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The importance of the future when deciding levels of personal responsibility and demand for redistribution

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Abstract. We experimentally investigate the link between individuals' value on future incomes and their support for redistributive policies today. The investigation identifies time preferences as a key driver of redistributive policies via their effect on personal responsibility, defined as costly but productive effort. The investigation also accounts for the strategic interplay between individuals in the choice of effort, identifying two key strategies: either exercise more effort and ask for less redistribution or free ride on others' efforts, asking for more redistribution. We find that individuals oriented toward the future tend to invest more and ask for less redistribution. We discuss the policy implications of this result.

JEL Codes: C91, D31, D91, H24, H30
Keywords: income redistribution, proportional income tax, personal responsibility, intertemporal preferences

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1. Introduction

This paper experimentally investigates the link between individuals' value on their future income prospects and their support for redistributive policies. The investigation identifies time preferences as a key driver of redistributive policies via their effect on personal responsibility, defined as a costly but productive individual effort.

We explicitly model the *redistribution game* as a public-good game, adding an intertemporal dimension. While the initial distribution of gross incomes is determined randomly (mirroring differences among individuals that are beyond their control), the future distribution of net incomes depends both on the effort that each individual decides to provide (reflecting personal responsibility) and on the redistribution carried out via a purely redistributive proportional income tax (the individuals vote for the rate). This framework has two main strategies to which anyone may conform: either the individual free rides on the effort provided by the others, asking for more redistribution, or they exercise more effort, asking for less redistribution (to secure future fruits of their effort). We experimentally test the hypothesis that the particular strategy chosen by each individual reflects the importance given to the future.

Overall, our paper suggests that in effort-rewarding societies, i.e., societies where everyone can reap the fruits of individual effort[1], people are ceteris paribus expected to ask for less redistribution.

Previous works investigating the determinants of individuals' preferences for redistribution using an experimental approach (Rutstrom and Williams, 2000; Checchi and Filippin, 2004; Cappelen et al., 2007; Konrad and Morath, 2011; Durante et al., 2014; Assandri et al., 2018; Becchetti et al., 2018) are generally designed with a two-stage structure. In the first stage, the initial distribution of incomes is determined either randomly (i.e., assuming luck as the *unique* source of income) or by considering the individual's success in performing a given task (i.e., assuming effort or ability as the *exclusive* source of income). In the second stage, participants' preferences for redistribution are elicited for any given income distribution to infer the criteria that individuals adopt in assessing the fairness of the

[1] Societies that reward individual effort are sometimes identified as "meritocratic" societies. According to Sen (1999), the term "meritocracy" was introduced in Michael Young's 1958 book "The Rise of Meritocracy." Young proposed a negative view of societies in which merit is equated with "intelligence-plus-effort" and attached to people because of their "talents." In particular, he imagined a society in which merit was defined according to individuals' IQ tested throughout life and described the future fall of these "meritocratic" societies. Recently, the word "meritocracy" has come under deep scrutiny, and the goal it indicates has become controversial (Sandel, 2020).

distribution. These works suffer from two critical limitations. First, they do not consider the intertemporal nature of the *redistribution game*, which becomes evident as soon as one thinks of the time needed to grasp the fruits of any investment (the moral of the Aesop's Fable *The Ant and the Grasshoppe, reflecting the* bourgeois spirit novel)[2]. Second, they do not properly account for the presence of incentives to free ride on the effort provided by the others.

Our main result suggests that time preferences can affect the demand for redistribution via their effect on individuals' willingness to undertake costly but productive efforts. Additional results show that the cost-to-benefit ratio of effort, inequity aversion, and perceived social mobility also affect support for redistributive policies. We find that informing subjects of a higher average level of effort by their fellows implies lower demand for redistribution.

The evidence we present provides insights into the ongoing academic debate linking the degree of redistribution to individuals' values and preferences (Almås et al., 2020; Pittau et al., 2016). In particular, our analysis is related to at least four strands of literature. First, by showing that individuals with strong preferences for the future are more willing to undertake costly investments lowering their demand for redistribution, we contribute to the literature highlighting that redistributive policies may lead to negative behavioral consequences, such as lower labor supply and lower effort (Trabandt and Uhlig, 2011; Saez et al., 2012; Doerrenberg et al., 2017). Second, our modeling strategy of the redistributive tax makes our experiment close to a public-good game. Concerning the standard public-good game (Ledyard, 1995), our setting adds an intertemporal dimension emphasizing the importance of time preferences. Third, we connect to the literature eliciting intertemporal preferences using surveys (Wang et al., 2016); however, differently from several papers considering hyperbolic discounting (Frederick et al., 2002), here we consider a straightforward approach, validated by Bauer et al. (2020) and Falk et al. (2022). experimental literature on fairness ideals and redistribution. In particular, the paper by Cappelen et al. (2007), which examines fairness in situations in which the size of the pie to be redistributed involves production, is very close in spirit to ours. Our investigation adds the consideration of the intertemporal nature of investment decisions. The typical situation

[2] See, e.g., Alesina and Giuliano (2010). The degree of social mobility may indeed play an important role, as shown by Piketty (1995), Bénabou and Ok (2001), and Alesina and La Ferrara (2005). Hence, the desired level of redistribution and the individual effort likely depend on considerations about the future position the individual aspires to occupy in the income ranking. For an example of experimental studies focusing on the role of perceived social mobility, see Checchi and Filippin (2004) and Konrad and Morath (2011).

we envision is an investment in education or training with an immediate cost whose benefits will only materialize in the future. As in Cappelen et al. (2007), we also find that the majority of the participants care about the investment made by others when they decide how much to invest, implying that fairness considerations cannot be reduced to income inequality aversion.

From a policy perspective, our study contributes to the public debate concerning the reform of redistributive policies to account for personal responsibility. Indeed, although rarely mentioned in traditional welfare economics, personal responsibility plays an influential role in public policy and has been scrutinized by social scientists and political philosophers in recent decades (Ahola-Launonen, 2016). Despite this popularity, personal responsibility's widespread use as a reference standpoint for the design of redistributive policies is controversial (Cappelen and Norheim, 2005) because people's concerns about the fairness-responsibility nexus are much more complex than a naïve view of responsibility might suggest (Cappelen et al., 2007; Mollerstrom et al., 2015). Concerning such an important debate, our paper outlines, on the positive side, that preferences for redistribution are related to personal responsibility through the importance individuals give the future.

This paper is organized as follows. Section 2 sketches a helpful conceptual framework for identifying all the variables at play when framing personal responsibility and the demand for redistribution in an intertemporal setting. Section 3 describes the experiment, and Section 4 illustrates our empirical analysis and discusses the findings. Section 5 concludes by discussing some practical implications of the analysis and avenues for future research.

2. An intertemporal conceptual framework to link responsibility with preferences for redistribution

This Section sketches a two-period model of individual choice. The model can highlight the nexus between individual preferences for redistribution and personal responsibility simply and intuitively. Appendix C presents a more formal version of the model. In this section, we sketch the model's main features and discuss the research hypotheses it suggests.

2.1. *Basic assumptions*

We consider a two-period model with $i = 1, \ldots, n$ individuals. Time is indexed by Present (P) and Future (F). The fundamental source of difference in the population is given by the individual-specific share of potential income y, defined as the maximum income an individual can earn both at P and F. At time P, this share only reflects *circumstances* beyond one's control (like the family background or innate capacities), whereas, at time F, it also reflects *personal responsibility*, depending on the number of resources the individual can decide to invest at P.

More precisely, at time P, all individuals i get a share q_{iP}, with $0 \leq q_{iP} \leq 1$, of potential income y. This share q_{iP} is exogenously determined; however, individuals can decide to invest part of the exogenous income available at P to increase the share q_{iF} of potential income obtainable in the future. We assume that $q_{iF}(e_i) = q_{iP} + \varphi_i(e_i)$, where e_i is the (costly) investment (e stands for *effort*[3]) made by i at P, and φ_i is an individual-specific function determining rewards from investment in terms of future higher portions of potential income y. In other words, the cost of the investment is borne at P, while rewards are available at F. We think of the investment as a proxy for *individual responsibility*, assuming that the monetary cost of the investment, impacting on income at P, is $\sigma(e_i)$. An intuitive interpretation relates to the investment in education an individual makes at P to increase their future productivity and income at F.

Besides choosing how much to invest, at P, any individual declares their preference over the rate τ of a purely redistributive income tax, with $0 \leq \tau \leq 1$, determining net income in both periods P and F. The tax is purely redistributive since the proceeds it generates are equally distributed between all community members (Durante et al., 2014). This means that individuals whose gross income is above the average pay a tax; they receive a transfer in the opposite case. The higher the tax rate, the more the post-tax incomes approach the mean income. In the limiting case where $\tau = 1$, post-tax incomes are all equal (see Appendix C for details).

Following the relevant behavioral literature, we assume that individuals' preferences over the investment and the tax rate, $U_i(e, \tau)$, combine the desire for material rewards with altruistic concerns (Fehr and Schmidt, 1999):

[3] Conceptually we have followed a long-standing tradition in Economics, dating back to Alfred Marshall's Principles of Economics, in which savings and the corresponding investments in the neoclassical tradition – is synonymous with abstinence; "the sacrifice of present pleasure for the sake of future," or "when a person abstained from consuming anything which he had the power of consuming, with the purpose of increasing his resources in the future" (Marshall, 1920, book 4, Chapter 7).

$$U_i(e,\tau) = \underbrace{[\hat{y}_{iP}(\tau) - \sigma(e_i)] + \delta_i \hat{y}_{iF}(\tau)}_{Material\ rewards} \underbrace{-\Omega_{\mathrm{i}}(\tau)}_{Unfairness\ concerns} \quad [1]$$

The first part of equation [1] represents material rewards, given by the sum of post-tax (net) income both at P and at F–$\hat{y}_{iP}(\tau)$ and $\hat{y}_{iF}(\tau)$, respectively–minus the monetary cost of the investment made at P, $\sigma(e_i)$. Income $\hat{y}_{iF}(\tau)$ is positively affected by the investment made at P; however, as future income is not available immediately, it is discounted at a rate δ_i, which represents the individuals' preferences for the future.

The second part of equation [1] represents unfairness concerns. We suppose that individuals dislike inequitable outcomes. The individual-specific parameter Ω_{i} captures the utility loss from inequitable outcomes.

2.2. *Individual optimal choices*

All the results contained in this section—including those related to the optimal choice of both e_i and τ_i—are derived in Appendix C. In what follows, we provide some intuition for them, gathering the key consequences of the formal analysis in hypotheses for experimental testing.

Three main factors drive individual choices: i) the intertemporal discount rate, δ_i; ii) the productivity of the investment; iii) the cost of the investment. Starting from the intertemporal discount rate, we expect, *ceteris paribus*, higher investments from individuals who care more about the future, i.e., we expect that e_i increases with δ_i. The intuition is that people who are less impatient and therefore attach a higher weight to the future are more willing to bear the present investment cost in exchange for future gains. This conclusion becomes less likely the higher the investment cost relative to productivity.

Likewise, the analysis in Appendix C shows a relationship between the investment chosen by a given individual and their optimal tax rate. Indeed, individuals who invest resources at P sacrifice to increase their future earnings. In light of the current sacrifice, they are likely to be less prone to redistribution, as a higher tax rate can reduce the reward of their current sacrifice.

Given these considerations, we expect that the preferences for the future described by the parameter δ—the *shadow of the future* according to Axelrod and Hamilton (1981)−play a role in determining the optimal investment and tax rate. When δ goes up, the future

becomes more important, and we expect an increase in the optimal investment and a reduction in the optimal tax rate, conditional on the productivity and the cost of the investment. When the cost-to-productivity ratio worsens, people are expected to reduce their investments. In the limiting case, they might even decide not to invest, irrespective of their preferences for the future.

All of these considerations lead to the following hypothesis, which we test experimentally:

Hypothesis 1. *When the importance of the future increases, individuals increase their investment and decrease their demand for redistribution. For given preferences for the future, the higher the investment cost relative to productivity, the lower the investment and the higher the demand for redistribution.*

Hypothesis 1 clarifies that the *more-investment-less-redistribution* strategy presumes a relevant concern for future outcomes. Whoever invests more at *P* to obtain a higher future income is probably in favor of containing the level of redistribution. On the contrary, individuals that do not value the future sufficiently (or those facing a very unfavorable cost-to-productivity ratio) are more likely to play the alternative strategy of free riding on the effort of others—investing little at *P* and asking for more redistribution.

2.3. *Fairness concerns*

To understand the role of time preferences properly, equation [1] clarifies that we should consider other variables. We consider fairness concerns first. If the last term in equation [1] Ω_i was zero, individuals would only be interested in the material consequences of their choices. Thus, individuals whose income is above the mean income in both periods would never desire a positive tax rate; given the tax structure, a positive income tax would squeeze their income toward the mean, and this, from [1], implies a utility loss.

It is a well-established result in the behavioral economics literature that individuals dislike inequitable outcomes and that, in addition to their material payoffs, they care about fairness and willingness to change the distribution of material outcomes at a personal cost (Heinrich et al., 2001). The term Ω_i captures this inequity aversion. Unfairness concerns can motivate the desire for a positive tax rate—promoting redistribution—even though one's

income is above the average income at P and *F*. In other words, individuals may favor redistributing income even though it is costly.

These considerations lead to a second hypothesis:

Hypothesis 2. *Inequity-averse individuals can support redistribution even if their income is higher than the average population income at P and F.*

If Hypothesis 2 were confirmed, a natural interpretation would be that psychological gains related to more equitable outcomes are sufficient to counterbalance the material losses that richer than average individuals experience because of redistribution.

2.4. *Strategic considerations*

The distribution of post-tax incomes at *F* depends on all individuals' investments decided at P and the society's tax rate. Individuals can only influence the tax rate's effective level by voting for their optimal tax rate. Investments made by the individual's fellow citizens can influence both the optimal tax rate and the optimal individual investment.

There are two possible alternative strategies. First, an individual might try to counterbalance the low investments of fellow citizens by increasing their investments, which, according to Hypothesis 1, should negatively affect their optimal level of redistribution. Alternatively, observing the scarce investments of the others, one might decide to provide a low investment (to avoid exploitation) and increase the demand for redistribution. Similar relationships in the two possible directions hold if high investments are observed for other citizens and can be reinforced by the observability of the investment choices of other fellows.

These considerations motivate the third hypothesis:

Hypothesis 3. *When investment decisions are interdependent, the individual demand for redistribution is ceteris paribus lower (higher) if high (low) investments provided by the other citizens complement the individual's investment; it is instead higher (lower) if high (low) investments by the others are a substitute of the individual's own.*

To sum up, according to theory, the keys to understanding individual choice among the two strategies of free riding on other's investments and asking for more redistribution

against that of investing more and asking for less redistribution are i) the individuals' time preferences; ii) the costs and benefits of investment; iii) the aversion to inequitable outcomes (especially when circumstances beyond the individual's control determine inequity); and iv) how the effort provided by observed other individuals affects one's effort.

All these factors are considered when defining the experimental setup to which we now turn.

3. The experiment

3.1. Design

This section illustrates our experimental design, which follows directly from the framework presented in Section 2. Complete instructions provided to participants are available in the Supplementary material. Subjects were informed that the experiment unfolds over two periods, Present (*P*) and Future (*F*)[4] and that monetary payoffs would be received *at due time*. In particular, while time *P* payoffs could have been cashed one month after the experiment−established to avoid the bias in favor of payments on the spot (Andreoni and Sprenger, 2012a,b)−time *F* payoffs could be cashed only later (two, three or four months after the experiment, depending on the treatment).

The timing of the experiment is represented in Figure 1.

[4] For clarity, in the paper, we use PRESENT and FUTURE for consistency with the conceptual framework; however, in the instructions to participants provided in the supplementary material, we use BEFORE and THEN, which are literal translations from the original instructions in Italian.

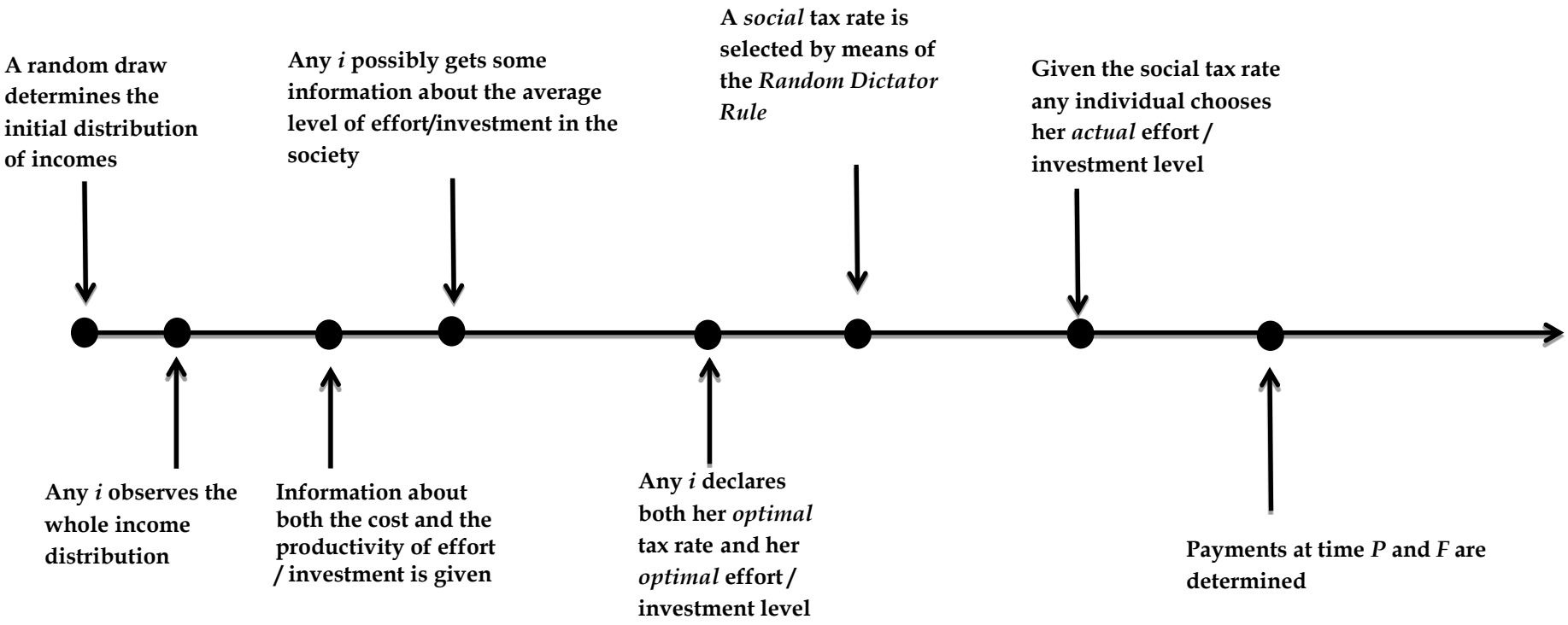

Figure 1. Timing of the experiment

At the beginning (time *P*), each individual is endowed with a share q_{iP}, with $0 \leq q_{iP} \leq 1$, of potential income y. The share of potential income at time *P* is fully exogenous; it is determined through an individual-specific random draw from a uniform distribution with support [0.3, 0.7]. Exogenous pre-tax income at time *P* is therefore obtained by multiplying the share q_{iP} by potential income y

$$\textit{pre-tax income at } P = (q_{iP} \times y),$$

where y = 100 tokens.[5] Tokens are convertible into euros at a fixed exchange rate: 1 token = 0.10 €; hence, pre-tax incomes at *P* range between 3 € and 7 €. Any subject observes the exogenous income of all participants. Then, each is asked to report their optimal investment and individual optimal rate of a purely redistributive proportional income tax.

Following these choices, to determine the payments for each subject, the tax rate to be applied to all incomes τ^s is picked from the set of optimal tax rates through the Random Dictator Rule (the probability is 1/n that *i*'s optimal tax rate becomes the effective tax rate τ^s, for any $i = 1, \ldots, n$). The effective tax rate τ^s is then publicly announced. Given this, each individual is also asked to choose their *actual* investment level for the sake of computing the final payments, as investment deterministically increases one's share of potential income at *F*. Given the tax rate τ^s, the cost of investments borne by any subject at *P*, and the benefits delivered at *F*, payoffs are computed for any participant.

As emphasized above, while time *P* payoffs were cashed by participants one month after the experiment, time *F* payoffs were cashed later (two, three, or four months after participation).

3.2. Choosing the optimal investment and the optimal tax rate

Following the conceptual framework in Section 2 above, in every experiment round, each subject can choose among 10 possible investment levels, $e_i \in [1, \ldots, 10]$. Investment produces deterministic benefits (to avoid the role of risk); however, it is costly in terms

[5] For instance, if q = 0.43, the gross income of the relevant individual would be 0.43×100 = 43 tokens.

of resources that subjects have to give up at time *P*. The monetary cost of investment $\sigma(e_i)$ (in tokens) is computed according to the following (convex) function:

$$\sigma(e_i) = \frac{e_i^2}{2+\alpha} \quad [2]$$

We define two different scenarios for parameter α: identifying a low cost (α=3) and a high cost of investment scenario (α=0.5). The number of tokens that individuals have to give up depends on their choice of e_i, as reported in Table 1. These amounts were clearly shown to participants. Subjects were only aware of the cost of each investment level in the scenario relevant to them.

Level of effort	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Cost of effort at time P when α=3	0.2	0.8	1.8	3.2	5	7.2	9.8	12.8	16.2	20
Cost of effort at time P when α=0.5	0.4	1.6	3.6	6.4	10	14.4	19.6	25.6	32.4	40

Table 1. The monetary cost of the investment in terms of tokens

The benefits of the investment are determined through an individual-specific function:

$$\varphi_i(e_i) = \left[\left(\frac{1-q_{iP}}{10}\right) \times \left(\sum_{e=1}^{e_i} \frac{3}{e}\right)\right] \quad [3]$$

Eq. [3] is used to compute pre-tax future gross income as follows:

$$\textit{pre-tax gross income at } F = (q_{iP} + \varphi_i(e_i)) \times y.$$

Table 2 reports useful examples for participants to understand the impact of their choice of investing part of income at *P* on future income at *F*. Eq. [3] holds the following two realistic properties: i) productivity is decreasing in the income level, i.e., the productivity associated to each effort level is higher for individuals who are initially more at a disadvantage; ii) re-ranking is not allowed, i.e., for any two individuals *providing the same effort*, the income at *F* is higher for the one with better starting conditions[6]. Notice also that $(q_{iP} + \varphi_i(e))$ approaches one as the effort tends to the maximum feasible level.

[6] However, social mobility is not ruled out within this setting since it might occur whenever the more disadvantaged provide more effort than individuals characterized by better starting conditions.

Hence, individuals can approach the top of the pre-tax income distribution at F by exercising higher levels of effort.

Pre-tax income at P in terms of tokens					
	30	40	50	60	70
Effort level	**Pre-tax income at F in terms of tokens**				
1	51.0	58.0	65.0	72.0	79.0
2	61.5	67.0	72.5	78.0	83.5
3	68.5	73.0	77.5	82.0	86.5
4	73.7	77.5	81.3	85.0	88.8
5	77.9	81.1	84.3	87.4	90.6
6	81.4	84.1	86.8	89.4	92.1
7	84.4	86.7	88.9	91.1	93.3
8	87.0	88.9	90.8	92.6	94.5
9	89.4	90.9	92.4	93.9	95.5
10	91.5	92.7	93.9	95.1	96.4

Table 2. Pre-tax income at F for 5 different pre-tax income levels at P and 10 possible effort levels

Raising investment is not the only available way to influence outcomes. One can try to modify the net income distribution via a purely redistributive income tax rate.

The tax-transfer structure in the experiment is equal to the one defined in the theoretical setting; any individual pays a share τ of their income, and the total revenues are equally distributed among all the participants. This implies that as τ increases, the tax-transfer structure drives any participant's final income toward society's average income[7].

Thus, *post-tax* individual incomes are computed as follows:

i's post-tax income at P = $(q_{iP} \times y) \times (1 - \tau)$ - $\sigma(e_i)$ + $\left[\frac{\tau}{n}\sum_{j=1}^{n}(q_{jP} \times y)\right]$

i's post-tax income at F =$\left(q_{iF} + \varphi_i(e_i)\right) \times y \times (1 - \tau)$ + $\left[\frac{\tau}{n}\sum_{j=1}^{n}(q_j + \varphi_j(e_j)) \times y)\right]$

Notice that to compute *i's* final net income at *P*, it is necessary to consider the monetary cost of the investment, $\sigma(e_i)$, for all individuals exerting a positive effort.

[7] Whether an individual pays a net tax or receives a net transfer depends on whether their income is above or below the average income. The tax is purely redistributive and produces the effect of reducing the variance around the mean as the tax rate increases. With $\tau = 1$, the income of any individual is equal to the society's average income.

3.3. Implementation

The experiment was conducted at the *Laboratory of Experimental and Simulative Economics* (AL.EX.) of the University of Piemonte Orientale in Alessandria. It was programmed with the Z-Tree software (Fischbacher, 2007).

We recruited 80 subjects for four experimental sessions (20 for each session, corresponding to the available workstations in the lab). Each subject participated in one experimental session only. Subjects were randomly drawn from the database managed by AL.EX. and contacted via e-mail. All participants were undergraduate students with academic backgrounds in social sciences (law, political science, economics, or sociology).

We ran two daily sessions: one in the morning, the other in the afternoon. In two sessions (first day-morning; second day-afternoon) the cost of effort was high (Scenario 1, $\alpha = 0.5$ in [2]); in the remaining two sessions (first day-afternoon; second day-morning) the cost of effort was low (Scenario 2, $\alpha = 3$ in [2]).

In addition to the *between-subject* treatment, our design exploits a *within-subject* approach. In each session, after the participants observed the cost of investment assigned to the scenario they were involved in (either low or high) and the income distribution, they declared their optimal *investment level-tax rate* combination. After observing the actual tax rate, the software used the participants' actual investment level to compute the final payoff. Each subject expressed their preference and made their choices 12 times under a different combination of the following circumstances.

A. *Observability of average effort:* Individuals either have (A1) or do not have (A2) information on the average effort provided in the society, i.e., information on the average investment level provided in a previous set of experimental sessions by participants drawn from the same population of students[8]. This information was displayed on the screen at the beginning of each treatment round, where the average effort level was observable. It allows an investigation of Hypothesis 3 in Section 2 above (for a recent application of this procedure, see Holst et al., 2015).

B. *Fairness in the distribution of exogenous gross incomes at P:* Participants are endowed either with different (B1) or equal (B2) shares of potential income. The aim is to check

[8] The experimenter clarified that the same experiment was run six months earlier by selecting a sample of participants from the same list of students who gave consent to be recruited.

whether inequalities due to circumstances beyond one's control affect the demand for redistribution (this circumstance provides information to test Hypothesis 2 above).

C. *Time of payment:* The delay required to obtain monetary payoffs at time *F* was established at two (C1), three (C2), or four (C3) months after participation in the experiment, to control for the impact of the time required to grasp the fruits of effort. For given time preferences, this corresponds to a reduction of the benefits from the effort. According to the conceptual framework in Section 2, effort should reduce when the delivered benefits get smaller; *ceteris paribus*, this would also make free riding more appealing.

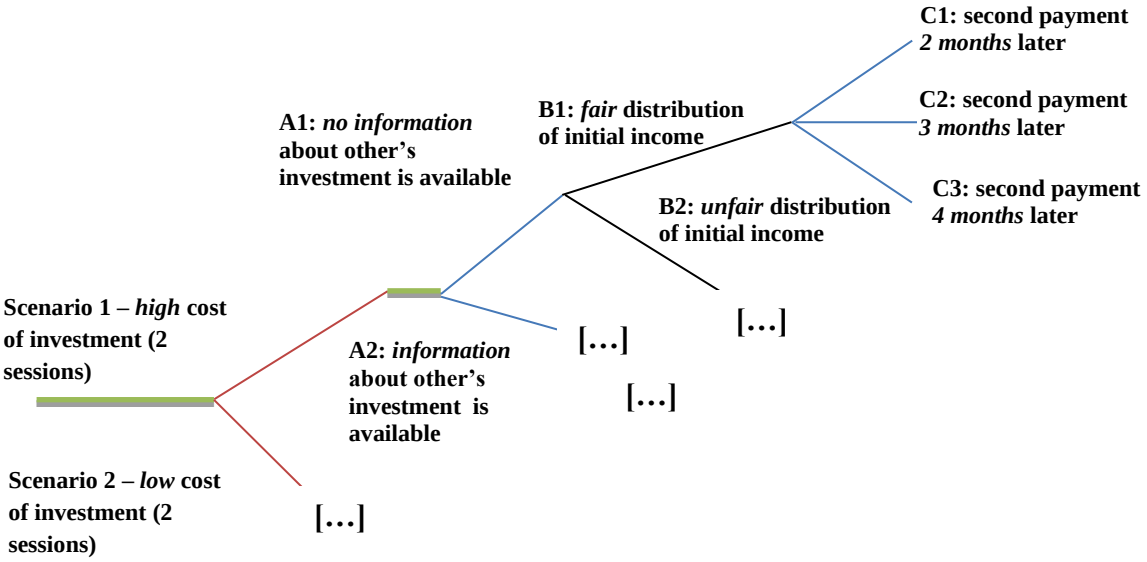

Figure 2. Structure of the experiment

Any individual makes choices repeatedly under different circumstances, in order to test how the optimal tax rate changes according to: A) the average investment level in the society, B) the fairness in the distribution of initial gross incomes, C) the time when individuals receive the second payment.

Individuals were informed that only the tokens won in a randomly selected round (determined at the end of each session) would be converted into euros. They were also informed that the attendance fee of 100 tokens (€10), due because of their participation in the experiment, would be equally split into two tranches of identical amounts (Andreoni and Sprenger, 2012a) to be paid at time *P* (one month after the experiment) and *F* (two, three or four months after the experiment), depending on the treatment (C1, C2 or C3).

Each participant was equipped with a table reporting the number of tokens they had to give up (at *P*) for any possible effort level (see Table 1) to facilitate choices during the experiment. Each participant was also endowed with a table reporting the number of tokens they would receive with certainty at *F* for 5 different income levels at P and 10 possible effort levels (see Table 2).

3.4. Post-experiment survey

At the end of each session, participants were asked to complete a post-experiment survey. Besides collecting demographic information, the survey aimed to elicit individual intertemporal preferences and investigate the beliefs that, according to the literature, are relevant drivers of the demand for redistribution.

Regarding the subjective importance individuals give to the future, we asked what amount of an unexpected monetary gift (supposed to be equal to one's monthly household income) one would save. The answer is based on a Likert scale, taking a value from 1 (no saving) to 5 (everything saved)[9]. The lower the selected value, the lower the individual's discount factor, hence the importance they attribute to the future. We use this question to provide a test for Hypothesis 1 above; we expect people with a longer time horizon to exert higher present costly effort to obtain desired benefits in the future, and we also expect these individuals to ask for less redistribution.

Regarding individual values and beliefs, we examined proxies for inequity aversion, asking questions on the perceived degree of upward mobility and the source of income inequality. We expect people who perceive a satisfactory level of upward mobility or believe that effort, not luck, is the main determinant of individual success to be less in favor of redistributive policies. The complete post-experiment survey can be found in Appendix B.

3.5. Experimental sample

The final sample comprised 71 subjects that showed up and completed all 12 rounds of the experiment. The average duration of each session was about 60 minutes, including identifying the participants and introducing the experiment.

[9] This approach to measure time preferences has been validated by Falk et al. (2022) and Bauer et al. (2020).

In particular, at the beginning of each session, participants were first asked to read the instructions carefully. In addition, after an appropriate amount of time, the experimenter read the instructions out loud. It was clear to all participants that we would use the expressions "investment level" and "effort level" interchangeably (see the discussion in footnote 3). Then, each participant was invited to examine the tables illustrating the cost and benefits of the investment and to follow an example on the computer screen. The example illustrated the functioning of the tax-transfer mechanism for a society formed by three individuals with three different initial endowments (30, 50, 70 tokens) under five alternative tax regimes (τ = 0.2, 0.4, 0.6, 0.8, 1). The purpose of the example was purely illustrative and had no effects on final payoffs.

At the end of each round, participants were informed about their net payments at *P* and *F*. The average earning was about 25 euros; thus, the part of the total payment related to individual choices (15 euros) was about 50% higher than the show-up fee (10 euros). As for the delayed payments, all the subjects returned to the lab to collect their money. This is unsurprising since the experiment was conducted at a small university, and students attend daily courses during the term. The lab is well known to students, close to the main entrance, and we also posted a reminder for students on the department bulletin board at due times.

4. Empirical analysis

4.1. Descriptive evidence on optimal investment and tax rate

This section provides descriptive evidence on the optimal tax rate and the investment level chosen by participants. First, Figures 3a and 3b show how the average tax rate and investment vary with the level of importance that participants gave to the future. To proxy time preferences, we consider the variable *future*, built using the specific question included in the post-experiment survey. The variable takes values from 1 (no importance given to the future) to 5 (future is very important).

We compare the mean of optimal tax rate and optimal effort levels between two groups of subjects: those characterized by a *weak* preference for future outcomes (subjects for whom the value of *future* is equal to 1 or 2) and those characterized by a *strong*

preference for future outcomes (those for whom the value of *future* is equal to 3, 4 or 5). Leaving out "3" as a neutral choice does not affect our analysis.

The average optimal tax rate decreases from 50% to 37% when passing from subjects with low to high preference for the future (the p-value of the Mann-Whitney test on the difference is 0.012; 0.079 with std. err. adjusted for clusters in sessions). Regarding the optimal effort level, we observe an increase from 4.5 to 4.6, although the difference, in this case, is not statistically significant.

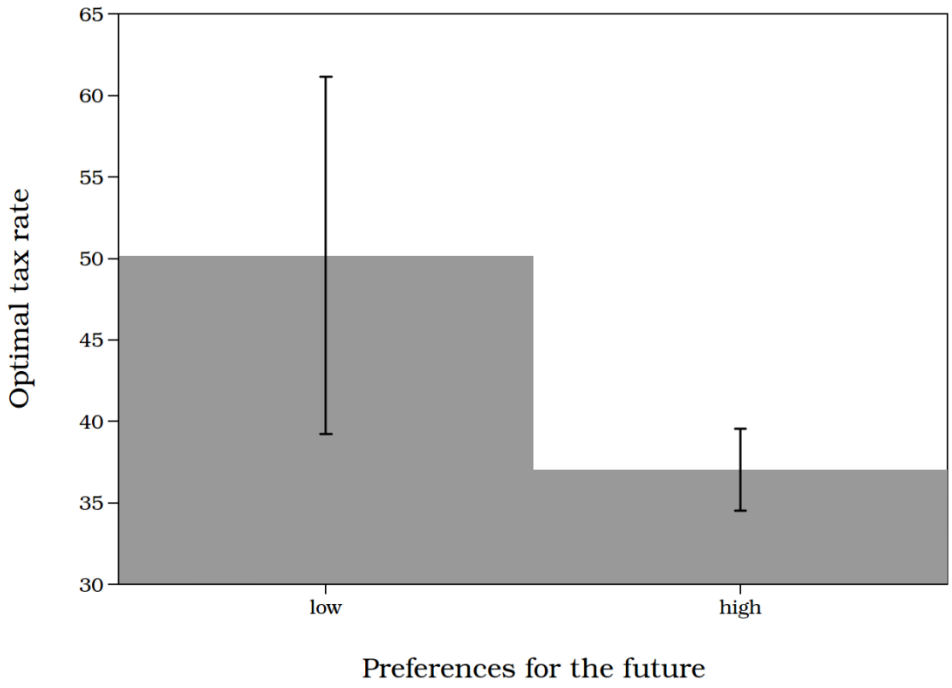

Figure 3a. Optimal tax rate and preferences for the future

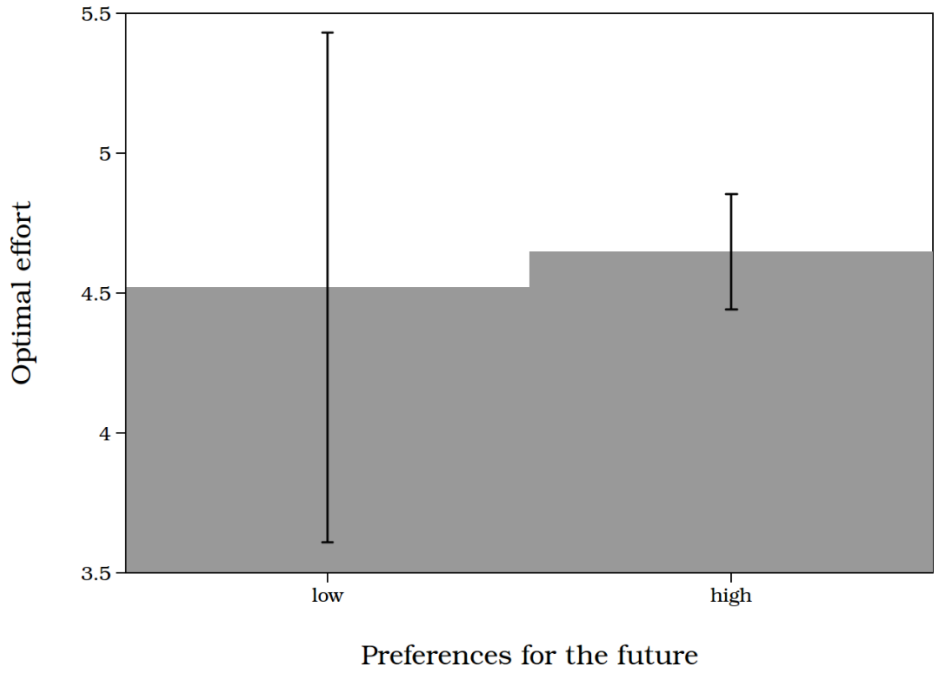

Figure 3b. Optimal investment and preferences for the future

Note: *low* preferences for the future refer to subjects for whom the values of the variable *future* are equal to 1, 2; *high* preferences for the future refer to subjects for whom the values of the variable *future* are equal to 3, 4, and 5.

Figures 4 to 6 focus on the interplay between personal responsibility and preferences for redistribution, comparing optimal tax rates and optimal investment across different scenarios. These are distinguished by a particular combination of average investment level provided in the society (*low* < 5, *high* ≥ 5); the size of benefits accruing from investment, as measured by the time required to grasp its fruits (*short* = 2 months later; *long* = 3 or 4 months later); and cost of investment (*low* when $\alpha = 3$, *high* when $\alpha = 0.5$).

Figures 4a and 4b show that when society's average investment increases, individual investment also increases (from 4.2 to 4.7, p-value = 0.10; 0.215 with std. err. adjusted for clusters in sessions); correspondingly, the demand for redistribution decreases (from 41% to 32%, p-value = 0.002; 0.015 with std. err. adjusted for clusters in sessions). These findings suggest some strategic complementarity in investment decisions. When most individuals in society choose a high investment to increase the size of the future pie, individuals are likely to react by increasing their personal investments;

consequently, they vote for less redistribution (see the discussion following Finding 3 in Section 4.2.2. below).

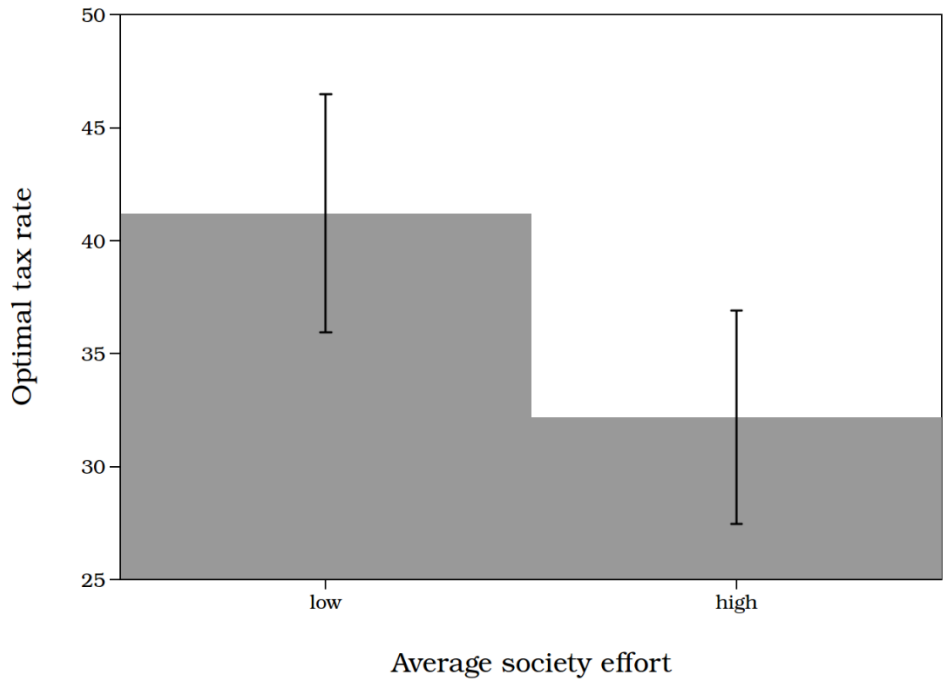

Figure 4a. Optimal tax rate and average society investment

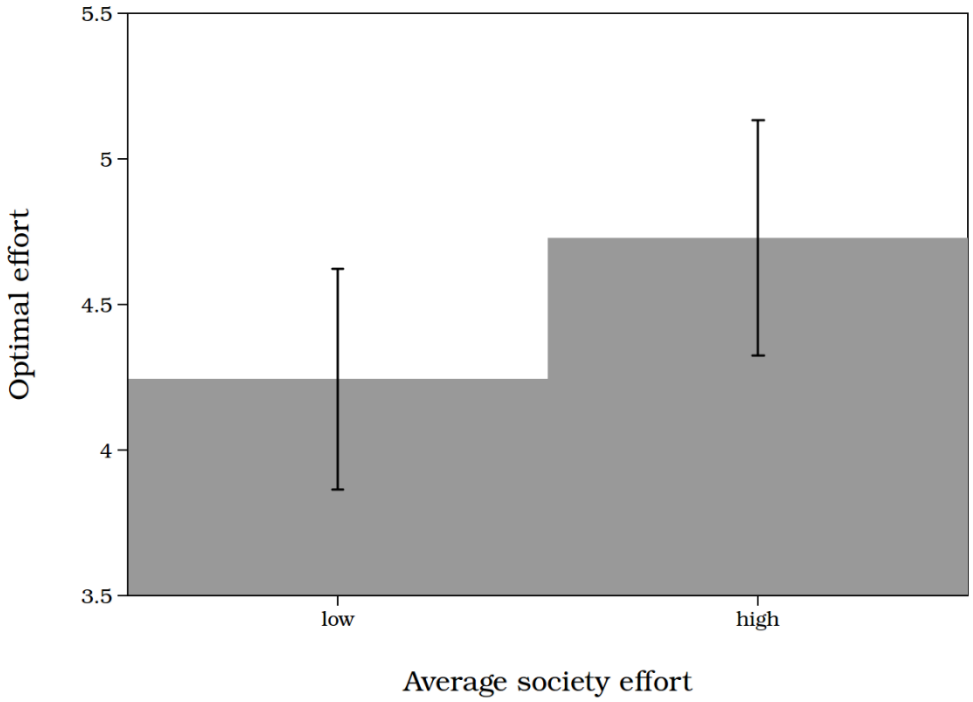

Figure 4b. Optimal investment and average society investment

Note: *low* average society effort refers to rounds where the subjects observe values of average effort provided in

previous experimental sessions lower than 5 (the median value); *high* average society effort refers to rounds where the subjects observe values of average effort provided in previous experimental sessions equal or higher than 5.

Less clear-cut findings arise when examining the role played by the benefits and costs associated with an investment. Figures 5a and 6a indicate a reduction of the optimal tax rate when the investment benefits decrease (due to the long delay in receiving the second payment) and its cost increases. On the contrary, Figures 5b and 6b suggest a lower optimal investment when the benefits of investment decrease but a higher optimal investment when its cost increases; however, the differences observed in the optimal tax rate and the optimal investment are relatively small (the maximum absolute difference is 1.7 percentage points for the tax rate and 0.5 for the investment) and never statistically significant.

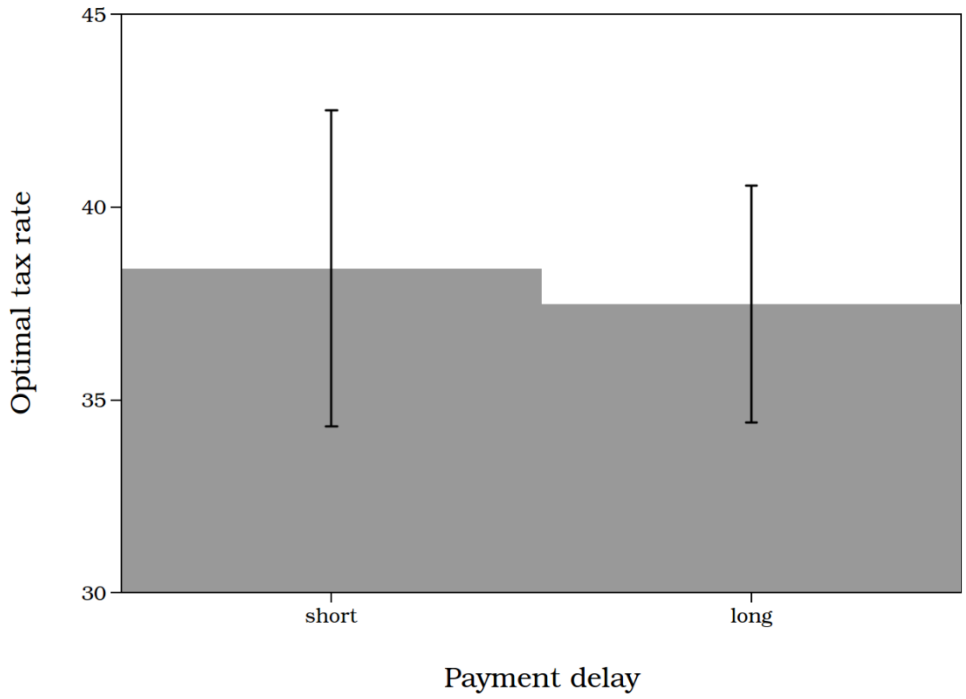

Figure 5a. Optimal tax rate and payment delay

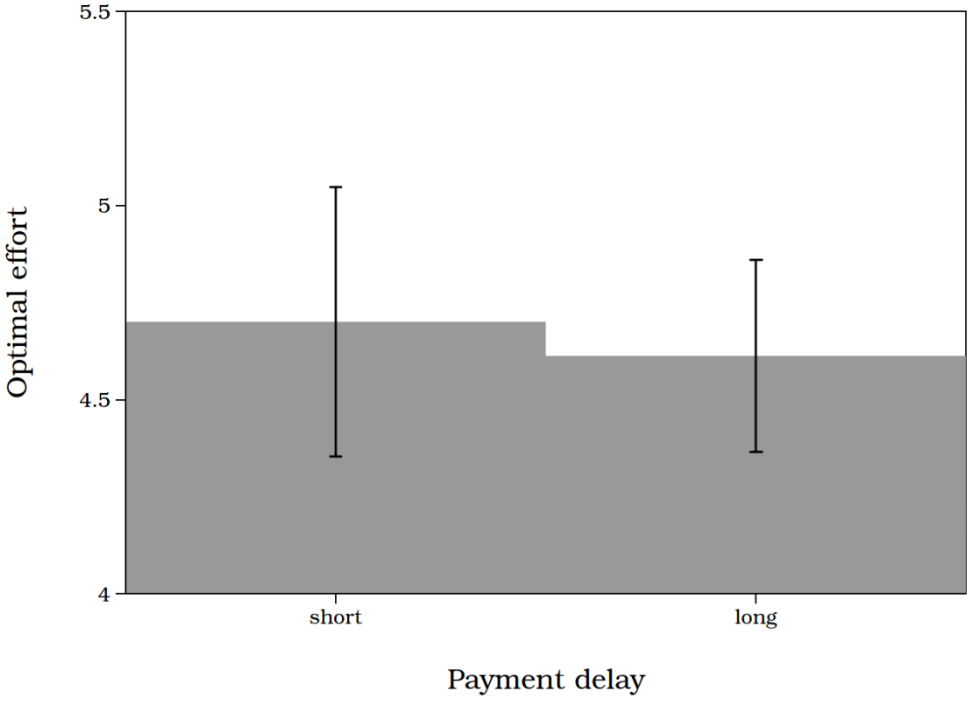

Figure 5b. Optimal investment and payment delay

Note: *short* payment delay refers to rounds where the delay required to obtain the second payment is 2 months later; *long* payment delay refers to rounds where the delay required to obtain the second payment is 3 or 4 months later.

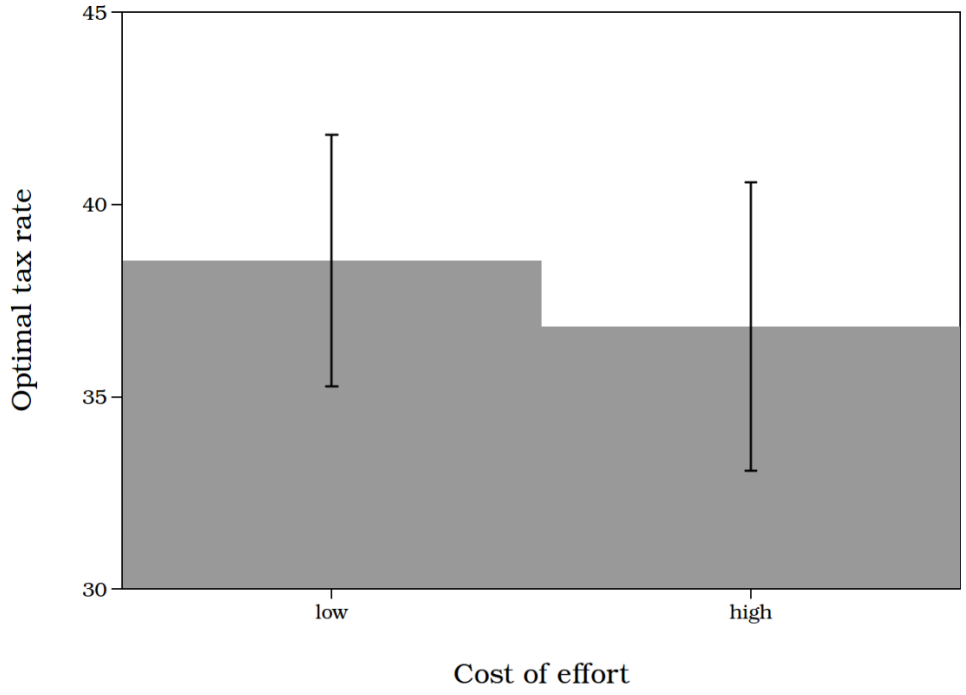

Figure 6a. Optimal tax rate and cost of investment

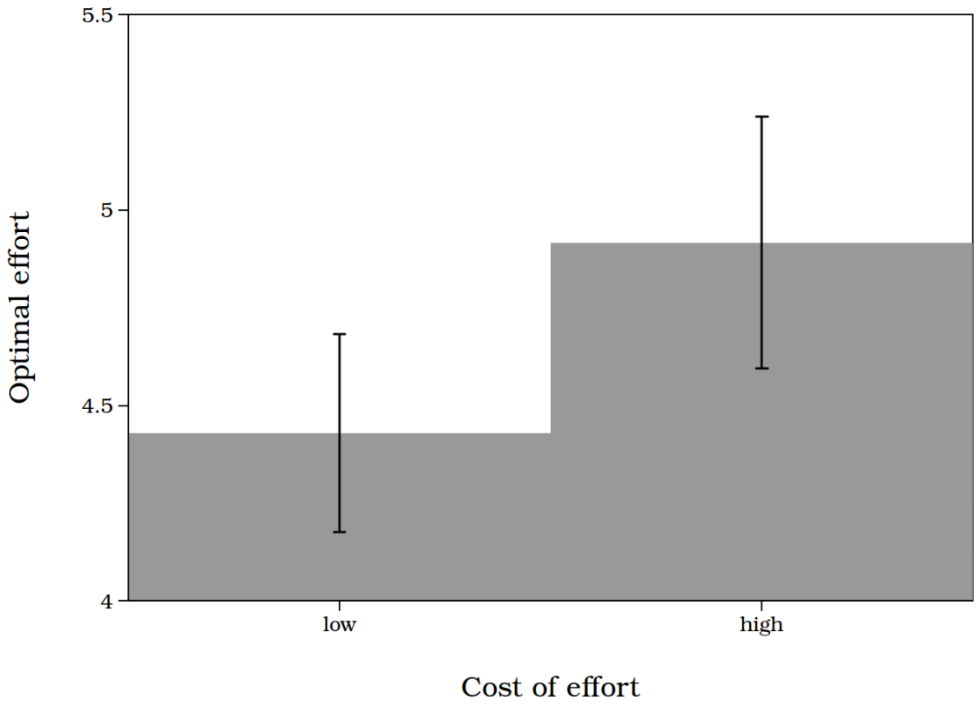

Figure 6b. Optimal investment and cost of investment

Note: *low* cost of effort refers to experimental sessions where the cost of effort is low (Scenario 2, $\alpha = 3$); *high* cost of effort refers to experimental sessions where the cost of effort is high (Scenario 1, $\alpha = 0.5$).

Regarding the effects of circumstances beyond the individuals' control (Figure 7a), the evidence shows that the optimal tax rate is higher (43% vs. 32%, p-value = 0.000; 0.001 with std. err. adjusted for clusters in sessions) when subjects are endowed with different initial incomes (*unfair* distribution). A possible explanation, in line with Hypothesis 2, is that subjects are averse to inequitable outcomes due to unfortunate circumstances and ask for more redistribution to help disadvantaged people.

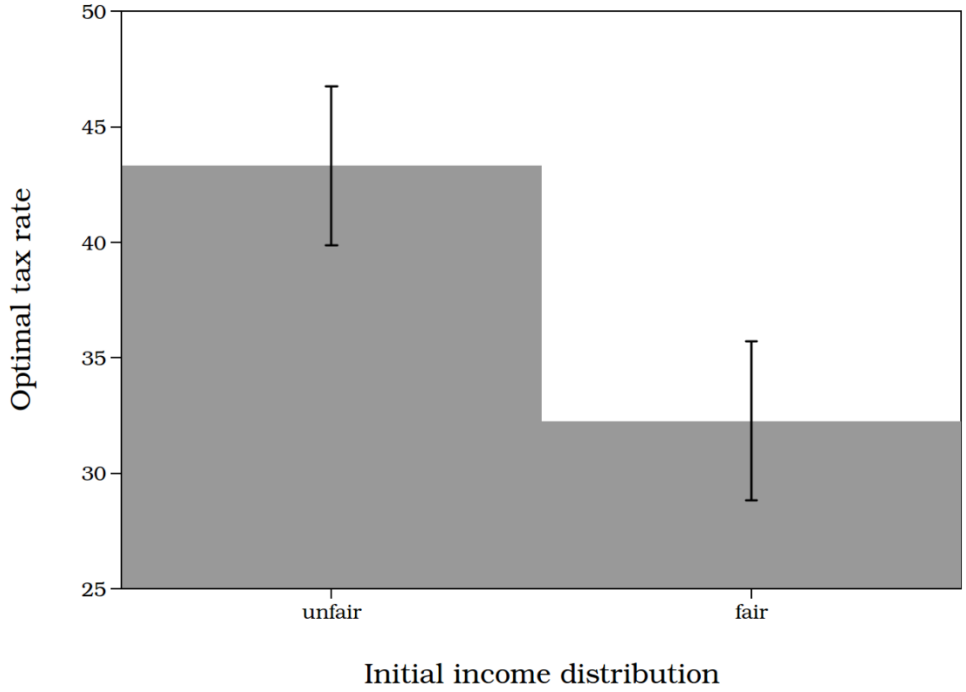

Figure 7a. Optimal tax rate and initial income distribution

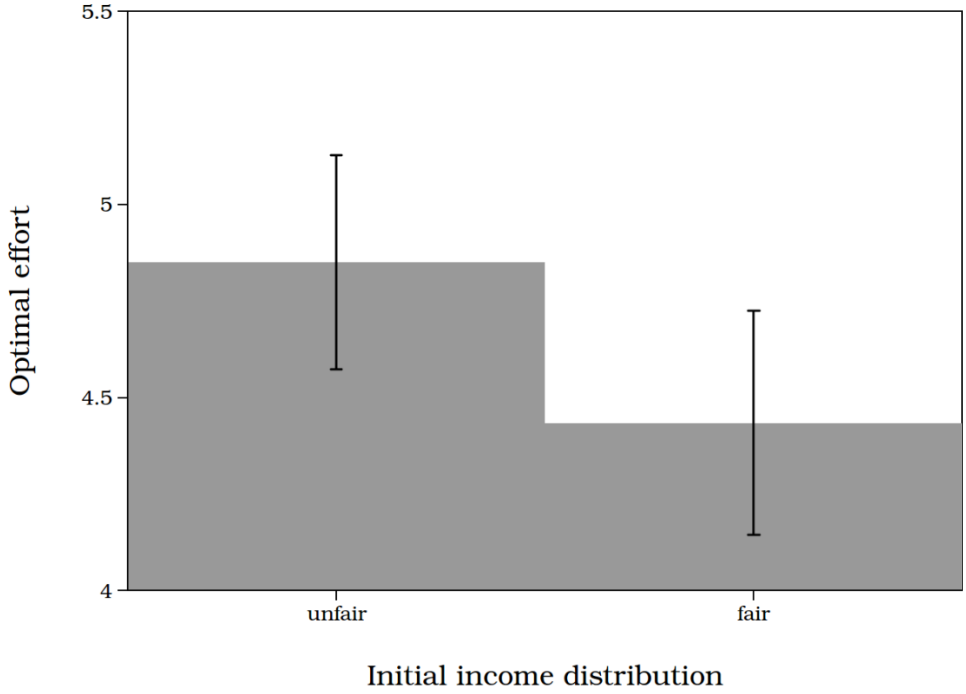

Figure 7b. Optimal investment and initial income distribution

Note: *unfair* distribution refers to rounds where the subjects are endowed with different initial incomes; *fair* distribution refers to rounds where the subjects are endowed with equal initial incomes.

The average individual investment also increases when passing from a fair to an unfair distribution of initial incomes (4.4 vs. 4.8, p-value = 0.012; 0.043 with std. err. adjusted for clusters in sessions, Figure 7b). This may be because individuals starting with smaller endowments are stimulated to invest more to improve their future income prospects.

4.2. Regression analysis

4.2.1. A model for the optimal tax rate

To better investigate the link between personal responsibility and preferences for redistribution, we now focus on the optimal tax rate. In particular, we consider a regression model where the dependent variable is the optimal tax rate, τ_{ir}*, reported by participants i (i = 1, …, 71) in round r (r = 1, …, 12):

$$\tau_{ir}^{*} = \boldsymbol{X}_{ir}'\beta + \boldsymbol{Y}_{ir}'\gamma + \boldsymbol{Z}_{i}'\delta + \boldsymbol{I}_{i}'\theta + \varepsilon_{ir}$$

where $\boldsymbol{X}, \boldsymbol{Y}, \boldsymbol{Z}, \boldsymbol{I}$ are groups of homogeneous variables. Following the framework outlined in Section 2, we consider two main groups of regressors. The first group, $\boldsymbol{X}$, aims to catch the impact of time preferences on demand for redistribution via its impact on individual investment decisions. We consider the variable *future*, defined above, to identify the role of time preferences. To disentangle the effect of time preferences on redistribution via its impact on investment, we control for different cost and information conditions by relying on the following two variables. *cost_level* is a dummy variable identifying a scenario characterized by a high cost of effort (α = 0.5); *info_emean* takes values from 0 to 10 and indicates—whenever this information is available to subjects—the average investment level provided in a previous set of experimental sessions.

We also include the variable *months_post*, indicating the number of months the second payment is postponed. This is an objective measure of the delay in grasping the fruits of investment; hence, it measures reducing investment benefits in actual terms.

In the second set of regressors, $\boldsymbol{Y}$ groups together variables identifying circumstances beyond an individual's control.

– y_{ir} is the income randomly assigned to individual i at the beginning of round r (corresponding to $q_{iP}y$ in the notation of Section 2 above).

– *unfair_d* is a dummy variable identifying whether the initial distribution of exogenous incomes is unfair.

– *unfair_ymean* is an interaction variable measuring the proportion to which the society's average exogenous income is higher than individual *i*'s income when income distribution is unfair (*unfair_d* = 1).

In addition to these two basic groups of variables, we also included additional controls $\boldsymbol{Z}$ to consider *individual beliefs* that could be potentially important in explaining the demand for redistribution (whenever not specified, these variables take values from 1: "strong disagreement" to 5: "strong agreement").

– *succ_father* is a dummy taking value 1 if the individual believes that their chances of earning are higher than their father's, a measure of perceived social mobility (Bénabou and Ok, 2001; Alesina and Giuliano, 2010).

– *succ_luck* captures the importance individuals place on luck as a determinant of economic success; this variable is meant to reflect individuals' opinions about the source of income differences (Alesina and Glaeser, 2004; Alesina and Angeletos, 2005).

– *noeff_poor* is a measure of the extent to which one believes that poor people are trapped in their condition because of little effort.

– *succ_god* measures agreement with the idea that God awards economic success to compensate individuals for their effort; it is meant to account for the role played by religion and political ideology (Alesina and Giuliano, 2010; Pittau et al., 2016).

– *equality* measures the extent to which individuals support equality-promoting public policies as opposed to libertarian policies (the range of variation is, in this case, from 1: strong disagreement to 10: strong agreement).

– *Civicness* measures the degree to which individuals believe they can trust most people in society (Kauppinen and Poutvaara, 2012). It is meant to account for the effect of trust (and, more generally, social capital) on the desired level of redistribution.

Finally, we also control for *demographic factors* $\boldsymbol{I}$ that might affect preferences for redistribution:

– a dummy *male* taking value 1 if the individual is male;

– the variable *age,* measuring the individual's age in years;

– a dummy *foreign* taking value 1 if the individual was not born in Italy.

Table A1 in Appendix A provides descriptive statistics for all variables included in our analysis**.** The average desired tax rate τ_{ir}* is about 38%. Future appears to be important since the average value for the variable *future* is 3.76 on a 1 to 5 scale; however, only 46% of subjects believe they will have higher earnings than their fathers. Interestingly, we observe mean values close to 2.5 (on a 1–5 scale) for beliefs relating to the role of luck, effort, and trust, with a standard deviation of about 1. Finally, our subjects seem inclined toward equality-oriented policies, with the average of the variable *equality* equal to 6.54 on a 1–10 scale.

Given the nature of our data, which contains observations for the same individuals over the 12 experiment rounds, the model is estimated using a Panel Corrected Standard Errors (PCSE) Prais–Winsten estimator. Errors ε_{ir} are assumed to be heteroskedastic, correlated across individuals, as well as within them, with individuals' specific correlation coefficient ρ[10]. Correlation across individuals accounts for the interdependence of choices *between* subjects. Correlation *within* subjects is crucial to account for possible learning effects, conditioning individual decisions over rounds.

4.2.2. Results

We adopt an incremental approach; we start with a baseline model (Model 1) that controls only for the role of time preferences and the determinants of individual investment and demographic variables. Then, to test the robustness of our results concerning potential confounding factors, we also augment this specification by considering the variables identifying circumstances beyond one's control (Model 2) and, in the complete specification, individual beliefs (Model 3).

[10] See Hoechle (2007) for more details on the PCSE Prais–Winsten estimator.

Regressors	MODEL 1	MODEL 2	MODEL 3
future	−0.044**	−0.046**	−0.033**
	(−2.14)	(−2.46)	(−1.91)
cost_level	−0.078***	−0.057**	−0.061*
	(−3.10)	(−2.23)	(−1.73)
info_emean	−0.004	−0.004*	−0.004*
	(−1.14)	(−1.67)	(−1.72)
months_post	−0.006	−0.012*	−0.012*
	(−0.50)	(−1.63)	(−1.68)
y_{ir}	-	−0.001	−0.001
		(−1.04)	(−1.22)
unfair_d	-	−0.182***	−0.166**
		(−2.74)	(−2.49)
unfair_ymean	-	0.280***	0.269***
		(4.73)	(4.53)
succ_father	-	-	−0.058**
			(−2.45)
succ_luck	-	-	−0.008
			(−0.56)
noeff_poor	-	-	0.023
			(1.23)
succ_god	-	-	0.016
			(1.16)
equality	-	-	0.032***
			(3.48)
civicness	-	-	−0.015
			(−0.65)
male	0.068**	0.062***	0.122***
	(2.21)	(2.22)	(3.70)
age	−0.014***	−0.013***	−0.012***
	(−4.47)	(−5.05)	(−5.50)
foreign	0.006	0.014	−0.003
	(0.12)	(0.29)	(−0.04)
Observations	852	852	852
Wald statistic (χ^2)	53.39***	166.62***	514.21***
R^2	0.31	0.35	0.38

Table 3 Determinants of optimal tax rate [a]

The findings reported in Table 3 are consistent across the different specifications and confirm simple descriptive evidence discussed in Section 4.1.

Finding 1: *Individuals with a greater concern for the future invest more and ask for less redistribution*.

The coefficient for the variable *future* is negative and significant in all specifications. Consistently with our framework, individuals valuing the future more, driven by the length of their time horizon to invest more in a risk-free environment, have a lower propensity toward redistribution (Hypothesis 1). This finding supports the view that in societies culturally characterized by longer time horizons, in which people are likely to invest more, the support for redistributive policies is expected to be lower.

Finding 2: *When the benefits of the investment decrease relative to its costs, individuals ask for less intense redistribution***.**

Our findings support the view that personal responsibility matters, as subjects reward individual investment differently. To start with, both the coefficients for *months_post* and *cost_level* are negative and statistically significant in almost all the specifications. For given productivity gains, individuals ask for less redistribution as the benefits of investment decrease (when months_post increases) and the cost of investment increases (when cost_level increases); hence, individuals appear to be less favorable to redistribution because of the increasing burden entailed by the provision of effort. When the benefit-to-cost ratio of investment shrinks, rather than reducing the investment—as standard theory would suggest (see Appendix C)—people tend to preserve its beneficial consequences by asking for less redistribution.

Finding 3: *When observed societal investment increases, individuals are induced to provide more investments themselves, asking for less intense redistribution***.**

The importance of personal responsibility is also emphasized by the negative and primarily statistically significant coefficient for *info_emean*. Informing subjects about the investment provided at the societal level reduces the desired tax rate by about 4 percentage points when the society's average investment level is at 10, the highest possible level. This finding suggests that individuals prefer less redistribution with higher average investment levels in society.

A possible explanation for this observed complementarity across effort levels is the individuals' adherence to social norms, which dictate reciprocating fairness with

fairness (Fehr and Gätcher, 2000). Analogous experimental evidence shows that in public-good games, anyone's behavior is oriented toward the average behavior of the other group members in the previous period (Keser and Van Winden, 2000). This evidence is in line with the principle of reciprocity, explicitly used by Axelrod (1984) to explain cooperation in the prisoner's dilemma. Our evidence is also in line with Cappelen et al. (2007). Their paper considers fairness in a situation involving production, hence more complex than the one typically depicted by the ultimatum game. They find that most of the participants care about the investment made by others when they decide how much to offer, implying that fairness considerations cannot be reduced to income inequality aversion[11].

Finding 4: *Aversion to inequalities due to circumstances beyond one's control matters in determining support for redistributive policies.*

We confirm the importance of assessing circumstances beyond an individual's control. While the coefficient for the exogenous income is never statistically significant, the coefficients for *unfair_d* and *unfair_ymean* are statistically significant but with opposite signs, negative and positive, respectively. To understand what this means, let us focus on the complete specification (Model 3); when the (initial) income distribution is unfair, people prefer a higher tax rate if the ratio between the average society's income and their individual income is above 0.62. Hence, people demand redistribution even if their income is *above* society's average and they are *net taxpayers*. This holds for incomes up to about 60% of society's average income. As a reference point, consider that when the ratio between society's average income and one's income is equal to one, the estimated impact of unfairness on the optimal tax rate is strongly positive (10 percentage points more). The impact shows its maximum (around 30 percentage points more) for the poorest, i.e., individuals whose income is about 40% of society's average income. Conversely, for wealthy people, the effect is negative.

These findings are consistent with Hypothesis 2 (Section 2), predicting that sufficiently inequity-averse individuals can support redistribution even if this is

[11] When the investment is generally high, individuals might also be more inclined to believe that effort, not luck, determines individual incomes. Hence, they might be encouraged to provide a higher investment and ask for less redistribution. This might explain why the coefficient of variables related to individual beliefs about the role of effort and luck as determinants of income is not statistically significant in our model.

detrimental to their material welfare. Moreover, this evidence is consistent with the extensive experimental literature showing that a sense of fairness or aversion to inequity can dictate preferences for redistribution[12]. Our analysis suggests that inequity aversion is less effective in mitigating self-regarding motivations when individuals are toward the top of the income distribution. Our results also confirm that equity concerns substantially depend on the specific source of unfairness, i.e., whether disadvantage comes from laziness as opposed to bad luck, as pointed out in the experiments by Konow (2000), Rutstrom and Williams (2000), Krawczyk (2010), Becker (2013), and Durante et al., (2014). In particular, when the differences in the (randomly assigned) initial income levels are beyond the individuals' control, we can argue that, up to a certain threshold, better-off individuals support a certain degree of redistribution to help the poorer overcome the disadvantages for which they are not responsible[13].

Finding 5: *Individual beliefs on the degree of social mobility and political orientation contribute to the support of redistributive policies.*

We find that perceived social mobility plays a role in individuals' beliefs. The result is negative and statistically significant concerning the coefficient for the impact of the individual's belief that their chances of earning more than their father (succ_father) on the tax rate. Subjects expecting to move upward on the income ladder tend to ask for less redistribution, falling about six percentage points in the optimal tax rate. This supports the *prospect of upward mobility* hypothesis advanced by Bénabou and Ok (2001), providing further evidence to stress the intertemporal nature of the redistribution game. The equality coefficient is positive (around 3 percentage points more), suggesting that people with a greater feeling toward equality-oriented policies prefer higher tax rates. With *equality* as a proxy for left-wing-oriented individuals, this finding is in line with Alesina and Giuliano (2010) and Durante et al. (2014), who emphasize the importance of political orientation in shaping preferences for redistribution.

Finally, looking at demographic characteristics, we find a positive coefficient for *male*; males exhibit an optimal tax rate higher than females (around 12 percentage points

[12] See, among others, Fehr and Schmidt, 1999; Cowell and Schokkaert, 2001; Tyran and Sausgruber, 2006; Ackert *et al.*, 2007; Cappelen et al., 2007; Schildberg-Hörisch, 2010; Durante *et al.*, 2014.

[13] Such behavior is consistent with a norm stating that a fair distribution of resources should even out inequalities that do not reflect an agent's choices and over which they lack control. In philosophy, this norm is usually called luck egalitarianism (Dworkin, 2000).

more in Model 3). This result is in line with previous evidence in Italy (Checchi and Filippin, 2004) but differs from that found among American women (Alesina and Giuliano, 2010)[14]. We also find—in line with Checchi and Filippin (2004)—that the coefficient for age is negative and statistically significant; younger individuals favor redistribution more than older ones.

5. Practical implications and conclusions

This paper analyzes the link between personal responsibility, indicating a costly but productive investment, and individual preferences for redistribution through a laboratory experiment based upon a novel conceptual framework. This allows us to examine a crucial dilemma confronting individuals: whether to provide a costly effort that can produce future benefits (i.e., invest part of their income) or free ride on the effort of the other members of the society by voting for more redistribution. Experimental evidence highlights the importance of time preferences. People giving more importance to the future are likely to invest more to grasp future benefits, asking for less redistribution. Societies in which individuals give more importance to the future have less likelihood of the free riding option being played. In addition to time preferences, our findings also stress the importance of the productivity of individual investment relative to cost; as the benefit-to-cost ratio of the investment decreases, individuals ask for less redistribution. This evidence suggests that as the relative cost of investment increases, individuals are more likely to preserve the related sacrifice by asking for less redistribution.

All of our results are robust to introducing the controls that the literature considers important. For instance, given a randomly assigned initial unfair distribution of income, we find that individuals lower on the income ladder ask for more redistribution; however, individuals endowed above average income also support redistribution, even if doing so would not be rational. These results corroborate the argument that ethical concerns or inequity aversion, besides self-interest, can significantly explain attitudes toward redistribution. At the same time, they suggest that inequity aversion depends on

[14] For a review of experimental evidence on gender differences in preferences, see Croson and Gneezy (2009).

the source of inequality, i.e., bad luck versus lack of effort, again emphasizing the key role of personal responsibility.

From a policy perspective, our analysis provides evidence to enrich the debate concerning the reform of redistributive policies to make public welfare interventions coherent with personal responsibility. The main practical implication is that individuals should be able to benefit from their efforts in the future to improve their efforts today. In general, in societies where social norms penalize individuals' investment by preventing a full appropriation of the resultant benefits (for example, because individuals must share the benefit of their success with others), the adoption of opportunistic behaviors is encouraged (Ostrom, 1999); hence, policies that change these social norms are essential to encourage individual investment.

In developing countries, characterized by poor institutions and low protection of property rights, individual investments can be encouraged by improving the rule of law. The alternative would be to remain in an equilibrium where people cannot invest and provide a better future for themselves; they can only wait to obtain their share from redistribution. In developed countries, where the rule of law is strict, efforts will be rewarded by policies encouraging activation of those outside the labor market and policies rewarding private investments. Educational policies can also be considered at the school level to educate people about the future's importance. Generally, information policies persuading people that greater concern for the future is consistent with their self-interest might play a critical role in stimulating private investment in human capital (Augé, 2014).

Our analysis has two main limitations that must be addressed in future research. First, considering the experimental design, the number of participants is relatively limited (i=71); in addition, the elicitation of time preferences could be better incentivized to avoid misreporting (Andreoni and Sprenger, 2012b). Second, other factors so far neglected by the literature might explain individuals' demand for redistribution. In particular, this paper has not considered individuals' attitudes toward risk or the possibility of participants hiding a share of their income from tax authorities. On the one hand, including risk attitudes (and possibly loss aversion) in the analysis would allow us to catch an additional feature of the investment process since the benefits of investment would be grasped in the future, but they would also be *uncertain*. In such a context,

redistributive policies may be seen as an effective insurance mechanism against the perceived risk of falling behind (Durante et al., 2014; Assandri et al., 2018), and for this reason, they are likely to receive stronger political support from more risk-averse citizens. On the other hand, including the possibility of evading taxes can allow us to understand how the demand for redistribution changes in countries where the shadow economy constitutes a large share of the national income.

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APPENDIX A

Table A1. Variable definition and descriptive statistics

	Definition	Mean	Std. Dev.	Min	Max
τ_{ir}^*	Optimal tax rate, reported by individual *i* in round *r*	0.38	0.37	0.00	1.00
future	Takes values from 1 to 5, depending on the quantity of an unexpected monetary gift (supposed to be equal to one's own monthly household income) one would save: 1 = *no saving*; 5 = *everything is saved*	3.76	0.83	1.00	5.00
cost_level	Dummy identifying Scenario 1, characterized by a high cost of investment	0.44	0.50	0.00	1.00
info_emean	Information on the average investment level provided in previous experimental sessions by participants drawn from the same population of students	2.68	3.41	0.00	10.00
months_post	Number of months the second payment is postponed	3.00	0.82	2.00	4.00
y_{ir}	Income randomly assigned to individual *i* at the beginning of round *r*	48.96	11.83	30.00	70.00
unfair_d	Dummy identifying whether the distribution of exogenously assigned incomes is unfair	0.50	0.50	0.00	1.00
unfair_ymean	Interaction variable measuring the proportion to which the society's average exogenous income is higher than individual *i*'s income	0.53	0.57	0.00	1.72
succ_father	Takes value 1 if the individual believes that their chances of earning are higher than those of their father	0.46	0.50	0.00	1.00
succ_luck	Measures the importance individuals place on luck as a determinant of economic success	2.86	0.94	1.00	5.00
noeff_poor	Measures the extent to which one believes that poor people are trapped in their condition because of little effort	2.30	0.98	1.00	5.00
succ_god	Measures the acceptance of the idea that God awards economic success to compensate for effort	2.46	1.29	1.00	5.00
equality	Measures the individual assessment of equality-oriented public policies	6.54	2.04	1.00	10.00
civicness	Measures the extent to which the individual believes that they can trust most people in the society	2.58	0.96	1.00	4.00
male	Takes value 1 if the individual is male	0.38	0.49	0.00	1.00
age	Individual's age in years	23.63	4.71	19.00	46.00
foreign	Takes value 1 if the individual was not born in Italy	0.11	0.32	0.00	1.00

APPENDIX B

Post-test survey

- Year of birth _____
- Gender: Male □ Female □
- Nationality: Italian □ Foreign □
- How much would you save if you received an unexpected monetary gift, supposed to be equal to your household's monthly income? Please answer using a scale of values ranging from 1 (*no saving*) to 5 (*everything saved*) _____
- Do you believe your chances of earning are higher than your father's?

  Yes □ No □
- How much do you agree with the following statement: "luck is the main determinant of a person's economic success"? Please answer using a scale of values ranging from 1 (*not at all*) to 5 (*a lot*) _____
- How much do you agree with the following statement: "poor people are trapped in their condition because they do not want to commit to finding a job"? Please answer using a scale of values ranging from 1 (*not at all*) to 5 (*a lot*) _____
- How much do you agree with the following statement: "the economic success of a person is a reward assigned by God to those who work hard"? Please answer using a scale of values ranging from 1 (*not at all*) to 5 (*a lot*) _____
- Along the political dimension right/left, on a scale from 1 (*priority: to protect individual freedom from the intrusion of politics*) to 10 (*priority: to promote maximum equality between people*), where would you place yourself? _____
- How much do you agree with the following statement: "One can trust most people in society"? Please answer using a scale of values ranging from 1 (*not at all*) to 5 (*a lot*) _____

Appendix C

To formally derive the optimal investment e_i^* and the optimal tax rate τ_i^*, let us consider Eq. [1]

$$U_i(e,\tau) = \underbrace{\hat{y}_{iP}(\tau) + \delta_i \hat{y}_{iF}(\tau) - \sigma(e_i)}_{Material\ rewards} \underbrace{-\Omega_{\mathrm{i}}(\tau)}_{Unfairness\ concerns}. \qquad [1]$$

Remember that the tax structure is purely redistributive. Any individual pays a share τ of their income ($0 \leq \tau \leq 1$), with the proceeds from taxation being equally distributed among the community members. Thus, an individual pays $(q_i y) \times \tau$ and receives $\frac{1}{n}\left(\sum_{j=1}^{n} q_j\, y\right) \times \tau$. The tax structure implies that the individual receives a subsidy whenever their income is below the mean income; they pay a tax in the opposite case.

Therefore, [1] can be re-written as

$$U_i = \underbrace{\left[q_{iP} y(1-\tau) + \frac{\tau}{n}\sum_{j=1}^{n} q_{jP}\, y\right]}_{\hat{y}_{iP}(\tau)} + \delta_i \underbrace{\left[q_{iF}(e_i) y(1-\tau) + \frac{\tau}{n}\sum_{j=1}^{n} q_{jF}(e_j)\, y\right]}_{\hat{y}_{iF}(\tau)} - \sigma(e_i) - \Omega_i(\tau).$$

where $\sigma(e_i)$, the monetary cost of investment, is such that $\sigma', \sigma'' > 0$, and $\Omega_{\mathrm{i}}'(\tau) < 0, \Omega_{\mathrm{i}}''(\tau) > 0$: we hypothesize that as τ increases, inequity concerns reduce at an increasing rate.

The function $\varphi_i(.)$ reflects the productivity of investment. As is expected, we assume diminishing marginal returns ($\varphi_i' > 0, \varphi_i'' < 0$) and make the following assumptions: *i*) $\varphi_i(0) = 0$; *ii*) $\lim_{e_i \to 0} \varphi_i' \to \infty$; *iii*) $\lim_{e_i \to \bar{e}_i} \left(q_i + \varphi_i(e_i)\right) \to 1$.

The first two assumptions are intuitively simple; the third states that the share of potential income approaches 1 when the investment tends to the maximum feasible level $\bar{e}_i$. Notice also that the function $\varphi_i(.)$ is individual specific, to capture potential differences across individuals in the productivity of investment, which may reflect innate abilities.

The assumption is that individuals are averse to inequalities due to poor luck (not due to responsibility). Formally, this implies that Ω_{i} is only sensitive to differences in income levels due to differences in circumstances, captured by differences in $\{q_{iP}\}_{i=1,\ldots,n}$.

Thus, individuals choose the effort/investment level and declare their desired tax rate to maximize [1]. The decision problem can be split into two stages and solved by backward induction. Each individual i determines, at the second stage, the optimal investment, e_i^*, taking as given the tax rate, τ, and the effort of any other individual in the society, e_h $(h \neq i)$. In the first stage, given e_i^*, each individual determines the optimal tax rate, τ_i^*.

We first study the individual's choice problem by ignoring the interdependence in investment decisions.

Differentiating [1] concerning e_i (given τ), it is easy to show–remembering that $q_{iF}(e_i) = q_{iP} + \varphi_i(e_i)$–that the optimal investment equates current marginal costs with future discounted benefits:

$$-\frac{d\sigma(e_i^*)}{de_i} + \delta_i \left[\frac{d\varphi_i(e_i^*)}{de_i} y\left(1 - \tau + \frac{\tau}{n}\right)\right] = 0 \qquad [1D]$$

From [1D], optimal investment decreases when:

- the tax rate increases (since this reduces the net benefit accruing to the individual for additional investment);
- the shadow of the future, δ_i, decreases (the future is less important);
- the marginal productivity of investment diminishes, or the marginal cost increases.

By differentiating Eq. [1] concerning τ and using Eq. [1D] we get to the optimal tax rate,

$$[\mu_P - y_{iP}] + \delta_i[\mu_F - y_{iF}] - \frac{d\Omega_i}{d\tau} = -\delta_i \frac{\tau}{n} \sum_{h \neq i} \left[\frac{d\varphi_h}{de_h}\frac{de_h}{d\tau} y\right] \qquad [2D]$$

where μ_P and y_{iP} (resp. μ_F and y_{iF}) are the mean gross (of taxes) income and *i*'s gross income at *P* (resp. at *F*). Eq. [2D] states that individual *i* determines their optimal tax rate by equating benefits and costs stemming from taxation. In particular, the cost of taxation on the RHS is the loss in the transfer received by *i* in the future because an increase in the tax rate reduces the investment provided by any other individual $h \neq i$. Such a cost increases with the tax rate, and it is higher (because the optimal tax rate is higher) when the difference between the average gross income and *i*'s gross income, both at *P* and *F*, is larger or when inequity concerns are stronger.

Equation [2D] clarifies that, unlike previous contributions, in our setting, the strategy of free riding on others' investments and asking for more redistribution is limited by the reaction of the other members of society.

Eq. [2D] is key to analyzing intertemporal preferences' impact and the aggregate investment level. As for the first issue, by differentiating [2D] concerning δ_i we get:

$$\frac{d}{d\delta_i}\left(\frac{dU_i}{d\tau_i}\right) = \mu_F - y_{iF} + \frac{\tau}{n}\sum_{h\neq i}\varphi'(e_h)\, e_h'(\tau) y \qquad [3D]$$

As the second term of Eq. [3D] is negative, *i*'s future gross income being greater than the average is a sufficient condition for τ_i^* to reduce as δ_i increases.

To interpret this result, notice that (Eq. [1D]) when the future matters more for individuals, their investment also increases. Since taxation reduces returns from investment, this pushes individuals more concerned with the future to ask for *less* redistribution. We then expect lower demand for redistribution as individuals' concern for the future increases, and people expect their investment to be beneficial.

These results are summarized in Hypothesis 1 (Section 2, main text).

Note from the LHS of Eq. [2D] that in the absence of inequity concerns, the preferences of any individual *i* would suggest no redistribution ($\tau_i^* = 0$) whenever expected gross income is not lower than the average at both *P* and *F*. The presence of inequity concerns suggests that individuals can support redistribution even if this is detrimental to their material welfare (Hypothesis 2, Section 2).

Interdependent efforts

If efforts are interdependent, i.e., $\partial e_h/\partial e_i \neq 0$, in deciding the investment level and tax rate, any individual must also consider the reaction of the others.

Differentiating Eq. [1] concerning e_i and τ_i and substituting the condition for the optimal choice of effort in the one determining the optimal desired tax rate, we obtain:

$$[\mu_P - y_{iP}] + \delta_i[\mu_F - y_{iF}] - \frac{d\Omega_i}{d\tau} = -\delta_i\left[\frac{\tau}{n}\sum_{h\neq i}\frac{d\varphi_h}{de_h}\left(\frac{\partial e_h}{\partial \tau} - \frac{\partial e_h}{\partial e_i}\frac{\partial e_i}{\partial \tau}\right) y\right] \qquad [4D]$$

What distinguishes Eq. [4D] from Eq. [2D] is the term on the RHS since the LHS is the same. The derivative $\partial e_h/\partial e_i$ on the RHS implies that the distortionary effect of taxation is amplified when investment decisions are complementary ($\partial e_h/\partial e_i > 0$); it is instead

mitigated when investments are substitutes ($\partial e_h/\partial e_i < 0$). This leads to Hypothesis 3 in the main text (Section 2).

There is no way to distinguish *a priori* between complementarity or substitutability in investment decisions. Neither can one be sure that all the individuals will react similarly when the investment the others provide changes; however, suppose individual *i*'s optimal investment depends on those provided by *most individuals*. With complementarity, in a society where most individuals decide to invest in increasing the size of the future pie, individuals are likely to react by increasing their investments and voting for less redistribution. In contrast, with substitutability, people will likely adopt the strategy of free riding on others' investments and ask for more redistribution.