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Inequality and Inter-group Conflicts – Experimental Evidence

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Abstract
In this paper, we study the determinants of inter-groups conflicts, focusing our attention on the role of inequality aversion. First, we experimentally investigate whether inequality is a driving force of inter-group conflicts. Second, we investigate the factors that make preferences for conflict translate into actions. Inter-group conflicts require both coordination and necessary financial material resources. Our experiment consists of a two-stage game. First, subjects play a proportional rent-seeking game to share a prize. In a second stage players can coordinate with the other members of their group to reduce ("burn") the other group members' payoff. Treatments differ in the degree of social inequality set between the two groups by attributing to some subjects (the advantaged group) a larger share of the price than other subjects (the disadvantaged group) for the same amount of effort. We observe frequent conflicts, where, as expected, disadvantaged groups "burn" more money than advantaged groups. Surprisingly, however the frequency of conflicts decreases with the degree of inequality. Our data allow us to identify resignation as the driving force behind this phenomenon.

Keywords
Design of experiments, Experimental economics, Social Inequality, Conflicts

JEL classification codes
D72, C91

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Introduction

The link between inequality and violent rebellion is almost a universal assumption, from ancient philosophers to modern economists and political scientists.[1] In the words of Gurr (1970), "the intuition behind this positive relationship is that "high levels of inequalities (relative deprivation) would lead the disadvantaged people, when they have nothing to lose, to express their emotion and achieve redistributive demands when it is possible by resorting to civil violence". In sharp contrast, some authors have argued that economic inequality may also decrease the probability of occurrence of conflicts (Collier and Hoeffler, 1996). According to Collier and Hoeffler (1996), "greater inequality might significantly reduce the risk and duration of war". There may be at least two main reasons behind this. First, when inequality increases, disadvantaged people may want to riot more, but may find it harder to do because they get less and less resources for mobilizing a rebel organization (Tilly, 1978; Collier and Hoeffler, 2002). Second, the disadvantaged may refrain from rioting if they fear counterstrikes anticipating that the advantaged groups have more and more resources for repression when inequality increases (Collier and Hoeffler, 1996). Some researchers have tried to solve these apparent contradictions by suggesting a concave (inverted U-shaped) relationship. Political violence would occur most frequently at intermediate levels of economic inequality, least frequently at very low or very high levels.

While the idea of a relationship between inequality and conflict is appealing, conclusive empirical proof of its existence has been elusive. Indeed there is no clear relationship in the data between inequality and violent conflicts. Some have found positive relationships between income inequality and political violence (Russet, 1964; Muller and Seligson, 1987; Midlarsky, 1988; Brockett, 1992; Binswanger, Deininger and Feder, 1993 and Schock,1996; Alesina and Perotti, 1996). Others have found a negative relationship (Parvin, 1973) or no relationship (Weede, 1981; Collier, Hoeffler and Soderbom, 2004). This is partly because it is hard to clearly disentangle economic inequality as a reason for conflict from other factors such as cultural, ethnic or religious differences or political contexts. Moreover, efforts to test this assumption have frequently been made by "working backward", starting with cases where civil violence occurred and investigating factors that seem to have contributed to the outcome. This neglects cases where similar factors were present but violence did not occur. These are, of course, hard to identify as they often just look like normality. Finally, most of the studies mentioned above have neglected several important dimensions of conflict, and in particular the collective dimension of conflicts (Stewart, 2002).[2]

[1] See Cramer (2005) for the lineage of this idea from Aristotle and Plato through Montaigne and de Tocqueville to today's academic debate.

[2] According to Stewart (2002), most of studies neglect the group dimension. Similarly Sen (1992) also argues that investigations of the relationship between inequality and conflicts must in many cases proceed in terms of inter-group variations and conflicts rather than in terms of individuals. Inequality between individuals is

Recently, the behavioural literature has attempted to address these issues by investigating conflicts in a laboratory controlled environment (see Abbink, 2010 in the Oxford Handbook of Political Economy and Blattman and Miguel, 2010 in the Journal of Economic Literature for an overview of this literature). Some studies have provided strong evidence that people may be willing to harm others despite the absence of immediate or future expected monetary return (Zizzo and Oswald, 2001; Zizzo, 2004; Abbink and Sadrieh, 2009; Bolle et al, 2011; Charness et al. 2011; Abbink and Herrmann, 2011).[3] In a seminal paper, Zizzo and Oswald (2001) designed a game where subjects could reduce (burn) other subject's money at own costs. Despite the cost of burning money decisions, the majority of subjects chose to destroy some part of others' money. Subjects did so mainly to reduce inequalities: Most burners burnt richer subjects more than poorer ones. Abbink and Sadrieh (2009) went one step further and removed even this motive from their game. In their experiment, two players could simultaneously destroy each other's endowment, but had no conventional reason to do so. In a first treatment called full information, players were informed about their partner's decision. In a second treatment, players could not exactly identify the partner's action because a part of endowment can also be randomly destructed by Nature. The authors observe that up to 40% of subjects are willing to burn money, in particular in the second treatment where agents can hide their action and assume impunity. Abbink et al. (2011) studied antisocial preferences in simple money-burning tasks, varying the initial endowment of the decider and the victim across tasks. They find that money burning decisions are sensitive to framing effects. In a recent study, Bolle et al. (2011) investigated the determinants of vendettas. The authors observe that vendettas frequently occur, leading agents to the worst possible outcomes. In the context of a real effort experiment, Charness et al. (2011) showed that individuals do not hesitate to pay to sabotage others' output although such activities provide no monetary or future monetary benefits.

In this current study we contribute to this existing behavioural literature by investigating experimentally the determinants of conflicts. In particular we focus our attention on the relationship between inequality and money burning activities at the group level. Precisely, two sets of questions are addressed in this paper: First, will the disadvantaged group "burn" significantly more resources than the advantaged group through conflict? Several studies have shown that people care about the distribution of payoffs and may be willing to sacrifice a part of their money to reduce differences in payoffs between themselves and others (Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000; Falk, Fehr and Fischbacher, 2005).[4] Based on

generally refereed as vertical inequality. In contrast, inequality between groups is generally referred as horizontal inequalities (see Ostby, 2003 for an excellent survey on inequalities and civil conflicts).

[3] Orthodox economic theory has long denied humans the desire to harm others without own benefit, but recent behavioural findings suggest that such a tendency does exist. Most of the behavioural economists have traditionally focused on situations in which humans are nicer than orthodox theory suggests, i.e. altruistic, fairness-driven, or reciprocal. The dark side of economic behaviour is only sparsely studied.

[4] This echoes the approach based on relative deprivation according to which inequality is a major determinant of conflicts (e.g. Davies, 1962; Feierabend and Feierabend, 1966; Gurr, 1970).

these previous findings, we conjecture that the disadvantaged groups, if sufficiently inequality averse, should burn more money than the advantaged groups.

The second aim of this paper is to investigate the conditions under which individual preferences for conflict driven by inequality aversion translate into actions. There may exist indeed several reasons why it may be not always necessary the case. A first reason relies on the collective dimension of conflicts. Collective decisions to burn or not money of the other group requires coordination. With a collective environment, it becomes clear that if there is a relationship between inequality and riots, it must work in an indirect way: Not only must disadvantaged individuals develop a level of frustration that makes them want to take destructive action, but also they must form a belief that sufficiently many others will take action *at the same time*. Second, as mentioned above, it might be also the case that strongly disadvantaged people may want to rebel, but may find it harder to do so if they have insufficient financial resources for mobilizing a rebel organization (Collier and Hoeffler, 1996).[5] This may in turn make it harder for the beliefs about other people's behaviour to flip towards the rebellious equilibrium. Third, this unpredictability may be also exacerbated by the strategic interaction between rioters and the authorities. In other words, the disadvantaged may feel grievance but may refrain from rioting if they fear repression by the advantaged players (Collier and Hoeffler, 2004). Finally, according to Nagel (1976), while the "grievances resulting from comparisons" may increase, the "tendency to compare" may decrease with the level of economic inequality. In this current study we attempt to isolate these different factors that might interact together with the relationship between inequality and conflicts.

In this paper we analyze the relationship between inequality and inter-group conflicts in a novel way. We first set up a two-stages conflict game with two groups of individuals. In stage one, two groups compete in a proportional rent seeking game to gain a share of a prize. This stage aims at inducing inequality that may originate from either players' decisions and/or differences in abilities between groups to win the prize. In a second stage, individuals can coordinate with the other group members to revolt against the other group. We find two extreme equilibria for each group: one in which nobody engage in conflict and one in which all of the members' coordinate to burn money of the other group. The structure of the game with multiple equilibria at the second stage makes the game theoretic prediction indeterminate, leaving it to empirical analysis to identify links between inequality and conflicts. We provide such empirical data by conducting a controlled laboratory experiment using our conflict game. Our experiment consists of three different treatments that differ in the extent of inequality induced in stage one of the conflict game. In our baseline treatment,

[5] A theoretical distinction has been drawn between so-called 'greed-driven" and "grievance-driven" rebellion. Among the greed factors are access to finance, natural resources and geographical factors necessary for conflicts. Using a global data set of civil wars during the period 1960-1999, Collier and Hoeffler (2004) found that greed provides considerably more explanatory power than grievance. Based on data on income inequality, Deininger and Squire (1996) observed that inequality has no significant effect on civil war.

both groups have the same ability to gain a share of the prize such that inequality results only from the individuals' own investment decisions. In the two remaining treatments, we exacerbate inequality between groups by attributing to one group a lower ability to gain a share of the total income.

Testing a model dealing with inequality and riot by using laboratory methodology that involves small number of players performing abstract tasks and interacting with one another for finite repeated number of periods, might be met with some skepticism. Of course riots is a complex issue since several motives could explain riots including economic and political, social or psychological factors other than inequality may drive riots. The laboratory has the advantage of measuring the relationship between inequality and riots in a controlled environment (e.g. the political, social and religious context), defining a priori the reference group, rather than having to infer it from survey data, and of avoiding any possible role for contextual effects. The use of university students also allow us to abstract from cultural differences and the meanings associated with belonging to a particular group. Finally, in contrast to survey studies, our analysis relies on actual and costly decisions instead of subjective reported behaviour.

Our paper is related to a growing literature on conflict and money burning experiments (see Zizzo and Oswald, 2001; Abbink and Sadrieh, 2009; Abbink et al., 2011 ; Bolle et al., 2011).[6] With the conflict model we use, our study is also related to the literature on rent-seeking games (Millner and Pratt (1989), Potters, de Vries, and van Winden (1998), Weimann, Yang, and Vogt (2000), Anderson and Stafford (2003), Abbink, Brandts, Herrmann, and Orzen (2009)). The issue of destructive inter-group conflicts has, to our knowledge, not been previously studied experimentally. Even the more general experimental literature on political conflict is surprisingly sparse. A few experiments on political systems focus on the emergence of regimes in a model in which citizens can devote their efforts to production or appropriation (Durham, Hirshleifer, and Smith (1998), Duffy and Kim (2004), Lacomba, Lagos, Reuben, and van Winden (2008)). Others (Abbink and Pezzini (2005), Cason and Mui (2007)) study revolting behaviour in a dictatorship, or examine independence conflicts (Abbink and Brandts (2009)).

Our paper brings two important innovations to these studies mentioned above. First, our paper experiments for the first time a setting with collective money burning decisions rather than individual burning decisions. Collective decisions to burn or not money of the other group involve coordination. Coordination may be particularly important to understand spontaneous outbreaks of revolt. For instance, when a wave of violence swept through the suburbs of French cities in 2004, many observers pointed at long-standing problems in the suburbs, and particularly tensions arising from inequality. However, it has been so for decades

[6] Our study is also related to previous literature on public good with costly punishment (see for instance Fehr and Gächter 2000 ;Anderson and Putterman, 2006; Carpenter, 2007; Carpenter, et *al*., 2004; Masclet, et *al.* (2003), Nikiforakis and Normann, 2008; Nikiforakis, et al., 2008).

and the situation has not noticeably deteriorated prior to the riots. So why has it been quiet for so long? How could the unrest suddenly emerge out of the blue? To answer these questions one has to look at the strategic environment. While many disadvantaged people may have a preference for unrest, turning this urge into action is another matter. A single rioter will not gain much satisfaction from his endeavour. In all likelihood he will be arrested and that is the end of the game. Only if the rioters reach a critical mass, they stand a chance against the authorities. The crucial factor lies in the beliefs that a rioter has about the actions of like-minded individuals. When a frustrated individual believes that sufficiently many other frustrated youths will turn to the streets, then it becomes the best response for him to join. If, however, he believes that most others will stay at home, then he better stays calm himself. These decisions have to be made almost simultaneously. In the game-theory language, the riot game has two extreme equilibria: One in which nobody riots and one in which all potential rioters do. Due to the two extreme equilibria of this game it is not surprising anymore that, although frustration may build up slowly over years, outbreak of violence happens extremely fast and seemingly out of nowhere.[7]

The second originality of our research lies in the fact that in this paper we explore the occurrence of conflicts in a setting where conflicts provide no immediate or future monetary benefits (in terms of obtaining future higher shares of the "pie"). In other words, subjects have no strategic gains (expectation of higher income in the future) from using conflicts. Rebellious actions are carried out solely to do harm to the other group. Furthermore conflicts cannot affect the current inequality level between the haves and the have-nots. Thus the situation is different from classic revolutionary action, which is driven by the aim to reach a political goal.

To anticipate our results, we first find that, despite the cost of entering into conflict, a substantial number of players choose to destroy the other group's money. These decisions to burn money strongly depend on expectations about decisions of others that are generally based on previous experience. Furthermore as one might expect, when disadvantaged and advantaged groups clash the disadvantaged initiate significantly more conflicts than the advantaged groups. Surprisingly however, we find that the number of conflicts *decreases* with stronger inequality. Our data allows us to identify resignation as the driving force behind this phenomenon.

The remainder is organized as follows. In section 2, we describe our game. Section 3 presents our experimental design. Section 4 provides theoretical predictions. In section 5, the experimental results are presented and discussed. A last section concludes and presents a discussion of our main results.

[7] The trigger for the French riots was the accidental electrocution of two immigrant youths. It was claimed that these teenagers died while they were chased by the police, a charge the authorities denied. Tragic as this case was, it would usually not be sufficient as a *cause* of a rebellion of that scale. However, it certainly served as a coordination device.

2. The game

We model the conflict game as a game in two stages. The first stage models the competition between two groups to gain scarce resources, e.g. access to education and good jobs. In a first stage, players are divided into two groups called group A and group D and compete in a proportional rent-seeking game (by purchasing tickets) to share a prize *P*.

This stage aims at inducing inequality between groups that may originate from decisions in term of investment in the rent seeking but also from different abilities across groups to win a share of the prize. We chose to play a rent-seeking game instead of simply endowing people with different payoffs for two main reasons. First, with the rent-seeking game in the first stage we want to capture important features of real-life competition for jobs and income and the fact that inequality may stem from both individuals' decisions and differences in abilities. It may be reasonable to assume that competition may lead to unequal distribution of the resources among the contestants, particularly if some contestants have lower abilities than others to get a share of the "pie". Such asymmetries are common in contests. For example, Esses et al., (1998) showed that competition in the job market is an important determinant of conflicts between natives and immigrants. Second it is more realistic to assume that initial exogenous inequality in term of abilities ("bad luck") may be reinforced by subjects' actions, i.e. by their own investment decisions in the rent seeking game. This situation is quite realistic. Imagine for example a situation where agents receive initial endowments in terms of capacity and have to decide to invest in education to compete to gain resources, e.g. access to good jobs.

The share of the prize received by each participant in stage one of the conflict game equals the proportion of her tickets relative to those of the entire group (including all players A and players D). Denoting by x_i the number of tickets individual *i* buys and by c_i the cost per ticket, the individual's share s_i of the prize is then

$$s_i = \frac{\left(\frac{x_i}{c_i}\right)}{\sum_{j=1}^{n} \frac{x_j}{c_j}}.$$

At the second stage of the game the two groups can engage in conflict. This is modelled as a coordination game in which the members of the group can simultaneously choose to take action in order to reduce the payoffs of the members of the other group. If the number of group members who choose to burn money reaches or exceeds a critical threshold *m*, then each member of the other group receives a payoff reduction. The own incentives of money burning follow the structure of a mass coordination game. If fewer than *m* group members 'riot', then 'rioters' bear a higher cost than non-rioters, a feature that captures sanctions from the authorities. If *m* or more members 'riot', then it actually pays off to join the riot, which reflects the ostracism that inactive group members receive from their fellow group members.

Note that a "successful riot » entails no material benefits to the 'rioters'; it is still pareto-dominated by the peaceful outcome. The exact payoffs are given in section 3.

Our experiment consists of three different treatments. In our baseline treatment called *sym*. treatment, the cost of the ticket in stage one is the same across groups. It is important to note here that the symmetric treatment does not mean the absence of inequality across groups but means that the only inequality that would arise in this case comes from differences in investments across players. In the two remaining treatments called *asym4* and *asym8* treatments, group D has a higher cost per ticket and therefore a much harder time to gain its share of the cake, as their lottery tickets have a much lower winning power than those bought by individuals of group A. Asymmetric treatments feature the fact that differences in abilities reinforce inequality which can distort the final outcome, always in favour of the advantaged group.

3. The experimental design

3.1. The parameterization of the game

At the beginning of the experiment, each participant is randomly assigned a role of player A or player D. They keep this role during the entire experiment. Further, 3 A-type and 3 D-type players are randomly matched to form a group of 6. Each player keeps her role during the entire experiment. There are three treatments in the experiment, all of which have a first and a second stage of interaction in common.

Our main research question involves the relationship between inequality and conflicts. Thus, we vary the level of inequality across the three treatments of our experiment. As a control treatment (called symmetric treatment) we conduct sessions with a symmetrical setup, in which both groups have the same opportunities to gain a share of the "pie". The cost parameter for both groups is therefore c_i=1. We then run two experimental treatments (called *asym4* and *asym8* inequality treatments, respectively) in which we vary the cost parameter c_i, making it increasingly harder for groups D to compete and therefore leading to higher inequality levels. We have sessions with $c_i = 4$ and $c_i = 8$. The cost parameter for groups A is always $c_i = 1$. In all experiment the prize to be won was set to $P = 576$. By varying the ability of some group to gain a share of the "pie", we attempt to increase the extent of inequality between groups.

At the first stage of the game players endowed each with 100 tokens can invest any amount between 0 and 80 tokens. In the second stage of the experiment subjects decide whether or not to burn money of the other group. A riot is successful if at least two of the three group members participate. The payoffs are chosen in a way that it is always preferable for an individual player to swim with the tide, i.e. to riot if the other group members riot and to abstain if the others do. The cost of being the only rioter is chosen to be greater than the cost of being the only absentee. Thus, we assume that the consequences of being caught (e.g. fines or arrest) are more severe than those of abstaining from a successful riot, which are mainly loss of face before an individual's peers. The following table shows the payoffs for the combinations of choices in the second stage subgame. These payoffs are simply added to the earnings obtained in the first stage of the game.

[Table 1 : about here]

3.2. The conduct of the experiment

The experiment consisted of 23 sessions of 20 periods each. Experimental sessions were conducted at the University of Rennes I, France. 378 subjects were recruited from undergraduate classes in business, art, science and economics. None of the subjects had previously participated in a similar experiment and none of them participated in more than one session. The experiment was computerised using the Ztree software. In a first experiment all sessions were run using a partner protocol; i.e. the composition of the groups remains the same throughout the experiment. In a second experiment, we used a stranger protocol in which the groups are randomly rematched in every round. Precisely memberships are fixed within each 3-players group but each disadvantaged group is paired with a different advantaged group in every round. This treatment will be described in section 5.

Some information about the sessions is given in table 2. In the first column, experiment I refers to the original data under a partner matching protocol while experiment II the new sessions (under a stranger matching protocol). The next three columns indicate the session number, the number of subjects that took part in the session and the treatment in use in the session. The matching protocol column indicates whether a partner or a stranger matching was in effect during the 20 periods.

At the beginning of the experiment, players are assigned to groups of size six that consists of 3 A-type and 3 D-type players. Subjects were not told who of the other participants were in the same group, but they knew that the composition of the groups did not change. The subjects were visually separated from one another in order to ensure that they could not influence each other's behaviour other than via their decisions in the game.

[Table 2 : about here]

Each session began with an introductory talk. A research assistant read aloud the written instructions (reproduced in appendix for the moderate inequality treatment). The language used in the instructions was neutral, i.e. we avoided references to the riot context.[8]

[8] By this we wanted to focus participants on the incentives given in the game, and avoid the possibly that strong opinions on the recent French riots could guide their choices.Evidence for the effects of instruction framing has been very mixed so far (Baldry, 1986; Alm, McClelland, and Schulze,1992; Burnham, McCabe, and Smith,2000; Abbink and Henning-Schmidt, 2006; Abbink and Brandts, 2009).

The total earnings of a subject from participating in this experiment were equal to the sum of all the profits he made during the experiment. On average, a session lasted about an hour and 20 minutes including initial instructions and payment of subjects. At the end of the experiment, subjects were paid their total earnings anonymously in cash, at a conversion rate of one euro for 328 talers. Subjects earned on average €12. At the time of the experiment, the exchange rate to other major currencies was approximately US-$1.20, £0.70, ¥140 and RMB10.5 for one euro.

4. Game theoreticical predictions

4.1. Theoretical predictions

The two-stage game can be solved by backward induction. It is easy to see that the second stage game, as mentioned earlier, has four pure strategy equilibria, two for each group. In one equilibrium nobody enters into conflict, in the other one everybody. This is independent from the decisions made in the other group, as all players decide simultaneously. Thus, every combination of one equilibrium in one group with an equilibrium in the other group is an equilibrium of the second stage game. Note however that the non-conflict equilibrium is payoff dominant.

For the first stage equilibrium we first look at the rent-seeking game in isolation. Identifying the equilibrium of the first stage, and subsequently the subgame perfect equilibrium of the whole game, is technically more involved. The symmetric tretament is straightforward: The equilibrium is the solution of the standard rent-seeking game (the fact that players receive shares rather than winning probabilities does not change equilibrium predictions). The equilibrium investment is given by

$$x_i^* = x^* = \frac{(n-1)}{(n)^2} P \, .$$

Where *n* stands for the total number of players by group (i.e. 6 players in our experiment).

This yields an equilibrium investment of 80, which is the maximum amount allowed.[9]

Investment decisions may sharply differ from these predictions, however. Indeed several previous studies on rent seeking games have shown that players' investments generally deviate from the theoretical predictions, players investing either too much or not enough (see Millner and Pratt, 1989, 1991; Davis and Reilly, 1998; Potters et al., 1998; Anderson and Stafford, 2003; Shupp, 2004; Schmidt et al., 2004). Such deviations from the equilibrium should have important implications in our game in term of inequality between groups. While

[9] Previous rent-seeking experiments have shown investments that are systematically above equilibrium levels. This possibility is excluded through our imposed restriction of the strategy space. In this study we are not interested in the behavioural properties of the rent-seeking game, but we rather use the game as a device to induce inequality of opportunities to study their effect on behaviour at the second stage.

no inequality of income should be observed in theory in the symmetric treatment, inequality can still arise in practice if the agents behave non-optimally by deviating from the equilibrium strategy profile.[10]

In the asymmetric treatments, the heterogeneity of the players from the different groups needs to be taken into account. We derive the first order conditions for the optimal investment, given the investment of the other players, as

$$x_i^* = \left[1 - \frac{c_i(p-1)}{\sum_j c_j}\right] \frac{P.c_i(n-1)}{\sum_j c_j}$$

$$= \left[1 - \frac{c_i}{\bar{c}} \frac{(n-1)}{n}\right] \frac{c_i}{\bar{c}} \frac{(n-1)}{n} P \quad \text{with} \quad \bar{c} = \frac{\sum c_j}{n}$$

In the asymmetric treatments this would imply equilibrium investments of 128 and 86.9 for the A-players, and –64 and –51.4 for the D-players, for c_i = 4 and c_i = 8 respectively. Since these investments lie outside the feasible range of 0 to 80 we have an identical corner equilibrium for the asymmetric treatments. The A-players invest the maximum allowed, the D-players invest nothing. So only the A-players receive a share of the prize (an amount of 192) in equilibrium. This implies higher inequality of income between groups D and A compared to the symmetric treatment. Note that although the equilibrium prediction is identical in the two asymmetric treatments, for similar reasons as mentioned for the symmetric treatment, the two asymmetric treatments may behaviourally very well differ. The reason is that any deviation from the equilibrium will induce higher inequality in the *asym.8* treatment than in the *asym.4* treatment.[11]

The game as a whole has multiple equilibria. If, for example, the group D selects the conflict equilibrium in response to the first stage equilibrium, but the no-conflict equilibrium for some neighbouring first stage outcome, then the A-players would choose different investments at the first stage. However, the one in which all players choose the first-stage best responses is very persistent. In particular, the D-group cannot use equilibrium selection as a threat to secure a positive share of the pie by forcing the A-players to invest less. This is because the equilibrium in which the three A-players choose (80,80,80) for all second stage

[10] For instance if an individual deviate by investing 60 tokens (instead of 80) in the symmetric treatment, this leads to a payoff of 197 token for this individual (instead of 212 tokens at the equilibrium). Note that in the symmetric treatment, the disadvantaged group should not be necessarily the same at each period neither would it fit the label assigned to each group (namely D and A).

[11] For example if a D-player deviates from the equilibrium strategy by investing 20 tokens instead of zero tokens, this gives him a lower payoff in the *asym8* (85.93 tokens) than in the *asym4* treatment (91.75 tokens). Note that a similar deviation from the equilibrium from the A-players does not lead to higher payoffs in the *asym8* than in the *asym4* treatment. Imagine for instance that a A-player invest 60 (instead of 80) in the asymmetric treatments. This leads to a similar payoff of 197.09 in both *asym8* and *asym4* treatments.

response patterns except those that are characterised by: “Conflict against (80,80,80) but do not conflict against (80,80,y)”, where $y < 80$. If such an equilibrium response pattern is selected, then it can be a best response for an individual to deviate from a choice of 80 and invest y instead. The individual’s unilateral deviation then avoids the conflict and this can lead to a higher profit for the individual. However, the smallest number y that can be used as a threat is 38, even lower values make it preferable for the individual to stick to an investment of 80 despite the conflict. Against an investment of the advantaged group of (80,80,38), however, a D-player’s best response is still to invest zero. Note that the threat must be chosen in a way that only one player is forced to reduce his investment, otherwise an advantaged group investment of (80,80,80) remains a subgame perfect equilibrium pattern. In such a case an individual reduction of the investment would not avoid the conflict but only reduce the deviator’s payoff.[12]

Due to the Pareto superiority of the non-conflict equilibrium, it seems reasonable to expect a convergence towards it over time in all treatments. Indeed several previous experimental studies have shown that players generally succeed in coordinating on the Pareto dominant equilibrium over time in repeated games when they are matched with a same opponent (see for instance Berninghaus, Ehrhart and Keser, 2002; Berninghaus and Ehrhart, 2001; Clark and Sefton, 2001).[13]

4.2. Behavioural assumptions

A possible objection to the predictions mentioned above is that individuals may not necessary coordinate on the non-conflict equilibrium, in particular if they belong to the disadvantaged group and incur disutility from being worse off in material terms than advantaged group (see Loewenstein et al. 1989; Charness and Rabin, 1992; Fehr and Schmidt, 1999; Bolton and Ockenfels, 1999). If one assumes that individuals may suffer from disadvantaged inequality, it may be therefore rational for the disadvantaged people to burn money of the advantaged group, despite its cost since it reduces the dissonance of payoff with the advantaged group. Based on these models, the disadvantaged groups may fail to coordinate on the non-conflict equilibrium. This is stated precisely in Hypothesis 1.

Hypothesis 1 (inequality aversion): *In all treatments, the disadvantaged group should burn more money than the advantaged group.*

[12] These deliberations turned out to be empirically irrelevant, as in the experiment the focal equilibrium investment was reached very quickly (see next section).

[13] Clark and Sefton (2001) compared coordination experiments played either in 10 sequences of one-shot games or in 10-fold repeated games in which subjects were matched with the same opponent for all the 10 rounds. The authors observed that interacting with the same partner increase coordination on the payoff dominant equilibrium. Berninghaus and Ehrhart (2001) showed that the higher the number of periods, the more likely is coordination on the payoff-dominant equilibrium. Cooper et al. (1992) found that subjects fail to converge on the efficient equilibrium when people interact with different opponents at each round. The reason is that in absence of repetition, players are uncertain about which strategy will be played and favour the safe strategy (strategic uncertainty).

Our second hypothesis concerns possible differences between treatments. Our treatments differ in the degree of inequality of income between groups induced both by competition (through deviations from the equilibrium) and by the difference of ability to gain a share of the prize. Does greater inequality lead to more conflicts? This is not so clear cut. On one hand, models of inequality aversion predict that higher inequality should lead to higher levels of conflicts. This is also in line with the political literature based on the theory of relative deprivation according to which one should observe higher levels of conflicts when frustration increases due to stronger inequality (e.g. Davies, 1962; Feierabend and Feierabend, 1966; Gurr, 1970). Based on these approaches, one should therefore observe more conflicts in the asymmetric treatments (and particularly in the asym.8 treatment) than in the symmetric treatments.

However for several reasons, frustration induced by inequality may not necessarily always translate into action. First, when inequality increases, disadvantaged people may want to riot more, but may find it harder to do because they get less and less resources for mobilizing a rebel organization (Tilly, 1978; Collier and Hoeffler, 2002). This interpretation can be related to previous behavioural studies that have showed that punishment decisions are influenced by their relative cost and obey the law of demand (see Anderson and Putterman, 2006; Zizzo, 2003; Nikiforakis, Normann and Wallace, 2008). Second, for similar reasons as those mentioned above, the disadvantaged may feel more and more grievance but may refrain from rioting if they fear counterstrikes because they anticipate that the advantaged groups have more and more resources for repression when inequality increases (Collier and Hoeffler, 1996). A third reason relies on the idea of resignation proposed by Nagel (1976). According to Nagel, while the "grievances resulting from comparisons" may increase, the "tendency to compare" may decline with the level of economic inequality.

Whether the first effect is totally offset by the other factors remains an empirical question. Based on these previous studies we can however conjecture that :

Hypothesis 2 (extent of inequality aversion)*: One should observe higher levels of conflict when inequality increases, unless the disadvantaged (1) fear more retaliations with the extent of inequality (2) have fewer resources to riot when inequality increases and/or (3) resign when inequality becomes too high.*

5. Experimental results

In a first sub-section, we present our findings concerning effort levels in the rent seeking and how it translates into inequality across groups. In subsection 5.2. we show our results on conflicts and test whether inequality arising from stage one leads to money burning in stage two of the conflict game. We follow our research agenda and first present the data from the original setup with partners matching. Sessions with a strangers protocol were added later to test competing hypotheses against one another. We will introduce them in section 5.2.3.

5.1. Average level of effort and first stage profit in the rent seeking game

Figure 1 illustrates the average individual effort in the rent seeking game by period. It shows that investment decisions differ substantially from the theoretical predictions during the earlier periods but converge over time toward the predicted outcome[14]. These findings are consistent with previous studies on rent seeking games (Millner and Pratt, 1989, 1991; Davis and Reilly, 1998; Potters et al., 1998; Vogt et al., 2002; Anderson and Stafford, 2003; Shupp, 2004; Schmidt et al., 2004).

[Figure 1 : about here]

Figure 2 shows the average first-stage payoff by group for each treatment. As expected the observed deviations from the equilibrium coupled with differences in ability across groups induce inequalities between groups in all treatments. On average, first-stage payoffs are significantly lower for disadvantaged groups than for the advantaged groups in all treatments. A Wilcoxon test comparing first stage payoffs between groups, maintaining the conservative assumption that each group's activity over the session is a unit of observation, indicates that advantaged groups receive higher payoffs (211.28 talers) than the disadvantaged groups (96.73 talers) in the *asym4* treatment (z=-2.66,p<0.01; two tailed).[15] A similar test indicates that advantaged groups (214.99 talers) also receive higher payoffs than the disadvantaged groups (90.62 talers) in the *asym8* treatment (z=-2.803,p<0.001; two tailed). Turning next to the symmetric treatment, our data also indicate that there are also some significant differences of income between groups in this treatment. However these inequalities are lower since they are only due to any deviations from the equilibrium strategy and do not always concern the same group over time. If one considers each group at each period as a unit of observation, the group with the lowest first stage payoff receives on average 125.53 talers while the group with the highest first stage payoff gets on average 128.96 talers. This difference is statistically significant (z =1.960, p=0.049; two tailed).[16]

[Figure 2 : about here]

Figure 2 also shows that inequality rises across treatments. These findings are summarized in result 1.

[14] Recall that the optimal number of tickets bought should be 80 each, for all of the players, in the symmetric game. In the asymmetric games (whether under $c_i=4$ or $c_i=8$), it should be 0 each for the disadvantaged members of the group, and 80 for the advantaged ones.

[15] In all statistical tests reported in this paper, the unit of observation is the group for the partner treatments and sessions in the stranger treatments.

[16] Note that this finding should be interpreted with cautious since our observations are not necessary independent as the disadvantaged group is not always the same at each period in the symmetric treatment. A parametric data analysis on first stage payoff provides similar findings showing a significant difference of payoff between groups in the symmetric treatment.

Result 1: *Both investment decisions in the rent seeking game and differences in abilities to win a share of the prize induce payoff differences across groups in all treatments. The inequality level increases significantly across treatments.*

Support for result 1.A Mann-Whitney test shows that first stage payoffs for the disadvantaged groups are highest in the *sym.* treatment, followed in turn by the *asym4* treatment (z=-3.464, p<0.01; two-tailed) and the *asym8* treatment (z=-3.55, p<0.001; two tailed). Our data also show that payoffs for the disadvantaged groups are higher in the *asym4* treatment than in the *asym8* treatment (z=-2.205;p<0.05; two tailed). First stage payoffs for the advantaged groups also increase across treatments. Payoffs for the advantaged groups are significantly higher in the *asym4* treatment than in the *sym.* treatment (z=3.464; p<0.01; two tailed).[17] Similarly, payoffs for the advantaged are also higher in the *asym8* than in the *asym4* treatment (z=1.6; p<0.1; two tailed). These results are robust to the choice of the non parametric test.

5.2. The determinants of conflicts

After having satisfied ourselves that our first stage procedure has indeed induced levels of inequality to a large extent and that inequality increases across treatments, we now turn to our main research question: what is the link between inequality and the emergence of conflicts? As mentioned earlier, we would expect that (1) disadvantaged players should burn more money than advantaged players in all treatments, and that (2) the greater the inequality the more money burning would be observed, a priori.

5.2.1. The level of conflicts

Figure 3 illustrates the time path of the average level of money burning decisions in each treatment.[18] It indicates that, despite the cost of entering into conflict, a substantial number of players chooses to destroy the other group's money. This is summarized in result 2.

Result 2: *In all treatment, the majority of people choose the peace strategy. However a non negligible number of subjects decide to burn money of the other group.*

Support for result 2. Our data indicate that despite the fact that a large majority of individuals choose the peace strategy, a non negligible number of people decide to burn

[17] The fact that people deviate from the equilibrium strategy exacerbate inequality in the *asym8* treatment compared to the *asym4* treatment.

[18] Conflicts shown in figure 3a include several different situations corresponding to the different pure strategy equilibria, two for each group: *i)* situations where both groups enter into conflict (called "war"), *ii)* cases where only the disadvantaged group burn money (called "riot") and *iii)* situations where only the advantaged group enters into conflict. Note that on average, irrespective of the treatment, riots correspond to 45.55% of conflicts while wars correspond to 32.50% of conflicts. Finally the situations corresponding to the case where only the disadvantaged group burns money amount to 21.90%. The last situation may reflect responses to previous conflicts or pre-emptive conflicts. It may also simply reflect the coordination dimension of conflicts. All these motives will be controlled in our parametric data analysis.

money of the other group. The average levels of money burning decisions are 0.431, 0.251 and 0.265 in the *sym*, *asym4* and *asym8* treatment, respectively. These findings are consistent with previous results showing that players generally succeed in coordinating on the Pareto dominant equilibrium over time in repeated games when subjects are matched with a same players (see for instance Berninghaus, Ehrhart and Keser, 2002; Berninghaus and Ehrhart, 2001; Clark and Sefton, 2001). Interestingly, here coordination on the pareto equilibrium does not seem to be explained by initial confusion by subjects. Indeed the average level of conflict generally does not exhibit a pronounced time trend. Only in the *asym4* treatment we can detect a slight downward trend in the first half of the experiment, which appears to be stopped later on.

[Figure 3: about here]

5.2.2. Inequality and money burning decisions

To what extent, conflicts observed in Figure 3 can be explained by inequality aversion? To answer this question, we checked whether the disadvantaged groups are more willing to burn money than the advantaged groups.

Figure 4 reports the average frequency of individual money burning decision depending on whether the membership group is advantaged or disadvantaged. it shows that, in all treatments, the disadvantaged burn significantly more than the advantaged, which strongly support our first hypothesis. With respect to our second hypothesis, Figure 4 shows a surprising result that the overall conflict frequency *decreases* sharply with the extent of inequality. In fact, most clashes are observed in the symmetric treatment than in the asymmetric treatments. Figure 5 reports the same findings. It illustrates the time path of the average level of money burning decisions initiated by the disadvantaged groups only in each treatment. The average frequency of money burning decisions of the disadvantaged groups is .0478 in the symmetric treatment. The overall rates of conflict drop strongly in the asym4 and asym8 treatments (0.354 and 0.292 respectively) compared to the *sym* treatment. These findings are summarized in result 3.

[Figures 4 and 5: about here]

Result 3: *in all treatments, disadvantaged enter into conflict significantly more than the advantaged groups. However the frequency of money burning declines with the extent of inequality.*

Support for result 3: Table 3 provides a formal support of result 3 . it shows the estimates on the determinants of individual money burning decisions. To explore how individual money burning decisions are affected by inequality aversion, we estimated random effects probit models to account for the panel dimension of our data. Marginal effects calculated at the mean of the random effect Probit models are reported in table 3. Table 3 consists of two panels. The left panel displays the results of three regressions for each treatment, separately. The right panel, which we will discuss below, presents the results of an estimate on all treatments.

With these estimations, we investigate to what extent conflicts are driven by inequality aversion. We also attempt to control for other motives that might explain the occurrence of conflicts at this stage including *i)* the coordination dimension of conflict and *ii)* retaliation (and fear of retaliation) for money burning received in the previous round from the other group.

The dependent variable takes the value 1 if individual *i* chooses to burn money in second stage of period *t*, and 0 otherwise. The independent variables include several dummy variables that are expected to be relevant. The "*disadvantaged group*" variable takes the value 1 if the individual belongs to the disadvantaged in a given period and 0 otherwise. This variable corresponds to group D in the asymmetric treatments. It corresponds to the group with the lowest average payoff for a given period in the symmetric treatment. The variable "*only one to burn in t-1*" takes the value 1 if the individual chose to burn in *t-1* while the two others group members decided not to burn and 0 otherwise. This variable seeks to capture the coordination dimension of the conflict decision. The intuition is that people may be willing to riot but may refrain from doing it if they anticipate that the other members of their group will not follow them. The dummy variable "*the other group chose to conflict in t-1*" indicates whether the other group decided to burn money in the previous period. This variable aims to capture the part of conflict that would reflect potential revenge effects. A *trend* variable was also included in the estimates to control for the dynamic of the game. Finally several demographic variables were also included. These control variables include *age*, *gender* and a binary variable indicating whether the participant is student with prior in *economics*. Column 1 reports estimate from the *sym*. treatment. The models are estimated for *asym.4* and *asym8* treatments in columns (2) and (3), respectively.

[Table 3 : about here]

The estimates summarized in Table 3 indicate that in all treatments, disadvantaged individuals are more likely to burn money than advantaged ones. The marginal effects 0.125 and 0.229 for *disadvantaged group* in the sym and asym4 treatments, respectively (see columns 1 and 2) show that individuals who belong to the disadvantaged groups have a 12.5 and 22.9 percentage points higher probability of burning money than others. It amounts to 8 percentage points in the asym8 treatment. Table 3 also provides information about co-ordination that is necessary for conflict. Indeed being the only one to burn in *t-1* has a negative and significant influence on money burning decision in the current period. This variable reveals the two-equilibria structure of the conflict game. Precisely it captures the fact that if player *i* believes from his previous experience that the others will not burn money, then it becomes the best response for him to not to burn, despite her/his preference for burning in order to avoid the cost of being the only rioter. Being the only one to burn money in t-1 decreases the probability of burning money in the current period by 27.3 percentage points in the sym treatment, almost 25 percentage points in the asym4 treatment and 33.7 percentage points in the asym8 treatment. The coefficient associated to the variable "*the other group chose conflict in t-1*" is also positive and significant at the 1% level for all asymmetric treatments. This result indicates that a part of money burning decisions could be explained by willingness to take revenge. Finally table 3 indicates that neither the trend variable nor the demographic variables are significant (except the variable "economics" that captures a positive and significant coefficient at 10 percent level in the sym inequality treatment).

Columns (4) and (5) of table 3 provide more formal evidence of the decline of money burning when inequality level increases. The dummy for each asymmetric treatment variables were included in specification (4) to control for the evolution of conflict decision when inequality increases. These variables are interpreted in relation to the omitted variable that corresponds to the symmetric treatment. Column (4) indicates that the dummy variable "*Asym4*" captures a negative and significant coefficient at the 5% percent level. The coefficient on the "*Asym8*" variable is also negative and significant at the 1% level. With respect to the symmetric treatment, these results indicate that the conflict frequency decreases significantly with the extent of inequality. Individuals in the *asym4* treatment have a 11.1 percentage point lower probability of burning money than persons who play the symmetric treatment. This reduction amounts to 14.7 percentage points for individuals playing the *asym8* treatment. The variables *asym4* and *asym8* also capture a negative coefficient when one considers the disadvantaged groups only, although only the asym8 dummy is significant.

5.2.3. Why does inequality reduce conflict?

The fact that more conflicts are observed when the level of inequality is lower is surprising art first glance. This finding clearly refutes the assumption in term of inequality aversion, according to which higher inequality should induce higher levels of conflicts. Several reasons may explain why the frequency of conflicts decreases with the extent of inequality. First, as mentioned above in section 4.2, when inequality increases, the disadvantaged people may feel more frustrated but at the same time they get lower levels of resources that are necessary to riot, which may turn into lower levels of conflicts. This hypothesis refers to the *mobilization opportunity* theory (Tilly, 1978; Collier and Hoeffler, 2004). Second, when inequalities are higher, the advantaged have more resources at their disposal and can afford losing some of them in a costly retaliation activities more easily (Collier and Hoeffler (1996). Anticipating this, the disadvantaged may fear more repression by the advantaged players and thus may refrain from rioting for high inequality levels. Our third possible explanation relies on the idea of resignation. In the spirit of Nagel (1976), the intuition is that when inequality increases, strongly disadvantaged players may realise that they are in a hopeless position and would accommodate with it. Lower conflict rates from disadvantaged groups would be then due to resignation.

We tested these alternative hypotheses by designing new experiments that allow separating them. First, we conducted two treatments using the *sym* and the *asym4* set-up, but with a stranger instead of a partner protocol, which allows to isolate the "fear of retaliation" motive from other motives. At the outset of each session the eighteen participants are divided into two sets of players, nine advantaged and nine disadvantaged players. These sets of nine remained unchanged, such that each participant kept the same role throughout the experiment. In every round the sets of nine players are then randomly divided into three groups of three players. These groups remain unchanged throughout the experiment as well. In every round, each group of the set of advantaged players is then randomly rematched with one group of disadvantaged players. By changing the matching of groups every round we expect to remove the opportunity to counterattack from the game. Thus, if the retaliation hypothesis is correct, we should expect burning money decisions among disadvantaged players to become more frequent, as the fear of a counterstrike is taken away. By keeping the composition of groups the same, however, we ensure that the rematching does not affect within-group coordination.[19] In addition, we also ran an individual money burning game in which the burner's endowment is unchanged in order to isolate a pure resignation effect from a pure income effect (i.e. lower resources to riot).

[Figure 6: about here]

Figure 6 indicates the frequency of individual money burning decision by the disadvantaged in the *sym* and *asym4* treatments under the stranger matching protocol. Figure 6 shows that in both treatments the disadvantaged groups burn significantly more money than the advantaged groups in both treatments. According to Wilcoxon sign rank tests, these differences are statistically significant (p=0.0277 and p=0.0280 for the symmetric and asym4 treatment, respectively).[20] The most important comparison, however, is between burning rates in the partners and the strangers treatment. Our data report very similar burning rates for the two matching protocols. A nonparametric Mann-Whitney test indicates that burning frequencies are virtually identical for the symmetric treatments (z=-0.646, p>.1) and for the advantaged players of the asym.4 treatments (z=0.944, p>1) under the stranger and partner matching, respectively. For the disadvantaged groups in the asym4 treatment we observe even a slight drop in burning rates from the original data, which is in the opposite direction from

[19] This matching naturally does not ensure that groups never meet the same group again (it would be impractical to implement such a scheme, as it would require 120 participants in each session for 20 rounds). Note that our aim was not to emulate a series of pure one-shot games, but to remove the possibility of effective counterattack. With our setup, there would be a two-third probability that a counterattack would hit the wrong group, which should be sufficiently discouraging.

[20] In statistical tests reported here, the unit of observation is the session for the stranger treatments.

the expected effect. This difference, however, is not significant (z=0.354; p>.1). Our findings are summarized in result 5.

Result 5: *Frequencies of burning decisions are similar in the partner and stranger matching protocols, which clearly refutes the fear of revenge motive.*

Support for result 5. Table 4 report similar estimates as those presented in table 3 except that both partner and stranger sessions are included in the data analysis. A "*partner*" variable is included as independent variable to check the existence of a matching effect. This variable is a dummy that takes 1 if the treatment was played under the partner matching and zero otherwise. The findings reported in table 4 corroborate our previous results obtained from the original data with partners matching. Table 4 indicates that in all treatments, the disadvantaged groups burn significantly more money than the advantage groups. In addition, columns (3) and (4) indicate that the level of money burning decisions initiated by the disadvantaged declines significantly with the extent of inequality, which confirms our previous findings (see also Figure 7). The coefficient associated to the dummy variable "partner" is not significant, which confirms the absence of matching effect.

Altogether, these new findings clearly refute fear of counterattack as a substantial driver of the effect of inequality.[21]

[Table 4 and Figure 7: about here]

5.2.4. Further support for the resignation hypothesis

In the series of experiments, which were designed to test the three possible explanations behind our findings, we also added a fully incentivized post-experimental individual decision task in order to identify the presence of resignation in general. We conjecture, in line with findings by Zizzo and Oswald (2001) that subjects may be willing to invest money in order to reduce their disadvantage. However, we hypothesize that they would be less inclined to do so if the disadvantage is severe. In this case, we expect that they rather save the money and accommodate with the inequality. To test this, we confronted the subjects with two choice tasks of the following kind.

> "You receive 50 points while the other player receives **x** points. You have the opportunity to reduce the other player 's payoff by 50 points. It will cost you 10 points. Do you want to reduce the other player's payoff?"

For x we used the values 100 (scenario 1) and 200 (scenario 2). Thus, in the first scenario a subject could get the other player's payoff close to the own one by burning money (40:50

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[21] We acknowledge that our design cannot totally rule out the possibility that a part of conflicts may be due to the fact that the advantaged groups burn money in term of pre-emptive retaliation. In other word, they may expect the disadvantaged group to destroy money and would "respond" by doing so themselves. This interaction is not the focus of our study, thus we do not model it here. See Abbink and Pezzini (2005) for experimental data on the relationship between repression and revolt.

points), while in scenario 2 the relative inequality would, though reduced, still be massive (40:150 points). The fact that the player's endowment remained unchanged in both scenarios allow us to isolate the pure effect of resignation from the effect of "lower access to resources". Each subject was asked both questions to enable us to do within-subject analysis, but the questions were presented in random order to control for sequence effects. The questions were fully incentivised. In total, 29.1% of subjects burned money in scenario 1. In scenario 2, this figure drops to 18.4%. A Wilcoxon sign rank test shows that this difference is significant (p<0.01, one-sided). Two thirds of the subjects who burn money in scenario 1 do not burn in scenario 2. Finally, only 9% of players choose to reduce the other player‘s payoff in both scenarios. These results strongly support the idea that individuals tend to resign when inequality becomes too high.[22]

6. Conclusions

We study the relationship between inequality and inter-group conflicts in a controlled laboratory setting. Our experiment consists of a two-stage game. In a first stage, subjects play a proportional rent seeking game to share a prize. The share of the prize depends both on their effort and on the effort of the other players. In our experiment, inequality is induced by the individuals' effort decisions and is accentuated by attributing to some subjects (the advantaged group) a bigger part of the prize than other subjects (the disadvantaged group). In a second stage, after being informed on the first stage payoff of each group member, they can coordinate with the other members of their group to reduce ("burn") other group members' payoff. The treatments differ in the degree of inequality between the two groups.

Three main results are found in this study.

First, consistent with inequality aversion hypothesis, we find that despite the cost of rioting, a substantial number of players choose to destroy other group's money, in particular when they belong to the disadvantaged group. They do so, although it entails no material benefit to themselves.

Second our data also indicate that in all treatment, individual preferences for money burning driven by inequality aversion do not necessarily translate into conflict. This may be partly due to the fact that money burning decisions are strongly conditioned by beliefs about decisions of others and that such beliefs are based on the issues of the coordination game observed in previous periods. For instance, an individual may be willing to riot but will refrain from doing it if she/he believes that he will be the only one to do so. Furthermore, subjects may also refrain from rioting if they fear retaliation

[22] It is worth noting that this effect confounds with the effectiveness effect observed in several experiments on voluntary contribution mechanism in which the decision to punish seems to by conditioned both by the relative cost of sanction (i.e. money burnt/the burner's payoff) but also by its relative efficiency, i.e money burnt/the target's payoff (see for instance (see Anderson and Putterman, 2006; Zizzo, 2003; Nikiforakis, Normann and Wallace, 2005).

Third, and more surprisingly, we find that the level of conflicts significantly *declines* with the extent of inequality. There are a number of explanations of this phenomenon, including fear of revenge, less resources necessary for collective action when inequality increases or resignation. Our data clearly refute the first hypothesis. Furthermore, although the considerations in term of resources necessary for riot may be part of the story, such interpretation is inconsistent with our results from the post-experimental questionnaire in which endowments were fixed. As such, an interpretation of our results in terms of resignation is the most consistent with all of our experimental findings.

The policy implications of our results are straightforward. Our data provide support for reducing the likelihood of unrest by reducing inequalities. However such policies should also consider other important factors such as the coordination dimension of conflicts that also interact in the relationship between inequality and conflicts. Of course our results are not the final word on the matter. To keep the experimental model simple we had to leave out many important features of real-life conflicts. For instance, our experiment was conducted under anonymous laboratory conditions, in order to establish the most controlled conditions. In real life communication and propaganda can be expected to affect the likelihood of unrest. Further, not all outbreaks of riots are spontaneous. Leaders are often important for the ability of groups to coordinate their actions. One might also speculate that the influence of communication and leadership on conflict is critical particularly in larger groups, as involved in many real-life conflicts. Another issue of importance is the fact that in real life inequality is often perceived to be the outcome of an unfair system where intentions matter a lot.

A possible extension of our work would be to endogenize inequality by allowing the advantaged group to choose the degree of inequality. Studying all these features is beyond the scope of the present study, but we believe our results pave the way for a promising future research agenda.

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Table 1. Second stage actions and payoffs

Choice of player *i*	Choice of player 2	Choice of player 3	Cost for the target group	Payoff for player *i*
R	R	R	-40	-5
R	R	NR	-40	-5
R	NR	NR	0	-20
NR	R	R	-40	-10
NR	NR	R	0	0
NR	NR	NR	0	0

Notes : a) R=Riot action and NR= No Riot action

b) the table reads as follows: line 2, if player *i* chooses to Riot (R), player 2 chooses to Riot too (R) while player 3 does not riot (NR), a majority is willing to riot. Riot takes place and the cost of the other group is reduced by -40. Player *i* incurres a minimal cost of -5.

Table 2. Characteristics of the First Experiment

Experi-ment	Session Number	Number of individuals	Treatment	Matching protocol
I	1-3	48	Sym	Partner
I	4-6	54	Asym4	Partner
I	7-10	60	Asym8	Partner
II	11-16	108	Sym	Stranger
II	17-22	108	Asym4	Stranger

Table 3. Determinants of burning decisions in partner sessions (Random Effects Probit) Marginal effects on Pr(Burn)

Dep var : burning decision	Marginal effects dy/dx				
Treatments	Sym.	Asym4.	Asym8	All treatments	All treat. Disad. groups
	(1)	(2)	(3)	(4)	(5)
Disad. group	0.125***	0.229***	0.080**	0.106***	
	(0.046)	(0.081)	(0.044)	(0.027)	
The other group	0.051	0.108**	0.091**	0.084***	0.218***
Chose burn in t-1	(0.048)	(0.051)	(0.041)	(0.025)	(0.053)
Only one to	-0.273***	-0.242***	-0.337***	-0.292***	-0.374***
burn in t-1	(0.046)	(0.058)	(0.069)	(0.032)	(0.045)
Sym.				Ref.	Ref.
Asym4				-0.111**	-0.051
				(0.046)	(0.095)
Asym8				-0.147***	-0.146*
				(0.042)	(0.086)
Final period	0.024	-0.001	0.029	-0.008	-0.039
	(0.089)	(0.050)	(0.050)	(0.037)	(0.066)
Age	0.019	-0.011	-0.000	-0.004	0.018
	(0.019)	(0.015)	(0.007)	(0.008)	(0.015)
Male	-0.049	-0.017	0.008	0.004	-0.030
	(0.111)	(0.060)	(0.038)	(0.008)	(0.079)
Economics	0.193*	-0.162	-0.051	0.008	-0.013
	(0.105)	(0.101)	(0.083)	(0.047)	(0.101)

Notes: Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4. Determinants of burning decisions in partner and stranger sessions (Random Effects Probit) Marginal effects on Pr(Burn)

Dep var : burning decision	Marginal effects dy/dx			
Treatments	Sym.	Asym4.	All treatments	All treat. Disad. groups
	(1)	(2)	(3)	(4)
Disad. group	0.100***	0.181***	0.093***	
	(0.025)	(0.043)	(0.018)	
The other group	0.118***	0.162***	0.134***	0.207***
Chose Burn in t-1	(0.025)	(0.030)	(0.017)	(0.032)
Only one to	-0.207***	-0.225***	-0.286***	-0.361***
burn in t-1	(0.027)	(0.033)	(0.020)	(0.029)
Sym.			Ref.	Ref.
Asym4			-0.198***	-0.147**
			(0.039)	(0.061)
Asym8			-0.173***	-0.192***
			(0.033)	(0.071)
Final period	0.022	-0.030	-0.028	-0.081*
	(0.052)	(0.022)	(0.025)	(0.045)
Partner	-0.084	0.038	-0.037	-0.028
	(0.091)	(0.042)	(0.040)	(0.065)
Age	0.0135	-0.008	-0.004	0.019
	(0.017)	(0.007)	(0.008)	(0.012)
Male	-0.013	-0.024	-0.013	-0.037
	(0.074)	(0.033)	(0.035)	(0.056)
Economics	0.139	-0.075**	-0.009	-0.002
	(0.098)	(0.036)	(0.042)	(0.070)

Notes: Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

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Figure 1. Number of tickets bought in each treatment over time

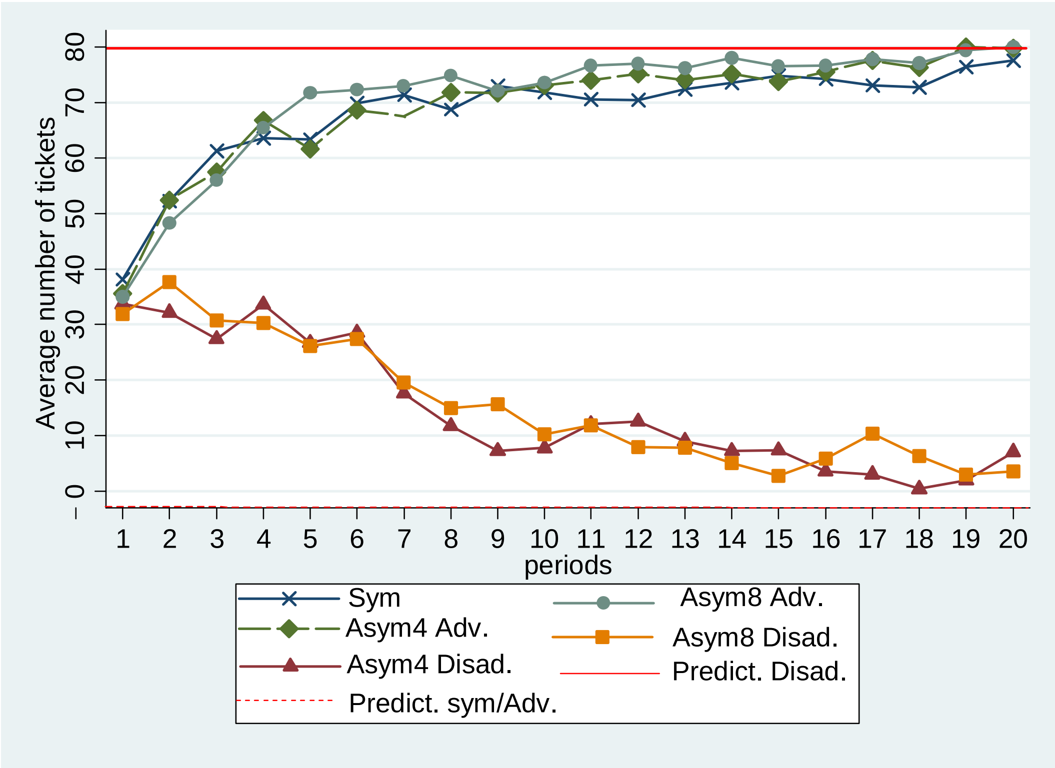


Figure 2. Average first stage profit in each treatment

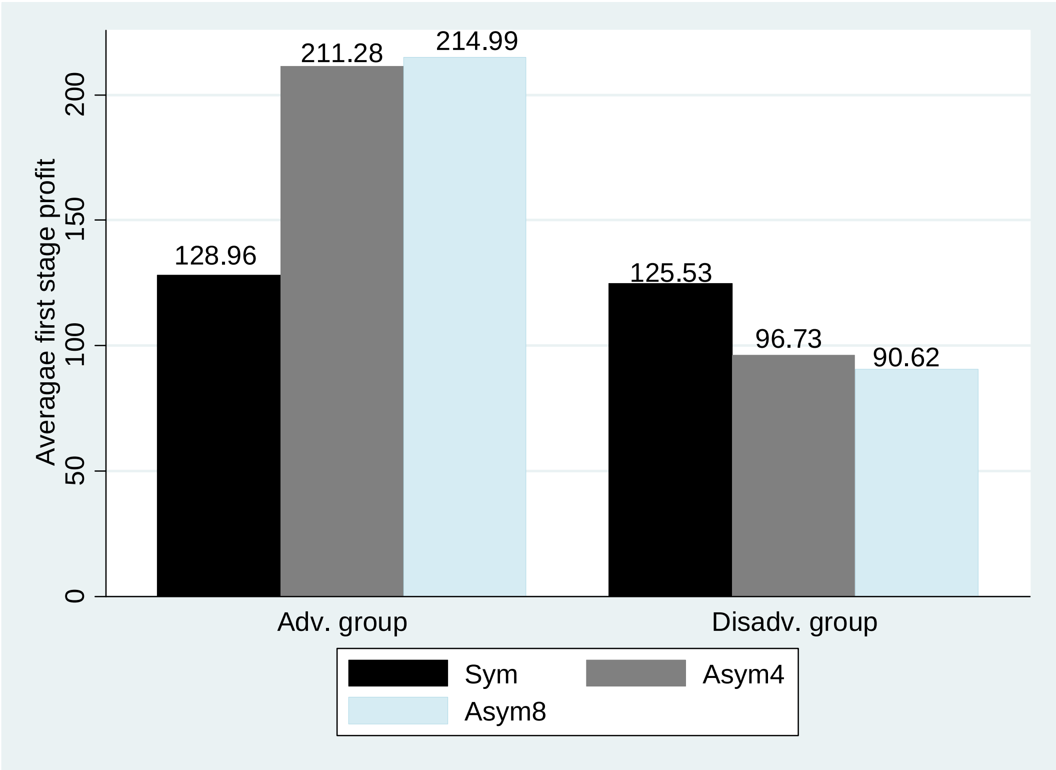


Figure 3. Conflict frequency over time (partner matching)

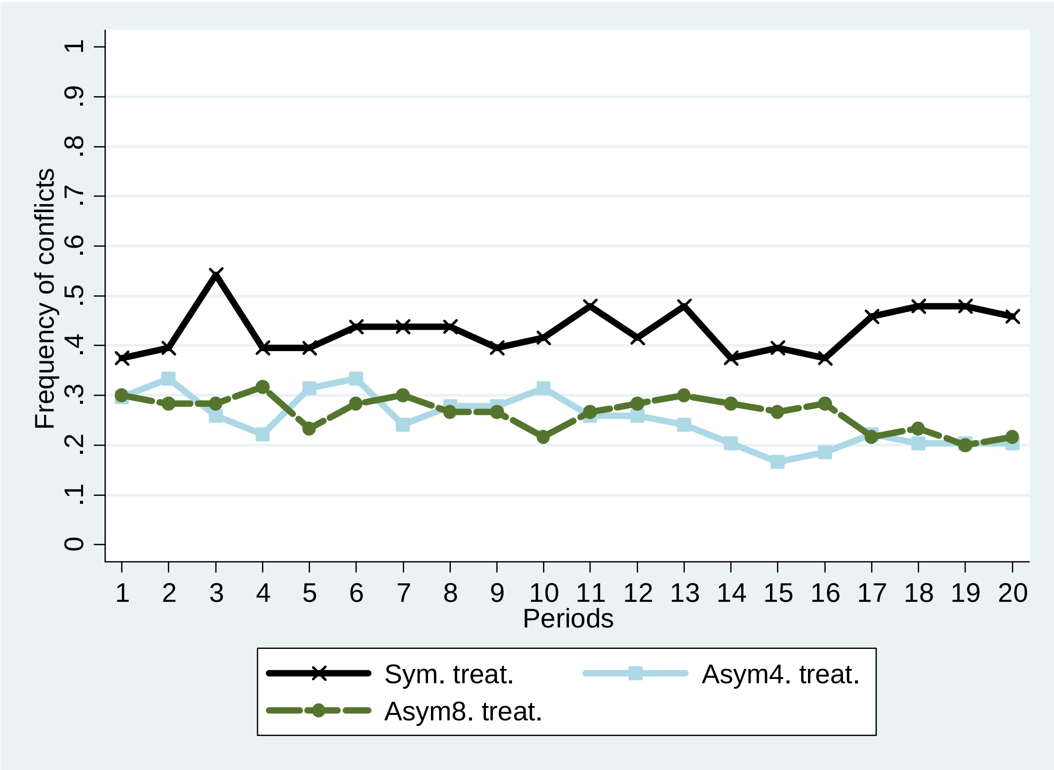


Figure 4. Burning frequency per treatment (partner matching)

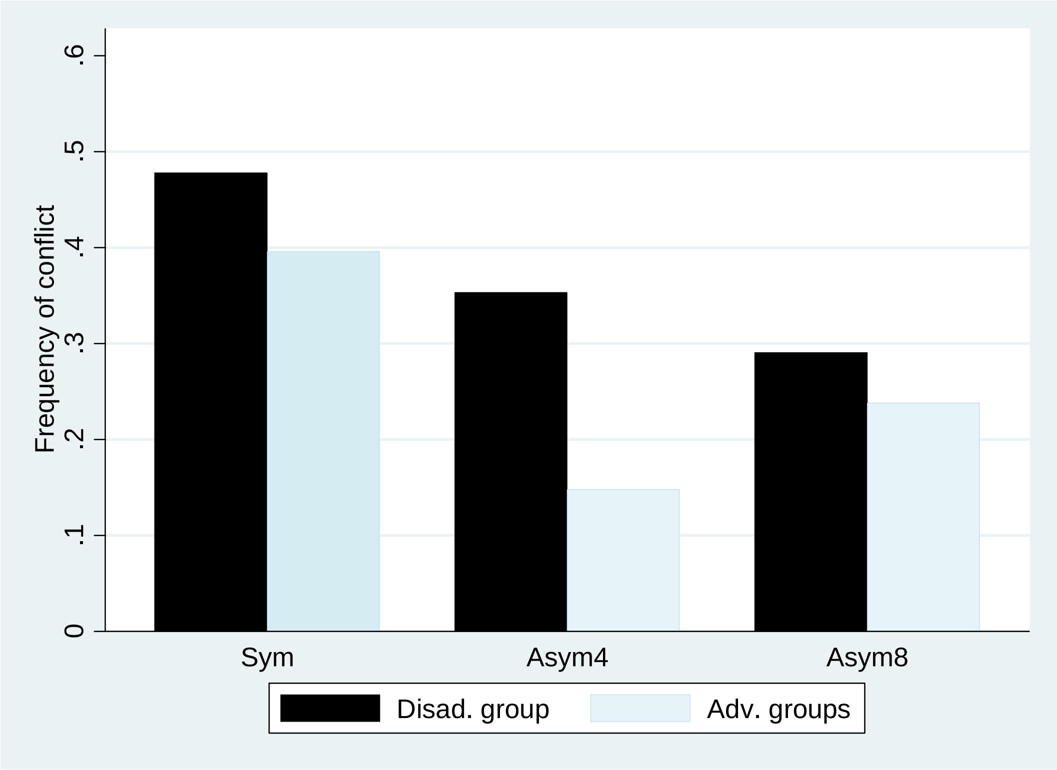


Figure 5. Frequency of conflicts initiated by the disadvantaged over time (partner matching)

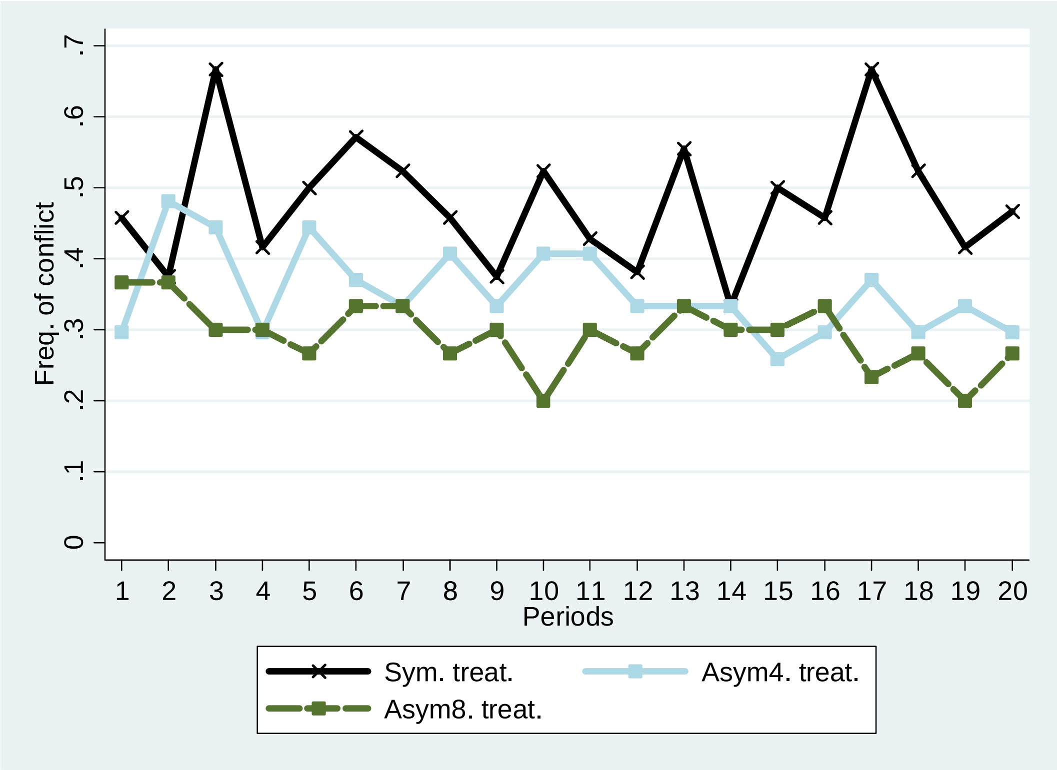


Figure 6. Burning frequency per treatment (stranger matching)

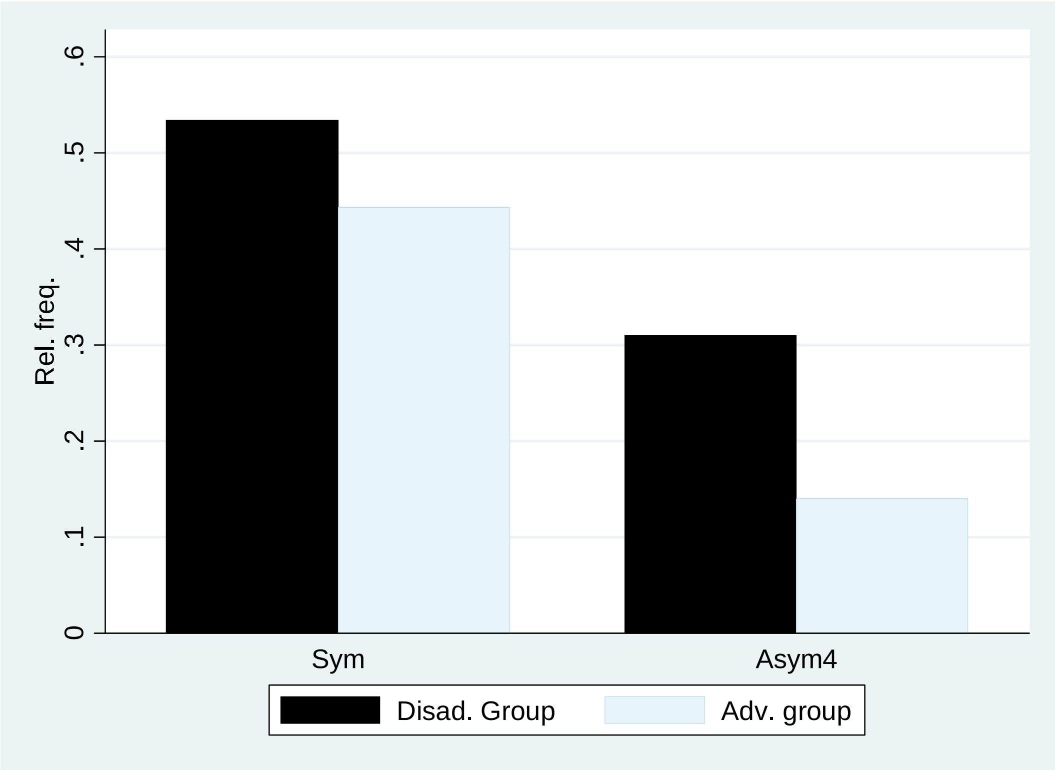
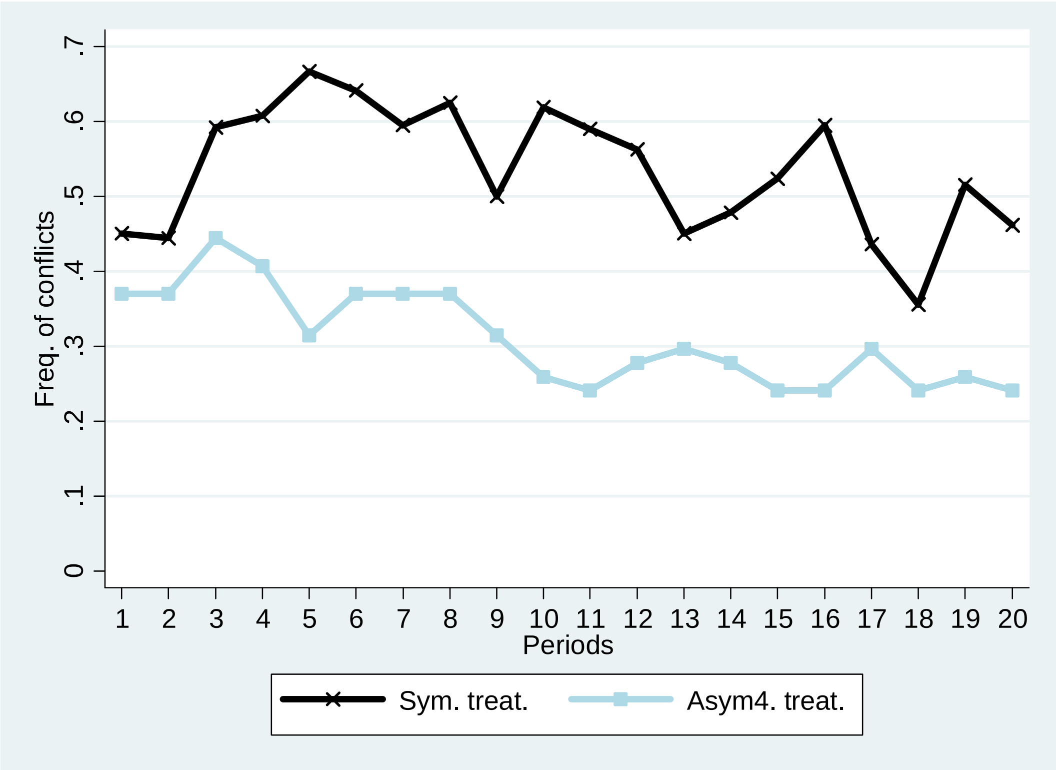


Figure 7. Frequency of conflicts initiated by the disadvantaged over time (stranger matching)



Instructions (asym4 treatment)

General instructions

You are now taking part in an economic experiment of decision making. The instructions are simple. If you read the following instructions carefully, you can, depending on your decisions and the decisions of others, earn a considerable amount of money. It is therefore very important that you read these instructions with care.

The instructions we have distributed to you are solely for your private information**. It is prohibited to communicate with the other participants during the experiment.** Should you have any questions please ask us. If you violate this rule, we shall have to exclude you from the experiment and from all payments

Each participant receives a lump sum payment of 3 euro at the beginning of the experiment. At the end of the experiment your entire earnings from the experiment will be immediately paid to you in cash. During the experiment your entire earnings will be calculated in points. At the end of the experiment the total amount of points you have earned will be converted to euro at the following rate :

328 points = 1 euro

At the beginning of the experiment, you will be assigned a role of player A or player B. You will keep your role during the entire experience. **T**he participants will be then assigned to a group of six which is composed of three players of type A and three players of type B. You will therefore be in interaction with 4 other participants. If you are player A, then you are matched with three players B and two player A, and reversely. **T**he composition of the groups remains unchanged during the experience.

The experiment is divided into twenty periods. The instructions for each period are given in the detailed instructions.

Detailed instructions

Each period consists of two stages.

<u>First stage</u>
In this stage, you and the 5 other participants in your group will have to share a monetary prize of 576 points. The share of the 576 points you receive depends on your decision and the decisions of the five other participants in your group.
You can affect your share of the prize by purchasing tickets. Your share of the prize in your group also depends on the number of tickets purchased by the three other participants in your group. More precisely, the prize is divided among the participants in amounts to the number of tickets they purchase. <u>However, for the same number of tickets bought, players A will receive 4 times more amount of the prize than players B.</u> Prior to your decision about how many tickets you wish to purchase, you will be able to observe the number of tickets the other participants purchase.

At the beginning of first stage of each period, each participant will get an endowment of 100 points. You can keep as much of this 100 points as you like, or you can use some of it to purchase tickets. Note that you cannot buy more than 80 tickets. Each ticket will cost you 1 point.
In your group, each participant's share, or proportion, of the 576 prize will be given by the number of tickets they purchased divided by the total number of tickets purchased in their four participant group.
Your earning in this decision will be the part of you endowment of 100 point which you do not spend on tickets, plus the share of the 576 prize you receive. To summarize, your earnings for this first stage at each period will be calculated :

If you are player of type A : Your earnings in points in first stage of each period is therefore :

$$100 - X_A + 576\left(\frac{4 * X_A}{4X_{A,TOT} + X_{B,TOT}}\right)$$ with X_A is the number of tickets you bought

$X_{A,TOT}$ is the total number of tickets bought by all members A (including yourself)

$X_{B,TOT}$ is the total number of tickets bought by all members B

If you are player of type B : Your earnings in points in first stage of each period is

$$100 - X_B + 576\left(\frac{X_B}{4X_{A,TOT} + X_{B,TOT}}\right)$$ with X_B is the number of tickets you bought

Example :

Suppose for example that you are player A1 and you buy 30 lottery tickets, player A2 buys 60 tickets, player A3 buys 0 tickets, players B1, B2 and B3 buy 10, 50 and 0 tickets, respectively. The probability that you win the prize equals 4*30/(4*30+4*60+10+50)=6/24=2/7. Your earnings for this first stage at each period will be 100+576*2/7-30=234

The second stage

At the beginning of the second stage, your screen shows you the income of each of the six group members (including your own income) as well as their type (A or B).
In this stage you have the opportunity to coordinate with the participant of your type **(your co-player) in order to reduce or leave equal** the income of **each** group member of the other type. For example, if you are a player A, you can coordinate with the two other players A to reduce the income of each other player of type B, and reversely. To simplify we will call **Reduce** the decision consisting in **reducing the payoff of the other group** and **Not Reduce,** the decision consisting in **not reducing the payoff of the other group**. If you and your co player coordinate choose to reduce the income, then the income of **each member** **of the other type will be reduced of 40 points**. On the contrary, the income of each member of the other group remains unchanged. You will also incur a cost in points which depend on your decision and the decision of your co-player. If you chooses to not to Reduce and that this decision is chosen at the majority, then your incur no cost. The income of the other group members remain unchanged. If you choose Not Reduce while the majority of your group chooses Reduce, you incur a cost of -10 and the income of each other player of thee other type is reduced of 40 points. If you choose to reduce and if this decision is chosen at the majority, then you incur a cost of -5. Finally, if you choose to reduce while the majority of your group chooses not to reduce, then, you incur a cost of -20. To summarize, your second-stage payoff table is :

Your decision	Choice of your first co-player	Choice of your second co-player	Cost for the other group	**Cost for your decision**
R	R	R	-40	**-5**
R	R	NR	-40	**-5**
R	NR	NR	0	**-20**
NR	R	R	-40	**-10**
NR	NR	R	0	**0**
NR	NR	NR	0	**0**

All players have exactly the same payoff table.
After having taken your decision of reducing or not (the income of the other group), you must press the ok button. Once you have done this, your decision can no longer be revised. When you make your decision you will not know the decision of the other participants. After all members of your group have made their decision, the computer will record the decisions of all participants and will inform you of :

- the global decision taken by your group : reduction or not of the income of each member of the other group
- the global decision taken by the other group : reduction or not of the income of each member of your group (including yourself)

At the end of the period, the computer will calculate your income of second stage that also corresponds to your final income for each period. Your total income from the two stages is therefore calculated as follows:

Your final income in points in each period is therefore :
[Income of first stage]- cost of received reduction-cost of your decision.

Example 2 : suppose you are player B1 and you choose Reduce. Suppose also that players B2 and B3 also chose Reduce. In this case, since all group member chose Reduce, then the global decision of your group is Reduce. Therefore, the income of players A1 A2 and A3 will be reduced of 40 points. You will incur a cost for your activity of reduction of -5 points.