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Individual Responsibility and Social Preferences for Redistribution: An Experimental Study[♦]

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Abstract. The paper provides an experimental test to analyze the determinants of individual preferences for redistribution. Participants in the experiment face a crucial trade-off between providing an effort on their own or free-riding on their fellows' effort, playing in a framework in which the pie and its distribution depend on circumstances that are both under and beyond the control of any individual. We find that individuals ask for more redistribution whenever differences in income levels are less dependent on personal effort. We also find complementarity among individual efforts. Unexpectedly, this means that free-riding behaviour becomes less frequent as the average level of effort in the society increases. We also confirm that the prospect of upward mobility increases the probability that an individual asks for zero redistribution, thus providing support to the POUM hypothesis. Further interesting results concerning the link between subjective values and preferences for redistribution are emphasized. Overall, our experimental evidence provides insights for the ongoing debate on how to reform welfare systems.

JEL Codes: C91, D91, H24, H30

Keywords: Income redistribution, Individual responsibility and effort

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1. INTRODUCTION

The present paper analyses the case for the recent stress put on individual effort (called *personal responsibility* in many official documents[1]) when designing financially and politically sustainable redistributive policies. In particular, it contributes to the ongoing debate by investigating – using a laboratory experiment - the following questions: Do individuals try to free-ride on their fellows' effort whenever they have the possibility of doing so? Are individuals more willing to accept redistribution whenever it counterbalances *bad luck* rather than *poor effort*? Besides subjective preferences and beliefs, which objective circumstances do affect individuals' attitudes towards redistribution? Are individuals more favourable to redistribution whenever they are poor relative to others or when they perceive a low degree of social mobility?

The idea of exploring such questions by means of a laboratory experiment is not novel. Some studies (e.g., Rustrom and Williams, 2000; Putterman and Durante, 2010; Becchetti et al., 2012) have already considered it. All these studies are basically structured in two stages. In *stage I* the initial distribution of incomes is determined either randomly (the source of income is luck, basically) or by taking into account the individual success in performing a given task (the source of income is either *effort* or *skills).* In *stage II*, participants reveal their preferences for redistribution.

These studies are not fully satisfactory for two reasons. First, they do not appropriately take into account the key characteristic of all *redistribution games*, i.e. the presence of strong incentives to free-ride on the contribution by the other members of the group. Second, these studies neglect the inter-temporal nature of redistribution (e.g., Alesina and Giuliano, 2008), which becomes

[1] The notion of personal responsibility has deeply inspired the political discourse and the academic debate over the last twenty years. Rarely mentioned in traditional welfare economics (Fleuerbay, 1995), the notion of personal responsibility has been the object of careful scrutiny (e.g., Arneson, 1990; Cohen, 1990; Dworkin, 1981; Rawls, 1971; Roemer, 1995, 1996; Sen, 1985, 1990) and has now received wide acceptance. The notion of personal responsibility has also inspired political debate on redistributive policies, as witnessed by Tony Blair's *Labour Party Manifesto* (1997),, and by the speech with which President Clinton introduced the *Personal Responsibility and Work Opportunity Reconciliation Act* (1996).

evident as soon as the long lasting nature of redistributive policies and the legitimate aspirations to upward mobility are taken into account. Both the *objective* level of social mobility and the *subjective* inter-temporal preferences and beliefs regarding the main source of income may indeed play an important role in explaining the demand for redistribution, a point not yet investigated in laboratory experiments.

In this paper we analyze the demand for redistribution by designing the *redistribution game* as a *public good game*. In our setting participants face a crucial trade-off between providing an effort on their own or free-riding on their fellows' effort. Put different, they operate in a framework in which the pie and its distribution simultaneously depend on circumstances that are both *under* and *beyond* their control. Thus, we design a setting in which the initial distribution of incomes is random and *beyond* individuals' control. However, individuals choose their level of effort (individual responsibility), which will influence income distribution in a second period); and they select the rate of a purely redistributive proportional income tax. In both periods, the tax structure is such that individuals with incomes below average receive positive net transfers, while those with incomes average incomes are net contributors. The key trade-off here consists in the fact that individuals may choose not to exert costly efforts and thus profit from the benevolence of their fellows.

The experimental results are of interest if compared either with the predictions derived by our theoretical framework (see Section T1, Technical Appendix at the end of the paper) or with what conventional wisdom would suggest. First, and consistent with previous studies, we find that self-interest alone cannot give a comprehensive explanation of the determinants of the demand for redistribution. Although self-interest matters – as expected, support for redistribution is indeed generally decreasing with income – many net contributors are still in favour of it. In particular, according to our experimental results, people with incomes up to 60% higher than the average society income (i.e., net taxpayers) are in favour of a tax rate higher than the sample mean level

(38%), and only those richer than this threshold support a lower degree of redistribution (i.e., a tax rate lower than the mean level). For example, this means that – taking average gross income in Italy to be around euro 20,000 – people with income up to euro 32,000 are still in favour of a higher degree of redistribution.

Second, and more importantly, we find that individuals reward effort: they prefer less redistribution. In other words, in meritocratic societies, in which effort matters for personal achievements and it is presumably higher than in other contexts, individuals seem to support *less* redistribution.

Finally, and in line with most of the literature on the subject (e.g., Rustrom and Williams, 2000), we also find that the demand for redistribution is clearly motivated by individual beliefs about the source of inequality. In particular, our results support the link between subjective values and the preferences for redistribution. The more individuals believe that economic success is guided by luck (or is a reward by God), the higher their demand of redistribution.

The perceived degree of social mobility also matters, as the prospect of higher upward mobility increases the probability that an individual rejects redistribution and lowers the preferred tax rate by about 7-10 percentage points with respect to the mean level.

The paper is organized as follows. Section 2 describes the experiment, while section 3 discusses the results. In Section 4 we compare experimental results with what conventional wisdom and a more sophisticated theoretical framework would predict. Section 5 concludes.

2. THE EXPERIMENT

The experiment was held at the *Laboratory of Experimental and Simulative Economics* (Università del Piemonte Orientale, Alessandria) on October 16th-17th, 2012. We elicited choices with respect to redistribution from about twenty participants divided in four sessions for a total of 71 subjects. Two sessions were run in each day, one in the morning, the other in the afternoon. Each session lasted about two hours. In any given session, participants were asked to play 12 rounds, i.e., they were asked to choose the level of redistribution 12 times under different conditions. This provided 852 observations overall. At the end of each session, participants were asked to fill in a socio-demographic questionnaire; questions mainly concerned their political attitudes and their views about both inequality and redistribution.

2.1. General characteristics of the experiment.

The experiment is structured as follows. In a generic round each individual is endowed with a randomly generated number of tokens (between 30 and 70) representing her present (time T) and future (time $T+h$) gross income. Tokens can be converted into euro at the given fixed rate 0.10 € per token, twice: at time T (time BEFORE, one month after the experiment); and at time $T+h$ (time THEN, *one*+h months after the experiment; h=1,2,3).[2] Individuals are given the possibility of modifying their own income (and the whole income distribution) both by choosing an *effort level* and by participating to the *selection of a purely redistributive tax*.

Effort is basically thought as an investment in human or financial capital. It is costly, since it reduces the number of tokens that can be converted into euro at time BEFORE. Yet, it enhances future income, since it increases the number of tokens available at time THEN.

The distribution of income can be modified also by choosing a purely redistributive income tax rate, structured in a way such that people with income above the average are net taxpayers, while people with income below the average are net recipients. Any individual participates in such a choice by simply declaring her preferred tax rate; anyone has the same chance that her

[2] Payments are delayed to test for the impact of inter-temporal preferences on the demand for redistribution. The first payment is provided one month after the experiment to avoid the bias in favor of payments on the spot (e.g., Andreoni and Sprenger, 2012*a*, *b*).

preferred tax rate will actually become the effective (or social) tax rate. This fact is known to all participants.

The sequence of a generic round is the following (see also Figure A1, Appendix A).

Each individual

- is endowed with a randomly generated income;
- observes both the whole distribution of incomes and the costs and benefits associated to any specific effort level;
- declares both her desired level of redistribution - i.e. the desired rate of a purely redistributive proportional income tax - and the desired effort level;
- selects an effective tax rate by means of the *random dictator rule* (there is an equal chance for every participant that her desired tax rate will actually become the effective tax rate);
- chooses her actual effort level, given the effective tax rate.

Payments (i.e. post tax and transfers income levels) are then computed as follows:

- payment at time BEFORE (one month after the experiment) =

i's gross income **-** *tax payment - cost of effort*

- payment at time THEN (one+*h* months after the experiment) =

i's gross income + *productivity gains due to effort – tax payment*

Individuals are informed that only the tokens won by them in a randomly selected round (determined at the end of each session) would be converted into euros. They are also informed that the show-up fee of 150 tokens would be been split in two tranches of identical amount, to be paid at time BEFORE and THEN respectively.

2.2. Choice of the effort level

As emphasized above, at each round individual *i* is given the chance to modify the payments in her favor by choosing an effort level. There are ten possible levels of effort. Effort is costly in terms of resources that *individuals* have to give up at time BEFORE. We run two different treatments: one in which the cost of effort is *low with respect to the productivity gains they yield*; another in which the cost of effort is *high*. Fig. 1 below shows the amount of tokens a generic individual has to give up for any effort level, depending on the treatment.

Fig. 1. Cost efforts in terms of tokens at time BEFORE

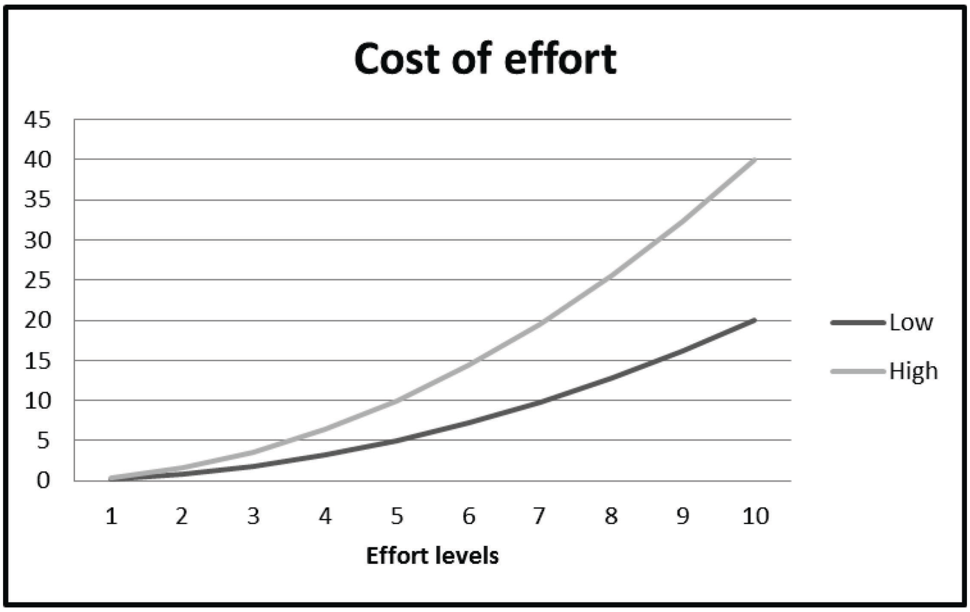


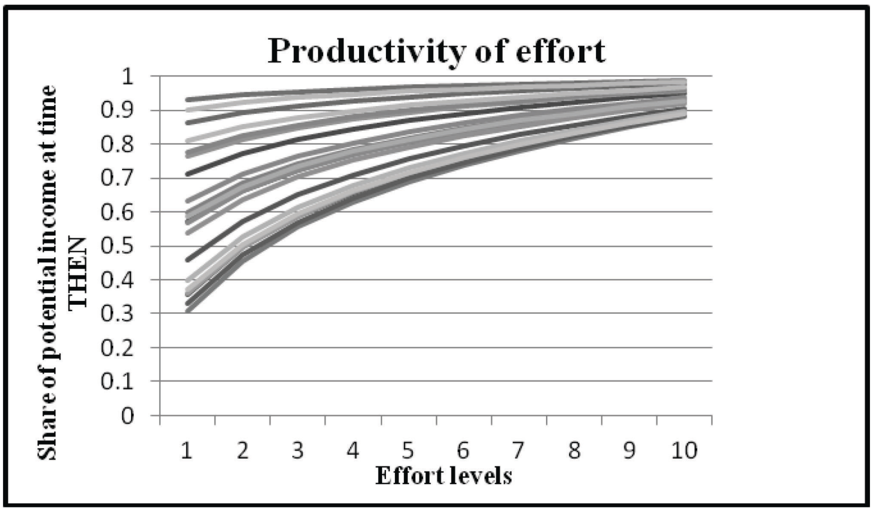
Table 1. *i*'s gross income at time THEN for six possible effort levels and five different starting conditions.

		Effort Levels					
	Gross Income	**0**	**1**	**3**	**5**	**7**	**10**
Individual 1	8.3	8.3	35.8	58.7	71.1	79.6	88.9
Individual 2	38.8	38.8	57.2	72.5	80.7	86.4	92.6
Individual 3	42.5	42.5	59.8	74.1	81.9	87.2	93.0
Individual 4	58.9	58.9	71.2	81.5	87.0	90.9	95.0
Individual 5	89.9	89.9	92.9	95.4	96.8	97.7	98.8

Effort is productive, since *i*'s pre-tax income at time THEN increases with it. It is worth noticing that *i*'s pre-tax income at time BEFORE is independent of one's effort, whereas i's pre-tax income at time THEN is not. The productivity of effort is determined according to a function with the following properties (see the Technical Appendix for the details): *a*) for any given income level, the productivity of effort is higher for more disadvantaged individuals (decreasing marginal utility of effort); *b*) for any two individuals providing the same effort, and for any effort level, the income at time THEN is higher for the individual with better initial conditions.

Table 1 indicates the gross income at time THEN for 5 individuals with different starting conditions (different gross income) and for 6 possible effort levels. Similarly, Figure 2 below shows the **s**hare of potential income at time THEN as a function of the effort provided (for 20 different initial conditions).

Fig. 2. Share of potential income at time THEN as function of the effort provided for 20 different initial conditions



2.3. Choice of the tax rate

As emphasized above, the distribution of incomes can be also affected by the choice of a purely redistributive income tax rate. Each individual declares her preferred tax rate, which is structured as follows: a) each individual pays a share of her income; b) the proceeds are equally distributed among all the participants. With such a tax structure, the following holds:

i's net income = *i's gross income* – [*effective tax rate* × (*i's gross income – average income*)].

This means that - as the tax rate increases - the tax structure drives the income of each participant to the average income. Whether a given individual pays a tax or receives a transfer depends on whether her income is above or below average income, respectively. The tax is a purely redistributive one, and basically produces the effect of reducing the variance around the mean as the tax rate increases. With a tax rate equal to 1 the income of all individuals is equal to the average income and the variance drops to zero.

2.4. Structure of the experiment.

The experiments consists of four sessions. In two sessions, the cost of effort is low with respect to the productivity gains; in the remaining sessions the cost of effort is high. In any session, each participant plays the game for twelve rounds, each time under a specific set of circumstances (see Figure A2, Appendix A and Technical Appendix for more details):

a) *fairness in the distribution* of gross incomes: gross incomes may vary across individuals. This is to explore how different conditions in terms of initial fairness in the distribution of incomes may affect the demand for redistribution.
b) *observability of effort*; individuals either have or do not have information on the average effort in the society. This is to explore whether effort levels are complements or substitutes.

c) *time of payment*; we study whether subjective intertemporal preferences affect the demand for redistribution by changing the timing of the second payment (two, three or four months respectively).

3. RESULTS

3.1. Models specification and variables description

Our econometric analysis is based here on two very simple and stylised models aimed at identifying the main determinants of redistribution. To this end, we define two different dependent variables: the first one, *tro_0*, is a dummy variable taking value 1 when the optimal tax rate for individuals is equal to zero. This variable allows us to explore the determinants of the extreme choice of no redistribution: *why do people do not want redistribution at all?* The second dependent variable is the continuous variable *taxrate_opt*. It spans a range of variation between 0 and 1 and identifies the tax rate desired by each individual in each round of the experiment. Here the question is: *what are the drivers of the desirable degree of redistribution?*

Let the set of preferred tax rate be identified as *preferred taxrate* = {*tro_0*, *taxrate_opt*}. As in most of the literature, our general econometric specification can be defined as follows:

$$preferred\ taxrate = \alpha + \beta_1\mathbf{X}_1 + \beta_2\mathbf{X}_2 + \beta_3\mathbf{X}_{3+}\beta_4\mathbf{X}_4 + \varepsilon$$

[3.1]

where $\mathbf{X}_1$ is a vector of variables identifying income distribution, $\mathbf{X}_2$ is a vector of variables identifying optimal individual effort, $\mathbf{X}_3$ is a set of variables identifying payment times, and finally $\mathbf{X}_4$ is a vector of different variables picking up individual characteristics. In particular,

- $\mathbf{X}_1$ includes the following variables: *yt*, i.e., the income assigned to each individual at the beginning of the experiment; *unfair_d*, a dummy variable identifying whether the distribution of exogenously assigned incomes in the initial period is unfair. We also consider an interaction variable, *unfair_ymean*, which measures the proportion to which the society's average income in the initial period is higher than the individual *i*'s income (yt_m/yt_i = *dist_ymean*) when the distribution of income is unfair (*unfair_d* = 1).

- vector $\mathbf{X}_2$ includes two variables: *prod_level*, a dummy variable identifying the productivity with respect to the cost of effort (*prod_level* takes value 1 when productivity is high); and *info_emean*, which measures the average effort level (with values from 1 to 10) *when this information is available to all members in the society*. This can be interpreted as a way of discriminating between anonymous and non-anonymous societies. In the former, information on average effort is unavailable before production takes place. In the latter, this information is available.

- $\mathbf{X}_3$, only considers the variable *months_post*, which measures the number of months before the second payment.

- vector $\mathbf{X}_4$ is an heterogeneous group of variables identifying personal characteristics, including demographic factors as well as individuals' opinions which might affect preferences for redistribution. As for demographic characteristics, we consider: the dummy *sex* which takes value 1 if the individual is a male; the variable *age* to measure the individual's age in years; the dummy variable *foreign* which takes value 1 if the individual was born in a foreign country. As for individuals' opinions, we consider four different domains. The first one is related to perceived social mobility (e.g., Benabou and Ok, 2001): we define the variable *succ_father* as a dummy taking value 1 if the individual believes that her chances to earn are higher than those of her father. The second domain is related to individuals' beliefs about the determinants of income (e.g., Alesina and Glaeser, 2004): we define the variable *succ_luck* – taking up values from 1 (strong disagreement) to 5 (strong agreement) – in order to measure how much one believes that luck determines the economic success of a person; we also define the variable *noeff_poor* (which takes also value from 1 to 5) in order to assess how much one believes that the poor are trapped in their condition because they do not exercise any effort to find a job. A third domain is related to religious and political ideology. We define the variable *succ_god* according to the degree to which one believes that the economic success of a person is an reward from God for her effort (again, from 1 – strong disagreement - to 5 – strong agreement). We also define the variable *equality* to take into account the feeling towards equality-oriented policies in regard to individual freedom-oriented policies. In this case, the range of variation is from 1 (strong disagreement) to 10 (strong agreement). Finally, we consider the variable *trust, which* measures the degree to which one has confidence in most people (the range of variation, in this case, is from 1 – strong disagreement - to 5 – strong agreement). Table 1 in Appendix B provides descriptive statistics for all the variables included in our econometric model. Notice that the average tax rate is about 38%, and in 16% of cases people prefer to have an tax rate equal to zero (no redistribution).

3.2. Results

The estimates of equation [3.1] for *tro_0* and *taxrate_opt* are in Tables 2 and 3, respectively. For the two dependent variables, the results are consistent across the seven different specifications. In both cases, we begin with a very simple model including variables in $\mathbf{X}_1$, $\mathbf{X}_2$, and $\mathbf{X}_3$ (Basic Model). We then augment this specification with demographic controls in Model 1, and other variables picking up different preferences and opinions (Models 2 to 5). We finally consider all the variables together in the Full Model.

Consider first the determinants of no redistribution (Table 2). The model has been estimated considering a Random Effects Logit specification to allow for unobserved residual heterogeneity across individuals. Most of the variables are significant and with the expected sign. A first strong and persistent result (in terms of magnitude and statistical significance) is the negative coefficient associated to *unfair_ymean* (while coefficients for *yt* and *unfair_d* are not statistically significant). Simply put, when the distribution of income is unfair, the higher the proportional gap between average income and individual in the initial period is, the lower the probability to reject redistribution. A second result (again, strong in terms of magnitude and statistical significance) is the positive coefficient on *info_emean*, which means that – *ceteris paribus* – the higher the observable average effort level, the higher the probability to advocate no taxation. As further discussed in section 4, there are two possible explanations for this result. The first is that individuals are inclined not to discourage their fellows' effort when they know that most of them are contributing to increase the size of the pie. Moreover – and this is the second explanation -- whenever the effort generally provided is high, an individual might feel more motivated to try harder, and thus advocate a lower tax rate.

As for demographic characteristics, we find that males prefer zero redistribution more than female, while age and the fact that one was born in a foreign country do not seem to matter. With regard to mobility, we find that the prospect of upward mobility increases the chances that redistribution is rejected, consistent with the POUM hypothesis advanced by Benabou and Ok (2001). The results on the determinants of income are less clear, though: we find that the coefficient on *succ_luck* is negative and statistically significant at the 10% level only in Model 3, while it is not significant but still negative in the Full Model. This is reasonable, since it means that the more individuals believe economic success is guided by luck, the more they find that redistribution is

Table 2. Determinants of the probability to choose a preferred tax rate = 0 (random effects logit estimates)

Regressors [a]	BASIC MODEL	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	FULL MODEL
Yt	0.013	0.013	0.013	0.014	0.013	0.013	0.012
	(0.80)	(0.82)	(0.81)	(0.84)	(0.79)	(0.79)	(0.76)
unfair_d	0.197	0.198	0.160	0.162	0.230	0.253	0.229
	(0.14)	(0.14)	(0.11)	(0.11)	(0.16)	(0.18)	(0.16)
unfair_ymean	-2.875**	-2.879**	-2.836**	-2.842**	-2.902**	-2.928**	-2.881**
	(-2.06)	(-2.07)	(-2.05)	(-2.05)	(-2.08)	(-2.11)	(-2.09)
prod_level	-1.236	-1.139	-1.147	-1.043	-1.180	-1.186	-0.939
	(-1.49)	(-1.40)	(-1.49)	(-1.30)	(-1.51)	(-1.48)	(-1.32)
info_emean	0.139***	0.138***	0.138***	0.138***	0.139***	0.139***	0.140***
	(3.32)	(3.32)	(3.32)	(3.30)	(3.33)	(3.32)	(3.36)
months_post	0.321*	0.321*	0.321*	0.321*	0.316*	0.319*	0.314*
	(1.84)	(1.84)	(1.85)	(1.84)	(1.82)	(1.83)	(1.81)
Sex	-	1.944**	1.827**	2.134***	1.388*	1.769**	1.640**
		(2.37)	(2.37)	(2.59)	(1.74)	(2.19)	(2.19)
Age	-	0.093	0.069	0.112	0.076	0.097	0.066
		(1.15)	(0.91)	(1.40)	(1.03)	(1.23)	(0.99)
Foreign	-	-0.937	-1.590	-1.318	-0.011	-0.939	-1.430
		(-0.73)	(-1.27)	(-1.01)	(-0.01)	(-0.74)	(-1.18)
succ_father	-	-	1.989**	-	-	-	2.106***
			(2.56)				(2.81)
succ_luck	-	-	-	-0.814*	-	-	-0.576
				(-1.87)			(-1.53)
noeff_poor	-	-	-	-0.034	-	-	-0.033
				(-0.09)			(-0.09)
succ_god	-	-	-	-	-0.906***	-	-0.858***
					(-2.85)		(-2.92)
Equality	-	-	-	-	-0.397**	-	-0.089
					(-1.99)		(-0.43)
Trust	-	-	-	-	-	-0.591	-0.681*
						(-1.46)	(-1.81)
Constant	-3.915***	-6.772***	-6.932***	-4.929*	-1.327	-5.200**	-0.740
	(-3.17)	(-2.97)	(-3.18)	(-1.87)	(-0.50)	(-2.13)	(-0.26)
Observations	852	852	852	852	852	852	852
Wald statistic (χ^2)	72.80***	75.67***	78.26***	76.89***	80.11***	76.55***	84.50***
Log-likelihood	-233.23	-229.75	-226.63	-227.98	-224.19	-228.72	-218.53

[a]Dependent variable: *tro_0*; z-statistics in round brackets; significance level: *** 1%, ** 5%, *10%.

Table 3. Determinants of preferred tax rate (OLS estimates with panel-corrected standard errors)

Regressors [a]	BASIC MODEL	MODEL 1	MODEL 2	MODEL 3	MODEL 4	MODEL 5	FULL MODEL
Yt	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-1.19)	(-1.07)	(-1.03)	(-1.10	(-1.22)	(-1.08)	(-1.23)
unfair_d	-0.179***	-0.177***	-0.188***	-0.174***	-0.165**	-0.176***	-0.164**
	(-2.83)	(-2.67)	(-2.77)	(-2.62)	(-2.52)	(-2.65)	(-2.45)
unfair_ymean	0.277***	0.275***	0.286***	0.273***	0.266***	0.274***	0.267***
	(4.94)	(4.66)	(4.73)	(4.61)	(4.59)	(4.64)	(4.49)
prod_level	0.001	0.043	0.030	0.042	0.059**	0.043	0.049
	(0.06)	(1.63)	(1.50)	(1.45)	(1.96)	(1.63)	(1.39)
info_emean	-0.004*	-0.004	-0.004*	-0.004	-0.004	-0.004	-0.004*
	(-1.72)	(-1.52)	(-1.81)	(-1.52)	(-1.61)	(-1.51)	(-1.72)
months_post	-0.014*	-0.012	-0.011	-0.012	-0.013*	-0.012	-0.012*
	(-1.72)	(-1.61)	(-1.50)	(-1.62)	(-1.83)	(-1.62)	(-1.71)
Sex	-	0.070**	0.075***	0.075***	0.127***	0.068**	0.124***
		(2.43)	(2.95)	(2.88)	(3.47)	(2.32)	(3.75)
Age	-	-0.014***	-0.012***	-0.014***	-0.015***	-0.014***	-0.013***
		(-5.34)	(-5.89)	(4.81)	(-6.59)	(-5.36)	(-5.95)
foreign	-	-0.002	0.043	-0.005	-0.028	-0.002	-0.003
		-0.04	(0.86)	(-0.11)	(-0.49)	(-0.04)	(-0.05)
succ_father	-	-	-0.108***	-	-	-	-0.074***
			(-5.77)				(-3.40)
succ_luck	-	-	-	-0.014	-	-	-0.010
				(-0.89)			(-0.66)
noeff_poor	-	-	-	0.006	-	-	0.019
				(0.40)			(0.98)
succ_god	-	-	-	-	0.013	-	0.015
					(0.94)		(1.10)
equality	-	-	-	-	0.033***	-	0.032***
					(3.73)		(3.44)
trust	-	-	-	-	-	-0.004	-0.013
						(-0.19)	(-0.55)
constant	0.457***	0.725***	0.726***	0.737***	0.459***	0.735***	0.467***
	(8.76)	(8.71)	(9.80)	(8.82)	(3.92)	(6.84)	(3.23)
Observations	852	852	852	852	852	852	852
Wald statistic (χ^2)	78.89***	121.78***	172.09***	137.01***	201.09***	132.51***	258.05***
R^2	0.31	0.34	0.35	0.35	0.37	0.34	0.38

[a] Dependent variable: *taxrate_opt*; z-statistics in round brackets; significance level: *** 1%, ** 5%, *10%.

desirable. This is somewhat in line with the estimated coefficient for *succ_god*, which is consistently negative and significant: the more individuals believe economic success is a reward by God, the less they vote for zero redistribution.

The coefficient for *equality* is negative as expected, but statistically significant only in Model 4: A greater feeling toward equality reduces the likelihood of no redistribution. Finally, the coefficient for *trust* is negative, but statistically significant only in the Full Model. As expected, trusting more the other individuals in the society encourages redistribution.

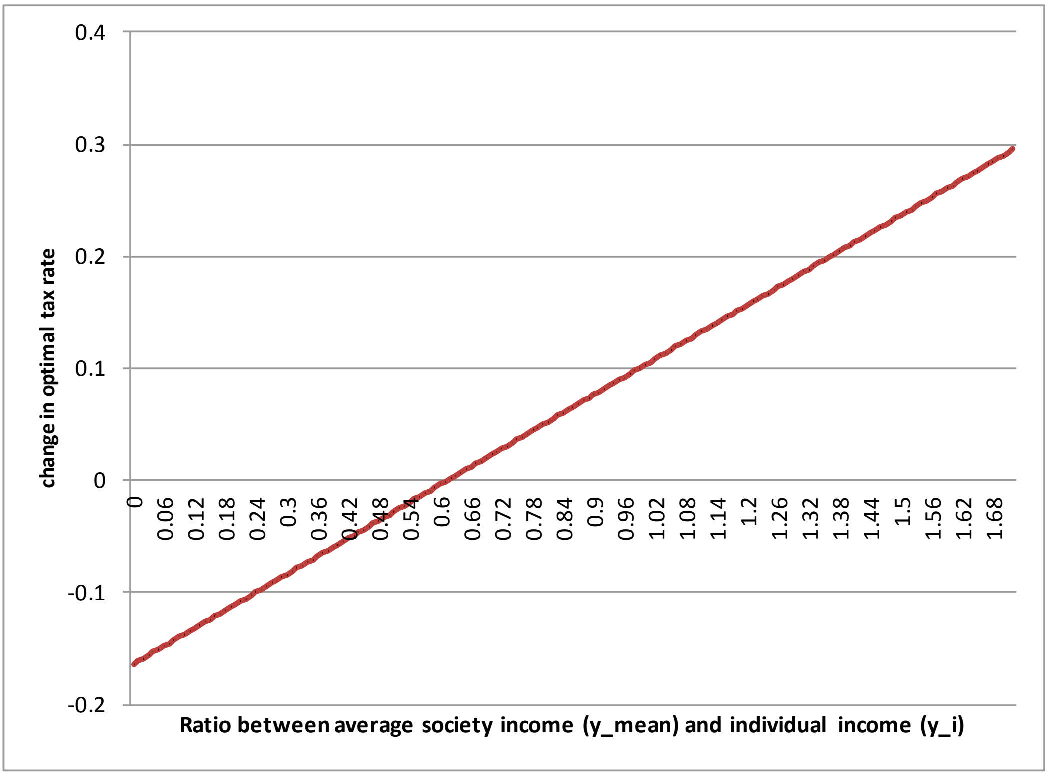
Let us now turn to the determinants of *taxrate_opt* (Table 3). We have run standard OLS methodology, but standard errors have been corrected by taking into account the correlation across individuals for the same round of the experiment, the correlation over time within individuals, and group heteroskdasticity. First, and consistent with previous literature, the relative position of individuals in the income ladder does matter when the income distribution is unfair. In particular, the relationship with the preferred tax rate is monotonically decreasing with income, being negative for the richer and positive for the poorer. In fact, the coefficients for *unfair_d* and for the interaction term *unfair_ymean* are now both statistically significant, with the expected signs. Let us consider the Full Model (Figure 3): *given that the income distribution is unfair*, people prefer a tax rate higher than the sample mean level (38%) if the ratio between the average society income and the individual income is at least 0.62. Hence, people want more redistribution *even if their individual income is above society average* and they are *net taxpayers.* This is true for incomes up to about 160% of the average (which is about euro 32,000 considering the Italian average income being around euro 20,000). When the ratio yt_m/yt_i is equal to one, the estimated impact on the preferred tax rate is strongly positive (+10% compared to the sample mean preferred tax rate). When the ratio hits its maximum at 1.72, the increase is even more substantial (around +30%). On the contrary, the impact is negative for very rich people (in relative terms): in the extreme case of yt_m/yt_i equal to zero, the estimated impact on the preferred tax rate is -16.4%.

Second, we find that individuals reward individual effort. On the one hand, the coefficient for *prod_level* is always positive, but statistically significant only in Model 4: when effort is relatively cheap (i.e., productivity is high relative to the cost of effort), individuals prefer more redistribution (+6% with respect to the sample mean tax rate of 38%) than when the cost of effort is high. On the other hand, the coefficient for *info_emean* is always negative, albeit not statistically significant at the usual confidence level in all models. This means that when people are able to know what the average effort is, they prefer a lower degree of redistribution the higher the average effort put forward by the members of the society, with a reduction of the preferred tax rate up to 4 percentage points when the average society effort is at the highest possible level. Put differently, according to our results, in meritocratic societies people vote for less redistribution.

Third, the result on *months_post* is also confirmed: the coefficient is consistently negative, although the 10% statistical significance is not observed in all the seven models. In a word, the longer individuals need to wait to obtain the second payment, the lower their preferred degree of redistribution. A likely interpretation is related to the fact that uncertainty increases with waiting time. And the greater uncertainty is, the lower the willingness to give away resources to the government.

As for demography, the coefficient for *sex* is at odds with the previous findings: males now seem to prefer more redistribution than females. We also find – in line with Checchi and Filippin (2004) – that the coefficient for *age* is negative and statistically significant in all models: younger individuals are more favourable to redistribution than older people. As for individuals' opinions, we find that the higher the prospect of upward mobility, the lower the preferred tax rate, with a reduction of about 7-10 percentage points compared to the sample mean level. This result is again in line with Checchi and Filippin (2004). By contrast, the coefficient for *equality* is now positive, suggesting that people with greater sensitiveness towards equality-oriented policies prefer a higher tax rate.

Figure 3. The impact of the relative position of individuals in the income ladder



4. DISCUSSION

In this section we compare our empirical findings with the results that a purely theoretical investigation would suggest (see Section T1 in the Appendix). To begin with, theory predicts that rational individuals with incomes above the average will ask for zero redistribution. Redistribution should only be supported by those with below average incomes, since they expect to be net recipients. This mostly coincides with what conventional wisdom would also suggest. However, although our experimental results show that disadvantaged individuals are indeed more prone to support redistribution, we also find that redistribution is supported also by individuals who are well aware of being net contributors – possibly out of ethical concerns (Fehr and Schmidt, 1999). The intensity of these ethical concerns seem to depend on the source of income inequality. In particular, the desired level of redistribution seems to increase whenever the initial distribution is unfair.

Second, the theoretical analysis does not have a clear prediction on how individual effort and the desired level of redistribution change in response to changes in the observed average effort exercised by the members of the society. This is because, there can be complementarity or substitutability among effort levels. In the case of substitutability, for example, the higher the observed average effort, the individual might be tempted to free ride (hence, the higher her desired tax rate). However, our experimental results show that the higher the average effort provided in the society, the lower the desired level of redistribution. Thus, one could argue that individuals are inclined not to discourage their fellows' effort whenever they know that most of them are contributing to increase the size of the pie. If so individuals would abstain from free riding and let the other expand the size of the common pie: it is better to make efforts in a rich community than to engage in free riding in a poor society. The second explanation is consistent with the hypothesis that effort levels are complementary. In this latter case, whenever the effort generally provided is high, an individual is encouraged to work harder and does not see the need for much redistribution.

Finally, experimental results are consistent with the theoretical analysis and conventional wisdom with regard to the effect that the prospect of upward mobility on the preferences for redistribution: whenever such a prospect improves, the desirable tax rate goes down.

5. CONCLUSIONS

In this paper we have undertaken an experimental test in order to analyze social preferences for redistribution. In our setting, participants face a crucial trade-off between making an effort to improve their wellbeing and free-riding on their fellows' efforts. Several results emerge from the analysis. First, given an initial unfair distribution of income, individuals ask for more redistribution the lower their position in the income ladder. Somewhat surprisingly, however, individuals endowed with above average income also ask for redistribution. We also find that the demand for redistribution is also affected by individual effort. In particular, our results suggest that individuals prefer less redistribution the higher the cost of effort, and the higher the average effort put forward in the society. It follows that in meritocratic societies, in which effort matters for personal achievement, individuals support less redistribution. Our results also confirm that the prospect of upward mobility increases the probability that an individual objects to redistribution.

Another set of results concerns the link between subjective values and preferences for redistribution: in particular, the more individuals believe economic success is guided by luck (or is a reward by God), the more redistribution they demand. This might provide an explanation for the observed different degrees of redistribution between US and Europe, the exploration of which we leave for future research.

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APPENDIX A

Figure A1. *Timing of the experiment*

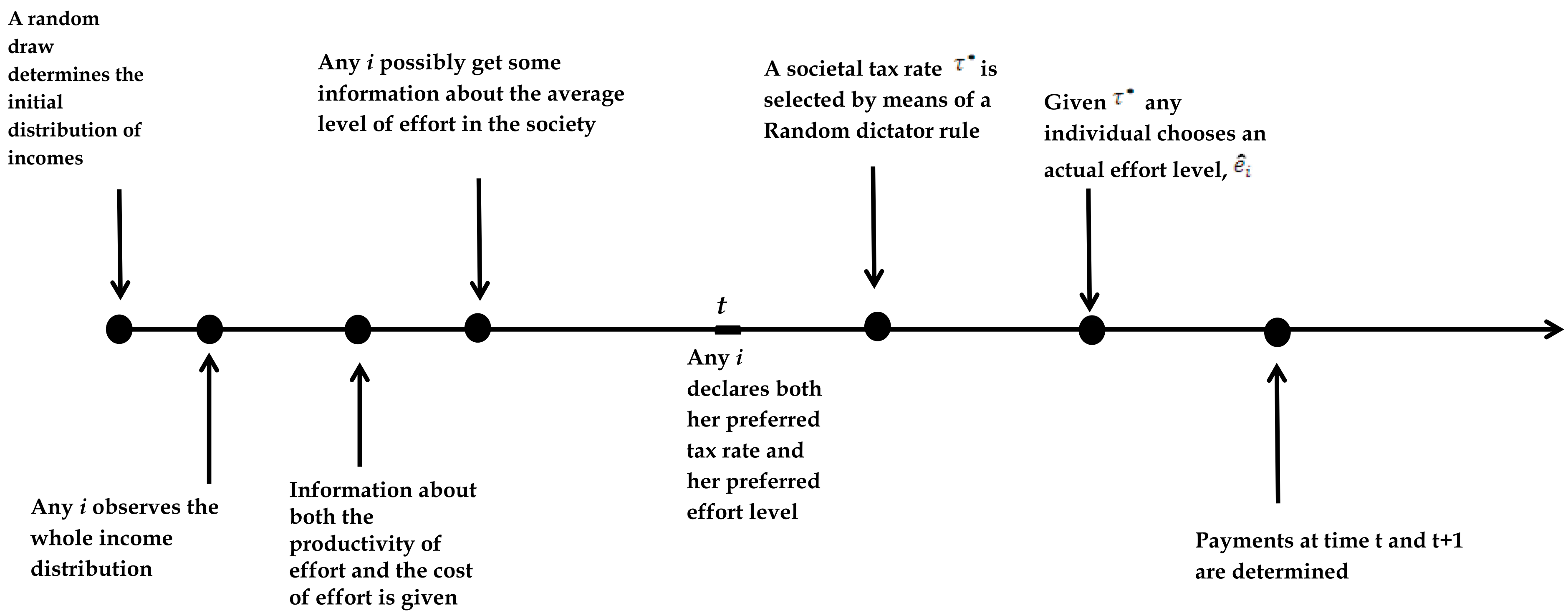
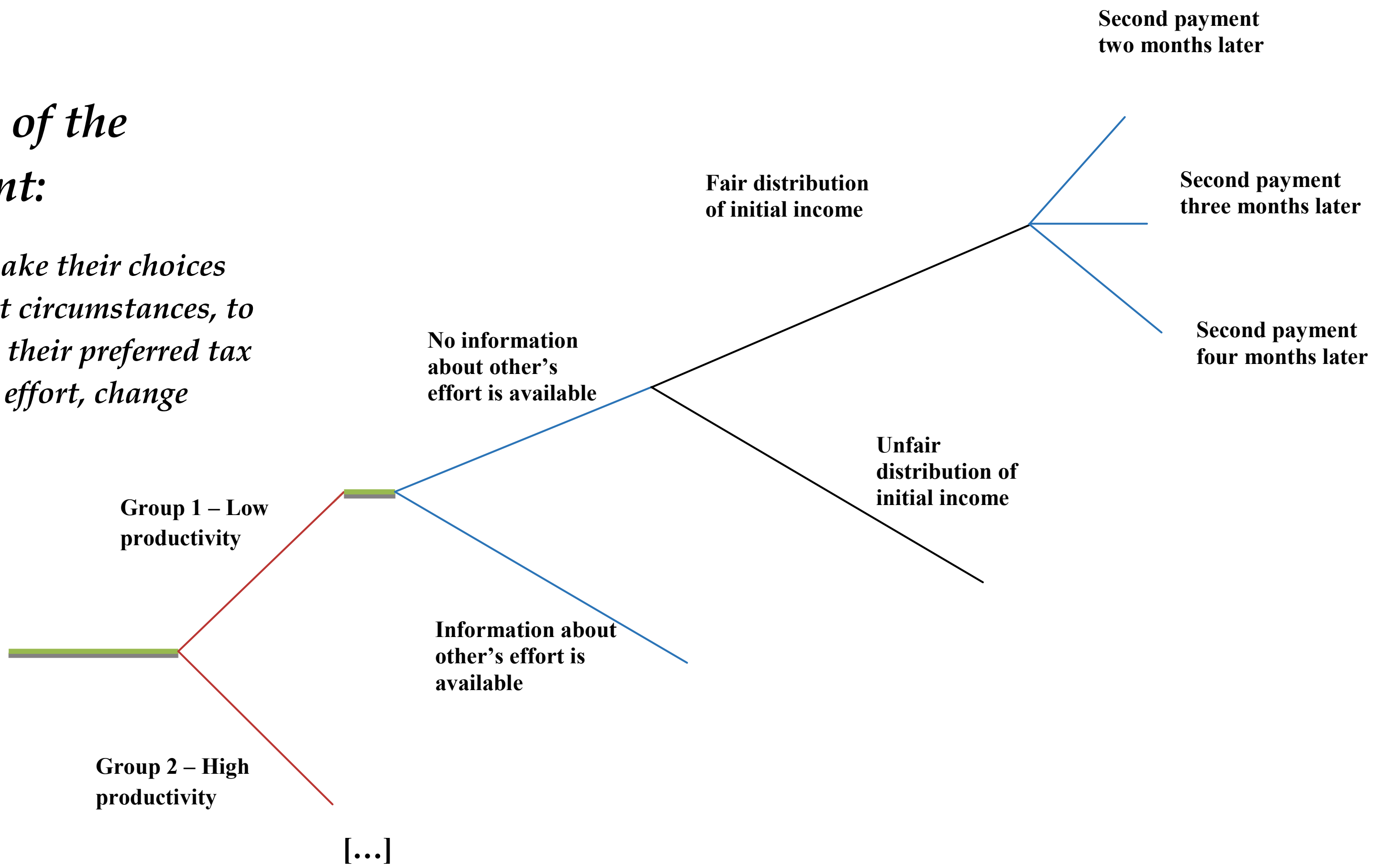


Figure A2.

Structure of the experiment:

individuals make their choices under different circumstances, to test both how their preferred tax rate and their effort, change



Appendix B.

Table 1. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
taxrate_opt	852	0.38	0.37	0.00	1.00
tro_0	852	0.16	0.37	0.00	1.00
tr_act	852	0.36	0.35	0.00	1.00
yt	852	48.96	11.83	30.00	70.00
unfair_d	852	0.50	0.50	0.00	1.00
dist_ymean	852	1.03	0.20	0.67	1.72
unfair_ymean	852	0.53	0.57	0.00	1.72
prod_level	852	0.56	0.50	0.00	1.00
info_e	852	0.50	0.50	0.00	1.00
mean_e	852	4.83	2.82	0.00	10.00
info_emean	852	2.68	3.41	0.00	10.00
months_post	852	3.00	0.82	2.00	4.00
e_opt	852	4.64	2.99	0.00	10.00
e_act	852	4.61	3.09	0.00	10.00
sex	852	0.38	0.49	0.00	1.00
age	852	24	5	19	46
foreign	852	0.11	0.32	0.00	1.00
succ_father	852	0.46	0.50	0.00	1.00
succ_luck	852	2.86	0.94	1.00	5.00
noeff_poor	852	2.30	0.98	1.00	5.00
succ_god	852	2.46	1.29	1.00	5.00
equality	852	6.54	2.04	1.00	10.00
trust	852	2.58	0.96	1.00	4.00

TECHNICAL APPENDIX

T1. THEORY

We consider a two-period economy where any individual $i = 1, \dots, n$ is entitled to the same quantity y of good *a*, which can be either consumed (both at time *t* and *t* + 1) or invested (at time *t*). The fundamental source of differences among individuals is given by the individual-specific probability of getting y, the *potential income*. At time *t* such a probability is given by $\hat{q}_i \in (0,1)$, $i = 1, \dots, n$, which is exogenous and reflects differences beyond one's control. A low probability of getting y may be due, for example, to bad family background, lower innate capacities and the like[3].

Whereas the probability of getting y is exogenous at time t, it is partially endogenous at $t+1$, as it depends also on the effort e_i provided by *i* at *t*, *i.e.* $q_{it+1}(e_i) = \hat{q}_i + \varphi_i(e_i)$.[4] Effort is costly; moreover its productivity is marginally decreasing $(\varphi_i', > 0, \varphi_i'' < 0)$. We suppose that $q_{it+1}(e_i) \to 1$ as $e_i \to \bar{e}_i$, *i.e.* we suppose that *i*'s probability of getting *y* goes to one as *i*'s effort tends to the maximum feasible effort for individual *i*. As it is natural, we assume $\varphi_i(0) = 0$.

Besides choosing the effort level, we suppose that any individual may affect the distribution of resources in the society also by *declaring* the preferred rate τ_i^* of a purely redistributive proportional income tax; this is done, by each individual, being aware that anyone has the same chance that her preferred tax rate will actually become the effective (or social) tax rate, τ.[5]

In this model, the choice of the tax rate is sufficient to uniquely determine the tax-transfer scheme, which is indeed structured as follows: any *i* pays a share τ of her income and the proceeds are equally distributed among the members of the community. Therefore, an individual receives a subsidy whenever her expected income is below the expected mean income; she pays a tax in the opposite case.[6]

Notice that in the setting at hand preferences are fully *self-regarding*. There is nothing which can lead an individual to prefer more redistribution except the consideration of the effects that such a redistribution has on her own material welfare. Hence we simply assume that each individual wishes to maximize her material welfare, given by her net income (hence her consumption) over time:

$$U_i = \delta_i^t \left[\hat{q}_{it} y(1-\tau) + \frac{\tau}{n} \sum_{j=1}^{n} \hat{q}_{jt}\, y - \sigma(e_i) \right] + \delta_i^{t+1} \left[q_{it+1}(e_i) y(1-\tau) + \frac{\tau}{n} \sum_{j=1}^{n} q_{jt+1}(e_j)\, y \right] \quad \textbf{[1]}$$

where: δ_i is *i*'s specific discount factor; $\sigma(e_i)$ represents the cost of effort, with $\sigma', \sigma'' > 0$; $\tau \geq 0$ is the purely redistributive proportional income tax.

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[3] Formally, $\hat{q}_i$ may be meant as a draw from a random variable X with supports (0,1), distributed according to some *f*(.).

[4] Note that the function $\varphi_i(.)$ is individual specific; this means that individuals may differ as far as the productivity of effort is concerned. In the context of this paper we mainly think at effort as an investment in human capital.

[5] This *random dictator rule* is incentive compatible (any individual has an interest in declaring her true preference), hence free of strategic considerations which come about whenever voting over preferred alternatives is allowed.

[6] Given τ, *i*'s net income is determined as follows: $E(y_i)(1-\tau) + \tau E(\bar{y}) = E(y_i) - \tau(E(y_i) - E(\bar{y}))$, where $E(.)$ is the expectation operator. It would be easy to show mathematically that the tax-transfer scheme can never imply re-ranking.

A1. *The individual's decision problem*

The decision problem of each individual can be conveniently split in two stages and solved by backward induction. Each individual determines at the second stage the optimal effort level $e_i^* = e_i(\tau|e_{h\neq i})$ as a function of the relevant tax rate τ, given the effort of any other individual in the society, $e_{h\neq i}$. At the first stage, given $e_i^* = e_i(\tau|e_{h\neq i})$, each individual declares her preferred tax rate, τ_i^*. Given the societal tax rate τ and the effort provided by any *i*, e_i^*, the material welfare of any individual *i* is determined by [1].

A2. *Individual's choices without interdependence.*

We first study the individual's choice problem by neglecting the fact that the effort provided by each individual might affect the effort provided by the others. In paragraph A3 we briefly consider how interdependence among effort levels might affect the solution to the individual choice problem. Without interdependence, the first order condition of [1] with respect to $e_i = e_i(\tau)$ is:

$$-\sigma'(e_i^*) + \delta_i \left[q'_{it+1}(e_i^*)y\left(1-\tau+\frac{\tau}{n}\right)\right]=0$$

[2].

This simple condition requires that the optimal effort level equates costs and benefits at the margin. Notice from [2] that the optimal effort decreases when: the relevant tax rate increases (for this reduces the net benefit accruing to the individual for additional effort); either (both) the discount factor or (and) the marginal productivity of effort decrease.

By differentiating [1] w.r.t. τ and using [2] we get to the following condition for the determination of *i*'s preferred tax rate, where $E(\bar{y})$ and $E(y_i)$ are the average expected income and *i*'s expected income respectively:

$$\frac{\delta U_i}{\delta \tau_i}\Big|_{e_j=e_j^*,\forall j} = \underbrace{[E(\bar{y}_t) - E(y_{it})]}_{\substack{difference\ between\ the\ average \\ income\ and\ i's\ income: \\ beyond\ i's\ control}} + \delta_i \underbrace{[E(\bar{y}_{t+1}) - E(y_{it+1})]}_{\substack{difference\ between\ the\ average \\ income\ and\ i's\ income: \\ under\ i's\ control}} + \underbrace{\delta_i\left[\frac{\tau}{n}\sum_{h\neq i} q'_{ht+1}(e_h)e'_h(\tau)y\right]}_{\substack{reduction\ in\ transfers\ in\ i's \\ favour\ as\ \tau\ increases}} = 0$$

[3].

Equation [3] states that *i*'s preferred tax rate, τ_i^*, is such as to equate her benefits from taxation to costs. The first addendum of [3] is the difference between the average expected income and *i*'s expected income at time *t*. Such a difference is beyond *i*'s control. The second addendum is the same difference at time *t*+1. It is at least partially under *i*'s control for *i* is able to affect it by varying the effort level. The third addendum represents the reduction in transfers received by *i* as τ increases (because of the disincentive effects of taxation on effort).

To better understand [3], suppose both that the societal tax rate τ is set such as $\tau = \tau_i^* > 0$ and that the effort levels have been consequently chosen according to [2]; suppose furthermore that *i* is benefitted by the redistributive scheme. As the societal tax rate is selected in accordance with *i*'s preferences, a marginal increase in the tax rate must be such as to leave *i*'s welfare (hence income available for consumption) unaltered. This means that the marginal resources *i* would get by increasing τ, $[E(\bar{y}_t) - E(y_{it})] + \delta_i\, [E(\bar{y}_{t+1}) - E(y_{it+1})] > 0$ must be offset by the reduction in transfers received by i as τ increases, i.e. $\delta^i[\frac{\tau}{n} \sum_{h \neq i} q'_{ht+1}(e_h) e'_h(\tau) y]$.

Clearly if i's marginal benefit by increasing τ is lower than the marginal cost for any given $\tau \geq 0$, the (corner) solution is such as to imply $\tau_i^* = 0$.

Notice that in this setting free riding is limited by the reaction of the others to an increase in the tax rate. That is why there are limits to the strategy of reducing effort and asking for an higher tax rate. Indeed, the less is the effort of any $h \neq i$ affected by an increase in the tax rate, the more is convenient for i both to reduce her effort (in such a way as to enlarge the difference between $E(\bar{y}_{t+1}) - E(y_{it+1}) > 0$) and to ask for an higher tax rate.

The following propositions summarize the results.

Proposition 1 *(Individual effort)*. Under the assumption that effort levels are independent, the effort of any i only depends on its net contribution to i's material welfare. It increases with both i's patience, δ_i, and i's productivity of effort, $\varphi_i(.)$, whereas it decreases with the tax rate τ. The optimal effort by individual i, e_i^*, is greater than zero at $\tau = 1$ as long as $\delta_i \left[q'_{it+1}(e_i = 0) y \left(\frac{1}{n}\right)\right] > \sigma'(e_i = 0)$.

Proof of Proposition 1. From [2] it is straightforward to notice that i's effort increases with both δ_i and $\varphi_i(.)$ and decreases with τ. If we suppose that the relevant tax rate equals one, [2] becomes:

$$-\sigma'(e_i) + \delta_i \left[q'_{it+1}(e_i) y \left(\frac{\tau}{n}\right)\right] = 0,$$

$e_i^* > 0$ if the marginal benefit of effort is greater than the marginal cost when $e_i = 0$, that is $\delta_i \left[q'_{it+1}(e_i = 0) y \left(\frac{1}{n}\right)\right] > \sigma'(e_i = 0)$. ■

It is worth noticing that, even if the social tax rate is set to one, an individual might still have an incentive to provide a positive effort - as the marginal cost of effort is low for low effort levels and a share $\frac{1}{n}$ of the gain deriving from her additional effort accrues at the individual herself. It is crucial, however, that the society is made up by a relatively small number of individuals[7], as the marginal benefit of effort goes to zero as the number of individuals increases.

The following two propositions characterize the desired tax rate by individual i.

Proposition 2 (Desired tax rate, $\tau_i^* = 0$). The desired tax rate τ_i^* is zero (no redistribution) for any individual for whom the marginal benefits of taxation are lower than the marginal cost for any given $\tau \in [0,1]$, *i.e.* $\frac{\delta U_i}{\delta \tau_i}|_{e_i = e_i^*} < 0$. A sufficient condition for $\tau_i^* = 0$ is that the sum of the average discounted expected incomes is no greater than the sum of i's discounted incomes at *t and t+1* respectively for any given τ.

Proof of Proposition 2. Suppose $\frac{\delta U_i}{\delta \tau_i}|_{e_i = e_i^*} < 0 \; at \; \tau' > 0$, hence, a lower tax rate $\tau = \tau'' < \tau'$, must be preferred by i. If $\frac{\delta U_i}{\delta \tau_i}|_{e_i = e_i^*} < 0$ holds $\forall \tau \in [0,1]$, $\tau_i^* = min\{\tau | \tau \in [0,1]\} = 0$.

Notice that, by [3], $\frac{\delta U_i}{\delta \tau_i}|_{e_i = e_i^*} < 0 \rightarrow$

[7] *i.e.* $n < \bar{n}$, where $\bar{n}$ is such that $\delta_i \left[q'_{it+1}(e_i = 0) y \left(\frac{1}{n}\right)\right] = \sigma'(e_i = 0)$.

$$E(\bar{y}_t) - E(y_{it}) + \delta_i[E(\bar{y}_{t+1}) - E(y_{it+1})] + \delta_i\left(\frac{\tau}{n}\sum_{h\neq i} q'_{ht+1}(e_h)e'_h(\tau)y\right) < 0$$

or

$$E(\bar{y}_t) - E(y_{it}) + \delta_i[E(\bar{y}_{t+1}) - E(y_{it+1})] < -\delta_i\left(\frac{\tau}{n}\sum_{h\neq i} q'_{ht+1}(e_h)e'_h(\tau)y\right)$$

[A2]

As - by Proposition 1 - $e'_h(\tau) < 0$, the r.h.s. of [A2] is positive. It is therefore sufficient for $\frac{\delta U_i}{\delta \tau_i}|_{e_i=e_i^*} < 0$ to hold that the l.h.s. is nonpositive for any given τ, which implies that $E(\bar{y}_t) - E(y_{it}) + \delta_i[E(\bar{y}_{t+1}) - E(y_{it+1})] \leq 0$ for any given τ, or that $[E(\bar{y}_t) + \delta_i E(\bar{y}_{t+1})] + [E(y_{it}) + E(y_{it+1})] \leq 0$. ■

The main result given by Proposition 2 is that with self-regarding preferences there might be individuals preferring no redistribution at all ($\tau_i^* = 0$). Among these, there are certainly those whose income is no lower than average for any tax rate at both *t* and *t* + 1. Proposition 2 simply establishes that with self-regarding preferences individuals who cannot get any gain from redistribution desire no redistribution at all. Notice that this is independent from the source of inequality among individuals, *i.e.*, it is independent from the fact that differences among individuals may ultimately depend on factors beyond one's control.
The following proposition establishes.

Proposition 3 (Desired tax rate, $\tau_i^* \in (0,1]$). *a)* For any individual *i* such that $\frac{\delta U_i}{\delta \tau_i}|_{e_i=e_i^*} > 0$ for some $\tau > 0$, $\tau_i^* \in (0,1]$. For any such i the desired tax rate τ_i^* increases whenever*:*

- *i)* income differences which are beyond i's control, *i.e.* $E(\bar{y}_t) - E(y_{it})$*,* increase*;*
- *ii)* the productivity of *i's* effort, $\varphi_i(\tilde{e})$, decreases for any given $\tilde{e}$*;*
- *iii)* the difference between the average productivity of effort and i's effort increases (provided that the following increase in $E(\bar{y}_{t+1}) - E(y_{it+1})$ is greater than the reduction in the transfer caused by an increase in τ*).*

b) The desired tax rate τ_i^* decreases if i's discount factor increases*,* provided that $E(\bar{y}_t) - E(y_{it}) > 0$*.*

Proof of Proposition 3. *a*) Suppose $\frac{\delta U_i}{\delta \tau_i}|_{e_i=e_i^*} > 0$ for some $\tau = \tau' \geq 0$. As $U(.)$ is continuous and $[\tau', 1]$ is a convex compact set, by the Bolzano-Weierstrass theorem either i's problem has an interior solution, $\tau_i^* \in (0,1)$, or the problem has a boundary solution with $\tau_i^* = 1$; in any case $\tau_i^* > 0$.
Suppose $\tau_i^* \in (0,1)$ is an interior solution to *i's* problem. Since*:*

$$E(\bar{y}_t) - E(y_{it}) = y[\bar{q}_t - \hat{q}_{it}] = y\left[\frac{\sum_{j=1}^{n}\hat{q}_{jt}}{n} - \hat{q}_{it}\right]$$

and

$$\delta_i[E(\bar{y}_{t+1}) - E(y_{it+1})] = \delta_i y[\bar{q}_{t+1} - q_{it+1}] = \delta_i y\left[\frac{\sum_{j=1}^{n}\hat{q}_{jt}+\varphi_j(e_j)}{n} - \hat{q}_{it}+\varphi_i(e_i)\right],$$

the first order condition of i's problem w.r.t. τ_i, [3], can be re-written as:

$$y\left[\frac{\sum_{j=1}^{n}\hat{q}_{jt}}{n} - \hat{q}_{it}\right] + \delta_i y\left[\left(\frac{\sum_{j=1}^{n}\hat{q}_{jt}}{n} - \hat{q}_{it}\right) + \left(\frac{\sum_{j=1}^{n}\varphi_j(e_j(\tau_i^*))}{n} - \varphi_i(e_i(\tau_i^*))\right)\right] +$$
$$\delta_i y\left[\frac{\tau_i^*}{n}\sum_{h\neq i}\varphi'_{ht+1}(e_h(\tau_i^*))e'_h(\tau_i^*)\right] = 0$$

[*].

i. $if \frac{\sum_{j=1}^{n}\hat{q}_{jt}}{n} - \hat{q}_{it}$ increases, $\frac{\partial U_i(\tau=\tau_i^*)}{\partial \tau_i}|_{e_j=e_j^* \forall j=1,\dots,n} > 0$, hence the desired tax rate increases;

ii. suppose $\left(\frac{\sum_{j=1}^{n}\varphi_j(e_j)}{n} - \varphi_i(e_i)\right)$ increases. This is because either $\varphi_i(\tilde{e})$ decreases or $\frac{\sum_{j=1}^{n}\varphi_j(\tilde{e})}{n}$ increases more than $\varphi_i(\tilde{e})$, for any effort level $\tilde{e}$. A decrease in $\varphi_i(.)$ $\forall\tilde{e}$, does not have any effect both on the first and the third term of [*], therefore if $\varphi_i(.)$ decreases $\forall\tilde{e}$, $\frac{\partial U_i(\tau=\tau_i^*)}{\partial \tau_i}|_{e_j=e_j^* \forall j=1,\dots,n} > 0$ and the desired tax rate increases.

iii. Suppose for some *j=1,…,n*, $\varphi_j(.)$ increases $\forall\tilde{e}$, in such a way that $\frac{\sum_{j=1}^{n}\varphi_j(e_j(\tau_i^*))}{n} - \varphi_i(e_i(\tau_i^*))$ increases. As $\varphi_j(.)$ increases $\forall\tilde{e}$, by [2] also the effort levels change. Let $\hat{\varphi}_j(.)$ and $\hat{e}_j$ be the novel productivity of effort and the effort level respectively. For τ_i^* to increase, a change from $\varphi_j(.)$ *to* $\hat{\varphi}_j(.)$ must be such that $\frac{\partial U_i(\tau=\tau_i^*)}{\partial \tau_i} > 0$, or, by [*],
$$\left(\frac{\sum_{j=1}^{n}\left[\hat{\varphi}_j(\hat{e}_j(\tau_i^*)) - \varphi_j(e_j(\tau_i^*))\right]}{n} - \left[\hat{\varphi}_i(\hat{e}_i(\tau_i^*)) - \varphi_i(e_i(\tau_i^*))\right]\right) + \frac{\tau_i^*}{n}\sum_{h\neq i}\hat{\varphi}'_{ht+1}(\hat{e}_h(\tau_i^*))e'_h(\tau_i^*) > 0,$$
that is: following a change in the productivity of effort (hence in the effort levels) τ_i^* increases if the variation in the difference between the average income and i's income is greater than the reduction in the transfer caused by an increase in τ;

b) Write the f.o.c. w.r.t. τ as follows:
$$\left[\frac{\sum_{j=1}^{n}\hat{q}_{jt}}{n} - \hat{q}_{it}\right] = -\delta_i y\left[\left(\frac{\sum_{j=1}^{n}\hat{q}_{jt}}{n} - \hat{q}_{it}\right) + \left(\frac{\sum_{j=1}^{n}\varphi_j(e_j(\tau_i^*))}{n} - \varphi_i(e_i(\tau_i^*))\right) + \frac{\tau_i^*}{n}\sum_{h\neq i}\varphi'_{ht+1}(e_h(\tau_i^*))e'_h(\tau_i^*)\right]$$
[**]

If δ_i increases, the l.h.s. remains constant, whereas the r.h.s. change is
$$-y\left[\left(\frac{\sum_{j=1}^{n}\hat{q}_{jt}}{n} - \hat{q}_{it}\right) + \left(\frac{\sum_{j=1}^{n}\varphi_j(e_j(\tau_i^*))}{n} - \varphi_i(e_i(\tau_i^*))\right) + \frac{\tau_i^*}{n}\sum_{h\neq i}\varphi'_{ht+1}(e_h(\tau_i^*))e'_h(\tau_i^*)\right] + -\delta_i y\varphi'(e_i(\tau_i^*))\left(\frac{1}{n} - 1\right)\frac{\partial e_i(\tau_i^*)}{\partial \delta_i}$$

[***]

Where $\delta_i y\varphi'(e_i(\tau_i^*))\left(\frac{1}{n} - 1\right)\frac{\partial e_i(\tau_i^*)}{\partial \delta_i}$ is the impact of a change in the effort level by i following a change in δ_i. For $\tau_i^*$to decrease as δ_i increases, [***] has to be positive (so that at τ_i^*, we would have $\frac{\partial U_i(\tau=\tau_i^*)}{\partial \tau_i} < 0$). Consider than that the term in brackets in [***], by [**], equals $-\frac{\frac{\sum_{j=1}^{n}\hat{q}_{jt}}{n} - \hat{q}_{it}}{\delta_i y}$. Therefore, the change in the r.h.s. of [**] following an increase in δ_i equals:
$$-y\left[-\frac{\frac{\sum_{j=1}^{n}\hat{q}_{jt}}{n} - \hat{q}_{it}}{\delta_i y}\right]\underbrace{-\delta_i y\varphi'(e_i(\tau_i^*))\left(\frac{1}{n} - 1\right)\frac{\partial e_i(\tau_i^*)}{\partial \delta_i}}_{+}$$
A sufficient condition for this to be positive is that $\frac{\sum_{j=1}^{n}\hat{q}_{jt}}{n} - \hat{q}_{it} > 0$, *or* $E(\bar{y}_t) - E(y_{it}) > 0$. ■

There are some things worth noticing. First, the desired tax rate increases with the difference with the average income and *i*'s income at time *t*, i.e., the desired tax rate increases when either (both) the differences which are beyond the individual's control get larger or (and) the productivity of *i*'s effort gets smaller. In a sense, these results can be interpreted by saying that individuals try to compensate with more redistribution the disadvantage they are not responsible for.

Notice however, that when *i's* productivity of effort increases, a tax increase is preferred by *i* if the relative (w.r.t. to the mean) productivity of her effort decreases (but only if the increase in the tax

rate increases *i*'s net income, which depends on the disincentive effects of taxation on the effort provided by the others).
As a last point note that the tax rate decreases if *i's* discount factor increases, i.e. if *i* takes the future more into account, provided that *i*'s income is below at time *t*. This result can be read as follows: when an individual is at the beginning at a disadvantage, an increase in the discount factor, leading to an increase in effort, constitutes an incentive to ask for less redistribution.

3. 3. Interdependent efforts.

Interdependence of the effort levels might affect the solution to the individual choice problem. Such interdependence has to be considered as producing an effect whose sign is not possible to determine a priori. On one hand, an increase in the effort provided by *i* may induce any other individual *h* to increase her effort (for any given τ). On the other hand, an increase in the effort provided by *i* may induce any other *h* to reduce her effort level in an attempt to free-ride on the effort provided by *i*.

If effort levels are positively correlated, effort levels are higher than in the case without interdependence (See Appendix A). Otherwise the opposite is true.

Notice that if effort levels are correlated, the disincentive effect of taxation is strengthened. In this case it is indeed necessary to consider not only the reduction in the effort provided by $h \neq i$ because of an increase in the tax rate, but also the disincentive effect on the effort provided by $h \neq i$ caused by a reduction in *i*'s effort when τ increases.

All the above suggests the following.

Proposition 4 (*Interdependent efforts*). *If $\partial e_h/\partial e_i \neq 0$, then in deciding both the effort to be provided and the tax rate, i has to take into account that her effort will have a direct impact on the effort provided by others hence on her welfare. If $\partial e_h/\partial e_i > 0$ effort levels are higher and the desired tax rate lower with respect to the case in which effort are independent.*

Proof of Proposition 4. Differentiating [3] w.r.t. e_i and τ_i we get to the following first order conditions, [A3] and [A4], implicitly determining the optimal choice of e_i and τ by individual *i*, that is e_i^* and τ_i^*:

$$-\sigma'(e_i) + \delta_i \left[q'_{it+1}(e_i)y\left(1-\tau+\frac{\tau}{n}\right) + \frac{\tau}{n}\sum_{h\neq i} y q'_{ht+1}(e_h)\left(\frac{\partial e_h}{\partial e_i}\right)\right]=0$$

[A3]

$$E(\bar{y}_t) - E(y_{it}) - \sigma'(e_i)\frac{\partial e_i}{\partial \tau} +$$
$$\delta_i\left[E(\bar{y}_{t+1}) - E(y_{it+1}) + y\left(1-\tau+\frac{\tau}{n}\right)q'_{it+1}(e_i)\frac{\partial e_i}{\partial \tau} + \frac{\tau}{n}\sum_{h\neq i} y q'_{ht+1}(e_h)\frac{\partial e_h}{\partial \tau}\right]$$
$$=0$$

[A4].

By substituting [A3] in [A4], we get to

$$E(\bar{y}_t) - E(y_{it}) + \delta_i[E(\bar{y}_{t+1}) - E(y_{it+1})] + \delta_i\left[\frac{\tau}{n}\sum_{h\neq i} y q'_{ht+1}(e_h)\right]\left(\frac{\partial e_h}{\partial \tau} - \frac{\partial e_h}{\partial e_i}\frac{\partial e_i}{\partial \tau}\right)=0 . \blacksquare$$

T2. STRUCTURE OF THE EXPERIMENT

In any round $(r = 1, \ldots, 12)$, a random draw q_{ir} from a uniform distribution X with supports (0.3, 0.7) determines the gross endowment for any participant *i, i.e.* her (gross) income, $\hat{y}_{ir} = q_{ir} \times y$,

where y, the *potential income* (see Section 2) is set equal to 100 tokens. If, for example, $q_{ir} = 0.43$, the (gross) income of individual *i* in round *r* will be $\hat{y}_{ir} = 0.43 \times 100 = 43$ tokens.
After observing the whole distribution of incomes in round *r*, $y_r = \{\hat{y}_{ir}\}$, any *i* declares both her desired level of redistribution, τ_i^d and the desired effort level, e_i^d. By means of the *Random Dictator Rule* an effective tax rate τ^* is then selected from the set of the desired tax rates $\{\tau_i^d\}$. Given the effective tax rate, τ^*, each individual chooses her actual effort level e_i^*.
During the experiment any *i* is given the chance of modifying the payments in her favor by choosing an effort level, $e_i \in [1,10]$. Effort is costly in terms of resources that *i* has to give up at time BEFORE. The cost of effort is set at $\sigma(e_i) = \frac{e_i^2}{2+\alpha}$ tokens, where $\alpha > 0$. We run two different treatments, one in which the cost of effort is *low*, i.e. $\alpha = 0.5$; the other in which the cost of effort is *high* $\alpha = 3$. Fig. 1 (see Section 3 above) shows the amount of tokens a generic individual has to give up for any effort level, depending on the value of the parameter α.
If we do not consider the possibility of redistribution[8] and let q_{ir} be the random draw generating *i*'s income in round r, *i*'s income at time BEFORE will be:

$$\hat{y}_{ir}(BEFORE) = (q_{ir} \times y) - \sigma(\bar{e}),$$

whereas i's income at time THEN will be:

$$\hat{y}_{ir}(THEN) = \{q_{ir} + \varphi_i(\bar{e})\} \times y,$$

where $\bar{e}$ is the effort level chosen by *i*.
It is worth noticing that *i*'s pre-tax income at time BEFORE is independent from her effort, whereas i's pre-tax income at time THEN is not. The productivity of effort is given by the following function (with $\theta = 3$):

$$\varphi_i(\bar{e}) = \left\{q_{ir} + \left[\left(\frac{1-q_{ir}}{10}\right) \times \left(\sum_{e_i=1}^{\bar{e}} \frac{\theta}{e_i}\right)\right]\right\}.$$

Such a function has some interesting properties which are worth noticing: *a*) it is concave in the income level, hence, for any given effort level, the productivity of effort is higher for more disadvantaged individuals; *b*) for any two individuals providing the same effort, and for any effort level, the income at time THEN will be higher for the individual with better starting conditions (see Table 1 and Fig. 2, Section 3 above).
The distribution of incomes $\{\hat{y}_{ir}\}$ can be modified also by the choice of a purely redistributive income tax rate. Given the costs and benefits associated to any given effort level and the tax structure, it is possible to write the payoffs of a given individual as follows:

1) *i*'s income at time BEFORE:

$$= \left[\underbrace{(q_{ir} \times y)}_{i's\ endowment\ beyond\ i's\ control} \times \underbrace{(1-\tau^*)}_{effective\ tax\ rate}\right] - \underbrace{\frac{e_i^2}{2+\alpha}}_{cost\ of\ effort},$$

[8] Without redistribution i's future income (at time $T+h$) would be $y[\hat{q}_i + \varphi_i(\bar{e})]$, where: y denotes potential income, $\hat{q}_i$ is the exogenous share of potential income accruing to the individual and $\varphi_i(e_i)$ is endogenously determined by i's effort.

2) i's income at time THEN:

$$\hat{y}_{ir}(THEN) = [q_{ir} + \varphi_i(\bar{e})] \times y \times (1-\tau^*) = \left\{q_{ir} + \left[\left(\frac{1-q_{ir}}{10}\right) \times \left(\sum_{e_i=1}^{\bar{e}} \frac{\theta}{e_i}\right)\right]\right\} \times y \times (1-\tau^*) =$$

$$= \left\{ \underbrace{q_{ir} \times y}_{i's\ endowment:\ beyond\ i's\ control} + \underbrace{\left[\left(\frac{1-q_{ir}}{10}\right) \times \left(\sum_{e_i=1}^{\bar{e}} \frac{\theta}{e_i}\right)\right] \times y}_{increase\ in\ i's\ endowment\ given\ an\ effort\ level\ \bar{e}:\ under\ i's\ control} \right\} \times (1-\tau^*)$$

The experiments consists of four Sessions. In two of such sessions the cost of effort is low with respect to the productivity gains (α=3) ; in the remaining sessions the cost of effort is high (α=0.5). In any session, each participant chooses the level of redistribution 12 times under a different set of circumstances, each resulting by a particular combination of fairness in the distribution of endowments, observability of effort, time of payment.

Any individual plays the game twelve times under the following circumstances:

$$\begin{Bmatrix} (A1, B1, C1), (A1, B1, C2), (A1, B1, C3), (A1, B2, C1), (A1, B2, C2), (A1, B2, C3), \\ (A2, B1, C1), (A2, B1, C2), (A2, B1, C3), (A2, B2, C1), (A2, B2, C2), (A2, B2, C3) \end{Bmatrix}$$

in a session characterized by either high or low cost of effort with respect to its productivity, where:

Fairness in the distribution of incomes: A1) different endowments for participants, $q_{ir} \neq q_{jr}, \forall i \neq j$; A2) equal endowments for participants, $q_{ir} = q_{jr}, \forall i \neq j$

Observability of effort: B1) Individuals do not have any information on the average effort in the society; B2) Individuals are informed about the average effort in the society;

Time of payment: C1) individuals get the first payment after one month (time BEFORE) and the second payment after two months (time THEN); C2) individuals get the first payment after one month (time BEFORE) and the second payment after three months (time THEN); C3) individuals get the first payment after one month (time BEFORE) and the second payment after four months (time THEN).