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Attacking the Weak or the Strong?

An Experiment on the Targets of Parochial Altruism

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Abstract

Studies on parochial altruism have insofar focused on the causes leading individuals to attack *any* out-group on the behalf of one's group. Yet, we have no clue to understand why parochial altruists target specific groups, such as big firms in some contexts and refugees in other contexts. The present paper introduces an experiment to analyse the conditions under which individuals costly attack strong versus weak out-groups. In our study, 300 participants played a repeated Inter-group Prisonner Dilemma (IPD) involving multiple groups and inter-group differences in resources. The results show that individuals have a basic preference for targeting strong out-groups, but that attacks decrease when the inequality in destructive capacity between groups is high. Besides, individuals target weak out-groups when they are threatening their in-group status. Decisions in the game correlate with participants' political ideology and social dominance orientation. Overall, the results give clues to understand historical variations in the targets of political violence.

Key words

Parochial altruism, Terrorism, Social comparison, Inequality, Ideology, Intergroup conflict

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Introduction

A large body of research has investigated parochial altruism - i.e. the coexistence of in-group contribution (altruism) and out-group aggression (parochialism) (Rusch, 2014, De Dreu et al., 2014, Choi & Bowles, 2007, Bernhard et al., 2006). The concept of parochial altruism captures a recurring pattern of inter-group relationships: that is, the costly attack of members of an out-group on behalf of one's in-group. In particular, this concept is applied to modern terrorism: the case of suicide-bombers sacrificing themselves to hurt the rivals of their political, religious or ethnic group is an archetypical example of parochial altruism (Ginges & Atran, 2009, Atran & Sheikh, 2015, Sheikh et al., 2014). While suicide-bombers may seem extreme cases of irrational behaviour, experimental studies demonstrate that parochial altruism is a widespread tendency. Indeed, in various economic game settings such as the Inter-group Prisoners' Dilemma (IPD) (Bornstein, 1992), a high proportion of people choose at their own cost to inflict losses to an out-group to the benefit of their in-group (Abbink et al., 2012, De Dreu et al., 2014, Bernhard et al., 2006).

Most research on parochial altruism has focused on its underlying motivations and the conditions under which it emerges. According to some research, the combination of both altruism and parochialism may have been an evolutionary stable strategy in human evolution under conditions of competition on resources (Choi & Bowles, 2007). Such motivation would have been embedded in humans across evolution through hormonal and neurologic mechanisms, shaping inter-group psychology (De Dreu et al., 2010, 2014).

Most experimental studies on parochial altruism have investigated the motivation for the aggression of *any* out-group on behalf of the in-group. Yet, in the real world, there is a great diversity of potential targets for parochial altruists. This may be illustrated by the heterogeneous targets of terrorist groups: depending on time and space, terrorism has been used as a strategy against minority groups, political authorities, large firms. Understanding the

conditions under which parochial altruists choose different targets may help to predict why certain groups receive more or less hostility in the real world. More specifically, answering this question may help understand the causes of the emergence and targeting of terrorist movements.

The literature gives limited clues to understand why parochial altruists target certain groups instead of others. On the one hand, macro-level studies reveal that terrorist attacks targeting distinct out-groups emerge in very different socio-economic contexts (Kis-Katos et al., 2014, Brockoff et al., 2016, Varaine, 2019). Yet, macro analyses do not allow to identify the underlying mechanism. On the other hand, experimental studies analyse the causes of different forms of out-group hostility, such as prejudice against minority groups (Krosch & Amodio, 2014, Outten et al., 2012) or aggression against advantaged groups (Halevy et al., 2010, Abbink et al., 2018). Yet, to our knowledge, there is no experimental study comparing the causes of these different forms of out-group hostility.

In this paper we distinguish two types of parochial altruism: parochial altruism directed against out-groups that have more vs. fewer resources than the in-group. We call the first type left-wing, and the second right-wing parochial altruism, based on the common definition of left-wing versus right-wing terrorism (Kis-Katos et al., 2014). Indeed, a definitional feature of left-wing terrorist ideologies is the strive for equality - which may take the form of the preference for reducing the resources of the richest. Left-wing terrorism often aims at attacking dominant groups - e.g. large firms, political authorities. In contrast, a definitional feature of right-wing terrorist ideologies is their hostility toward minority groups, such as ethnic minorities and immigrants (Kis-Katos et al., 2014).

Based on the literature on social comparison, we posit that these types of parochial altruism result from two forms of inter-group comparison: envy and jealousy. According to the logic of envy, individuals should have a basic preference for targeting richer out-groups.

According to the logic of jealousy, individuals should tend to attack poorer out-group when they get close to the level of resources of the in-group. The effects of envy and jealousy should depend on the groups' destructive capacity: a higher destructive capacity of richer groups should limit the effect of envy while it should enhance the effect of jealousy.

To test our hypotheses, we introduce a novel economic experiment allowing to identify the targets of parochial altruism. Our game is an extended version of the Inter-group Prisonner Dilemma (Bornstein, 1992) with multiple groups and inequality in resources across groups. We exogenously manipulate the groups' variation in resources to test whether subjects target poorer out-groups when they get close to the level of resources of the in-group. We also manipulate the destructive capacity of groups to test whether a higher destructive capacity of richer groups moderates the effects of envy and jealousy.

The hypotheses and experimental design were preregistered on Open Science Framework, and all details are available at http://osf.io/neaqu[1]. Moreover, the paper includes not pre-registered analyses assessing the implications of our results to left-wing and right-wing terrorism, based on a post-experimental survey and on historical data on terrorist events.

Social Comparison and Parochial Altruism

In an environment with multiple groups, parochial altruists cannot attack all out-groups. This would be too costly and may dilute the effect of each attack. Moreover, this shooting-in-the-dark strategy may generate vindictive coalitions from the other groups against the in-group. For a given constant incentive to attack, parochial altruists have to choose which out-group(s) to target. The core of our argument is that the individual decision to target specific out-groups depends on the repartition of resources across the different groups (Halevy et al., 2010, Abbink et al., 2018).

[1] Note that the present paper focuses on the hypotheses 2 and 3 (about social comparison) of the pre-registered project. The hypothesis 1 (about the in-group situation) is explored in a separate study.

Drawing from studies on social comparison, we focus on individual motivation to achieve the best relative position for their group compared to other groups. Many studies show that individuals evaluate their own payoff relatively to others rather than in absolute terms (Solnick & Hemenway, 1998, Boyce et al., 2010, Card et al., 2012). For instance Solnick and Hemenway (1998) find that most individuals preferred a lower absolute to a higher relative income. Similarly, Boyce et al. (2010) find that relative income predicted life satisfaction, while absolute income did not once controlling for the first. Neurologic evidence indicates that higher relative payments and lower relative losses compared to other individuals are related to the activation of the ventral striatum - indicating reward-related brain activity (Dvash et al., 2010, Luo et al., 2018).

Some evidence indicates that inter-group comparison elicit similar mechanisms to inter-individual comparison. For instance, a study based on football teams show that fans being presented with the failures of the rival team experienced higher ventral striatum activity (Cikara et al., 2011). Individuals displaying high ventral striatum responses to the rivals' failures are also more willing to harm fans of the other team (see also Hein et al., 2010). Based on this reasoning, we distinguish two forms of inter-group comparison, i.e. envy and jealousy, that respectively motivate left-wing and right-wing parochial altruism.

Envy and Left-Wing Parochial Altruism

Envy occurs "when a person lacks another's superior quality, achievement, or possession and either desires it or wishes that the other lacked it" (Parrott & Smith, 1993: 906). Research demonstrates that upward comparison with people or groups with higher resources generate negative feelings that display neural signatures (Takahashi et al., 2009, Luo et al., 2018). Envy in its malign form is related to "*schadenfreude*": gloating when the envied other falls from grace. Various studies show that individual display positive emotions

and reward-related brain activity when the envied person or group experiences losses (Takahashi et al., 2009, Dvash et al., 2010). In this line, economic experiments show that people are willing to pay to burn the money of richer individuals (Zizzo & Oswald, 2001, Zizzo, 2003).

At the group level, Halevy et al. (2010) analyse the effect of between-group relative deprivation on parochial altruism in a version of Inter-group Prisoner Dilemma in which individuals can use money either to benefit the in-group or reduce the income of the out-group without benefits for the in-group (see Halevy et al., 2008). They find that players from groups that are relatively deprived are more likely to costly attack the out-group, thus reducing the in-group absolute welfare but increasing its relative status.

Hence, we predict that, in general, parochial altruists have a basic preference to target groups with high resources to advance their relative status.

H1: the higher the resources of an out-group the higher the level of attacks.

Jealousy and Right-Wing Parochial Altruism

Jealousy is "the belief, suspicion or fear that what one desire to keep for one self is in danger of being diverted to a known or suspected rival" (Salovey & Rodin, 1991: 396). In the case of inter-group comparison, jealousy refers to the fear that an out-group, which was initially less well off, challenges and overtakes the in-group's status.

It has long been proposed that perceived threats to their status may lead the majority group to backlash against minority groups (Blalock, 1967, Funke et al., 2016). Experimental studies reveal that making a future shift in the demographic composition of the society salient increases prejudice against minority groups (Outten et al., 2012) and right-wing attitudes in general (Craig & Richeson, 2014), due to the feeling that the in-group status is threatened.

Besides, some historical analyses suggest that increases in minority and immigrant populations are positively related to hate crimes and far-right offenses (Green et al. 1998, Boutcher et al., 2017). In this line, minorities overtaking the position of the traditional majority group is a recurring theme in far-right ideologies (Hewitt, 2003, McVeigh, 2009).

Hence, we posit that individuals are more likely to target poorer out-groups when they get close to the in-group level of resources.

H2: the closer the out-group is getting to the in-group the higher the level of attacks.

How Destructive Capacity Affects Envy and Jealousy

Some conditions may affect the logics of envy and jealousy. Regarding envy, if the advantage of the out-group is far too high, the effect of an attack may be too small to alter the relative position of the in-group. This may lead to a resignation effect and decrease the actual level of attacks. In an economic contest between two groups, Abbink et al. (2018) find that in a setting with increased inter-group inequality, the level of attacks from the disadvantaged group significantly decrease. Furthermore, if richer groups have higher destructive capacity, targeting a richer out-group may be dangerous because the latter may retaliate and cause great damages to the in-group in the future. Hence:

H1bis: the effect of envy (H1) is reduced if richer groups have higher destructive capacity

In contrast, we posit that the logic of jealousy should be especially strong when richer groups have a higher destructive capacity. Indeed, experimental studies show that fear of future attacks is a major motivation for first strikes against an out-group (Böhm et al., 2016,

De Dreu et al., 2010), more than nastiness and out-group anger (Simunovic et al., 2013, Abbink et al., 2014). Letting a group overtake one's rank is dangerous since the out-group will be able to destroy the in-group in the future. Hence, to secure its rank, the best option for a group is to attack groups that is getting close to his level of resources. Hence:

H2bis: the effect of jealousy (H2) is increased if richer groups have higher destructive capacity

Implications for Left-Wing and Right-Wing Terrorism

What are the implications of our hypotheses regarding the societal conditions generating left-wing and right-wing terrorism? Arguably, richer groups have a higher destructive capacity in societies with high economic inequality. Indeed, in unequal societies, economically powerful groups have a higher political influence on policies (Gilens, 2012). Richer groups may have higher impact on governmental repression of left-wing insurgencies, or even fund far right movements or paramilitary groups in response to threats from left-wing movements (Acemoglu & Robinson, 2005). If this is true, H1-bis implies that attacks against richer groups should decrease when inequality is high. In contrast, H2-bis implies that attacks against poorer groups that get close to the in-group should increase when inequality is high. As mentioned earlier, attacking stronger groups is a definitional feature of let-wing terrorism, while right-wing terrorism mostly targets weaker groups (Kis-Katos et al., 2014). Hence, H1-bis implies that left-wing terrorism decreases when inequality is high, while right-wing terrorism increases when inequality is high.

Method

Measuring Parochial Altruism: the Inter-Group Prisoners' Dilemma

Parochial altruism is commonly captured through the Inter-group Prisoner's Dilemma (IPD) paradigm (Bornstein, 1992, 2003, Halevy et al., 2008, 2010, Böhm et al., 2016). In a standard version of this game, subjects are divided in 2 groups of 3 players. Each subject receives a fixed initial amount of resources in points p_0 that the subject either choose to keep (k) or to contribute to attack the out-group (a). $p_0 = k + a$. For each point kept, the subject gains 1 point. For each point contributed to attack the out-group, each subject of the in-group gains 0.5 point and each subject of the out-group loses 0.5 point. Decisions are made simultaneously.

The payoff of a given subject is determined by the number of points p he gained at the end of the round. It is a function of the number of points k he kept, the number of points a_i contributed in attacks by the subjects i of the in-group and the number of points a_j contributed in attacks by the subjects j of the out-group:

$$p = k + 0.5\times \sum_{i=1}^{3} a_i - 0.5\times \sum_{j=1}^{3} a_j$$

This game consists of two prisoner's dilemmas embedded into each other, one at the individual level and the other at the group level. Table 1 shows the payoff matrix for a subject depending on the decisions of the other in-group subjects, assuming that all subjects of the out-group keep their points[2]. It demonstrates that at the individual level, the *Nash equilibrium* is for each subject to keep his points. Indeed, a subject gains 0.5 more points when keeping a point rather than attacking.

[Insert Table 1 around here]

Table 2 shows the payoff matrix for a subject depending on the decisions of the in-group and out-group subjects, assuming that subjects of the same group take the same decision. It demonstrates that at the group level, the *dominant group strategy* is to contribute

[2] Attacks from subjects of the out-group symetrically reduce the payoffs presented in Table 1, which do not change the payoff structure. Hence, they do not alter the game strategies.

all points to attack. Indeed, each subject gains 0.5 more points if all in-group subjects attack rather than keep. Yet, the *dominant collective strategy* is for all subjects to keep their points. Indeed, if all subjects attack, no subject gains any points as the gains form the in-group's attacks are offset by the losses from the out-group's attacks.

[Insert Table 2 around here]

The game captures core features of parochial altruism. From a purely individual perspective, it is costly to engage in attacks on behalf of one's group. Yet, the group would be better off if all their members engaged in such attacks. However, at the aggregate social level, attacks have negative consequences.

Design of the Present Experiment

We propose a new version of the IPD. In our version, subjects play a repeated IPD game with a number T of rounds (Bornstein et al., 1994, Halevy et al., 2012). Subjects stay in the same group for the whole duration of the game. We keep unchanged the payoff structure and the dominant strategies of the game. Yet, we bring three new elements to test our hypotheses.

Firstly, we increase the number n of groups. Each subject may now contribute points to attack different out-groups. When deciding to contribute, subjects have to choose which out-groups to attack. The consequences for the in-group stay the same.

Secondly, we introduce inequality across groups. This allows us to test the conditions under which subjects attack richer or poorer out-groups. Before playing the IPD game, subjects perform a word-creation task akin to a Scrabble game (Brüggemann et al., 2016). Differences in skill generate considerable variance. Each subject starts the IPD game with resources in points p_0 proportional to the results of the word-creation game. The groups for the IPD are then created based on the subjects' performance during the task: the three best

subjects form a group, the three-second best another, and so on. This generates endogenous inter-group inequality in the IPD. Moreover, inequalities are (loosely) meritocratic, inducing feelings of entitlement in the subjects.

To test H2, we exogenously manipulate inequality across the groups. To do so, at each round, each subject receives a random endowment in points α. This allows manipulating the variation in resources of groups to test H2, independently from the variation that is due to the attacks across groups. The random endowment α is determined by three economic conditions. Every five rounds, each group is randomly assigned to one of three conditions with equal probabilities: in the *improving* condition, subjects have an endowment α of 6% of their resources in points p_0 by round; in the *stable* condition, subjects have an endowment α of 2% of their resources in points p_0 by round; in the *declining* condition, subjects have a negative endowment α of -2% of their resources in points p_0 by round. We choose to assign groups to a given economic conditions for five rounds rather than every round because pure random variations of endowment from one round to another would probably not affect the targeting of parochial altruists because subjects could not draw expectations from the present on the future resources of the out-group.

Hence, at the end of a given round, the number of points p of a subject is a function of the number of points k he kept, the number of points a_i contributed in attacks by the subjects i of the in-group, the number of points $a_{j\rightarrow in-group}$ invested in attacks against the in-group by the subjects j of the $n-1$ out-groups, and the subject's random endowment α:

$$p = k + 0.5\times \sum_{i=1}^{3} a_i - 0.5\times \sum_{j=1}^{3\times(n-1)} a_{j\rightarrow in-group} + \alpha$$

The number of point p of a subject at the end of each round determines the resources in points p_0 with which he will start the next round. This also allows inequality to endogenously vary during the course of the game.

The payoff of each subject is determined by the number of points p he gained at the *end* of the last round of the game.

Finally, in our version of the game, subjects have a limit β on the number of points a they can contribute to attack out-groups at each round. $a \leq \beta$. To test H1-bis and H2-bis, we use two between-subjects treatments. In the *absolute* treatment, subjects face an *absolute* limit to the number of points a they can contribute to attack. That is, β is fixed. In the *relative* treatment, the limit β is proportional to the subjects' resources in points p_0 at the beginning of each round. In the absolute treatment, a rich subject can attack as much as a poor subject[3]; in the relative treatment, a rich subject can attack more than a poor subject. In both treatments, the rich have an advantage over the poor: the opportunity cost for attacking is lower for rich subjects because contributing a point is relatively less costly for a rich than a poor. Yet, the relative treatment enhances this advantage. In the relative treatment richer groups have more destructive capacity than poorer groups, while in the absolute treatment all groups have the same destructive capacity within each round. If H1-bis is correct, subjects should diminish their attacks against richer groups in the relative treatment. If H2-bis is correct, subjects should increase their attacks against close poorer groups in the relative treatment.

As shown in Table 2, the IPD game entails the possibility that subjects have negative payoffs. As it is impossible to withdraw money to subjects, negative payoffs are equivalent to zero payoffs, thus altering the structure of the game. The possibility of negative payoffs is even more likely in our version of the game because subjects may experience cumulative losses across rounds, and because the higher number of groups means that the in-group may be simultaneously attacked by multiple out-groups. The limit β partly addresses this issue, since lowering the level of attacks decreases the probability that players have negative points. However, it was impossible to avoid completely the possibility of negative payoffs. Hence,

[3] Except the case in which the resources in points p_0 of the poor subject are below the absolute limit β.

we decided that a subject who has negative points can no longer attack and no longer loses points from out-group attacks. Yet, subjects of the out-groups continue to gain points when attacking his in-group irrespectively of his number of points[4]. When all subjects of the in-group attain zero, we consider the in-group "dead" and the out-groups can no longer attack it.

Procedure and Parameterization

The experiment took place at the GAEL experimental laboratory in Grenoble, France. The experimental software was written in Python using the oTree platform (Chen et al., 2016). We recruited 300 subjects from the GAEL subject pool, made in roughly equal parts by students and subjects issued from the general population. We ran 20 sessions of 15 subjects, divided in $n = 5$ groups in the IPD game. Upon entering the lab, subjects were randomly assigned to individual computers. Instructions were read aloud and presented on overhead and individual screens. Clarification questions were answered collectively[5]. Subjects received a 10€ show-up fee, which was not at stake during the game.

Subjects first took part to the word-creation task[6]. After completing the task, subjects were informed about their individual gains. Based on pre-tests, we estimated that subjects would start the IPD game with around 500 points on average. Subjects were then divided in groups labelled with colours - yellow, red, purple, blue and green - to be easily identified. Subjects played the IPD game for $T = 15$ rounds, putting at stake their individual gains from the first task.

[4] We chose this rule because it is implicitly applied in the standard IPD game, in which subjects may potentially be "over-attacked" by subjects of the out-group. Indeed, if subjects of the in-group do not contribute points to attack and if subjects of the out-group contribute more than 2/3 of their points to attacks, any additional points contributed by the out-group no longer makes any difference for the in-group – whose payoff is negative - while still giving points to the out-group.

[5] Instructions and screenshots from the software are provided in the online appendix. The oTree package is available upon request.

[6] The results of the word-creation task are described in a forthcoming paper.

Half of the subjects played in the *absolute* treatment, with the limit β fixed at 50 points; the other half in the *relative* treatments, the limit β fixed at 10% of their points at the beginning of each round.

Exploratory Analyses

At the end of the IPD, subjects filled out a short questionnaire. It included socio-demographic questions - age, gender, level of education and professional status. We also included two questions about whether subjects found themselves and the other subjects cooperative during the game. This allows us to check whether attacking other groups is perceived as cooperative behaviour, in line with results from the literature on the IPD (Halevy et al., 2008, Weisel & Böhm, 2015, Halevy et al., 2012). Besides, we included a political and a psychometric measure to test the relationship between left-right parochial altruism and the subjects' left-right political attitudes. Subjects indicated their political self-placement on a scale from 1 (left) to 10 (right) and filled out the French short version of the Social Dominance Orientation scale in 8 items (Bizumic et al., 2008) - which captures individual's sense that some groups are inferiors and that some groups should dominate in society (Sidanius & Pratto, 2001).

Furthermore, we conduct not pre-registered analyses based on historical data to assess the implications of our experimental results to right-wing and left-wing terrorism. We look at the simple relationship between economic inequality and left-wing and right-wing terrorism in nine developed countries that experienced a significant number of terrorist events since 1970. We measure inequality by the share of the pre-tax national wealth owned by the 1% richest (WID, 2019). The number of terrorist events is based on the Global Terrorism Database (START, 2016). Left-wing and right-wing terrorist events are distinguished based on the political identity of the terrorist organisation following Kis-Katos et al. (2014).

Results

Gameplay and Learning in the Game

Consistent with the IPD literature, and despite the Nash prediction of no attacks, subjects engage in a considerable level of attacks. On average, subjects contribute 390 points in attacks (sd = 181), which represent around 75% of their resources in points at the beginning of the game (mean = 522, sd = 156). A look at the payoffs confirms that subjects lose a significant amount of money because of their mutual attacks. The mean payment at the end of a session was 6.35 € (sd = 4.22). If no subject had ever attacked, the mean payment based on the observed resources at the beginning of the game would have been of 17.55 €. This means that subjects on average lost 65% of their payoff because of their mutual attacks. There was a difference in payoffs between the treatments: 5.28 € in the absolute treatment and 7.42 € in the relative treatment (Student's t = -4.5370, $p < .001$).

This level of attacks is inconsistent with Nash predictions. Nonetheless, subjects could attack in the first rounds but then learn in time to attack less. We see no evidence of learning. There are no major differences in the level of attacks, i.e. the sum of the number of points contributed in attacks by the in-group subjects against a given out-group, between the initial and the final rounds, for neither treatment. We use negative binomial regressions to model the level of attacks[7], controlling for the in-group level of resources, which mechanically affects the capacity to attack in the relative treatment. Figure 1 plots the marginal effect of such a regression for each round. We also test for a linear effect of rounds, controlling for in-group resources. Regression results show no significant effect of rounds on attacks in the absolute treatment (b = -.0408, p = .176) and a slight negative effect in the relative treatment (-.0538, p

[7] We use negative binomial regressions in all subsequent analyses instead of linear regression (as pre-registered) because the level of attacks is over-dispersed (mean = 19.48, sd = 21.12). Note that in all of the subsequent analyses, we exclude observations relative to rounds in which one group or more is dead to alleviate potential biases in the comparisons. Nonetheless, including all observations in the analyses does not alter our conclusions. The authors can send results upon request.

= .023). Overall, the level of attack is quite stable through the game. There is little convergence toward the dominant individual strategy.

[Insert Figure 1 around here]

Figure 2 plots the mean resources of the five playing groups, i.e. the sum of the resources in points of the subjects of each group, across the rounds of a session. We see that in both the relative and absolute treatments, the level of resources of all groups generally decreases during the course of the game because of mutual attacks. We see different patterns in the relative and absolute treatments. In the absolute treatment, rich groups lose relatively more resources than poor groups, leading to close levels of resources for all groups at the end of the last round. In contrast, in the relative treatment, the slopes are quite similar from the richer to the poorer groups, leading to a higher level of inter-group inequality in the last rounds.

[Insert Figure 2 around here]

Pre-Registered Analyses

Figure 3 displays the results relative to H1. Figure 3 plots the marginal effects of out-group resources on the level of attacks based on negative binomial regressions, controlling for the in-group resources. We include a quadratic term to model the slope of the effect of the out-group resources. In line with H1, the higher the level of resources of the out-group the more it is attacked, both in the absolute and relative treatments. This finding suggests that the logic of envy is predominant, since subjects tend to attack richer out-groups more.

[Insert Figure 3 around here]

The relative treatment introduces an inequality in destructive capacities depending on the subjects' resources. According to H1-bis, the destructive capacity reduces the attacks against the richest. Results from figure 3 are consistent with this hypothesis. Indeed, in the

absolute treatment, the relationship between the attacks and the out-group's resources follows an exponential slope: attacks are concentrated against the richest out-groups. In contrast, in the relative treatment, the slope is decreasing: a richer out-group is attacked more until it reaches a certain level of resources (around 2000 points). After that level, attacks stagnate. This indicates that subjects refrain from attacking the richest out-groups when they have a higher destructive capacity, in line with H1-bis.

Figure 4 displays the results relative to H2. According to H2, the closer a poorer out-group is getting to the in-group the higher its probability to be attacked. If H2 is true, poorer out-groups should be attacked more when they are in an improving economic condition - i.e. they are getting closer to the in-group - while this should not be the case for richer out-group. Figure 4 plots the marginal effect of the out-group economic conditions on the level of attacks, based on negative binomial regressions. We now split the sample depending on whether the target is a poorer out-group or a richer out-group.

[Insert Figure 4 around here]

Consistently with H2, Figure 4 shows that poorer out-groups are attacked more when their economic condition is improving. When analysing absolute and relative treatments together, compared to the declining condition, the stable condition has a positive significant effect ($b = .125$, $p = .026$), and the improving condition has a sizable significant effect ($b = .415$, $p < .001$) on the attacks received by the poorer out-group. However, Figure 4 shows that richer out-groups are also targeted more when their situation is improving. When analysing absolute and relative treatments together, compared to the declining condition, the stable condition has a positive but insignificant effect ($b = .0779$, $p = .154$), and the improving condition has a significant positive effect ($b = .221$, $p < .001$) on the attacks received by the poorer out-group. This does not generally support the logic of jealousy (H2): subjects attack

more out-groups in improving economic condition but irrespectively of whether they are poorer or richer[8].

The absolute and relative treatments considerably influence the level of attacks against poorer and richer out-groups. As figure 4 shows, the richer out-groups in an improving condition are attacked more in the absolute treatment. In contrast, the poorer out-groups in improving condition are attacked more in the relative treatment. This means that when all groups have the same destructive capacity, subjects are envious: they tend to attack more richer out-groups that have prospects to become even richer. This effect is much weaker against poorer groups. This finding is consistent with H1bis. In contrast, in the relative treatment, the attacks are consistent with the logic of jealousy, as predicted by H2bis. The poorer out-groups with prospects to become richer are more strongly and significantly attacked than the others in the relative treatment, while this effect disappears for the richer out-groups. Overall, our results suggest that if the groups' destructive capacity depends on their resources, subjects attack more the poor who gets richer than the rich who gets richer.

Not Pre-Registered Analyses

In this section, we assess the implications of our results regarding left-wing and right wing terrorism. If we start from the realistic assumption that the destructive capacity of individuals is associated with their wealth in the real world, this capacity is equally distributed across individuals in equal societies, while it is unequally distributed in unequal societies. Therefore, our results imply that left-wing terrorism targeting richer out-groups should decrease under high inequality, while right-wing terrorism targeting poorer out-groups should increase under high inequality. We here present favourable evidence of the correlation of our

[8] Yet, supplementary analyses show that the effect on attacks of the economic condition of out-group resources is slightly smaller for richer than for poorer out-groups: there is a significant positive interaction between the improving condition, compared to the declining condition, and the out-group being poorer, compared to richer, on the level of attacks it receives (coefficient of the interaction: b =.194, p = .012).

experimental measures of left-wing and right-wing parochial altruism with left-right political attitudes of subjects. We then show that the effect of inequality is observed within our experiment and provide evidence that it generalizes to historical data on terrorist events.

Table 3 presents results from negative binomial regressions of subjects' attacks with subjects random effects. The models include at a first level independent variables related to the game, and at the second level subjects' characteristics - including attitudinal and socio-demographic variables. Model I explains parochial altruism in general, i.e. the level of attack against any out-group, while models II and III focus on left-wing parochial altruism, i.e. the level of attack against a richer out-group, and models IV and V focus on right-wing parochial altruism, i.e. the level of attack against a poorer out-group.

[Insert Table 3 around here]

Results based on the post-experimental survey indicate that behaviours in the game correlate with subjects' attitudes. First, in line with previous study on parochial altruism, attacks were perceived as an altruistic behaviour. Model I shows that subjects who perceive themselves as cooperative during the game actually contribute more points in attacks. The effect of perceived cooperation on attacks is different for left-wing and right-wing parochial altruism. In model II, relative to attacks against richer out-groups, the coefficient of perceived cooperation only attains the 10% significance threshold. In contrast, in model IV, perceived cooperation is strongly related to attacks against poorer out-groups. By running a random slope model, we confirm that the effect of perceived cooperation on attacks is significantly higher for poorer than for richer out-groups (coefficient of the interaction between perceived cooperation and the out-group being poorer: $b = .0739$, $p = .028$).

Second, we test for the relationship between the targets of parochial altruism and the political attitudes of subjects. Regarding left-wing parochial altruism, model II shows that the more the subjects are at the right of the left-right scale the less they attack richer out-groups in

the game. In contrast, model IV shows that subjects' left-right self-position has no significant effect on attacks against poorer groups. The Social Dominance Orientation[9] has no effects on the attacks against richer groups, while it has a positive and significant effect on attacks against poorer groups. Overall, behaviors in the game correlate with political attitudes of subjects in the expected direction. Finally, the models in Table 1 include socio-demographic variables, i.e. gender, age, educational attainment and professional status. None of these variables are statistically related to any form of parochial altruism. Note however that self-employed participants are significantly less prone to attack in general.

Results relative to the game variables first confirm previous results. An out-group is attacked more when it has high resources. An out-group is also attacked more when its resources are growing because of its economic condition, especially when the out-group is poorer than the in-group[10]. Moreover, the results show that subjects tend to attack in retaliation of previous attacks by the out-group. Besides, subjects tend to attack more when members of their in-group attacked during the previous round.

We include a indicator of inequality across groups in the models. Inequality is measured, using a fractionalization index, as the sum of the squared share of resources respectively owned by the five groups[11]. Results from model I show that, overall, attacks decrease when inequality is high. Models II to V show that this effect of inequality is actually different when we distinguish between attacks against richer and poorer out-groups. Indeed, attacks against richer out-groups are lower when inequality is high while this is not the case against poorer out-groups. Results from model IV suggest that inequality even increase attacks against poorer out-groups, albeit the 5% conventional level of significance is not reached. Model III shows that inequality has a significant effect on the attacks against richer

[9] The internal validity of the Social Dominance Orientation scale was satisfactory (Cronbach's α = .73).
[10] Further analyses confirm again that the coefficient of the variation of the out-group resources due to the economic is significantly higher when the out-group is poorer rather than richer.
[11] The variable theoretically goes from 20% (perfect equality across the five groups) to 100% (perfect concentration of the resources in the richest group). Empirically, the variable goes from 20.0% to 34.2%.

out-groups only in the relative treatment. Indeed, the main effect of inequality is no longer significant once we include an interaction term between inequality and the relative treatment. In contrast, model V shows that there is no interaction effect between inequality and the relative treatment on the attacks against poorer out-groups.

Altogether our results suggest that inequality has different effects on left-wing and right-wing parochial altruism: when richer groups have a high destructive capacity, high inequality reduces left-wing parochial altruism, while it has no clear effect on right-wing parochial altruism. This dampening effect of inequality on left-wing parochial altruism is paradoxical since left-wing ideologies precisely strive against inequality. Yet, this effect generalize to historical cases of terrorist events.

[Insert Figure 5 around here]

To illustrate this, Figure 6 plots the number of left-wing and right-wing terrorist events in nine developed countries. Two main pieces of information in Figure 6 suggest our experimental findings have some generalizability to terrorist events. Firstly, in line with experimental results, we see that left-wing terrorism (in red) is more widespread that right-wing terrorism (in blue). Secondly, left-wing terrorism is more frequent when inequality is low, while there is no clear relationship in the case of right-wing terrorism, as in our experiment.

Conclusion

Research on parochial altruism has mostly focused on the causes leading individuals to attacks an out-group on the behalf of the in-group. Yet, we insofar had few clues to understand why, in a world with multiple groups, parochial altruism targets specific out-groups. The present study addresses this issue by introducing a new version of the Inter-group Prisoner Dilemma (IPD) with multiple groups, in which subjects have to choose which out-

groups to attack. We distinguish between two types of parochial altruism: left-wing parochial altruism, directed against out-groups with more resources than the in-group, and right-wing parochial altruism, directed against out-groups with fewer resources than the in-group.

Results partly confirm previous results and partly introduce new evidence. We confirm that participants chose to spend substantial amounts of money to attack out-groups for the benefit of their group, thus reducing collective welfare (Bornstein, 2003). We also corroborate that attacks mainly emerge from "in-group love" rather than "out-group hate" (Halevy et al., 2008, Halevy et al., 2012; Abbink et al. 2018). New evidence is provided about the targets of parochial altruism: on average, subjects choose to attack the richest out-groups more. However, when the destructive capacity of groups increases with their resources, rich groups are less attacked and the poor groups more, especially when they have good prospects to become rich.

Results based on the post-experimental survey indicate that the targets of parochial altruism correlate with subjects' political attitudes: left-wing parochial altruism correlates with subjects' left-wing political orientation and right-wing parochial altruism was higher among subjects high in Social Dominance Orientation. This confirms the usefulness of distinguishing between the two forms of parochial altruism that may have distinct psychologic and social antecedents. It also suggests that our experimental setting is an effective measure of the ideological orientation of individuals in inter-group interactions, and that the results may be extrapolated to inter-group conflicts.

Then, what are the implications of our findings regarding the targets of terrorism and political violence in general? Firstly, our results shed light on the linkages between inequality and the orientation of political violence. Indeed, a historical look reveals close relationships between ideological waves of political violence and the variation in inequality. For instance, high levels of inequality in the Europe of the 1930s coincided with a right-wing orientation of

political violence, incarnated by the Nazi Party in Germany, and by movements such as the Young Patriots in France and the British Union of Fascists in the UK. In contrast, violent political movements in the 1970s, under unprecedented low levels of inequality, were mainly left-wing oriented, as illustrated by the Red Brigades in Italy, the Red Army Fraction in Germany or Action Directe in France. In the current context of increasing inequalities, right-wing violence seems again to gain prevalence over left-wing violence. Recent empirical studies on French radical movements (Varaine, 2018) and US terrorists (Varaine, 2019) statistically confirm this trend: the higher the increase in inequality the more right-wing the orientation of political violence.

The present experiment offers clues to understand this relationship. Our results suggest that inequalities may lead to a right-wing orientation of political violence. Not necessarily through increasing right-wing violence, but through decreasing the share of left-wing violence targeting strong groups. Indeed, we find that high inequality, through increasing the retaliation capacity of economically dominant groups, reduces the level of attacks targeting them. One could think this mechanism occur in real group interactions, in which economically powerful groups have a higher influence on policy responses (Gilens, 2012) and on direct repression of left-wing insurgencies (Acemoglu & Robinson, 2005). This mechanism of retaliation may reduce left-wing violence targeting economically dominant group, in parallel with a resignation mechanism, due to the feeling that inequalities are far too high to be reduced (Abbink et al., 2018).

Furthermore, our experiment gives clues to understand the relationship between the economic mobility of social groups and the orientation of political violence. In this regard, various comparative studies find that increases in the demographic and economic status of minority groups are related to increases in right-wing violence (Green et al., 1998, Boutcher et al., 2017). Our results suggest that a logic of jealousy may be at play here, leading members

of strong groups to target weak groups with high prospects of prosperity, especially in contexts in which strong groups have a higher destructive capacity.

Finally, the data reveals an interesting difference between right-wing and left-wing parochial altruism. We find that subjects' perceived level of cooperation is related with attacks against poorer groups, while it has a limited effect on attacks against richer groups. This result is close from the findings of Halevy et al. (2010) that, although attacks are generally based on altruistic motives (Halevy et al., 2008), attacks against relatively advantaged groups may be inspired by purely hateful motives. This is also congruent with recent evidence suggesting that the widespread individual tendency to punish non-cooperative players result from a basic human inequality aversion rather than from a desire of reciprocity (Dawes et al., 2007, Raihani & McAuliffe, 2012). An implication of this finding is that, individual identification with an in-group may not be a pre-requisite for all types of political violence, contrary to predictions of the identity fusion model of conflict (Whitehouse et al., 2014, see also Atran et al., 2014). Although individual identification with an in-group may be crucial in motivating right-wing violence, left-wing violence might emerge solely from personal inequality aversion.

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Tables

Table 1: payoffs of the IPD game, individual level

Decisions of the two other in-group subjects	My decision	
	Keep	Attack
Both keep	1	0,5
One attack, one keep	1,5	1
Both attack	2	1,5

Note. We present individual payoffs assuming that each subject has one point to contribute ($p_0 = 1$) and that subjects of the out-group keep their points.

Table 2: payoffs of the IPD game, group level

Out-group	In-group	
	Keep	Attack
Keep	1	1,5
Attack	-0,5	0

Note. We present individual payoffs assuming that each subject has one point to contribute ($p_0 = 1$) and that subjects of the same group take the same decision.

Table 3: Standardised coefficients from mixed effect negative binomial regression analyses

	I	II	III	IV	V
Dependent variables	Attacks against an out-group	Attacks against a richer out-group		Attacks against a poorer out-group	
Subject-level variables					
Perceived self cooperation	0.111***	0.0627+	0.0651*	0.135**	0.135**
	(0.0275)	(0.0341)	(0.0332)	(0.0423)	(0.0425)
Left right self position	-0.0680*	-0.0945*	-0.0858*	-0.0306	-0.0264
	(0.0311)	(0.0378)	(0.0370)	(0.0482)	(0.0485)
Social dominance orientation	0.0549+	-0.0115	-0.00811	0.106*	0.110*
	(0.0313)	(0.0382)	(0.0372)	(0.0485)	(0.0490)
Socio-demographics (age, sex, education, work)	Yes	Yes	Yes	Yes	Yes
Subject*Round variables					
Out-group resources	0.291***	0.231***	0.237***	0.418***	0.423***
	(0.0186)	(0.0299)	(0.0298)	(0.0383)	(0.0385)
Out-group variation due to economic	0.0778***	0.0514**	0.0524**	0.105***	0.103***
condition	(0.0153)	(0.0182)	(0.0182)	(0.0275)	(0.0276)
Attacks by the subject against the out-	0.321***	0.216***	0.219***	0.353***	0.353***
group at t-1	(0.0162)	(0.0215)	(0.0216)	(0.0243)	(0.0243)
Attacks by the out-group against the in-	0.252***	0.244***	0.245***	0.259***	0.258***
group at t-1	(0.0153)	(0.0196)	(0.0196)	(0.0248)	(0.0248)
Attacks by other in-group subjects at t-1	0.261***	0.312***	0.298***	0.237***	0.236***
	(0.0260)	(0.0355)	(0.0355)	(0.0370)	(0.0371)
Subject resources	-0.0418+	-0.00345	0.0104	-0.0443	-0.0418
	(0.0232)	(0.0426)	(0.0424)	(0.0380)	(0.0383)
Inequality	-0.0653**	-0.159***	-0.0350	0.0582+	0.141+
	(0.0205)	(0.0283)	(0.0611)	(0.0329)	(0.0729)
Relative treatment			-0.246***		-0.105

			(0.0707)		(0.0871)
Inequality * Relative treatment			-0.133*		-0.0941
			(0.0677)		(0.0799)
Constant	1.586***	1.555***	1.718***	1.764***	1.848***
	(0.113)	(0.141)	(0.145)	(0.177)	(0.187)
Var(subjects)	0.150***	0.188***	0.174***	0.277***	0.279***
	(0.0230)	(0.0364)	(0.0356)	(0.0456)	(0.0460)
ln(alpha)	1.024***	0.815***	0.815***	1.157***	1.156***
	(0.0149)	(0.0212)	(0.0212)	(0.0223)	(0.0223)
Observations	16,428	8,159	8,159	8,269	8,269
Number of subjects	300	276	276	267	267

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Rounds in which at least one group was eliminated excluded from the analyses.

Figure 1

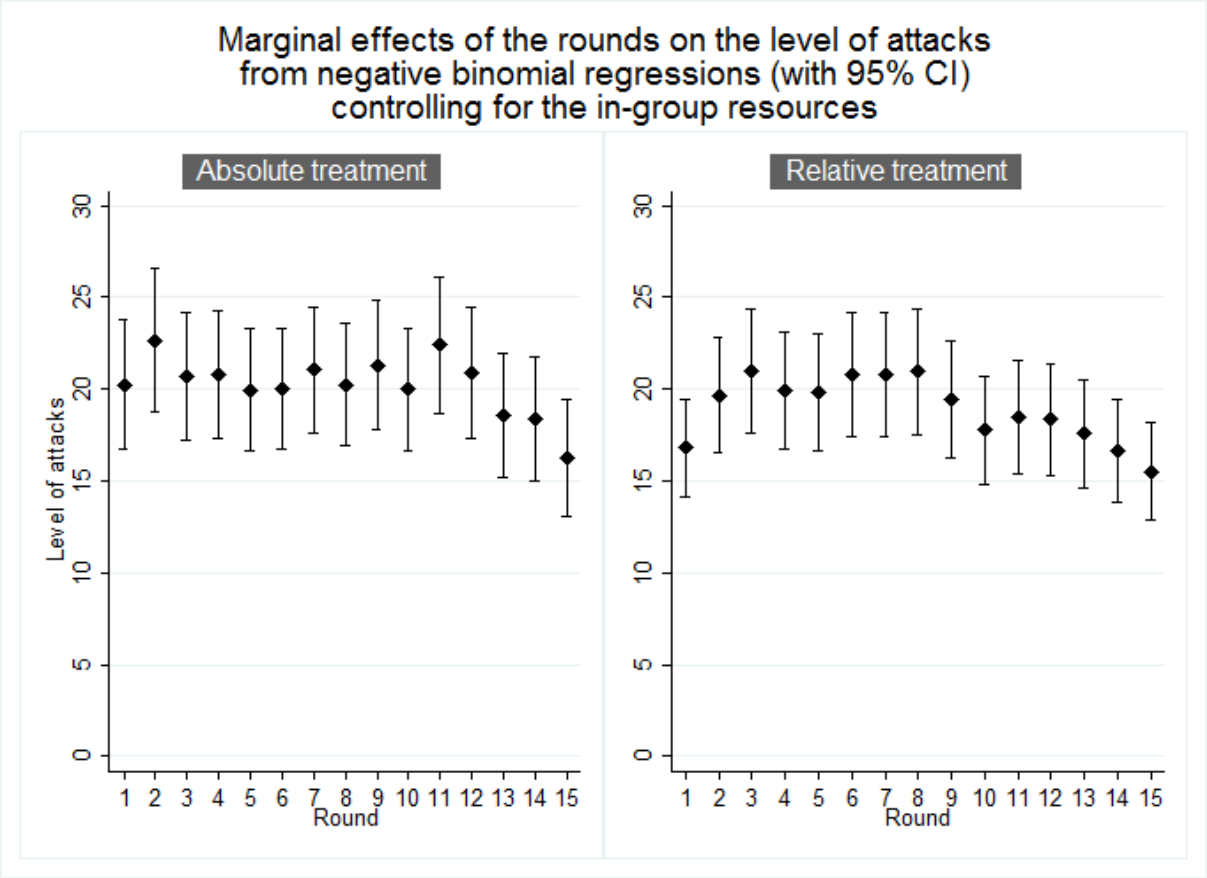

Marginal effects of the rounds on the level of attacks
from negative binomial regressions (with 95% CI)
controlling for the in-group resources
Absolute treatment
Relative treatment
Level of attacks
0
5
10
15
20
25
30
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Round

Figure 2

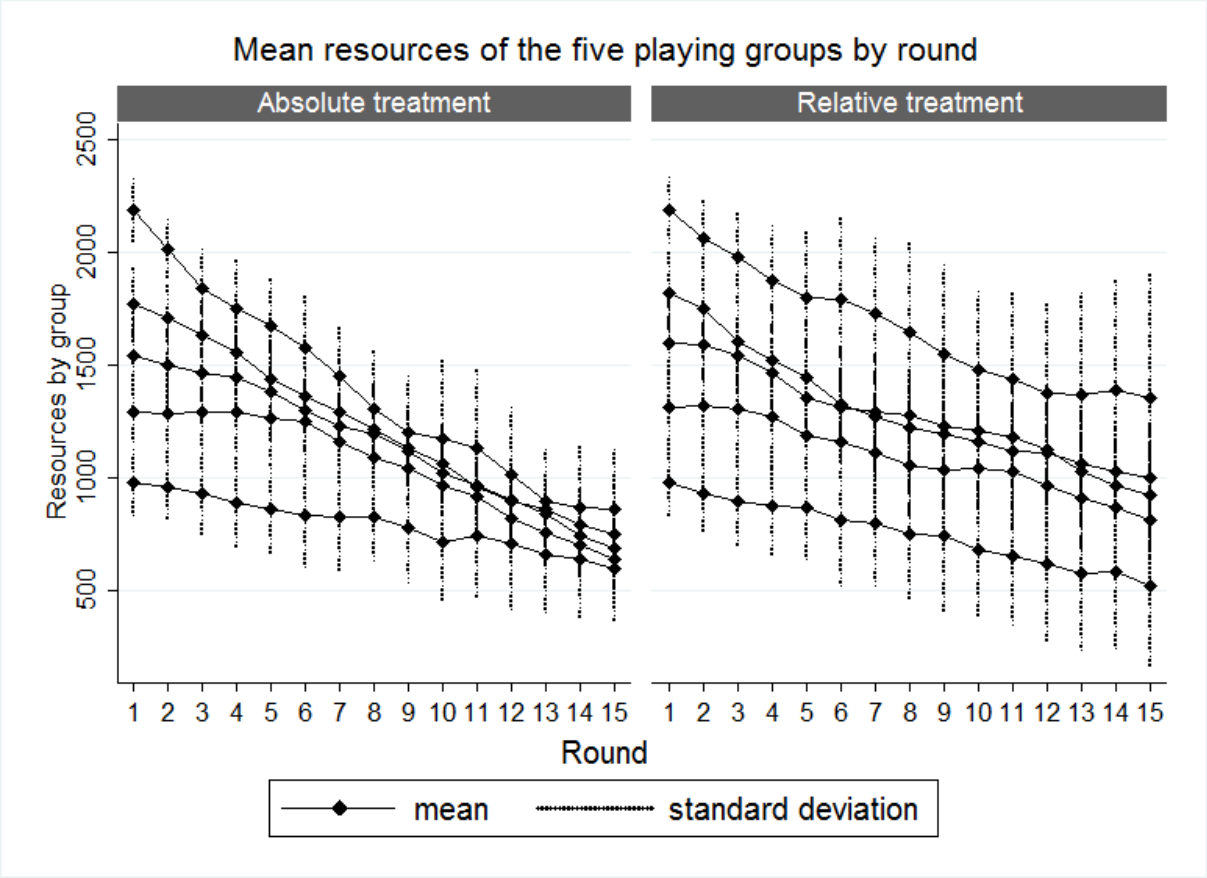

Mean resources of the five playing groups by round
Absolute treatment
Relative treatment
Resources by group
500
1000
1500
2000
2500
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Round
mean
standard deviation

Figure 3

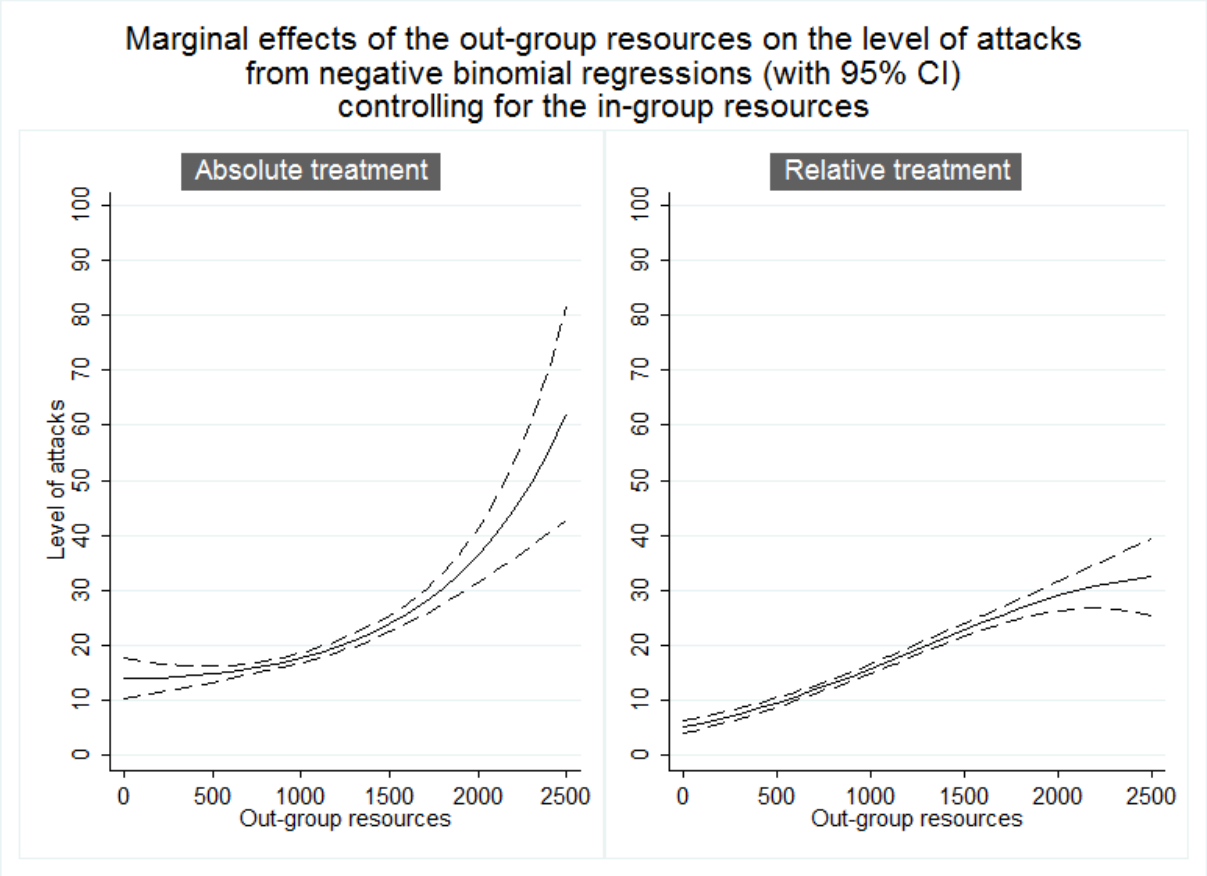

Marginal effects of the out-group resources on the level of attacks
from negative binomial regressions (with 95% CI)
controlling for the in-group resources
Absolute treatment
Relative treatment
Level of attacks
0
10
20
30
40
50
60
70
80
90
100
0
500
1000
1500
2000
2500
Out-group resources

Figure 4

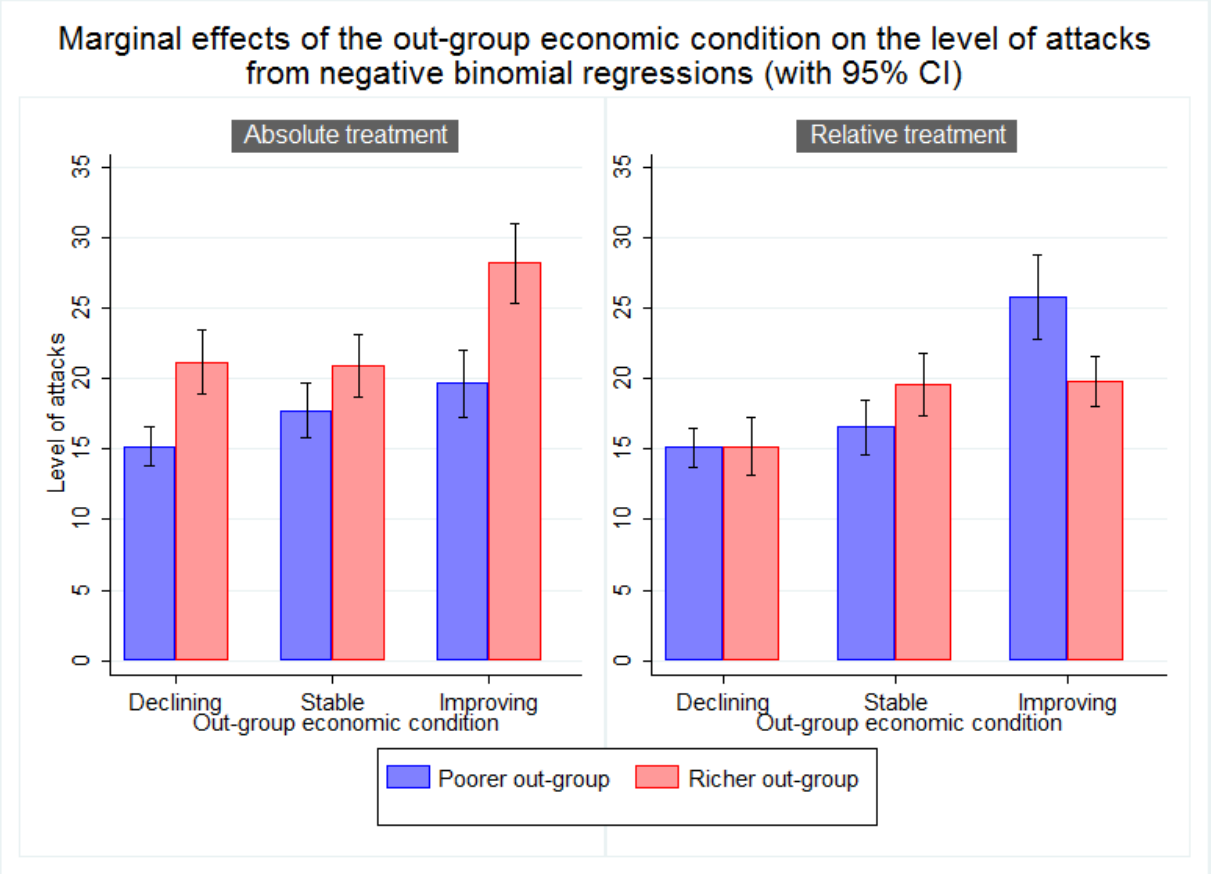
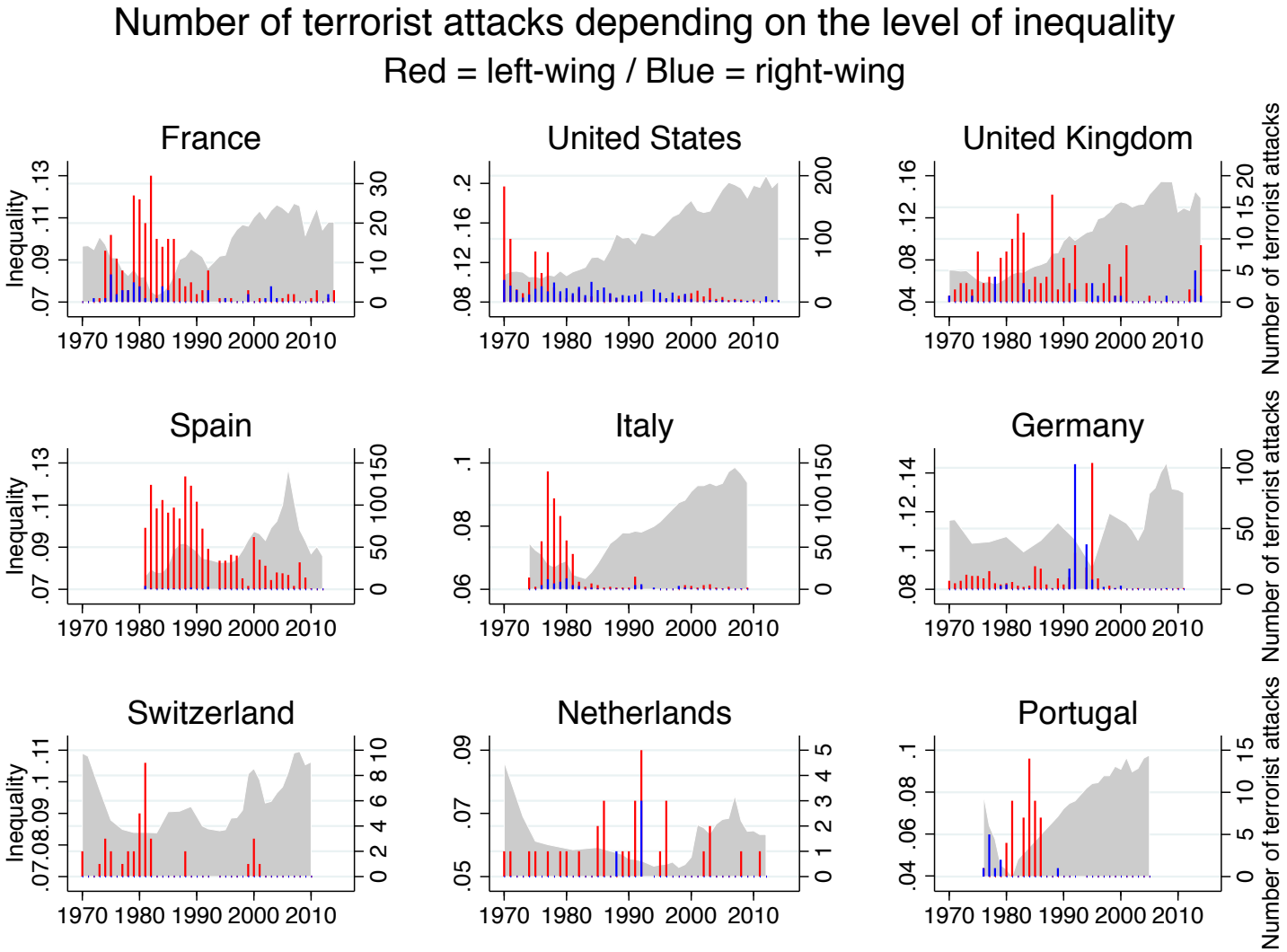

Marginal effects of the out-group economic condition on the level of attacks from negative binomial regressions (with 95% CI)
Absolute treatment
Relative treatment
Level of attacks
0
5
10
15
20
25
30
35
Declining
Stable
Improving
Out-group economic condition
Poorer out-group
Richer out-group

Figure 5


Number of terrorist attacks depending on the level of inequality
Red = left-wing / Blue = right-wing
France
United States
United Kingdom
Spain
Italy
Germany
Switzerland
Netherlands
Portugal
Inequality
Number of terrorist attacks
1970 1980 1990 2000 2010

Appendix: instructions of the experiment

[General instructions]

Hello and thank you for your participation in our study.

In order to preserve anonymity during the session and when analysing the data, we have assigned you a code. No identifying data will be collected. It will be impossible to link your decisions to your name. The data will only be used for academic research purposes, always respecting anonymity.

Any communication between participants is strictly prohibited, as is any comment on what is appropriate or inappropriate to do during the experiment.
Please turn off your cell phones. We ask you to stay focused on your own computer screen.
During the session, you will have to make simple decisions. Nevertheless, if you face any problem, please do not hesitate to consult us.

During the session, you will have to perform several tasks. Three phases will take place: First, you will participate in a word creation game, then you will engage in an economic group game, and finally you will be asked to fill out a questionnaire.
A new phase will only begin when all participants have finished the previous phase.
We will give you instructions before the beginning of each phase. For everyone's understanding, these instructions will be read aloud.
The duration of this session will not exceed two hours.

You have 10 euros in cash for your participation.
You will find this amount in your personal envelope.
This sum is yours.
In addition to this amount and depending on the choices you make, you can earn more money throughout the games.
You will be informed of your final earnings at the end of the session.

Do you have any questions?

[First task]

We will now begin the first phase: the word creation game.

(See instructions in Brüggemann et al., 2016)

[Inter-group prisoner dilemma]

You have now completed the word creation game. Therefore, we are going to move on to the economic group game.

In this new game, you will be divided into 5 groups of participants depending on your ranking in number of points during the word creation game:
- The top three players will be in the yellow group.
- The next three in the red group.
- The next three in the purple group.
- The next three in the blue group.
- The last three players in the green group.
You will be part of the same group throughout the game.

In this new game, you have a number of individual points: your personal prize pool. At the beginning of the game, your prize pool contains 10 times the number of points you won during the word-creation game.

The game is composed of 15 successive rounds. In each round you must decide how many points you want to take from other groups to give them to your group.

Taking points from another group has a cost: to take 1.5 points from a group, you must spend 1 point of your personal prize pool. In that case :
- You take 1.5 points from the other group, that is 0.5 points per player from this group.
- You give 1.5 points to your group, that is 0.5 points per player in your group (including you).

[Relative treatment]
{
There is a limit to the number of points you can spend to take points from other groups: you can not spend more than 10% of your personal prize pool per turn.
}

[Absolute treatment]
{
There is a limit to the number of points you can spend to take points from other groups: you can not spend more than 50 points of your personal prize pool per turn.
}

[Screenshot Decision page 1]

Here is a capture of the game screen. The screen is framed by the colour of your group. In this example, you are part of the blue group. At the top of the screen, you see information about the situation of your group and the other four groups. Atthe top left, you see a graph that shows the number of points of each group in previous rounds. At the top centre, you have the total number of points of each group in the round being played. At the top right, you have the weather: I'll explain what it means a little later.

In the middle of the screen, you see piles of coins. The pile on the left is your personal prize pool. You see that here you have 500 points. The piles on the right each correspond to another group from which you can take points. It is at the level of these piles that you will have to indicate your decisions. You must choose how much you want to take from each of the other groups to give to your own group. To do this, you must click on each of the piles corresponding to the other groups and decide how many points you want to take. It is imperative to click on each pile, even when you decide to take away zero points, in order to validate your decision.

You have a limited time to choose how many points you want to take from each of the other groups: you have 45 seconds to indicate your choices. After this time, if you have not indicated a decision for one or more groups, the computer will randomly decide how much you take from each of them. It is therefore important to validate your decisions quickly. To help you, you have a little extra-time in the first round.

[Screenshot Decision page 2]

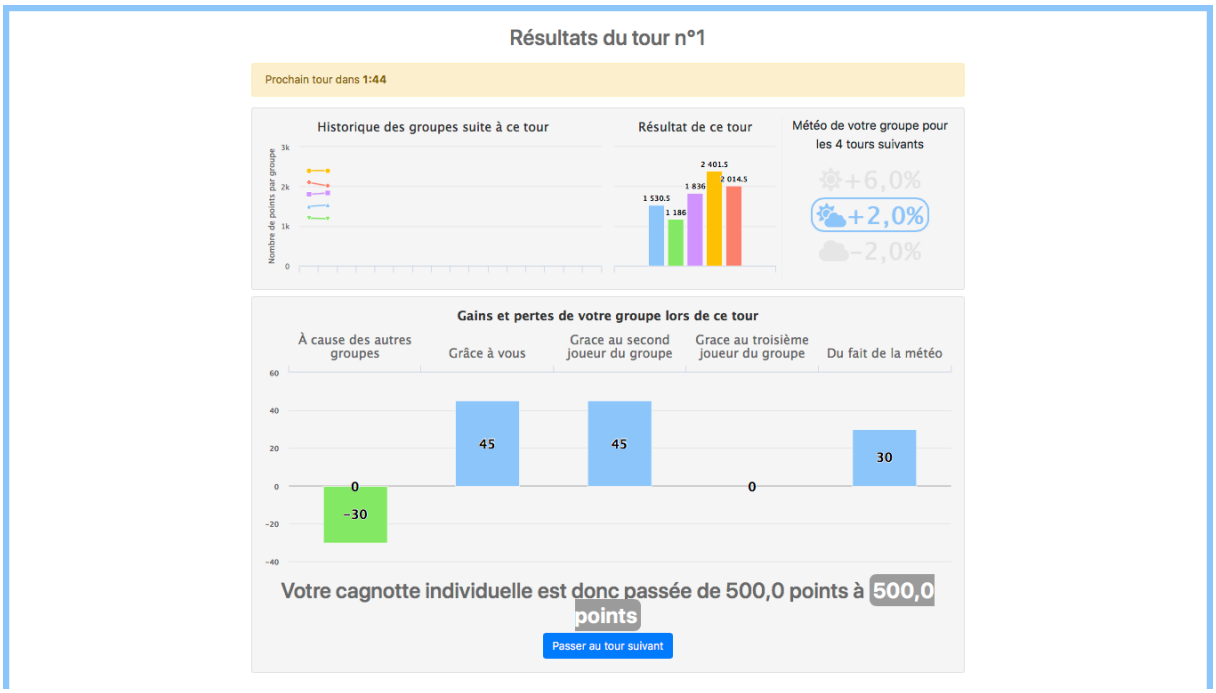
Let's see an example. Say you want to take 45 points from the red group to give them to your group. Say you do not want to take points from other groups.
In practice, you have to click on each of the piles to select the amount you want to take from each group: zero for groups green, purple and yellow and 45 points for the red one.
As you can see, your decision is summarized below: to take 45 points from the red group and give them to your group, you spend 30 points of your personal prize pool. The 45 points you take from the red group will be evenly distributed in your group: 15 points for you and 30 for the other two players in your group.
Once you have indicated your choices, you must click on validate.

At the end of each round, your personal prize pool will increase or decrease depending on your choices and those of other players.
But not only ... Chance will determine a part of your gains and losses.

In practice, every 5 rounds, the chance will decide the weather of your group for the next rounds. You will be randomly assigned to one the following weather conditions:
- Good weather: your prize pool will increase by 6% at the end of each round.
- Average weather: your prize pool will increase by 2% at the end of each round.
- Bad weather: your prize pool will decrease by 2% at the end of each turn.

Each turn, the weather will affect your prize pool after the calculations related to your choices and those of the other players.

[Screenshot Result page]



Let's go back to the game screen. After validating your decision and once everyone has played, the results page is displayed.
At the top of the screen, you still see information about the situation of your group and the other groups. This information has been updated based on the results of the tour that has just been played.
In the middle of the screen, you now see a summary of the gains and losses of your group of the round that has just been played. In this example, you see on the left that the green group has taken 30 points from your group overall - that is 10 points per player in your group, including you. As for you, you have given 45 points to your group - 15 points per player - by taking them from the red group. For that purpose, you spent 30 points of your personal prize pool. On the right, you see that another player in your group has also given 45 points to your group by taking them from another group. Then you see that the third player in your group has not brought points to your group by taking to other groups. Finally, on the far right, you see that the weather, which is of +2% for your group, has brought 30 points to your group.
Finally, at the end of this round, your personal prize pool after these different calculations is 500 points.
Indeed, you spent 30 points to take points from the red group. You have gained 15 points from this action and 15 points thanks to another player in your group. This compensates. In addition, you lost 10 points because of the green group and gained 10 points because of your weather. This also compensates. Therefore, you still have the same number of points.

At the end of the 15 rounds, you will see the number of points accumulated in your personal prize pool.

Thus, in this new part you put into play your gains of the word creation game.

At the end of the game, the number of points in your personal prize pool will be divided by ten, and this score will determine your final gains in Euros, at the conversion rate of 1 POINT = 0.25 €.

This final amount will be added to the 10 Euros in you envelope.

Do you have any questions?

[Questionnaire and end of experience]

Now that you have completed the economic group game, we will ask you to complete a brief questionnaire.

Once this questionnaire is completed, we will call you to proceed to the payment.

We thank you for participating in this study.

References

Brüggemann, J., Crosetto, P., Meub, L., & Bizer, K. (2016). Intellectual property rights hinder sequential innovation. Experimental evidence. *Research Policy*, *45*(10), 2054-2068.