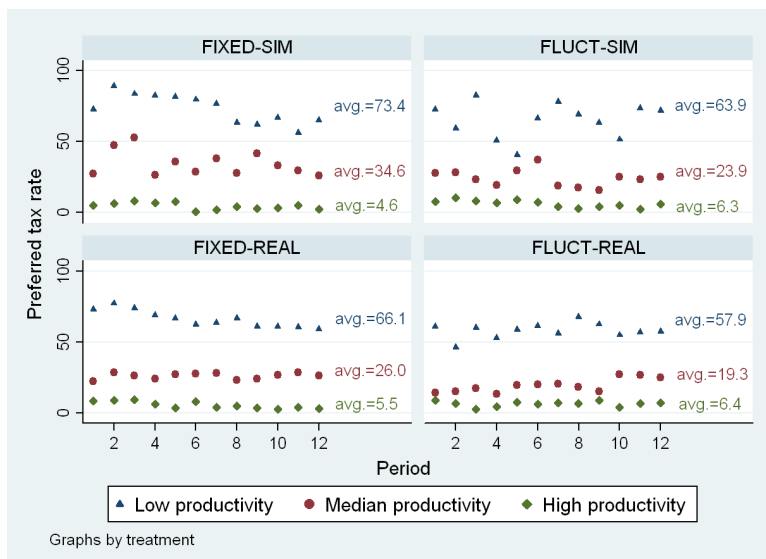
Figure 1: Summary of preferred tax rates (by treatment).

are higher than the theory prediction of 50%. Both higher mean and higher variance could be explained by the fact that those preferred tax rates had almost never been implemented, and thus there was little chance of learning what effect such high tax rates would have for individual payoffs.

Third, and most importantly, Figure 1 shows that there are differences in median tax rates across treatments. In the FIXEDSIM treatment, the average median tax rate is 34.6% and hence almost exactly equal to the theory prediction of 33%. Hence, in the absence of all possible effects that could disturb the tax rate choices, the median voter selects tax rates that perfectly reflect the trade-off between redistribution and efficiency, as predicted by MR. Taking into account other-regarding preferences or fluctuating productivities, however, distorts this choice. With fluctuating productivities (FLUCTSIM), the average median tax rate is only 23.9% and therefore clearly lower; the same occurs in the FIXEDREAL treatment, where we also observe lower median tax rates (26% on average). This is a surprising result, since

the consideration of inequity aversion should have caused median tax rates to be higher. Finally, median tax rates are lowest in the FLUCTREAL treatment (19.3% on average).

Altogether, the inclusion of real co-players leads, both with fixed and with fluctuating productivities, to a decrease of median tax rates, although with fluctuating productivities this effect is smaller. Similarly, the fact that productivities are changing during the experiment decreases median tax rates; here, the effect is weaker with real co-players than with simulated co-players. Hence, even if the effect per se may be surprising, both variations in the experimental setup lead to a consistent change in median voters' choices of tax rates. We will discuss the implications of these results below, after estimating the standard errors corresponding to the average median tax rates. For this purpose, we estimate the median voter's tax rate choice τ_{kt} in group k and period t as a function of treatment dummies (vector TR) as well as control variables for individual-specific characteristics (vector $CONTROL$).[15] The estimation results are shown in Table 3.

The constant α_0 measures the average median tax rate in the FIXEDSIM treatment, which is the baseline category in the estimation. In estimation (1), α_1 and α_2 measure the average effect of fluctuating productivities (FLUCT) and of real co-players (REAL), respectively. Estimations (2)-(4) include the interaction term FLUCTREAL=FLUCT×REAL; hence, α_1 ($\alpha_1 + \alpha_3$) estimates the average effect of fluctuating productivities if co-players are simulated (real participants), and α_2 ($\alpha_2 + \alpha_3$) estimates the average effect of other-regarding preferences in the cases of fixed (fluctuating) productivities (compare Figure 2). In addition, estimations (3) and (4) control for individual-specific characteristics.[16] The results basically confirm what the overview of preferred tax

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[15] Again, we cluster standard errors on the level of matching groups to control for non-independence of observations.

[16] The control variables use data from the exit questionnaire and include gender, age, height, number of siblings, and field and year of study. Apart from gender, age and year of study turn out to have small significant effects. The dummy variable "economist" indicates students from economics, business administration, and business mathematics (in

Median tax rate

Estimation results	Estimated equation $\tau_{kt} = \alpha_0 + \boldsymbol{\alpha} \times TR + \boldsymbol{\beta} \times CONTROL + \varepsilon_{it}$			
	(1)	(2)	(3)	(4)
α_0 (CONSTANT)	33.081***	34.573***	30.057***	29.328***
	(3.389)	(4.501)	(4.673)	(5.285)
α_1 (FLUCT)	-7.692**	-10.724**	-9.775*	-9.872*
	(3.305)	(5.330)	(5.073)	(5.687)
α_2 (REAL)	-6.546*	-8.535	-10.891**	-9.988*
	(3.369)	(5.458)	(4.718)	(5.722)
α_3 (FLUCT×REAL)		4.026	7.763	5.628
		(6.674)	(5.631)	(5.888)
Individual characteristics	No	No	Yes	Yes
male			9.985***	12.820***
			(2.975)	(5.644)
male×REAL				-4.099
				(7.287)
economist				-0.916
				(7.342)
economist×REAL				12.957
				(8.058)
R^2 (overall)	0.052	0.054	0.116	0.142
N	765	765	762	762

Note: Tax rates in percentage. ***(**,*) significant at 1% (5%,10%). Standard errors in parentheses (clustered at the level of matching groups).

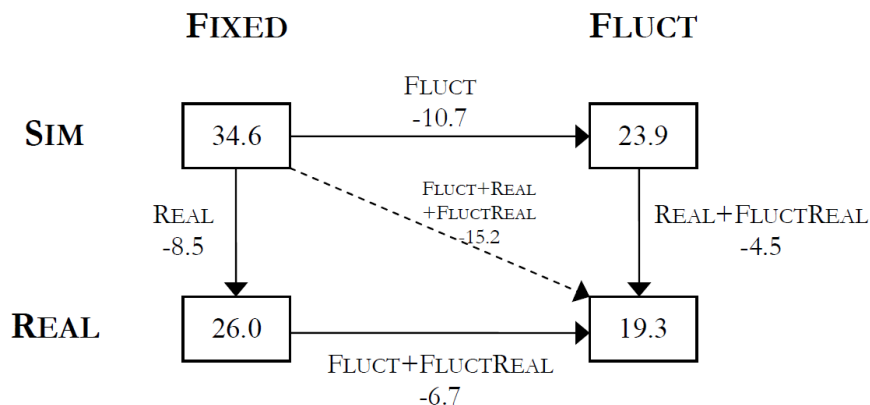Table 3: Regression results for median tax rates.

Figure 2: Average median tax rates (in percentage) and treatment effects.

rates has already suggested. Median tax rates in the FIXEDSIM treatment almost perfectly match the theory prediction, but median tax rates in all other treatments are lower.

Hypothesis 1 Consider first the impact of real co-players, which allows us to examine how other-regarding preferences interact with the balancing of redistribution versus efficiency. Overall, introducing a reference group has a significantly *negative* effect on median tax rate (see α_2 in estimation (1); the corresponding p-value is 0.058). Estimations (2)-(4) separate the effect of real co-players across treatments with fixed and with fluctuating productivities. We find that there is a strong negative effect of having real instead of simulated co-players in the treatments with fixed productivities (see α_2). Median tax rates are by about 10 percentage points lower with real than with simulated co-players; the difference is significant as soon as we control for individual-specific characteristics. Contrary to what one might have expected, we find support for median tax rates being lower, rather than higher, when including the reference group.

The treatment effect of real co-players is weaker in the treatments with

total 17.8% of the participants).

fluctuating productivity (measured by $\alpha_2 + \alpha_3$), and it is not significantly different from zero. The change in median tax rates, however, has the same sign: including other-regarding preferences into the picture leads, if at all, to lower tax rate choices of the median voter. Thus, our evidence suggests that inequity aversion does not play a role for tax rate choices; if at all, other-regarding preferences cause an adjustment of tax rates in the opposite direction than predicted.[17] After testing Hypothesis 2, we will discuss possible explanations for this finding.[18]

Hypothesis 2 Contrary to the theory prediction, changing the productivities during the experiment leads to lower tax rates. The average impact of fluctuating productivities is significant at the 5%-level (see α_1 in estimation (1); p-value is 0.024). Moreover, if we separate treatments with simulated and with real co-players, we find a large and significantly negative effect of fluctuating productivities in the case of simulated co-players where median tax rates decrease by 10 percentage points (see a_1 in estimations (2)-(4)). The effect is weaker and no longer statistically significant in the case of real co-players (compare $\alpha_1 + \alpha_3$ in estimations (2)-(4)).[19]

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[17]Note that separating the choices of economics students from non-economics students reveals that the effect of introducing a reference group is mainly driven by non-economics students (compare estimation (4) in Table 3). In the treatments with simulated co-players, choices from economics students differ only by -0.9 from those of non-economics students; introducing real co-players, however, leads to lower tax rate choices of non-economists (see α_2) while choices of economists remain rather unchanged (compare a_2+economist×REAL).

[18]Running non-parametric tests on average median tax rates per matching group confirms our findings: tax rate choices with and without real co-players do not significantly differ. In the case of fixed productivities we can reject that median tax rates with real co-players are higher than with simulated co-players (FIXEDREAL versus FIXEDSIM); accounting for learning effects and considering only observations from periods $7-12$, we can reject at the 10%-level that median tax rates in FIXEDSIM and FIXEDREAL are the same. Test statistics reflect the importance of individual-specific characteristics for tax rate choices.

[19]Non-parametric tests on average median tax rates per matching group again support these results: we find a significant impact of fluctuating productivity if co-players are simulated (FLUCTSIM versus FIXEDSIM), but we do not find a significant difference in the case of real co-players (FLUCTREAL versus FIXEDREAL).

Keeping in mind that rounds are completely independent from each other and exactly identical in all treatments, this is a strong result. First, in the case of simulated co-players, this effect cannot be attributed to a different perception of co-players in the sense that, for instance, individuals develop increased empathy with other individuals because of productivity fluctuations. An explanation remains that the variability of productivities makes individuals perceive their own productivity as being random, even if, in each particular round, the productivity is fixed. Such a perceived randomness should lead to lower preferred tax rates because efficiency concerns become more pronounced.

Taking together the results from all four treatments, we will now discuss whether redistributive choices are in line with some widely applied explanations for preferences for redistribution. In particular, we will focus on four categories of other-regarding preferences: inequity aversion, reciprocity, maximization of group payoffs, and status concerns.

Inequity aversion. If median voters' preferences express inequity aversion, this should lead to an upward adjustment of median tax rates in order to achieve more redistribution compared to the own payoff-maximizing choice. An increase in redistribution reduces both the distance to the poor and to the rich individual, which increases the utility of inequity-averse individuals. Our estimation results, however, show that such an adjustment of median tax rates can be rejected: in all estimations, we can reject that median tax rates are higher with real than with simulated co-players when productivities are fixed, and we do not find a difference when productivities fluctuate.

Looking only at the treatments with real participants, one might think that individuals do express some degree of inequity aversion since there is less redistribution, although insignificantly, when productivities fluctuate and payoff differences are equalized throughout the experiment. In the same way, however, fluctuating productivities lead to lower median tax rates in the treatments with simulated co-players, where the effect cannot be attributed

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to other-regarding preferences, but rather to a different perception of mobility. On the contrary, the fact that α_3 is positive means that including both fluctuating productivities and other-regarding preferences has weakened one or the other effect, or both (the joint effect of FLUCT and REAL is smaller than the sum of the isolated effects; see also Figure 2). Hence, taking into account the strong effect of fluctuating productivities in the treatments with simulated co-players does not leave room for interpreting the weak difference between FIXEDREAL and FLUCTREAL as inequity aversion.

Reciprocity. Alternatively, the fact that median tax rates are lower in the presence of real co-players could hint at reciprocal behavior: by choosing lower tax rates the median voter might try to induce higher work effort choices by high-productivity individuals and in this way increase his own monetary payoff. To analyze more closely this hypothesis, we run the regression on work effort only for the individuals with the high productivity and estimate the tax elasticity in "some interior interval". In the estimations shown in Table 4, we estimate work effort choices as in Table 2 above, restricting observations to high-productivity individuals and implemented tax rates being between 10 and 50.[20]

Considerations of reciprocity should lead to a stronger tax elasticity of effort choices in the treatments with real participants, i.e., a larger estimated coefficient β. As the estimation results show, however, we do not find evidence for reciprocal behavior in the sense of a larger β in the estimations with real co-players. In contrast, the tax elasticity in the treatments with real participants does not differ from the elasticity in the treatments with simulated participants (compare coefficients β_2 and $\beta_2 + \beta_3$). This is in line with the estimation in Table 2 where we did not find treatment differences with respect to work effort choices.

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[20]The results do not change if we vary the boundaries of the "interior interval" for the tax elasticity. The estimations, however, become more variable if we include implemented tax rates up to 100%; those observations stem almost entirely from the treatments with real participants, where the variance of implemented tax rates is higher.

Work effort of high-productivity individuals

Estimated equation

$$x_{ikt}= \alpha_0 + \boldsymbol{\alpha} \times TR + \beta_0(1-\tau_{kt})w_{ikt}+\boldsymbol{\beta}\,(1-\tau_{kt})\,w_{ikt}\times TR + \varepsilon_{it}$$

Estimation results

α_0 (CONSTANT)	0.194	0.017
	(0.670)	(0.309)
α_1 (FLUCT)	0.344	0.705
	(0.491)	(1.325)
α_2 (REAL)	-0.319	-0.024
	(0.772)	(0.444)
α_3 (FLUCT×REAL)		-0.674
		(1.468)
β_0 $((1-\tau_{it})\,w_{it})$	0.992***	1.024***
	(0.169)	(0.083)
β_1 $((1-\tau_{it})\,w_{it}\times$FLUCT$)$	-0.055	-0.120
	(0.111)	(0.323)
β_2 $((1-\tau_{it})\,w_{it}\times$REAL$)$	0.041	-0.013
	(0.185)	(0.110)
β_3 $((1-\tau_{it})\,w_{it}\times$FLUCT×REAL$)$		0.123
		(0.346)
R^2 (overall)	0.347	0.348
N	538	538

Note: *** significant at 1%. Observations included if wage rate equals 6 and tax rate between 10 and 50. Standard errors in parentheses (clustered at the level of matching groups).

Table 4: Tax elasticity of effort choices of high-productivity subjects.

Maximization of group payoffs. If median voters care about total payoffs within their society, this would explain why we observe lower tax rates whenever there are real co-players. (In addition, we would expect effort choices to be higher; the estimation results in Table 2, however, confirm that effort choices maximize own monetary payoff.) Concerns about group payoffs should be more pronounced in the treatments with fluctuating productivities, where individuals experience different roles throughout the experiment. Here, the equity-efficiency trade-off shifts in favor of efficiency considerations because equity is restored through income mobility. While median tax rates are indeed lowest in the FLUCTREAL treatment, the impact of real co-players is much weaker in the treatments with fluctuating productivities compared to those with fixed productivities, and it is statistically insignificant. Experiencing different roles already reduces the tax rate choices of median voters in the treatments with simulated co-players, where it cannot be interpreted as an attempt to maximize group payoffs. Hence, even if group payoffs may play a role for individual choices, we do not find consistent evidence for such behavior.

Status considerations. A final explanation remains that median tax rates express status concerns: the choices of tax rates might be driven by income comparisons with the poor and the rich individual. While the monetary payoff of the rich is considerably higher than the median voter's payoff (unless the tax rate approaches 100%), redistribution blurs the difference between the poor and the "middle class"; by choosing lower tax rates, the median voter can keep distance to the group of poor individuals. Since fluctuating productivities equalize differences across individuals throughout the experiment, such status concerns should be much more pronounced in the treatments with fixed productivities. Indeed, in the treatments with fixed productivities we observe a significantly negative effect of introducing a reference group, while in the treatments with fluctuating productivities this effect becomes weaker and is no longer significant.

Summarizing, we interpret our finding on the role of other-regarding preferences as positional concerns of the median voters when they vote on redistribution.

Our experiment also reveals interesting findings with respect to gender differences.[21] A considerable amount of empirical evidence suggests that male beings are more willing to assume risks (Byrnes, Miller and Schafer 1999), and evolutionary biologists and economists have argued that greater sexual selection pressures for men may have shaped their higher risk-taking as a useful strategy in "winner-take-all" situations.[22] Applying these considerations to the context of income distribution, male subjects may care more about their income position relative to the top earners and may be willing to sacrifice income in absolute terms if this brings them closer to the top income position, whereas females may care more for high absolute income. Translated to the tax rate choices, males with median income should choose *higher* tax rates than females: if median voters choose more redistribution, this implies that the income distance to the rich individual is reduced, accepting that also the distance to the poor decreases. In turn, median tax rates should be lower whenever the individuals' status concerns are expressed vis-à-vis the poor rather than relative to the top earners. Using statistical information about the participants of our experiment, we find that, on average, tax rates preferred by males with median productivity are 10% higher than those chosen by female median voters (compare "male" in estimations (2)-(4) in Table 3).[23] This difference is in line with the idea that tax rate choices are affected by status concerns and relative standing comparisons, rather than by group payoff or inequity considerations.

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[21] See Croson and Gneezy (2009) for a survey of gender differences in experiments in economics.

[22] Risk-taking, or the choice of the higher variance outcome, in turn, is a viable strategy in some types of competition for high rank or status (Dekel and Scotchmer, 1999).

[23] Note that $male + male \times$ REAL is significantly different from zero (p-value is 0.018); hence, looking only at treatments with real participants, this confirms our result of more redistribution being chosen by male participants.

4 Conclusion

In this paper we consider median voters' decisions on income redistribution in a formal framework that has been introduced by Meltzer and Richard (1981) and that has become the benchmark model for the study of the political economy of redistributive taxes. Our main research question is on the distinction between instrumental, but genuinely selfish motives for income redistribution, and genuine other-regarding preferences. We focus on the median voter, who represents a member of the middle class. We ask: is this representative of the middle class mainly guided by motives that are genuinely selfish, and is redistribution therefore mainly instrumental for achieving what can ultimately be identified as selfish goals? Or do voters have genuine other-regarding preferences? The main tool for distinguishing between these two sets of distributional concerns is to eliminate human co-players from the picture in one half of the treatments, and to replace them by computerized automated co-players. We find that the desired amount of redistribution for the middle class is highest if the individual income position is stable over time, whereas the desired amount of redistribution decreases in a less stable environment. Second, voters choose less redistribution -thereby implementing a less egalitarian society- if their co-players are real human players. This result strongly indicates that inequity aversion, if it exists at all in political economy contexts, must be superseded by other types of other-regarding preferences that dominate for the overall effect. The type of other-regarding preferences that is mapped well by the data is an aspiration of the middle class to be different and more clearly distinguishable from the poor.

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