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IT IS HOBBES, NOT ROUSSEAU: AN EXPERIMENT ON SOCIAL INSURANCE

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Abstract

We perform an experiment on social insurance to provide a laboratory replica of some important features of the welfare state. In the experiment, all individuals in a group decide whether to make a costly effort, which produces a random (independent) outcome for each one of them. The group members then vote on whether to redistribute the resulting and commonly known total sum of earnings equally amongst themselves. This game has two equilibria, if played once. In one of them, all players make effort and there is little redistribution. In the other one, there is no effort and nothing to redistribute. A solution to the repeated game allows for redistribution and high effort, by the threat to revert to the worst of these equilibria. Our results show that redistribution with high effort is not sustainable. The main reason for the absence of redistribution is that rich agents do not act differently depending on whether the poor have worked hard or not. There is no social contract by which redistribution may be sustained by the threat of punishing the poor if they do not exert effort. Thus, the explanation of the behavior of the subjects lies in Hobbes, not in Rousseau.

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1 Introduction

The welfare state is viewed as a remarkable achievement of modern societies. It is credited with large reductions of poverty in developed countries (see e.g. Moller et al. 2001).[1] It certainly eases the pain of negative shocks to income and utility coming from cyclical involuntary unemployment, health problems and even structural economic changes that leave the skills of some members of society outdated. It is obvious, at the same time, that this reduction of uncertainty can come accompanied by large negative effects on incentives to exert productive effort in different dimensions. It lowers the incentives of the unemployed to look for jobs, to work when minor health afflictions arise, to maintain human capital up to date, or to choose judiciously the line of business in which to work (Atkinson 1995). This was clear even to the predecessor of the modern welfare state, the Poor Laws of the 1830s. They were based explicitly on the twin principles that relief to poverty should be provided in the workhouse and that the poor should not be better off without work than at work. In the words of Porteous (1783): "every person on charity should descend at least one step below the station which he occupied in the season of health and labour."

In principle, this trade-off could be made explicit and, ideally, the decision on the amount of insurance should be made behind the *veil of ignorance*, (Rawls 1972). In this way, the "station in life" of various decision makers would not condition the resolution of the trade-off. Life, however, is imperfect, and most democratic societies make periodically choices that have a direct impact on the welfare state. Almost every election is fought, to a large extent, through platforms that give considerable weight to the position of different parties on welfare state issues (Pacek and Radcliff 1995).

Moral philosophers and politicians sometimes ask us to consider political choices as Rawls (1972) does in his Theory of Justice. In the words of Binmore (1998) "Each citizen is asked to envisage the social contract to which he would agree if his current role in society were concealed from him behind a veil of ignorance." It is possible that the behavior of the players in our game is such that they in fact act this way. But we certainly do not want to "force" them into that position. In real life people vote knowing their position in the income scale.

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[1] "Researchers have found that the size of the welfare state (for example, as measured by spending on social programs) is a key determinant of poverty reduction," Moller et al. (2001) p. 1.

Whether they then choose to vote as if they were behind the veil of ignorance is, of course, their own choice. So it is in our experiment.

At the time of voting, individuals already know the cards that economic life has dealt them. In the short run they can vote, if "poor," to appropriate resources from the "rich," or, if "rich," to avoid this expropriation. All this without even taking into account the negative effects on incentives of this purely redistributive conflict, or the insurance value that redistribution has behind the veil of ignorance.

The pessimistic depiction of voting about redistribution expressed in the previous paragraph is what we will call the *Hobbesian* point of view. To this view, we also oppose a *Rousseaunian* perspective. The negative incentive effects of the welfare state on incentives do not have to happen, even in a world of selfish and forward-looking agents. They can engage in a beneficial *social contract* where redistribution and high effort are not incompatible. That social contract is possible precisely because the Hobbessian world exists. In such world, any "sucker" who made effort would be exploited by the "wise guys" who would free-ride on the efforts of others, and would vote themselves into sharing the returns from their effort. The Hobbesian world can become the "credible" punishment that gives incentives for all individuals to work hard, and redistribute only to insure against economic shocks that occur "through no fault of their own." In the Rousseaunian view, monitoring and punishment of individual effort is not even necessary.[2]

But the fact that the Rousseaunian perspective is an equilibrium possibility does not mean that it will occur, given that the Hobbesian world is also an equilibrium. As a matter of fact, the literature on the political economy of the welfare state has mostly overlooked Rousseaunian-type of equilibria. Dynamic political economy papers often focus in Markov perfect equilibria, and the Rousseaunian world is not the outcome of a Markov-perfect equilibrium. In that world, the decisions on a period may have to punish/reward past decisions, which are payoff-irrelevant in the present.

Nevertheless in the political discussion there seems to be aspects of Rousseau. Reductions

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[2]It is arguably realistic that government bureaucracies are not very good at monitoring the kinds of effort that has to be done for achieving a "first-best" welfare state. Think, for example on the difficulty of monitoring the job-search efforts of the unemployed. Given this, any attempt to give individual incentives would be second-best, at least.

on the welfare state are justified not because they will leave the rich richer, but because they will punish the "undeserving" poor. Many of the arguments given against the welfare state would be empty if the poor where poor in spite of their best efforts. For example Alesina, Di Tella and McCulloch (2004) say: "Americans definitively believe that society is mobile and one can escape poverty with hard work." There is an "ethical" outrage that induces one to think as if a contract had been breached.

The literature has addressed related issues. Lindbeck, Nyberg and Weibull (1999) suggest that the welfare state breaks down when people start breaking the implicit contract that lies at its root: "you work hard, and if you are unlucky, we will help you." A similar motif can be glanced in the work of Alesina and Angeletos (2003), in this case guided through fairness concerns internalized in the utility function.

The Rousseaunian paradise can be achieved via social norms that replicate an equilibrium where the threat of ending the paradise induces people to exert effort even if one's back if covered. For this to be the case it is necessary that the victims of the breach of contract express outrage. That is, they should be more willing to vote for redistribution if the poor are poor because they were unlucky, than if the poor are poor because they were lazy.

For these reasons we conduct a laboratory experiment to sort out the different possibilities empirically. In the experiment, all individuals in a group decide whether to make a costly effort. If they choose high effort, the outcome is a high level of income with probability 2/3 and a low level of income with the complementary probability. If they choose low effort, income is low for sure. The group members then vote on whether to redistribute equally the total income of the group (without deducting the cost of effort). This design intends to mimic the features of the welfare state we have been discussing above, with the minimum number of complications, and giving the Rousseaunian "social contract" a fair chance of working. To this end, for example, the group is kept relatively small, with only nine players, and the aggregate effort is observed every period before voting and repeating the game. This is the political game where a "social contract" equilibrium has an easier chance to appear. If it does not appear in our game, it is most unlikely that it can arise in the real world.

When played only once (in a static framework) the game we just described has two equilibria. This is perhaps a surprise, as the traditional view tends to make the possibility of the welfare state an apocalyptic threat on honest effort. To understand the equilibrium

structure, first notice that, in the static game, it is weakly dominant for the individuals with high income to vote against redistribution and for the individuals with low income to vote in its favor. Anticipating this, the players face a sort of coordination game. If all of them make effort, it is quite likely that most of them will be rich (and there will be no redistribution), so as long as expected utility of the extra output created from the high effort compensates the cost, they are prepared to do it. On the other hand, if no one makes an effort, most people will have low output with certainty, so a lone player contributing high effort will see most of its proceeds taken away from him. These two equilibria are Pareto-ranked, with the one with high effort being more efficient.[3]

In the repeated game, redistribution with high effort is sustainable during most of the game, even if there is a finite number of repetitions. The "social contract" equilibrium establishes that up until the last few periods players should make effort and vote for redistribution. As long as that happens, the last few periods are characterized by the high-effort no-redistribution static equilibrium. Any deviation from the equilibrium path is "punished" by reversion to the no-effort equilibrium. This is a credible punishment, as it is a Nash equilibrium of the stage game.

The experimental results show that the Rousseaunian social contract of redistribution with high effort is not sustainable in the laboratory. The few times when we observe redistribution with high effort, it does not last very long. The main reason is that voting behavior does not vary with the observation of different levels of aggregate effort. Furthermore, even the static equilibrium with high effort is fragile. It is sustained to the end of the game in very few groups. More frequently several players start making effort, only to give up later in the game. The no-effort equilibrium, on the other hand, seems quite robust. The worst Hobbesian outcome seems to be the most common fate of our experimental societies.

In our main treatment, the rich very seldom vote for redistribution. This could be because they cannot condition their behavior on the reason why each of the poor is poor. We introduced two additional treatments to test further whether rich people would like have a differential behavior toward those who are poor "through no fault of their own." Thus, in some treatments we changed the voting procedure, either demanding unanimity

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[3]Remember that no effort-no income is a possible choice in the all-effort equilibrium. If it is not chosen, it must be because the players prefer to make costly effort and obtain a random level of income.

for redistribution, or excluding non-effort makers from redistribution. These changes make high effort robust and sustainable, but they do not yield redistribution very often. We also include a treatment where there is no effort decision. Income realizations are random and exogenous to the subjects. This is an important control treatment in order to check to which extent voting behavior is influenced by past observations of effort levels.

We interpret our results as strong indication that agents play political games in a manner which does not punish or reward past actions. That is, in our experimental societies there is no evidence of a functioning social contract. Or, more technically, the behavior of our subjects is consistent with the Markov perfect equilibria which are the main focus of the political economy literature, since they do not seem to condition their voting decisions in payoff irrelevant events.

Most experimental papers on voting study committee behavior or the paradox of voting.[4] There are a few voting experiments related to ours. Some study the problem of voting in the context of contributions in public good games which, unlike ours, have a unique equilibrium (Sutter, Weck-Hannemann 2003, Sutter, Kocher, Haigner 2005). There are also some experiments with voting on redistribution. A random draw typically determines whether a player is rich or poor, so there is no effort decision, (Tyran and Sausgruber 2002 in a static game or Sutter 2002 in a repeated game). Finally in experiments by Frohlich and Oppenheimer (1982) the redistribution scheme can be determined by the subjects. But when this is the case, the subjects vote for a redistribution scheme from rich to poor under the veil of ignorance.[5] Our experiments are also related to the large literature on coordination games as surveyed in Ochs (1995).

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[4] See e.g. Fiorina and Plott (1978), Schram and Sonnemans (1996).

[5] One problem with this approach is that at the time of voting subjects do not know whether success is determined through effort, luck or personal characteristics (as skill). In addition using a "costly" mouse click task, as in our paper, instead of real tasks has the advantage of easily disentangling whether increasing or decreasing effort levels can be attributed to changes in the effort levels of others, instead of, say, attributing it to learning the task.

2 The games

We model a politico-economic game of redistribution where agents choose the policy via a well established voting mechanism *once they know their station in life.* We depart from the standard macro model (see Hassler, Rodríguez Mora, Storesletten and Zilibotti 2003, for instance) in only two qualitative respects.

First, we do not have state variables. In this manner we abstract from issues related to rational dynamic voting and from self-reinforcing mechanisms in the determination of political outcomes (multiple steady states as different from multiple equilibria). We focus on whether subjects condition their actions on past behavior in a way which allows for the sustainability of the first best. The experimental study of dynamic rationality is an important item for future research, but we consider that the present question is sufficiently important to be studied in isolation.

The second way in which we depart from the standard model is by making our set of voters finite. We do so in order to facilitate the sustainability of the (Rousseaunian) first best equilibrium. If even in this circumstances it is not sustained, it is difficult to conceive how it could be done.

There are 9 players in each group $N = \{1, 2, ..., 9\}$. The game G proceeds in two stages.

In the first stage, each player $i \in N$ takes a decision on whether to make an effort $e_i \in \{e^H, e^L\}$. Effort choice $e_i = e^H$ has a cost $c > 0$. Effort choice $e_i = e^L$ has no cost. The outcome from this effort choice is a random variable y_i, drawn independently for all players. A realization of $y_i \in \{y^H, y^L\}$. for all players. A realization of $y_i \in \{y^H, y^L\}$. Its relationship with effort is as follows. When $e_i = e^H$, then $y_i = y^H$ with probability $\frac{2}{3}$ and $y_i = y^L$ with probability $\frac{1}{3}$. When $e_i = e^L$, then $y_i = y^L$ with probability 1.

In the second stage, each player $i \in N$ casts a vote $v_i \in \{Y, N\}$. If 5 or more players vote $v_i = Y$, then the final income of every player is $y_i^F = \sum_{j=1}^{n} y_j / 9$. If 4 or less players vote $v_i = Y$, then the final income of every player is $y_i^F = y_i$. Before the second stage, the players know the aggregate realization of the true stage: How many are rich or poor, how many put effort and the total sum to distribute (in the design section we go into more details).

The game G is repeated for 50 periods. The repeated game is denoted $\Gamma(G)$.

Let us first analyze theoretically the game G.

Let A denote the expected payoff for agent i, if all players (including i) choose to make effort, that is, $e_i = e^H$. Let also B denote the expected payoff for agent i if all other players $j \neq i$ choose to make effort, that is, $e_j = e^H$ but player i chooses to make no effort, that is, $e_i = e^L$. Finally, let C denote the expected payoff for agent i if all other players $j \neq i$ choose to make no effort, that is, $e_j = e^L$ but player i chooses to make effort, that is, $e_i = e^H$

Then we have (assuming, as we will show is indeed optimal, that in the second stage the rich players vote N and poor players vote Y):

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\begin{aligned}
A \;\equiv\; & \sum_{j=5}^{8} \binom{8}{j} \frac{2^j}{3} \frac{1^{8-j}}{3} \left(\frac{2}{3} u(y^H - c) + \frac{1}{3} u(y^L - c) \right) \\
& + \binom{8}{4} \frac{2^5}{3} \frac{1^4}{3} u(y^H - c) + \sum_{j=0}^{4} \binom{8}{j} \frac{2^j}{3} \frac{1^{9-j}}{3} u \left(\frac{(y^H)j + (y^L)(9-j)}{9} - c \right)
\end{aligned}
$$

$$
B \equiv \sum_{j=5}^{8} \binom{8}{j} \frac{2^j}{3} \frac{1^{8-j}}{3} u(y^L) + \sum_{j=0}^{4} \binom{8}{j} \frac{2^j}{3} \frac{1^{8-j}}{3} u \left(\frac{(y^H)j + (y^L)(9-j)}{9} \right)
$$

and

$$
C \equiv \frac{2}{3} u \left(\frac{y^H + 8y^L}{9} - c \right) + \frac{1}{3} u(y^L - c)
$$

PROPOSITION 1 *The game G has two subgame-perfect equilibria if $A > B$ and $C < u(y^L)$. In one of them $e_i = e^H$ for all $i \in N$ and in the other one $e_i = e^L$ for all $i \in N$. In both equilibria, for all $i \in N, v_i = Y$ when $y_i = y^L$ and $v_i = N$ when $y_i = y^H$.*

Proof 1 *See the appendix.*

Both equilibria exist if players have constant relative risk aversion with an Arrow-Pratt risk aversion coefficient $r \geq 0.2$. For $r \leq 0.1$, there is only a no effort equilibrium. Notice also that if $r \geq 0.2$, in the equilibrium where all players make effort, this is a strict best-response. That is, even if not all other players made effort for sure, it would still be optimal to make effort.[6]

Now we turn to the repeated game, $\Gamma(G)$. The unconditional repetition of the stage-game equilibria are also equilibria in $\Gamma(G)$. But, when there are two (Pareto-ranked) equilibria in

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[6]How many and how far they can go until it is not optimal any more depends on the parameters.

the state game, we can also look for a third super-game equilibrium in which redistribution might be sustainable. In order to see whether cooperation is sustainable we need to define some more parameters. Let D denote the expected payoff of player i if all other players $j \neq i$ choose to make effort, that is, $e_j = e^H$ but player i chooses to make no effort, that is, $e_i = e^L$ and there is redistribution for all realizations of income and E be the expected payoff of i, if all players (including i) choose to make effort, that is, $e_i = e^H$ of i if all including i choose effort and there is redistribution for all realizations of income:

$$D \equiv \sum_{j=0}^{8} \binom{8}{j} \frac{2^j}{3} \frac{1^{8-j}}{3} u \left(\frac{(y^H)j + (y^L)(9-j)}{9} \right)$$

and

$$E \equiv \sum_{j=0}^{9} \binom{9}{j} \frac{2^j}{3} \frac{1^{9-j}}{3} u \left(\frac{(y^H)j + (y^L)(9-j)}{9} - c \right)$$

Then we have:

PROPOSITION **2** *Let K such that*

$$D - E < K(A - u(y^L))$$

The game $\Gamma(G)$ has a subgame-perfect equilibrium where in the equilibrium path in periods $t = 1$ through $50 - K - 1$, $e_i = e^H$ and $v_i = Y$, for all $i \in N$.

Proof 2 *See the appendix.*

This equilibrium exists if players have constant relative risk aversion with an Arrow-Pratt risk aversion coefficient $r \geq 0.3$ and the necessary K in this case is $K = 2$.

2.1 Equilibrium with social preferences

A Markovian equilibrium (that is, one that can occur even in a non-repeated setting) where all players make effort and vote for redistribution also exists if subjects have preferences which take into account the material payoff of other players. Suppose, for example, that players are as in Fehr and Schmidt (1999). That is, let u_i be the expected material payoff of

player i in the game. Then, total preferences for player i (including the "social preferences") are:

$$U_i = u_i - \frac{\alpha}{N-1} \sum_{j \neq i} \max\{(u_j - u_i), 0\} - \frac{\beta}{N-1} \sum_{j \neq i} \max\{(u_i - u_j), 0\}$$

With these preferences, it is easy to show that poor agents still want to vote for redistribution. Rich agents vote for redistribution (for all income realizations in the group) if they are sufficiently risk averse and have strong enough social preferences. For example, if they have constant relative risk aversion and their Arrow-Pratt coefficient $r \geq 0.5$, and the Fehr and Schmidt (1999) coefficient $\beta \geq 0.8$. With those same preferences, there would be an all-effort equilibrium as well as a no-effort equilibrium. In the all-effort equilibrium there are two things that work to impede a deviation. One is that the income realizations are worse (in the sense of first order stochastic dominance). But, more importantly, the shirking worker ends up with higher material payoff than all others, as redistribution guarantees him a higher income, but they make no effort. The "social preferences" make this worker "feel bad" enough about this that she does not want to deviate. In the equilibrium with no effort nobody wants to deviate. Any deviator would end up with a lower final utility than the others (there would be redistribution which guarantees equal income, but the deviator incurs the effort cost), and agents have the same utility already without a deviation.

2.2 Control treatments

We also introduce three control treatments:

1. EXCLUSION: In this treatment only those subjects who choose effort in the first stage can vote for redistribution in the second stage. Those who choose NO effort are excluded from redistribution and receive y^L. A necessary condition for the existence of the all effort equilibrium is $A > y^L$. This equilibrium exists if players have constant relative risk aversion with an Arrow-Pratt risk aversion coefficient $r \geq 0.1$.

2. UNANIMITY: In this case redistribution takes place if all vote Yes. If all agents have the same preferences, then only one equilibrium exists. The high equilibrium exists if $\frac{2}{3} u \left(y^H - c \right) + \frac{1}{3} u \left(y^L - c \right) > u(y^L)$

This all effort equilibrium exists if players have constant relative risk aversion with an Arrow-Pratt risk aversion coefficient $r \geq 0$ (that is, if agents' risk aversion is no higher than with logarithmic preferences).

3. NO-EFFORT: In this treatment there is no effort stage. Without social preferences, the unique undominated equilibrium in the stage game is that the rich will vote No and the poor will vote Yes for redistribution. With just one equilibrium in the stage game, there is only one equilibrium in the repeated game.

3   Experimental design

Sessions were run at a PC pool (LeeX) in the department of economics and business at Universitat Pompeu Fabra, Barcelona, in November 2004 and January and February 2005. In 2004 students were notified via posters within the university and had to sign up on a list at the door of the laboratory. In 2005 students could sign in through on-line recruiting system, ORSEE. All sessions were computerized, using a program done with z-tree (Fischbacher, 1999). Students were seated in a random order at PCs. Instructions in Spanish (see Appendix A1 for English translation) were then read aloud and questions were answered in private. Throughout the sessions students were not allowed to communicate and could not see others' screens.

The basic design is the following:

The experiment consisted of two stages, an effort stage and a voting stage. In the effort stage all subjects within the same group had to decide whether or not to choose effort. After everybody had decided, those who did not choose effort received a fixed payoff ($L = 30$) and those who chose effort had to pay a cost of 20 and participated in a random lottery, independently drawn for each subject, which determined a high ($H = 100$) or a low ($L = 30$) income with $p = 2/3$ for (H), $< H = 100, L = 30; p(H) = 2/3 >$. In the second stage, subjects had to vote for or against equal redistribution of the total sum of income to all their members. After the first stage, and before voting, subjects were informed of the number of subjects who chose effort, the number of rich (with H income), the total sum to be equally distributed if there were enough votes for redistribution, the individual

income if there were no redistribution (excluding costs), the individual income if there were redistribution (excluding costs) and the cost of effort.

The main treatment is as the basic treatment with majority voting in the second stage. We will call this *effort- majority* treatment. We also introduce 3 control treatments:

1. *Effort - unanimity rule*: as the basic treatment with unanimity voting.

2. *Effort-exclusion-majority rule*: as the basic treatment, but in the voting stage only those who chose effort can vote (according to majority rule) and participate in the redistribution if implemented. Here we can check whether the rich indicate that they like to redistribute only to those who choose effort and then are poor. After redistribution all are equal, unlike in the main treatment where because of sunk cost, the poor who do not choose effort are the richest.

3. *No effort-majority rule*: as the basic treatment, but without the effort stage. Everybody participates in the lottery and there are no additional costs.The voting is according to majority rule:[7]

Treatment	effort	voting rule	who votes	# of sessions (session= 2 indep.obs)
Effort/majority	YES	Majority	all	5
Effort/unanimity	YES	Unanimity	all	3
Effort/exclusion	YES	Majority	those who choose effort	2
No Effort/majority	No	Majority	all	1

Table 3: the different treatments

In each session there were two separate groups of 9 subjects each. Each group of the same subjects interacted together for 50 periods according to the rules of one of the above treatments. No subject could participate in more than one session. We run 5 sessions of the

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[7]In this treatment we can test whether equalizing total returns (not just monetary ones) makes it easier to obtain redistribution (in the effort treatments, those who did effort had a lower total return afer redistribution than does who did not). Furthermore, being rich now only depends on luck, which should also make redistribution less "morally" questionable.

effort - majority rule (thus 10 independent observations), 3 sessions of the effort-unanimity rule (6 observations) , 2 session of effort-exclusion majority rule (4 observations), and 1 session of no effort -majority rule (2 observations). At the end of the experiment one period was chosen randomly (the same for all subjects of a session) and each subject was paid according to the points he earned in that period with an exchange rate of 2 points = 1 Euro. The payment for each subject was on average 30 Euros including the show up fee. Each session lasted about 1 1/2 hours.

4 Results

4.1 Behavior of rich and poor agents

4.1.1 Effort-majority rule treatment

In table 1 we show the main results of each session of each treatment pooled over all periods. Table 2 shows the average results within a treatment. In this section we concentrate on the main treatment, the effort majority treatment. We can identify 3 sessions in which high effort levels are maintained throughout the 50 periods. We call these sessions with effort levels above 80%, *high effort sessions*. In the remaining 7 sessions, the effort levels converge to those of the low effort equilibrium (see also section 4.2. for behavior over time). Aggregate effort levels are typically far below 50% with one exception of 60% (see first column of table 1).

A high level of effort tends to produce a high number of rich individuals (remember that people choosing to make effort get the high level of income with 2/3 probability) and high levels of aggregate income in this experiment are associated with low redistribution levels. More precisely, when the majority of the players is poor *in a given period*, redistribution took place 90% of the time across all periods and groups. When the majority was rich, redistribution occurred 15% of the time. Across all groups the majority was poor in 74.6% of all periods.

The poor vote overwhelmingly in favor of redistribution in all groups, with some quantitatively small (but sometimes statistically significant) differences between different subgroups

of poor people. For example, there is a difference in YES votes between poor individuals who chose no effort (91%) and those who chose effort (86%) (see table 2, effort majority). This difference is significant at the 0.055 level using a binomial test, since in 8 out of all 10 groups no effort choosers show higher propensity to vote yes than effort choosers.There is also a statistical difference between those poor individuals who chose to make no effort in the two different kinds of *effort* groups (99-100% vote YES in groups with high average effort level, 83% vote YES in groups with low average effort level) with a value of $U = 21$, $p = 0.008$. There is, on the other hand, no statistically significant difference in voting patterns between those poor individuals who chose to make effort in the two different kinds of groups (93% vote YES in groups with high average effort level, 83% in vote YES groups with high average effort level).

The rich, on the other hand, vote overwhelmingly against redistribution. They also show a slightly different behavior in the different subgroups: in groups with high average effort levels 7% of them vote YES and in the low effort groups 16% vote YES. This is significantly different on a 9% level ($U = 16.5$). Notice, however, that the differences between any two subgroups of rich people is much smaller than between a given subgroup of rich compared to any subgroup of poor people.

The small differential behavior of different subgroups, together with the different initial conditions on effort, may explain the different behavior over time in different sessions, which we discuss in section.4.2.

We summarize these facts in:

OBSERVATION 1 *The rich and the poor are clearly distinguished in their behavior. The poor people typically vote YES, and the rich typically vote NO with only slight differences in the different groups.*

After discussing behavior in the other treatments, we will show how the differences in effort choices and voting patterns translate into the means and standard deviation of payoffs.

4.1.2   Control treatments

One explanation for the fact that in our main treatment the rich vote YES infrequently could be that they cannot condition their behavior on the reason why the poor are poor.That is,

their vote cannot be made conditional on whether or not the poor chose to make effort. We introduced two additional treatments in order to test further whether rich people would like have a Rousseaunian kind of behavior. That is, we wanted to see if the rich would like to punish lazy behavior but to support the 'undeserving' poor.

With our exclusion treatment, the rich can vote for a sort of redistribution which helps only the 'undeserving' poor. In that treatment the individuals who chose no effort cannot participate in redistribution. With the no effort treatment, wealth is the result of a purely random outcome over which individuals have no control. So all poor are necessarily 'undeserving', and maybe individuals are more likely to help one another.

A final treatment, where redistribution requires a unanimous agreement, is useful to check how much effort is made when subjects cannot be unvoluntarily expropriated. In this case, the final utility does not depend essentially on other people's decision, so the main consideration for whether an individual should make effort or not is her degree of risk aversion (high effort implies choosing a lottery with high mean and high dispersion.).

Figure 2 presents the four groups of *Effort-exclusion-majority*-rule treatment. In Table 1 we display average effort levels, as well as the voting patterns for all individuals across treatments. Effort levels are very high (on average 95%, compared to 83% in the high effort groups of the main treatment, a significant difference with $U = 12, p = 0.03$). There is not much difference from the beginning (90%) to the end (98%) of the game. Redistribution is 49% on average, ranging from 34% to 62% in the different groups. This is similar to the redistribution in the high effort groups of our main treatment, which is 38%[8] and very different from the level of redistribution-85%-in the low effort groups of the main treatment.

The proportion of rich people who vote YES is 25% across periods, which is significantly different from the proportion of the main treatment with high effort (7%) ($U = 12$ and $p = 0.03$). Comparing the voting patterns of the rich people in the low effort groups of the main treatment (16%) and their behavior in this treatment (26%), there is a significant difference with $U = 22, p = 0.08$. However, the proportion of YES votes of the rich is still very far from that of the poor in the low effort groups of the main treatment (over 80%) or in this treatment (over 90%). Thus clearly, we can reject the (Rousseaunian) idea that there

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[8]The difference is not statistically significant. Note, however, the low number of observations.

can be redistribution in favor of the 'undeserving'. Also, the poor who chose effort behave in the same way in the two experimental treatments.

OBSERVATION **2** *Even when the rich players can control who benefits from redistribution, a large majority of them still dislike redistribution. However, a few individuals prefer redistribution when they can control who benefits (the YES votes increase from 13% in the main treatment to 26% in this one).*

Figure 3 shows the two *No effort-majority* groups. On average redistribution occurs 25% of the time and 21% of the rich and 82% of the poor vote YES. Thus, also in this treatment the rich do not show much compassion for poor people.

Figure 4 shows the six groups of the unanimity rule treatments. The average effort level (77%) is significanly lower than in the high effort groups of the main treatment (83%) with $U = 12, p = 0.03$. It is also significantly lower than in the exclusion treatment (95%), with $U = 44$ and $p = 0.005$. There is no redistribution in any period. There is no difference in the proportion of YES votes by the rich between the exclusion treatment (26%) and the unanimity treatment (23%). As pointed out before, since a player can always impede redistribution, if she chooses not to make effort, this indicates that she is quite risk averse.

Across all groups the rich typically do not vote for redistribution (the averages range between 7% to 25% in the different treatments). Thus, it seems clear that the rich do not vote against redistribution because they dislike laziness. Instead, they do not want to contribute to the poor, independently of the cause of poverty. On the other hand, the 'undeserving' poor as well as no-effort choosers agree on voting YES to redistribution (ranging from 82% to 95% on average).

4.1.3 Payoffs

We now show how these differences in behavior impact the distribution of payoffs.

Obviously, in the low-effort groups of the main treatment we find the lowest inequality (standard deviation is on average 13.01, see table 1) while in the high-effort groups the inequality is much higher (standard deviation is 25.64). The highest inequality can be found in the Unanimity and in the No effort treatments (standard deviations are 31.32 and 28.55

respectively). The inequality of the Exclusion treatment is not significantly different from that of the high effort groups of the main treatment (standard deviation is 24.95).

In terms of average monetary payoffs, the richest groups are those in the Exclusion treatment (55.18) and in the No effort treatment (76.98).[9] Unanimity produces slightly worse average payoff (49.90) than in the high effort groups in the Effort-majority rule treatments (52.84) and both are much better than in the low effort groups of that same treatment (38.67).

4.1.4 Summary

A one-line summary of the results *of our control treatments* could thus be: rich subjects vote against redistribution and poor vote for redistribution, independently of the rule linking voting to allocations or the reasons for poverty. This pattern leads to high effort levels with little redistribution.

4.2 Behavior over time in effort majority treament

We behavior over time in our main treatment, the effort-majority rule treatment. In Figure 1 we show, for every one of the 10 independent groups, the effort choice, the number of poor subjects and the number of yes votes for redistribution. These numbers are averaged over the 9 subjects in the group and over blocks of 5 consecutive periods. We also show, for each group, the proportion of periods in each lock of 5 when there was redistribution (*note that this is a number between 0 and 1*).

We see two distinct patterns:

1. There are three groups (1.1, 2.1 and 3.2) which maintain high average levels of effort (7.8 to 8.6 out of 9 subjects in the three groups) with relatively low levels of redistribution (32% to 46% averaged over all periods).

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[9]The numbers are not comparable strictly speaking, as in the No effort sessions the subjects can get the "good" lottery without paying an effort cost. But even if we subtracted the effort cost (say because effort was compulsory and not a decision) to make the numbers comparable, we still would have an average of 56.98.

2. There are 6 groups which in the first periods of the experiment have intermediate levels of effort (3.8 to 6.8 out of 9) and in the final periods have low levels effort (less than 2 out of 9). These groups also have high levels of redistribution during the whole time (76% to 98% across the 6 groups). In one of these groups (group 11.1), it looks like there was an unsuccessful attempt to revert to a situation with higher effort levels. An additional group (group 2.2) started out with a high effort level (8.2) and nevertheless ended up with low effort and high redistribution.

We summarize these facts in:

OBSERVATION 3 *In the majority of groups (7/10) behavior in the final periods is similar to the low effort equilibrium with high redistribution, but we also see some groups whose behavior in the final periods is similar to the high effort equilibrium with low redistribution. There are no groups whose behavior is similar to the equilibrium with high effort and high redistribution.*

The initial condition seems to explain whether final behavior looks more like one or the other equilibrium. In Table 1 we report average effort levels, as well as the voting patterns for the rich, the poor who made effort, and the poor who did not make effort. We also report on that table the average redistribution levels for each single group and across all sessions of every treatment. In bold we present these variable for groups with high effort and low redistribution in our main treatment, the effort-majority treatment. Comparing the initial effort level at the beginning of the session (first five periods), we observe in the high effort sessions an average effort level of 8.26, while it is 5.51 in the sessions with low effort in the final periods. This difference is significant different at the 0.02 level (U=20), using Wilcoxon-Mann-Whitney U test. We obtain a similar result by comparing the initial redistribution level in the high effort sessions (0.2) and in the remaining session (0.8). The difference is significant also at p=0.02 (for U=20).

We summarize these facts in:

OBSERVATION 4 *Initial behavior of effort seems to be one driving force explaining the behavior in the final periods. The higher is the initial effort in a group, the more likely is that*

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group to end in the high effort equilibrium. The less initial effort in the group, the more likely is that group to end up in the low effort equilibrium.

5   Analysis

When an agent is rich, *she has a weakly dominant strategy to vote against redistribution and hence* her vote does not depend on whether the other agents are doing effort or not. We can see this in Tables 3 and 4.

In both tables we present results investigating under which circumstances an individual votes in favor of redistribution in our main [base–line] treatment. Table 3 runs a probit determining the probability that an individual votes in favor of redistribution for all the individuals and during all the periods. Table 4 does the same but restricting the sample to those agents who were rich when they voted.

The right hand side variables are characteristics of the individual and of the state of the economy during the period:

- "largeperiod" is a dummy that takes value 1 if the number of times that the agents have played is larger than 15, that is, after agents have had time to learn how the other agents are playing.

- "ipooreffort" and "irich" are dummies that determine the type that the agent has when she votes.

  - "ipooreffort" takes value 1 only if the agent has made effort but is unlucky.

  - "irich" takes the value 1 only if the agent has made the effort, and she is "rich". Thus the reference group are the agents who made no effort.

- "n–effort", "redistpast" and "n–effortpast" look at general characteristics of the economy at the type of the vote which are known to the agent.

  - "n–effort" is the number of agents who did make effort in the current period.

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- "redistpast" is a summy that determines if there was redistribution in the previous period.

- "n–effortpast" is the number of agents wha made effort the previous period.

- "ratio–effort–poor" is the ratio of the number of poor who made effort to the total number of poor.

- Finally we introduce control for individual effects and session effects in the form of dummies for each individual and for each session.

Table 3 presents the results for all individuals and periods. Column (1) reports the results with controls for individual heterogeneity, while column (2) presents the results without individual dummies. Not surprisingly the larger effect corresponds to rich individuals, who are much less likely to vote for redistribution than anybody else in the economy. Poor agents who made effort are less likely to vote for redistribution than the ones who did not made the effort, but they vote for redistribution with a much larger probability than the rich ones. This might be the consequence of a certain inertia in voting in the equilibrium without redistribution.[10]

In Table 4 we adress the main issue raised by our experiment: do agents act in a non-markovian fashion? In such a case we would expect the rich agents to react to the effort made by the poor. That is, if the poor were poor because they were lazy I would not vote for redistribution, but if they were poor out of bad luck I would be more prone to favor redistribution.

Thus, we run a probit to determine the probability of voting for redistribution but restricting our sample to the agents and periods of time when the individuals are rich. That is, we include in the sample only the occasions when individuals were rich, and see if their probability of voting for redistribution depends on the state of the economy, in particular if it depends on the level of effort being exerted by the poor agents. Columns (1) and (3) include individual dummies, and columns (3) and (4) a variable determining the effort exerted by

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[10]Another posibility is that people make effort out of ideological fervor,... and this fervor bars some of them from completely enjoying redistribution when they need it.

the poor.[11]

Clearly the rich agents do not react to their environment. They do not vote against redistribution because the poor do not make effort: they vote against redistribution because they are rich and the poor would expropriate them from their money (*see insignificant coefficient of ratio effort poor*). It is Hobbes, not Rousseau, who explains their behavior. The only thing to which they seem to react is the passage of time: once they have learned to play the game, they systematically vote against redistribution, and only in the initial periods there might be a larger probability of voting for redistribution (*see significant coefficient for large period*).

The variable (proportion of poor who made effort) is meaningless in the exclusion case. Because all the beneficiaries of redistribution have, by definition, made effort.

The difference in the proportion of yes votes by the rich between treatments can be explained by the fact that in the majority game, voting no is the only way to sustain a high effort equilibrium outside the Rousseaunian world (where we cannot be, by our empirical result above.) In the exclusion and unanimity worlds, redistribution is a "consumption" good, you do it because you like it, not to sustain an equilibrium. It can be done for "fairness" reasons (see Alesina-Angeletos (2003) Bolton-Ockenfels (2000), Fehr-Schmidt (1999)).

6   Conclusions

We have seen that the political behavior of the rich individuals is independent of the reasons that have driven the poor to their status. The rich vote against redistribution because they do not want to share their resources with the poor. There are no ethical issues involved in redistribution. That is, there are no question about who "deserves" and who does "not deserve" welfare assistance. There are only poor people who crave for the assistance irrespectively of the paths that conducted them to poverty, and rich people who do not want to share their wealth, irrespectively of how hard and unlucky have been the lives of those less fortunate than themselves.

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[11]The number of observations varies because multicolinearity issues induce us to drop many individuals when including individual dummies.

In our game it is theoretically possible to sustain an equilibrium where everybody makes effort, and where everybody who is unlucky gets help from the lucky ones. Its enforcement would be possible via a strategy relying in the (credible) punishment of reverting to the (bad) Hobbesian equilibrium. Our results show that this equilibrium is not reached. When there is effort in our experiments, redistribution is not sustained over time. This result arises in one of two ways. In three of our main treatment sessions with high initial effort, the rich did not want to redistribute from the beginning. One other session (session 2, group 2) started with high effort and high redistribution, but behavior converged to the equilibrium with low effort. We interpret this as implying that there is no social contract binding the destinies of rich and poor. The rich simply do not feel indebted to the "deserving" poor. Instead, our subject groups either reach the equilibrium with high effort and no redistribution, or the one with low effort and nothing to redistribute.

In any real-world situation it would be more complicated than in our model to sustain political outcomes close to the first best with strategies that rely on reversion to bad equilibria, as the coordination problems would be even stronger. Thus, the absence of first-best outcomes in our experiment, suggests that they would be unlikely to occur in the real world.

A reading of our results can be that if a society has an encompassing welfare state, then its presence must have strong positive effects on efficiency. And conversely, if a society does not provides a generous social insurance system, it is probably because its political institutions prevent the "poor" from getting enough political leverage.

From a technical point of view our results can be read as indicating that, at least when confronting politico-economic situations, agents tend to

disregard non payoff relevant events. The outcomes of the game thus constitute Markov perfect equilibria. This is good news for the large macroeconomic literature that has dealt with the issue, as it has almost in its totality concentrated on Markov perfect equilibria.

This paper is a first step in an experimental investigation of the political economy of redistribution in context with effort decisions and multiple equilibria. But there are some important issues that we have left behind. In particular it would be important to determine to which extent agents behave rationally in voting on inter-temporal issues. That is, we have seen that they do not vote as if they were behind the veil of ignorance (as the rich and the poor systematically differ in their voting); their vote depends on their station in life.

Another relevant rationality issue is whether people take into account the effect of their vote on the future distribution of rich and poor, and how this future distribution will affect the future outcome of the political game?

We consider, though, that the two questions, "can there be a social contract?" and "are people dynamically rational voters?" as two qualitatively different questions. We have given in this paper a negative answer to first question in this paper: "NO, there is no social contract". We intend to answer the second one in a follow-up paper.

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7   Appendix

Proof 3 (Proposition 1) *As a first step, notice that, in the voting stage of the game, it is weakly dominant to vote $v_i = Y$ when $y_i = y^L$ and $v_i = N$ when $y_i = y^H$. The reason is that the vote affects the final payoff only if the voter is pivotal. In that case, voting Y rather than N shifts the outcome from $y_i = y^L$ to $\sum_{j=1}^{n} y_j/9$ when poor and from $y_i = y^H$ to $\sum_{j=1}^{n} y_j/9$ when rich.*

Then, we need to check first that $e_i = e^H$ is a best-response in the first period when $e_j = e^H$ for ll $j \in N$, $j \neq i$. This is indeed true as, in that case, the expected payoff from choosing $e_i = e^H$ is A whereas the payoff from choosing from choosing $e_i = e^L$ is B and by assumption $A > B$.

Finally, we need to check that $e_i = e^L$ is a best-response in the first period when $e_j = e^L$ for ll $j \in N$, $j \neq i$. This is indeed true as, in that case, the expected payoff from choosing $e_i = e^H$ is C whereas the payoff from choosing from choosing $e_i = e^L$ is y^L and by assumption $C < u(y^L)$. In one of them $e_i = e^H$ for all $i \in N$ and in the other one $e_i = e^L$ for all $i \in N$. In both equilibria, for all $i \in N$, $v_i = Y$ when $y_i = y^L$ and $v_i = N$.

Proof 4 (Proposition 2) *The strategies that sustain the equilibrium are as follows:*

I $\gamma_i(h^{t-1}) = (e^H, Y)$ $\forall t \leq 50 - K - 1$,*if for all $\tau \leq t - 1$ there was no unilateral deviation from (e^H, Y).*

II $\gamma_i(h^{t-1}) = (e^H, N)$ $\forall t > 50 - K - 1$, *if for all $\tau \leq 50 - K - 1$ there was no unilateral deviation from (e^H, Y).*

III $\gamma_i(h^{t-1}) = (e^L, Y)$, *otherwise.*

Obviously the strategies prescribe equilibrium actions after histories in II and III, as they are static (and unconditional) equilibria of the stage game. In histories like I the strategies prescribe equilibrium actions since a deviation implies a gain of $D - E$ with respect to the equilibrium action, but a loss of at least $K(A - y^L)$ afterward. Then the deviation is not optimal since $D - E < K(A - y^L)$ by assumption.

Table 1: Table with averages for all groups.

	% effort	%red/rich	% red/poor	%red/no eff.	% red	exp pay	s.d. pay
effort-majority	0,87	0,12	0,97	1,00	0,46	52,91	24,96
effort-majority	0,34	0,07	0,68	0,90	0,92	37,82	13,97
effort-majority	0,81	0,07	0,82	1,00	0,32	53,80	25,45
effort-majority	0,60	0,24	1,00	0,85	0,76	44,71	18,56
effort-majority	0,18	0,22	0,65	0,74	0,76	33,49	8,52
effort-majority	0,20	0,1	0,77	0,82	0,8	35,33	9,51
effort-majority	0,31	0,28	0,87	0,86	0,96	38,51	12,21
effort-majority	0,34	0,15	0,93	0,96	0,98	37,47	12,00
effort-majority	0,48	0,03	0,93	0,97	0,78	43,36	16,33
effort-majority	0,82	0,024	0,99	0,99	0,36	51,82	26,50
effort-unanimity	0,73	0,21	0,75	0,91	0	51,11	30,38
effort-unanimity	0,77	0,33	0,91	0,87	0	48,53	31,36
effort-unanimity	0,73	0,17	0,85	0,94	0	50,51	31,36
effort-unanimity	0,79	0,25	0,80	0,91	0	50,20	31,41
effort-unanimity	0,79	0,29	0,98	0,98	0	49,76	31,59
effort-unanimity	0,80	0,11	0,93	0,91	0	49,27	31,80
effort-exclude	0,97	0,3	0,95	n.a.	0,62	54,40	22,81
effort-exclude	0,95	0,19	0,94	n.a.	0,34	54,80	27,34
effort-exclude	0,95	0,20	0,97	n.a.	0,44	54,80	25,34
effort-exclude	0,93	0,34	0,94	n.a.	0,56	56,73	24,30
no effort	0,00	0,22	0,76	n.a.	0,32	74,33	28,56
no effort	0,00	0,2	0,87	n.a.	0,18	79,62	28,54

Table 2: Table with averages-separating high-low groups.

	% effort	%red/rich	% red/poor	%red/no eff.	% red	exp pay	s.d. pay
effort-majority-HE	0,83	0,07	0,93	1,00	0,38	52,84	25,64
effort-majority-LE	0,35	0,16	0,83	0,87	0,85	38,67	13,01
effort-majority	0,49	0,13	0,86	0,91	0,71	42,92	16,80
effort-unanimity	0,77	0,23	0,87	0,92	0,00	49,90	31,32
effort-exclusion	0,95	0,26	0,95	n.a.	0,49	55,18	24,95
no effort	n.a.	0,21	0,82	n.a.	0,25	76,98	28,55
total	0,64	0,19	0,88	0,90	0,51	46,67	21,52

Table 3: Probit on voting for redistribution. **All agents**.

All Sample	(1)	(2)
largeperiod	0.109	0.111
	(0.074)	(0.068)
ipooreffort	-0.393**	-0.479**
	(0.104)	(0.089)
irich	-3.424**	-3.215**
	(0.106)	(0.088)
n–effort	0.279**	0.267**
	(0.026)	(0.024)
redispast	0.275**	0.257**
	(0.073)	(0.067)
n–effortpast	0.026	0.025
	(0.022)	(0.021)
constant	-0.585*	-0.390*
	(0.351)	(0.208)
Session Controls	Y	Y
Individual Controls	Y	N
Number of obs	4312	4410
Pseudo R^2	0.569	0.51

Standard deviations in parenthesis.

Starred (*) coefficients are significant at the 10% confidance level, double starred ones (**) at the 5%.

Table 4: Probit on voting for redistribution. **Only rich agents**.

Only Rich	(1)	(2)	(3)	(4)
largeperiod	-0.362**	-0.217*	-0.532**	-0.326**
	(0.142)	(0.111)	(0.167)	(0.124)
ratio–effort–poor			0.079	0.080
			(0.085)	(0.064)
n–effort	0.079	-0.009	0.005	0.064
	(0.052)	(0.041)	(0.063)	(0.049)
redispast	0.09	0.019	0.307*	0.099
	(0.153)	(0.119)	(0.182)	(0.137)
n–effortpast	-0.042	-0.016	-0.038	-0.012
	(0.047)	(0.037)	(0.051)	(0.039)
constant	-1.926**	-0.883**	-5.875	-1.270**
	(0.694)	(0.410)		(0.426)
Session Controls	Y	Y	Y	Y
Individual Controls	Y	N	Y	N
Number of obs	908	1423	676	1250
Pseudo R^2	0.307	0.106	0.32	0.139

Standard deviations in parenthesis.

Starred (*) coefficients are significant at the 10% confidance level, double starred ones (**) at the 5%.
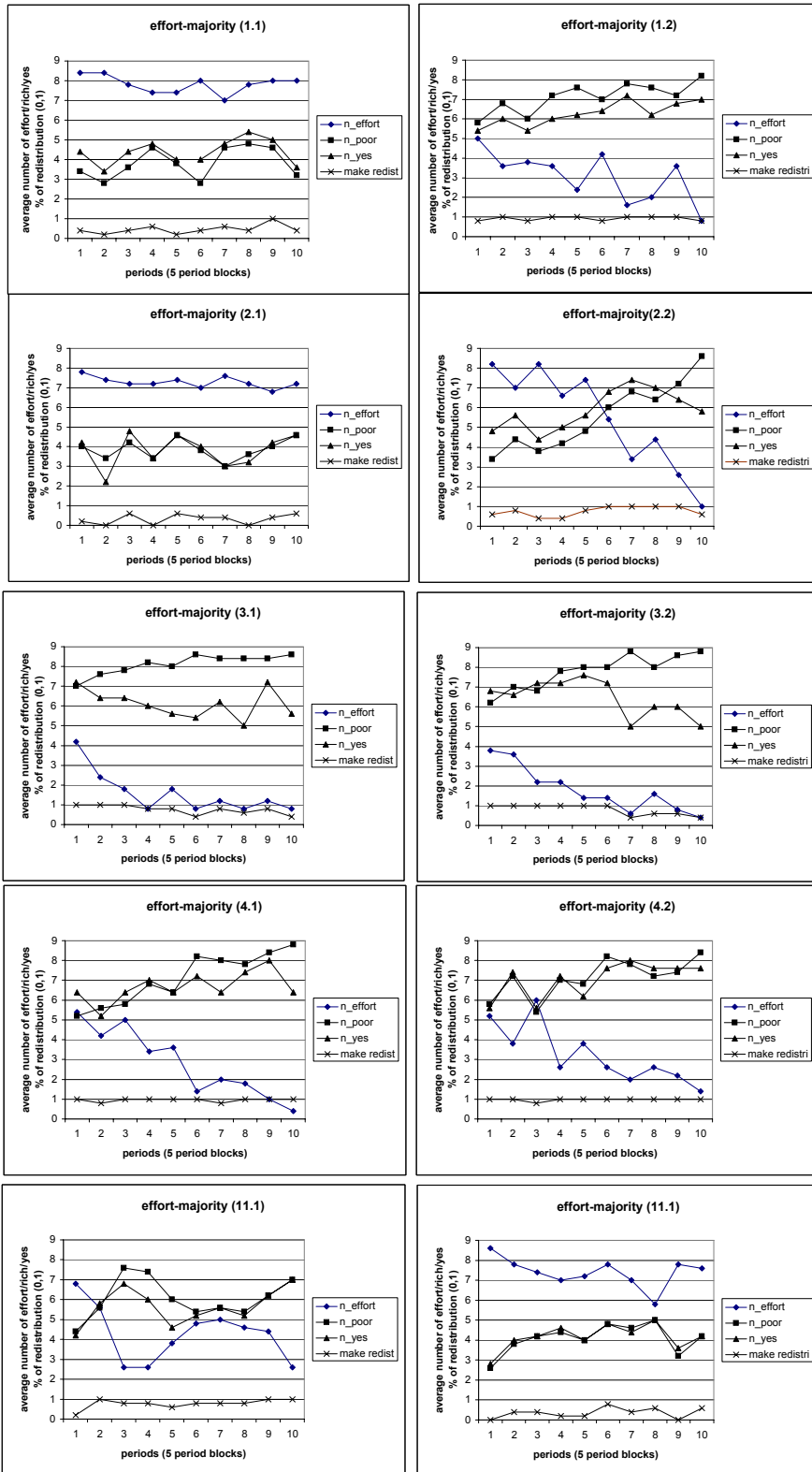
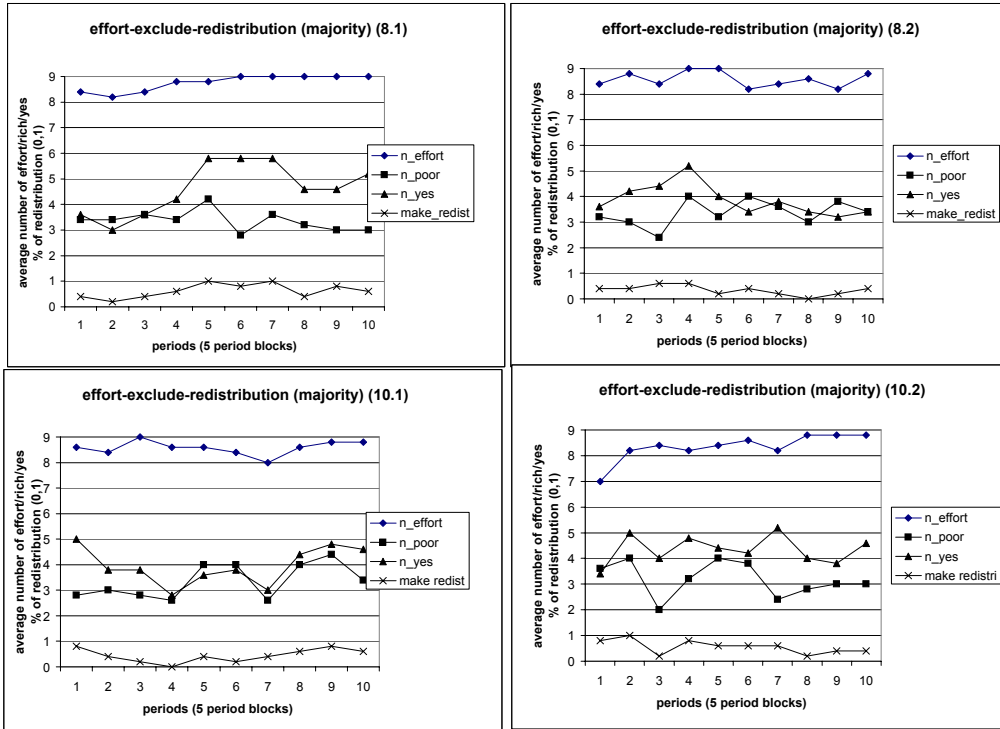figure 1: effort-majority sessions

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Figure 1: Effort majority

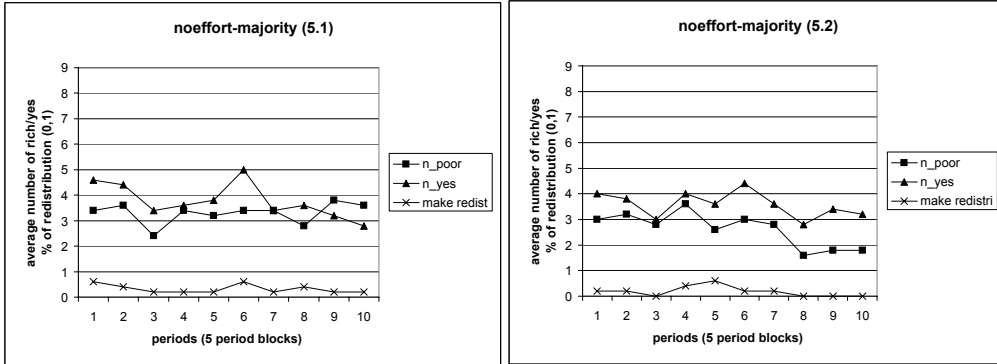figure 2: effort-exclusion-majority sessions

Figure 2: Effort exclude majority
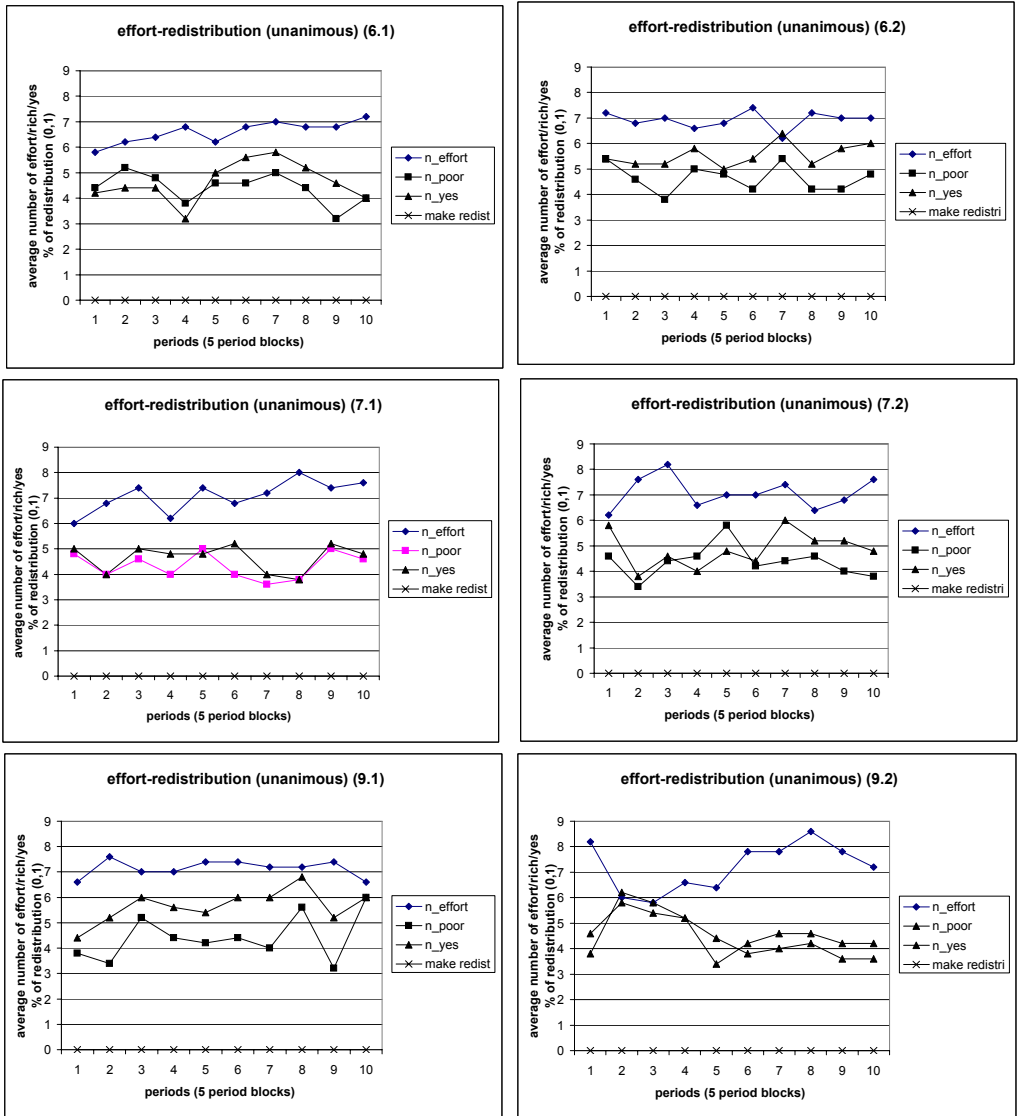
figure 3: no effort-majority sessions

Figure 3: No effort

figure 4: effort-unanimity session

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Figure 4: Effort unanimity