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Affirmative Action and Retaliation in Experimental Contests

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Francesco Fallucchi† and Simone Quercia‡

Abstract We conduct a real-effort experiment to test the effects of an affirmative action policy that reserves a share of the prize to subjects of a disadvantaged category in rent-seeking contests. We test three potential pitfalls of the affirmative action policy: (i) whether the introduction of the policy distorts effort and selection in the contest, (ii) whether it leads to reverse discrimination, that is, discourages entry from the advantaged category and (iii) whether the possibility of ex-post retaliatory actions undermines the effectiveness of the policy. We find that the affirmative action contest increases entry of players from the disadvantaged category without affecting entry of advantaged players. This increases overall effort in the contest. However, we find that the possibility of retaliation can undermine the benefits of the affirmative action policy reducing contest participation. This suggests that retaliation is an important aspect to consider when implementing affirmative action policies.

JEL: C72, D72, J78.

Keywords: Rent-seeking, contest design, affirmative action, retaliation

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1. Introduction

Affirmative action policies are adopted in markets structured as contests or tournaments in the form of quotas or leg up for members of disadvantaged groups (Holzer and Neumark (2000)). Despite their wide use they have been criticized for several reasons. Some advocate that these types of policies lower performance standards for specific groups and therefore could reduce average effort. Another common critique is that these policies lead to reverse discrimination, i.e., reduce opportunities and participation of non-targeted categories. Finally, an additional concern is the possibility that, if the policies are perceived as unfair, they may generate frictions between targeted and non-targeted individuals (see, e.g., Shteynberg et al. (2011)). This could lead to retaliation towards the protected category as a consequence of their preferential treatment under the policy. In the workplace, for example, retaliation can take various forms of conflict between employees such as, for example, bullying (Einarsen (1999), Samnani and Singh (2012)).

The aim of this paper is to test experimentally a novel affirmative action policy assessing whether this policy is affected by the three critiques above. In particular, we study an affirmative action policy of the type introduced and studied theoretically by Dahm and Esteve (2014), that is, the creation of an extra prize for a disadvantaged category in the Tullock (1980) model of rent-seeking. This model is used to describe a variety of real-life settings, such as job-seeking or sports competitions (see Konrad (2009)), where players exert effort in trying to get ahead of their rivals and prizes are assigned in a probabilistic way, proportional to participants' effort. For a given level of effort, players' probability of being successful may be heterogeneous across subjects because of differences in individual productivity. Due to this heterogeneity, inefficiencies may arise as less productive individuals could decrease their effort to maximize the expected payoff (Leininger (1993)) or could abstain from actively participating in the contest (Stein (2002)).

The policy we study aims at increasing the participation of the disadvantaged category avoiding the efficiency deterioration effects mentioned above. This is obtained by transforming a contest with one prize into a contest with two prizes of unequal size, where competition for the bigger prize is open to all participants while the smaller prize is reserved only to participants with the low level of productivity (disadvantaged category). Given that the two prizes in the latter contest are derived splitting the prize in the former, the policy comes at no cost for the contest organizer. This prize structure is frequently used in arts and sports competitions, where a smaller prize is reserved to categories which are less likely to win the main prize. For example, in the Academy Awards, foreign language movies can be nominated both for the prize as "Best foreign language film" and for the one as "Best picture".[1] However, foreign language movies may be disadvantaged as the jury is composed by English native speakers and frequently US and UK movies have access to larger budgets and are arguably more likely to win the "Best picture" prize. Similarly, the NBA every year assigns the prize to the Most Valuable Player (MVP) and another prize reserved for the "Rookie of the year", that is the best player at the first year of his career as a professional. Typically it is unlikely that a player at the first year of its career wins the MVP prize; however, it happened twice in the past that the winner of the "Rookie of the year" prize also won the MVP prize.[2] In the same spirit, this policy can be designed in workplace environments where there is a disadvantaged category of subjects, but to the best of our knowledge this policy has so far been rarely utilized in workplace setups.

In our experiment, to mimic closely the conditions on productivity heterogeneity of Dahm and Esteve (2014), we conduct a real-effort experiment where we exogenously manipulate subjects' productivity to create two categories of players. We compare the participation

[1] As an example consider "Life is beautiful" that was nominated both for best picture and best foreign language movie (https://en.wikipedia.org/wiki/Life_Is_Beautiful) accessed on 01/08/2018.
[2] https://en.wikipedia.org/wiki/NBA_Rookie_of_the_Year_Award accessed on 01/08/2018.

properties of a basic contest structure with just one prize against the modified affirmative action contest, i.e., two prizes. Furthermore, we test whether the possibility of retaliation can diminish the benefits of the affirmative action policy. Our experimental implementation of retaliation consists of the opportunity for all subjects to reduce the value of each of the prizes at their own monetary cost after they exerted effort and before the contest winners are revealed. We will consider retaliation as resources spent by the advantaged against the disadvantaged subjects. In our implementation, retaliation lowers overall efficiency and can be thought as the destruction of some public good beneficial for the group as a whole. An example of a similar activity has been documented in a recent paper where the introduction of an affirmative action policy beneficial to low-caste people in rural India leads the high-caste individuals to threaten and exclude the low-caste individuals from the use of public services such as public roads (see Girard (2018)).[3]

We find that the affirmative action policy strongly increases participation of subjects from the disadvantaged category without discouraging the participation of advantaged subjects. However, our results from the retaliation treatment indicate that, the possibility of prize reduction can have a substantial effect on participation of the disadvantaged subjects, decreasing the positive participation effects of the affirmative action policy.

Previous laboratory experiments proved to be a powerful tool to understand the role of affirmative action policies (see Schotter and Weigelt (1992), Balafoutas and Sutter (2012), Niederle et al. (2013), Balafoutas et al. (2016), Beaurain and Masclet (2016), Leibbrandt et al. (2016), Kölle (2017), Maggian and Montinari (2017) and Banerjee et al. (2018)). Our paper

[3] Retaliation differs from the more studied sabotage (see for example Harbring and Irlenbusch (2003, (2008); see Chowdhury and Gürtler (2015) for a review). While the former is not strategically relevant under standard self-regarding preferences, the latter is since the saboteur benefits from it, therefore it is justifiable from a rational and selfish point of view. Leibbrandt et al. (2016) show that due to sabotage there can be a backlash against women in the presence of affirmative action to promote female participation in contests.

extends the literature in several important ways. First, we provide the first experimental investigation of affirmative action through extra prizes. Second, we are the first, to our knowledge, to test retaliation as an obstacle to the effectiveness of affirmative action policies. Finally, we study a setting where there is heterogeneity in subjects' productivity, while most of the recent contributions study affirmative action in the context of gender differences in tournament participation where there are typically no differences in productivity between men and women (see Calsamiglia et al. (2013) for a notable exception).

One important difference between ours and most of the studies above is that we study the affirmative action in an environment with a probabilistic outcome such as the lottery contest (see Freeman and Gelber (2010) for an experimental comparison of one prize versus multiple prizes in deterministic tournaments). We envisage many real-life applications where the nature of the contest is probabilistic rather than deterministic (e.g. patent races, art or sport competitions, job settings where performance is not exactly measurable and hence stochastic components determine the assignment of performance bonuses). In this respect, our study also contributes to the flourishing experimental literature investigating the effects of different contest structures on subjects' participation and effort (e.g. Cason et al. (2010) or see Dechenaux et al. (2014) for a review).

Our paper also contributes to the literature on behavioral spillovers of affirmative action policies. This literature typically finds no spillover effects of affirmative action policies on subsequent unrelated tasks. Balafoutas and Sutter (2012) and Kölle (2017), for example, show that affirmative action to promote female participation does not impair subsequent ability to coordinate and willingness to work in teams, respectively. Maggian and Montinari (2017) show no effect of affirmative action on the likelihood of lying in a subsequent cheating game. Banerjee et al. (2018) show that lying to reduce earnings between categories is not significantly increased by the introduction of affirmative action in a framed field experiment using castes in

India. One exception is Leibbrandt et al. (2016) who study sabotage and find that affirmative action to increase female participation increases significantly sabotage towards them. Similar to Leibbrant et al. (2016), we also study a spillover within the same environment and not in a subsequent unrelated task. However, while sabotage may be a rational response to the increased competition and may not necessarily be related to spite towards the protected category, we study ex-post retaliation which cannot be justified under self-interested preferences and hence constitutes a clear indication of retaliatory behavior.

The remainder of the paper is structured as follows: in section 2 we introduce the contest framework and describe the affirmative action policy; we proceed in section 3 with the description of the experimental design, providing a detailed description of the real-effort task and our treatments; in section 4 and 5 we report the experimental results and in section 6 we summarize and conclude.

2. The framework

Our framework is a standard lottery contest (Tullock (1980)), where *N* contestants exert costly effort in order to win a prize *V*. The probability for player i to win the prize is proportional to her output, x_i, and it is defined by a contest success function:

$$p_i(x_i, X_{-i}^N) = \frac{x_i}{x_i + X_{-i}^N}$$

where X_{-i}^N is the total output of the *N-1* i's opponents, i.e., $\sum_{j \neq i}^{N} x_j$. Contestants are heterogeneous in productivity leading to different cost functions, that is each unit of output for player i costs $1/\alpha_i$, where $\alpha_i > 0$. Therefore, the expected payoff for player i is given by

$$\pi_i = \frac{x_i}{x_i + X_{-i}^N} V - \frac{x_i}{\alpha_i}$$

Dahm and Esteve (2014) study a setting with a continuum of productivity parameters α. Without loss of generality we restrict the possible values of α such that there are two categories of players, a disadvantaged category with $\alpha = \underline{\alpha}$ and an advantaged category with $\alpha = \bar{\alpha}$, where $\underline{\alpha} < \bar{\alpha}$. The authors introduce affirmative action policies in the form of an extra prize for the disadvantaged players and show that this policy can increase, under certain conditions, overall efficiency. More precisely, they introduce a contest structure that reallocates a fraction βV from the main prize $(0 < \beta < 1)$, to create an extra prize reserved to disadvantaged subjects. Assuming that the number of disadvantaged players is $D < N$, the expected payoff of a disadvantaged player *i* becomes:

$$\pi_i^D = \frac{x_i}{x_i + X_{-i}^N}(1-\beta)V + \frac{x_i}{x_i + X_{-i}^D}\beta V - \frac{x_i}{\underline{\alpha}}$$

For a generic advantaged player j the expected payoff is:

$$\pi_j^A = \frac{x_j}{x_j + X_{-j}^N}(1-\beta)V - \frac{x_j}{\bar{\alpha}}$$

Hence, it is possible that disadvantaged players win both prizes while this is not possible for advantaged players. In the next section we describe the experimental design that aims at testing the effects of the introduction of the policy on contest participation.

3. Experimental design and procedures

In this section, we first introduce the real effort task used in the experiment and highlight the differences with previous implementations; we then describe the structure of the experiment, the experimental treatments and procedures and review behavioral predictions from Dahm and Esteve (2014).

3.1 The real effort task

In our experiment, subjects are asked to perform a task under different incentive schemes. This real effort task is a modified version of the "slider task" (Gill and Prowse (2012)). In the original implementation by Gill and Prowse (2012), each subject faces one screen with a number of sliders positioned at 0 and they have to position the sliders at 50 using their mouse. Subjects receive a piece-rate payment for each slider they position correctly at 50 and have a time limit to perform the task. Importantly, the number of the sliders on the screen does not vary across experimental subjects or across repetitions of the task.

Our implementation modifies three aspects of the original task. First, we consider multiple screens with sliders and incentives are linked to the number of screens completed. Second, we exogenously manipulate the difficulty of the task by varying the number of sliders per screen across subjects. These two differences are necessary to create exogenous variation in productivity across subjects. In particular, half of the subjects in our experiment are advantaged (called "white players" in the experiment) as they had to position 4 sliders to complete one screen while the other half ("blue players") are disadvantaged as they had to position 8 sliders per screen. Subjects knew about the heterogeneity from the beginning of the experiment. This implements closely the conditions in Example 2 in Dahm and Esteve (2014, p. 16), i.e., we have two subjects whose productivity is twice as high as the other two subjects and productivity is homogeneous within groups. These conditions would have been difficult to obtain using a different design such as, for example, using natural differences in productivity. Finally, we allow subjects to use both mouse and keyboard to position the sliders at 50. This last difference compared to the original implementation of the slider task is needed to minimize heterogeneity in productivity "per slider" across subjects. We explain to subjects in the instructions how to use the mouse by clicking twice on the slider and then arrows on the keyboard to adjust the slider at 50. This ensures substantial differences in productivity between advantaged and disadvantaged subjects but very low differences within each category.

3.2 Experimental design and treatments

Our design is based on the task described above and it consists of 5 parts.[4] Subjects were informed that the experiment consisted of 5 parts and were given details about each part at a time. Subjects were informed that they would get paid the sum of earnings from the 5 parts.

Part 1 is a practice round; subjects are asked to perform our modified slider task for 5 minutes without monetary incentives. Only for this part all subjects have ten sliders per screen. Subjects are explicitly told to practice the slider task using both mouse and keyboard as described above. At the end of Part 1, we reveal to subjects whether they are advantaged or disadvantaged players. The assignment of the disadvantage is randomly determined and this is common knowledge.

In Part 2, subjects are asked to perform the real effort task for 5 minutes under piece-rate incentives. Subjects receive 0.10€ per screen completed.

In Part 3, participants are randomly matched into groups of four composed by two advantaged and two disadvantaged players (the different productivity of types is common knowledge). In each group, subjects compete in a Tullock contest: following the standard

[4] The design structure is inspired by an experimental paradigm frequently used to study competitive settings (see, e.g., Gneezy et al. (2003), Niederle and Vesterlund (2007), Dohmen and Falk (2011)) and affirmative action in tournaments (see, e.g., Balafoutas and Sutter (2012) and Niederle et al. (2013)).

contest success function, the probability of a subject to win the prize(s) depends on the number of screens completed individually divided by the total number of screens completed by the group.

In Part 4, subjects choose between a piece-rate analogous to Part 2 and the contest as in Part 3. One difference with previous similar designs (with the exception of Dohmen and Falk (2011)) is that we allow subjects to select the contest in Part 4 and compete against the others who made the same choice rather than letting them compete against the performance of all other players in the group in Part 3 (see Niederle and Vesterlund (2007)). Although this feature of our design adds strategic uncertainty, it is a crucial aspect in order to be able to test the effect of retaliation on contest entry. Specifically, we need a setting where the contest participation of an additional player reduces the probability of winning for the other players in the contest and potentially generates resentment that leads to retaliatory actions. This cannot happen in the Niederle and Vesterlund (2007) implementation where the probability of winning the contest is independent from sorting choices of other group members.

In Part 5, we elicit subjects' risk attitudes using both an incentivized choice list task and a survey measure. In the former, subjects choose between a lottery paying €0 or €4 with 50% probability and a certain amount. The certain amount increases along the table, from 0.75€ to 3.75€. Furthermore, we conducted a socio-demographic questionnaire where we also elicited risk aversion using a well-established survey measure validated in a representative subject pool (see Dohmen et al. (2011)). Subjects are asked to answer the following question on a Likert scale from 0 to 10: "How do you see yourself: are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?"

After performing under piece-rate incentives (Part 2, and possibly 4), subjects are informed only about their individual performance and earnings. After performing in the contests (Part 3, and possibly 4), subjects are also informed about the performance of each of the other contestants together with their probability of winning each prize. The winners of the contest prize(s) are revealed only at the end of the experiment. Subjects know the existence of several parts but do not know the details of subsequent parts while they are making their choices.

We run three between-subjects treatments using the design structure described above. The three treatments differ in the contest structures of Part 3 and 4: in the BASE treatment subjects compete for a contest prize of 10€; in the affirmative action treatment (AA) the prize is split between a big prize of 8€ and a small prize of 2€. All group members in Part 3 and all those who choose the contest in Part 4 compete to win the big prize, while only the disadvantaged participants can compete for the small prize. Hence, given the prize draws are fully independent, it is possible for a disadvantaged participant to win both prizes. In case none of the disadvantaged participants decides to enter the contest in Part 4, the main prize becomes 10€.

The third treatment, retaliation (AA-RET), has the same contest structure of AA but it gives subjects participating in the contest the additional opportunity to reduce any of the prizes at their own expenses. This opportunity is revealed to subjects in the instructions for Part 3 and 4. Hence, their effort and entry decisions can be affected by the expected prize reduction. Subjects know that they had received an additional €0.50 that they can keep or spend in the reduction of one or both prizes after their entry and effort decision. Notice that the additional 0.50€ are allocated independently of the choice between contest and piece-rate, thus leaving unaltered the ex-ante value of the two options compared to the AA treatment. In Part 3 every group member can reduce the prizes, while in Part 4 only the subjects who entered the contest can reduce the prizes. When subjects receive feedbacks on their and the other contestants' probabilities of winning, they also see two input boxes on their screens, one for each prize. They are asked to enter a number in each input box and the maximal sum allowed is 0.50€. For each 0.01€ spent on the reduction, the targeted prize is reduced by 0.02€.

3.3 Procedures

The experiment was conducted at the BonnEconLab in June 2015 using the software z-tree (Fischbacher (2007)). Once seated, subjects were given instructions that introduced details of the experiment (see Appendix B) and were read aloud by the experimenter. Specific instructions for each part were computerized and shown to subjects on screens just before each part. The experimenter answered questions in private and no communication between participants was allowed. We conducted nine sessions in total, with either 16 or 20 subjects, each resulting in 172 subjects recruited from a wide range of disciplines through HRoot (Bock et al. (2014)). No participant took part in more than one session. Participants did not know the identities of the other subjects with whom they were grouped. A session lasted on average 60 minutes and subjects earned on average 11.70€.

3.4 Predictions and Hypotheses

The model by Dahm and Esteve (2014) has a unique Nash equilibrium, regardless of the share of the extra prize, that depends on the distribution of productivity among contestants. The size of the extra prize β is chosen by the contest organizer to increase contest entry and hence maximize total effort. Assume for simplicity the case of four contestants, like in our experiment, two advantaged and two disadvantaged.

Total effort is predicted to be concave in the size of the extra prize. For low levels of the extra prize, the total effort will be higher than without the extra prize, but for high level of the extra prize will be lower than the case of one prize only. The intuition for this pattern is that while the introduction of an extra prize has always a positive effect on the participation of disadvantaged subjects, the effect on the advantaged players is more ambiguous as there are two offsetting forces. On the one hand, the introduction of an extra prize has a negative effect on the advantaged subjects because their expected value of winning the contest decreases. On the other hand, there is a positive effect as there is more competition from disadvantaged subjects and advantaged subject raise their effort. Which of these two forces prevails depends on the size of β. In our experiment, we have chosen $\beta = 0.2$ which is predicted to increase overall participation and effort. [5]

Different from the model, in our experiment, we test the effect of the affirmative action with a heterogeneous outside option determined by the piece-rate performance. The creation of an extra prize in this case increases the expected payoff of disadvantaged players, and hence their entry. The effect on the advantaged players is more ambiguous due to the two forces described above and it is our empirical objective to establish which of the two forces prevails. This leads us to formulate our first hypothesis:

H1: Disadvantaged players increase their entry in the contest in AA compared to BASE.

Next we turn to the predictions on contest participation for our AA-RET treatment. As described in the previous section, the act of retaliating is costly and available ex-post. Therefore, it does not play any strategic role. Hence, subjects should not use the opportunity to retaliate under the assumption that they behave as self-interested individuals. If players correctly anticipate this, they should enter the contest at the same rate of AA because the structure of the contest is exactly the same with the only difference of the retaliation possibility. However, under some classes of social preferences subjects could decide to reduce the prizes. If some group members have social preferences causing them to retaliate and players correctly anticipate this, this may render the contest less attractive and reduce contest participation.[6]

[5] For a formal derivation of the equilibrium we refer the reader to Proposition 3 in Dahm and Esteve (2014) and to Example 2 at pag. 16 for the same parametrization we use in our experiment.

[6] For example, if disadvantaged subjects dislike disadvantageous inequality (Fehr and Schmidt (1999)) they may reduce the larger prize because this reduces expected earnings of the advantaged players more than their expected earnings.

H2: if subjects anticipate potential retaliation and hence reduction in the value of the prizes, we predict a reduction in entry levels in AA-RET compared to AA.

4. Results

We investigate the main results of the experiment analyzing Part 4, where subjects choose between piece-rate and contest after having experienced them in Part 2 and 3, respectively. We divide our results section in five subsections: in the first we use data from Part 2 and Part 3 to check that our exogenous productivity manipulation was successful. In the second, we analyze the determinants of contest participation in Part 4 and the differences in contest entry across treatments. In the third we assess the extent of retaliation in AA-RET and in the last two sections we analyze efficiency and sorting, respectively.

4.1 Descriptive statistics

In Table 1 we report descriptive statistics classified by treatment and type of player (advantaged or disadvantaged). For each category, we report the average number of sliders positioned correctly and the number of screens completed in Part 2. Furthermore, we report the average realized probabilities of winning the contest in Part 3 for the main prize (€10 in BASE and €8 in AA and AA-RET) and the probability of winning at least one prize for the disadvantaged players.[7]

[7] For the extra prize the average probability of winning is 0.5 by construction.

Table 1. Descriptive statistics from Part 2 and Part 3.

Treatment	Type	Average Sliders in Part 2 (Std. Dev.)	Average Screens in Part 2 (Std. Dev.)	Likelihood of winning the main prize in Part 3 (Std. Dev.)[8]	Likelihood of winning at least one prize in Part 3 (Std. Dev.)
BASE	Advantaged	92.57	22.80	0.34	
		(16.30)	(4.01)	(0.04)	
(*n* = 60)	Disadvantaged	91.23	11.27	0.16	
		(13.92)	(1.74)	(0.02)	
AA	Advantaged	90.43	22.17	0.33	
		(16.80)	(4.28)	(0.05)	
(*n* = 60)	Disadvantaged	93.07	11.63	0.17	0.58
		(16.20)	(2.02)	(0.03)	(0.07)
AA-RET	Advantaged	90.42	22.38	0.32	
		(14.42)	(3.65)	(0.08)	
(*n* = 52)	Disadvantaged	91.15	11.23	0.18	0.59
		(15.39)	(1.90)	(0.04)	(0.08)

On average subjects position 91.51 sliders correctly, with a standard deviation of 15.38. The statistics indicate that we were successful in our modification of the slider task to create low heterogeneity in productivity "per slider" as shown by the average number of sliders positioned at 50, but substantial heterogeneity in productivity "per screen" between advantaged and disadvantaged as shown by the number of screens completed. Moreover, the average number of sliders positioned is not statistically different between advantaged and disadvantaged in any

[8] For completeness we also report the average number of screens completed in Part 3 and Part 4. In Part 3: in BASE 25.43 (3.49) by the advantaged and 12.00 (1.58) by the disadvantaged; in AA 24.17 (4.18) by the advantaged and 12.03 (1.87) by the disadvantaged; in AA-RET 23.31 (5.84) by the advantaged and 12.46 (2.18) by the disadvantged. For subjects who enter that contest in Part 4: in BASE 27.20 (3.38) by the advantaged and 12.40 (1.96) by the disadvantaged; in AA 26.20 (2.93) by the advantaged and 12.89 (1.63); in AA-RET 26.05 (3.81) by the advantaged and 13.50 (1.92) by the disadvantaged. For subjects who choose the piece-rate, the average number of screens completed is: in BASE 21.00 (6.08) by the advantaged and 12.00 (1.20) by the disadvantaged; in AA 20.40 (4.83) by the advantaged and 12.33 (4.51); in AA-RET 22.75 (3.86) by the advantaged and 12.00 (2.67) by the disadvantaged.

of the treatments (Mann-Whitney U-test, $p \geq 0.576$) while the number of screens completed by advantaged and disadvantaged is significantly different in all treatments (Mann-Whitney U-test, all $p < 0.001$). The data from the contest in Part 3 show that the productivity manipulation holds also under a different incentive scheme. Advantaged subjects are twice as much likely to win the main prize compared to disadvantaged subjects in all treatments (Mann-Whitney U-test, all $p < 0.001$). The low standard deviations within each category shows that these results are common across all groups in our experiment. In the next subsection, we analyze how the affirmative action policy affects contest participation in Part 4.

4.2 Contest entry

Result 1. *Affirmative action increases participation of players from the disadvantaged category without affecting entry of players from the advantaged category.*

Figure 1 shows the entry rate of advantaged and disadvantaged subjects across treatments. The treatment AA increases contest participation significantly compared to BASE (from 67% (n = 40/60) to 87% (n = 52/60), $\chi^2(2) = 8.1$, $n = 30$, $p = 0.017$).[9] This effect is entirely driven by different entry levels of the disadvantaged players. While in BASE only 50% (n = 15/30) of the disadvantaged players choose the contest, their participation increases significantly up to 90% (n = 27/30) in AA. Advantaged participants are not affected by the prize structure: in both BASE and AA exactly 83% (n = 25/30) of them choose the contest. Of the 15 groups in BASE, four have no disadvantaged players choosing the contest, in seven groups we observe entry of only one of the two disadvantaged players, while only in four groups both

[9] All χ^2 tests reported are conducted using the average rate of entry at the group level as independent observation to control for the fact that subjects received feedbacks from Part 3 before their entry choice. Degrees of freedom are always 2 as it only occurs that rate of entry at the group level is either 0.5, 0.75 or 1.

disadvantaged players choose the contest. In all the fifteen groups in AA we observe entry of at least one disadvantaged player, with entry of both players in twelve of them.

Result 2. *The threat of retaliation reduces participation of the disadvantaged players without affecting entry of the advantaged ones.*

In AA-RET the overall entry rate drops to 77% (n = 40/52) from 87% of AA (n = 52/60). As shown in Figure 1, this reduction is again entirely due to disadvantaged subjects. While entry for the advantaged subjects is unaffected by the possibility of retaliation, the entry rate of disadvantaged subjects decreases to 69% (n = 18/26) compared to 90% (n = 27/30) in AA. Interestingly, the overall rate of participation in AA-RET is not significantly different from the entry rate in BASE ($\chi^2(2) = 2.13$, $n = 28$, $p = 0.344$). The overall participation rate in AA-RET is also not significantly different compared to AA ($\chi^2(2) = 2.20$, $n = 28$, $p = 0.333$).

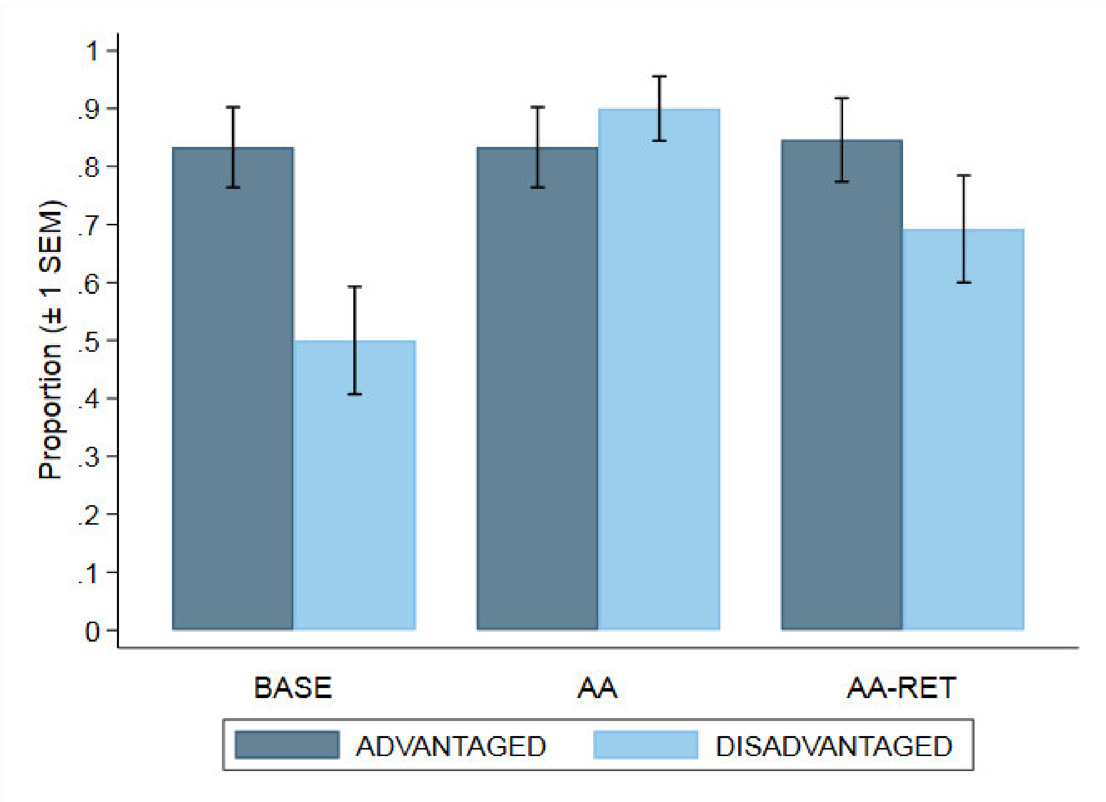

Figure 1. Proportion of subjects choosing contest in Part 4

Results 1 and 2 are supported by parametric estimates in Table 2, where we report linear mixed models regressions estimating the determinants of entry decisions using random intercepts at the group and type (advantaged or disadvantaged) level. All models estimate the effect of the treatments on the choice between contest and piece-rate. The dependent variable, "Entry choice", takes value 1 if a subject choose to participate in the contest and 0 otherwise. We regress this variable on treatment dummies (AA and AA-RET) with BASE as omitted category. We control for subjects' ability in the task using the number of sliders correctly positioned in Part 2 of the experiment and for the level of competition within the group using the total number of screens completed by other group members in Part 3. In Model (2) we add further controls for risk attitudes and gender. In Model (3) we estimate heterogeneous effects at type level, adding a dummy for disadvantaged players and the interaction terms between the treatment dummies and the disadvantaged dummy.

Model (1) shows that the affirmative action (AA) significantly increases the likelihood to enter the contest compared to BASE, while this is not the case for AA-RET. Previous performance of other players influence negatively the likelihood to enter the contest, while own ability is a significant predictor for choosing contest in Part 4. Model (2) confirms the positive effect of the affirmative action on entry controlling for risk attitudes and gender. It further reveals that risk attitudes have a significant impact on the choice between contest and piece-rate, that is, subjects who declare to be more willing to take risks are more likely to choose contest. We do not find significant gender differences in our data. Ceteris paribus, women enter the competition as much as men do. This result contrasts the previous literature in tournaments with real-effort tasks, where women tend to shy away from competition.[10]

[10] We speculate that the difference with the existing literature may be due to the different nature of the task. It is worth mentioning that our result are also in line with the findings by Morgan et al. (2012) though we need to be cautious about the differences of the design: subjects in their experiment play a repeated rent-seeking contest with chosen-effort and a fixed outside option.

Model (3) investigates asymmetric effects of the affirmative action between advantaged and disadvantaged players. It shows that being a disadvantaged player reduces significantly the likelihood of participating in the contest in BASE. It shows also that the treatments (dummies AA and AA-RET) have virtually no effect on participation choices of advantaged players. In contrast to this, the interaction term Disadvantaged × AA reveals that the difference in entry rate between AA and BASE is significantly higher for disadvantaged than for advantaged players. However, this is only true in AA and not in AA-RET where the interaction term is not significant. Additional insights can be derived from Wald tests on coefficients: being in the treatment AA raises significantly the probability that a disadvantaged player chooses contest compared to BASE (H_0: AA + Disadvantage × AA= 0, $p < 0.001$), while the corresponding effect is not significant in AA-RET (H_0: AA-RET + Disadvantage × AA-RET = 0, $p = 0.107$). Finally, the treatment effect of higher participation under the affirmative action policy is significantly stronger in AA than in AA-RET for disadvantaged players (H_0: AA + Disadvantage × AA - AA-RET - Disadvantage × AA-RET = 0, $p = 0.011$).[11]

[11] Results are robust to alternative specifications. We conducted alternative estimates using the incentivized measure of risk aversion instead of the questionnaire one, and using the number of screens instead of the number of sliders completed in Part 2. In both cases results are very similar and reported, respectively, in Tables A1 and A2 in Appendix A.

Table 2. The determinants of participation decisions. Dependent variable: Entry choice.

	(1)	(2)	(3)
AA	0.185***	0.220***	0.054
	(0.071)	(0.070)	(0.094)
AA-RET	0.090	0.103	0.079
	(0.074)	(0.073)	(0.099)
Disadvantage			-0.237**
			(0.120)
Disadvantage × AA			0.355***
			(0.132)
Disadvantage × AA-RET			0.080
			(0.138)
Risk loving		0.059***	0.060***
		(0.015)	(0.014)
Female		0.008	0.037
		(0.062)	(0.062)
Others performance	-0.009**	-0.010***	-0.006
in Part 3	(0.004)	(0.002)	(0.006)
Piece-rate performance	0.009**	0.008***	0.008***
	(0.004)	(0.002)	(0.002)
Constant	0.398	0.220	0.044
	(0.290)	(0.301)	(0.375)
N	172	172	172

Notes: the table reports estimated coefficients from linear mixed effects models using random intercepts at the group and type level. * significant at 10%, ** significant at 5%, *** significant at 1%.

To sum up, the results show that the introduction of the affirmative action policy successfully creates a 'level playing field' by encouraging disadvantaged players to enter the contest without discouraging the advantaged players. However, the possibility of retaliation constitutes a strong enough threat for disadvantaged players to reduce their willingness to participate.

4.3 Realized retaliation

Next, we look at the amount of realized prize reduction and retaliation. As mentioned earlier, we will denote as retaliation the resources spent by advantaged subjects to reduce the prize reserved to the disadvantaged subjects. We will speak of prize reduction in general to identify any other prize reduction. First, we analyze the amount of retaliation in the contest in Part 3 which serves as an indication of the level of resentment between the two categories.

In Part 3, 25% (n = 13/52) of the participants engage in prize reduction. Overall, 16% of all the potential resources allocated are spent in prize reduction. Conditional on deciding to spend some resources, subjects spend on average 66% of their resources. This indicates that subjects engage in this activity even if wasteful from a material point of view. Interestingly, the highest amount is spent by disadvantaged to reduce the €8 prize (€2.4). This can be explained by inequity aversion (Fehr and Schmidt (1999)) as from the point of view of disadvantaged players any reduction of the 8€ prize reduces the expected earnings of the advantaged players more than it reduces their expected earnings. The second highest amount is spent in retaliation, that is, by the advantaged subjects to reduce the €2 prize (€1.7).

Next we turn to the prize reductions in Part 4. Overall, we find a lower level of prize reduction among the subjects who enter the contest compared to Part 3. This is not surprising as there is less entry from the disadvantaged players (see Section 4.2). It suggests that expenditures are indeed the results of frictions between different types of players, which are less prominent when fewer disadvantaged players enter the contest. In particular, among the subjects entering the contest, 12% (n = 5/40) engage in prize reduction and 6.5% of overall resources of these subjects are spent to reduce prizes. Conditional on deciding to spend some resources, subjects spend on average 51% of their resources. As before, the highest amount is spent by disadvantaged to reduce the €8 prize (€0.9) and the second highest amount is spent by advantaged to reduce the €2 prize (€0.2). As we do not observe what would have happened if disadvantaged players would have entered in the contest in AA-RET as much as in AA, we think the most informative data in terms of retaliation comes from Part 3 when full entry was forced by design. In Part 4, the lower entry of disadvantaged suggest that they anticipate the potential extent of retaliation. [12] It is also interesting to note that only the most able advantaged players in each group, i.e. those with the higher likelihood to win the contest, reduce the €2 prize. We conjecture this may be indicative of the perception of unfairness driven by the reduction of the main prize.[13]

4.4 Efficiency

In this section, we assess the effects of the affirmative action on efficiency in Part 4 of the experiment. We assume that a contest organizer employs the affirmative action to redirect effort from piece-rate to the contest and he/she is mainly interested in the effort exerted in the contest. Under such assumption, in BASE, the average per group contest effort in Part 4 is 70.9 sliders, while this number rises significantly to 91.3 sliders in AA due to the increased participation (MWU-test, $p = 0.001$). In AA-RET, the average group performance raises only to 82.6 sliders, a level not significantly different from BASE (MWU-test, $p = 0.102$). Hence, the presence of retaliation may challenge the intent to redirect effort from the piece-rate to the contest. If instead we consider both the piece-rate and the contest as activities the contest organizer cares about we find no significant differences in effort neither in the comparison between BASE and AA nor in the one between BASE and AA-RET (MWU-tests, $p = 0.687$ and $p = 0.447$, respectively).

[12] We conjecture that the expenditures in Part 3 and 4 are not driven by demand effects as we find lower expenditure in the contest in Part 4 compared to Part 3. If the expenditure was caused by demand effects and not by frictions between players we would have found the same level of expenditure across the two contests. However, we do find that with lower entry by disadvantaged subjects the level of prize reductions decreases, indicating that prizes are likely reduced due to frictions between the two categories.

[13] For a more detailed analysis of the reasons for expenditures in prize reductions see section 5.

4.5 Selection and sorting

Finally, we analyze whether the introduction of the extra prize or the possibility to retaliate have consequences on the composition of the pool of contestants. This is important as previous literature studying affirmative action to promote women participation in tournaments has found that the introduction of affirmative action promotes the participation of most productive women who otherwise would shy away from competition (see Balafoutas and Sutter (2012)). To do this, we divide our each category of subjects in "strong" and "weak" performers using a median split of their performance in terms of number of sliders in Part 1. Then, we look at whether the affirmative action has asymmetric effects for strong and weak performers in each category. For advantaged players, we see absolutely no effect of the affirmative action policy when we split between strong and weak performers. Strong performers have an entry rate of 93% in BASE and 93% in AA. Weak performers have an entry rate of 73% in BASE and 73% in AA. The more interesting case regards disadvantaged players for whom the affirmative action policy has an overall strong and significant effect. Weak performers among the disadvantaged enter 36% of the times in BASE and 86% in AA. Strong performers enter 58% of the times in BASE and 94% in AA. Hence, the affirmative action policy seems to have a stronger effect on the weak performers among the disadvantaged. To check whether this heterogeneous effect is significant we regress the entry choice on the AA dummy, a dummy for weak performers and the interaction between these two dummies. Results are reported in Table A3 in Appendix A. The interaction term is not significant neither for advantaged nor for disadvantaged indicating that affirmative action has no differential impact depending on individuals' productivity.

Another interesting question is to assess whether the ranking of participants within their group in Part 3 has an effect on their entry decision in Part 4 and whether this interacts with our treatment, i.e., whether the affirmative action has heterogeneous treatment effects depending on individual ranking in their group. To assess this, we conduct regression analyses reported in Table 3. In Model (1) we consider the effect of the relative ranking on the likelihood to enter the contest in the whole sample. The results show that the lower the rank, the less is the likelihood to enter the contest, while the affirmative action dummy has still a positive effect on entry. In models (2) to (5) we analyze the advantaged and disadvantaged separately. We replace the ranking variable with a dummy (highest rank) equal to one for the most productive subject within each category in each group. From model (2) we infer that being the highest ranked advantaged player increases the likelihood of entering the contest. In Model (3) we add the interactions between the treatment dummies and the highest rank dummy to assess potential heterogenous treatment effects. We find no evidence, however, that treatment effects depend on the rank. Finally, we do not find any effect of ranking on disadvantaged players, as shown by models (4) and (5). To sum up, the relative ranking has a small effect only on advantaged players, while it is not a relevant consideration for disadvantaged players.

Table 3. The effect of relative ranking on participation decisions. Dependent variable: Entry choice.

	All players	Advantaged		Disadvantaged	
	(1)	(2)	(3)	(4)	(5)
AA	0.236***	0.039	0.010	0.449***	0.450***
	(0.073)	(0.092)	(0.131)	(0.111)	(0.153)
AA-RET	0.101	0.031	0.107	0.189	0.045
	(0.076)	(0.096)	(0.140)	(0.117)	(0.164)
Risk loving	0.047***	0.037*	0.041*	0.064***	0.060**
	(0.016)	(0.021)	(0.022)	(0.024)	(0.024)
Female	-0.442	-0.040	-0.030	0.034	0.041
	(0.064)	(0.080)	(0.081)	(0.104)	(0.102)
Ranking in Part 3	-0.101***				
	(0.027)				
Highest Rank		0.203***	0.228*	0.145	0.068
		(0.077)	(0.127)	(0.092)	(0.163)
Highest Rank × AA			0.063		-0.007
			(0.183)		(0.214)
Highest Rank × AA-RET			-0.140		0.288
			(0.190)		(0.232)
Constant	0.688***	0.546***	0.502***	0.047***	0.109
	(0.131)	(0.151)	(0.173)	(0.194)	(0.203)
N	156	82	82	74	74

Notes: the table reports estimated coefficients from linear mixed effects models using random intercepts at the group level. * significant at 10%, ** significant at 5%, *** significant at 1%.

5. Disentangling the motives behind prize reduction

As noted in Section 4.3, the results from the AA-RET treatment indicate two possible reasons for prize reduction. While we have interpreted prize reduction by advantaged players as retaliation towards the disadvantaged, the observed retaliation by disadvantaged could be due to inequity aversion towards the advantaged players. However, given that our AA-RET treatment modifies two aspects compared to BASE, we cannot establish whether the observed retaliation is due to the frictions that may exist between categories due to our exogenous manipulation of productivity or due to the introduction of the affirmative action policy. To address this, we conducted an additional treatment that sheds light on the underlying motivations for prize reduction.

5.1 Experimental design

The new treatment, which we label BASE-RET, is identical to our BASE treatment except that it adds the possibility of prize reduction after Part 3 and 4. Clearly, given that there is only a prize of 10€, the motives for reducing the prize cannot be due to frictions arising from the affirmative action policy. Hence, the comparison between this treatment and our AA-RET treatment reveals to what extent the introduction of the affirmative action policy generates frictions between the two categories. In particular, if we have correctly interpreted reduction by advantaged players of the 2€ prize as retaliation towards disadvantaged players, we should observe the advantaged players spending zero resources in prize reduction in BASE-RET given that in this case there is no affirmative action. This additional experiment was also conducted at the BonnEconLab in July 2018 using the software z-tree (Fischbacher (2007)). Procedures were identical to the experiment reported in Section 4. We conducted three sessions in total, with either 16 or 20 subjects, resulting in 56 subjects recruited from a wide range of disciplines through HRoot (Bock et al. (2014)). A session lasted on average 60 minutes and subjects earned on average 12.50€.

5.2 Experimental results

We first present descriptive statistics of the BASE-RET experiment and compare it with our previous treatments. Overall, we find a slightly lower level of productivity in our sample (compare Table 1). Advantaged participants correctly position on average 82.68 sliders and complete on average 20.36 screens in Part 2; for them the average probability of winning the €10 prize is 0.33. Disadvantaged participants correctly position on average 78.64 sliders and complete on average 9.68 screens in Part 2; for them the average probability of winning the

€10 prize is 0.17. Despite the differences in productivity with respect to our previous experiment we find similar ratios of productivity between advantaged and disadvantaged as reflected in the probabilities of winning. As in our previous experiment, there are no significant differences in the average number of sliders between advantaged and disadvantaged (Mann-Whitney U-test, $p = 0.279$) but there is a significant difference in the number of screens (Mann-Whitney U-test, $p < 0.001$).

Next, we look at contest entry in Part 4. Contest entry is remarkably similar to our BASE treatment. In particular, 85.7% (n = 24/28) of the advantaged players enter in BASE-RET versus 83.3% (n = 25/30) in BASE and 42.9% (n = 12/28) of the disadvantaged players enter in BASE-RET versus 50.0% (n = 15/30) in BASE. In both cases we cannot reject the null of equality of proportions ($\chi^2(1) = 0.1$, $n = 29$, $p = 0.782$; $\chi^2(1) = 0.3$, $n = 29$, $p = 0.862$). This suggests that prize reduction does not constitute a threat that further reduces entry levels for neither categories when there is only one prize.

Next, we analyze the realized retaliation and compare it with our AA-RET treatment. In Table 4, we report the percentages of subjects who decide to reduce prizes in AA-RET and BASE-RET by category of players for both Part 3 and 4. For AA-RET we also report this figure broken down for the 8€ and the 2€ prizes.[14]

Recall that in AA-RET, we found that disadvantaged tend to reduce only the 8€ prize, an observation consistent with inequity aversion motives. The advantaged players instead tend to reduce mostly the 2€ prize, but only in Part 3 suggesting that their behavior is motivated by retaliation against the disadvantaged as we observe lower frequency of reductions when there is less entry by disadvantaged in Part 4.

The latter explanation is corroborated by the results of BASE-RET. Strikingly, when there is only one prize the advantaged players never reduce the prize, neither in Part 3 nor in Part 4.

[14] See Table A4 in Appendix A for a comparison of the average amount spent in prize reduction.

We still observe some prize reductions by disadvantaged players although to a smaller extent compared to AA-RET.

Table 4. Proportions of subjects engaging in prize reduction in Part 3 and 4 in AA-RET and BASE-RET.

Treatment	Type	Total	8€ prize	2€ prize
Part 3				
AA-RET	Advantaged	23% (6/26)	8% (2/26)	19% (5/26)
(n = 52)	Disadvantaged	27% (7/26)	27% (7/26)	0% (0/26)
BASE-RET	Advantaged	0% (0/28)		
(n = 56)	Disadvantaged	14% (4/28)		
Part 4				
AA-RET	Advantaged	9% (2/22)	6% (1/18)	6% (1/18)
(n = 40)	Disadvantaged	17% (3/18)	17% (3/18)	0% (0/18)
BASE-RET	Advantaged	0% (0/24)		
(n = 36)	Disadvantaged	8% (1/12)		

Statistical comparisons using χ^2 tests treating groups as independent observations, show only one significant result, the comparison between the total fraction of advantaged players reducing at least one prize in AA-RET versus the fraction of advantaged players reducing the prize in BASE-RET ($\chi^2 = 5.1$, $n = 27$, $p = 0.080$).

6. Concluding remarks

In this paper, we have explored experimentally the effects of an affirmative action policy in Tullock contest settings. We find that the introduction of an extra prize reserved to disadvantaged subjects strongly encourages disadvantaged players' participation without discouraging advantaged ones. As a result, the total rent-seeking effort by groups increases, proving the effectiveness of the affirmative action in encouraging competition in the contest. Finally, we have also shown how the threat of retaliation may challenge the beneficial effects of the affirmative action policy reducing willingness to participate of the disadvantaged category.

Given our results from the retaliation treatment, we believe that, to fully exploit the participation benefits of the policy, it is important to protect subjects under affirmative action from possible retaliatory behavior. We think that retaliation, and the various forms it may take under different settings, is an important factor to take into account when analyzing the implementation of new affirmative action policies. Research suggests, for example, that some organizational structures that do not foster a procedurally fair environment, may encourage retaliation (see Samnani and Singh (2012)). Recent evidence on Indian local elections shows that, the election of a low caste woman under gender quota is positively correlated with the increase in discrimination against low castes, suggesting the presence of retaliation from members of higher castes (Girard (2018)).

We acknowledge that more research is needed to understand whether and how our findings on retaliation extend to other affirmative action settings and different organizational structures. For example, a psychologically similar phenomenon happens when managers retaliate against subordinates because of their use of some affirmative action policy. The U.S. Equal Employment Opportunity Commission (EEOC) reports that retaliation, considered as "the adverse action against someone filing a complaint regarding discrimination in the workplace", has been the most frequently alleged basis of discrimination in the federal sector from fiscal years 2008 to 2013 and it constitutes a major threat to the effectiveness of affirmative action policies.[15] Hence, future studies should also focus on retaliation in settings that mimic the manager-subordinate relationship, rather than retaliation among peers as in the current study.

[15] http://www.eeoc.gov/laws/types/retaliation_considerations.cfm accessed on 17/07/2018.

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Appendix A

Table A1. The determinants of participation decisions using a choice list measure of risk attitudes instead of the survey measure. Dep. variable: Entry choice.

	(1)	(2)	(3)
AA	0.185***	0.201***	0.042
	(0.071)	(0.071)	(0.098)
AA-RET	0.090	0.089	0.060
	(0.074)	(0.075)	(0.103)
Disadvantage			-0.251**
			(0.126)
Disadvantage × AA			0.342**
			(0.137)
Disadvantage × AA-RET			0.091
			(0.144)
Risk loving		0.038***	0.039***
		(0.012)	(0.012)
Female		-0.033	-0.007
		(0.062)	(0.062)
Others performance	-0.009**	-0.009**	-0.004
in Part 3	(0.004)	(0.004)	(0.006)
PR performance	0.009**	0.007***	0.007***
	(0.004)	(0.002)	(0.002)
Constant	0.398	0.269	0.028
	(0.290)	(0.319)	(0.407)
N	172	172	172

Notes: the table reports estimated coefficients from linear mixed effects models using random intercepts at the group and type level. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table A2. The determinants of participation decisions using the number of screen completed instead of the number of sliders in Part 2 as PR Performance. Dep. variable: Entry choice.

	(1)	(2)	(3)
AA	0.207***	0.239***	0.063
	(0.073)	(0.070)	(0.094)
AA-RET	0.114	0.120	0.079
	(0.076)	(0.074)	(0.099)
Disadvantage			0.199
			(0.151)
Disadvantage × AA			0.346***
			(0.132)
Disadvantage × AA-RET			0.080
			(0.138)
Risk loving		0.060***	0.061***
		(0.015)	(0.014)
Female		-0.013	0.034
		(0.063)	(0.062)
Others performance	0.002	-0.000	-0.006
in Part 3	(0.005)	(0.005)	(0.006)
PR performance	0.022***	0.019***	0.039***
	(0.007)	(0.006)	(0.062)
Constant	0.398	0.025	-0.109
	(0.290)	(0.411)	(0.340)
N	172	172	172

Notes: the table reports estimated coefficients from linear mixed effects models using random intercepts at the group and type level. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table A3. The determinants of participation decisions by strong and weak performers. Dep. variable: Entry choice.

	Advantaged	Disadvantaged
AA	0.006	0.433***
	(0.125)	(0.136)
AA-RET	-0.033	0.033
	(0.131)	(0.143)
weak performer	-0.213*	-0.124
	(0.128)	(0.152)
AA × weak performer	0.036	0.012
	(0.180)	(0.208)
AA-RET × weak performer	0.096	0.251
	(0.186)	(0.216)
Risk loving	0.042**	0.088***
	(0.021)	(0.023)
Female	-0.059	0.050
	(0.079)	(0.096)
Others performance in Part 3	-0.009	-0.011
	(0.008)	(0.008)
Constant	1.186***	0.731
	(0.429)	(0.528)
N	86	86

Notes: the table reports estimated coefficients from linear mixed effects models using random intercepts at the group level. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table A4. Average amounts (Std. Dev.) spent in prize reduction conditional on deciding to reduce the prize in Part 3 and 4 in AA-RET and BASE-RET

Treatment	Type	Total	8€ prize	2€ prize
Part 3				
AA-RET	Advantaged	0.07 (0.16)	0.01 (0.03)	0.07 (0.16)
(*n* = 52)	Disadvantaged	0.09 (0.18)	0.09 (0.18)	0
BASE-RET	Advantaged	0		
(*n* = 56)	Disadvantaged	0.01 (0.04)		
Part 4				
AA-RET	Advantaged	0.02 (0.06)	0.01 (0.04)	0.01 (0.04)
(*n* = 40)	Disadvantaged	0.05 (0.13)	0.05 (0.13)	0
BASE-RET	Advantaged	0		
(*n* = 36)	Disadvantaged	0.04 (0.14)		

Appendix B – Experimental instructions

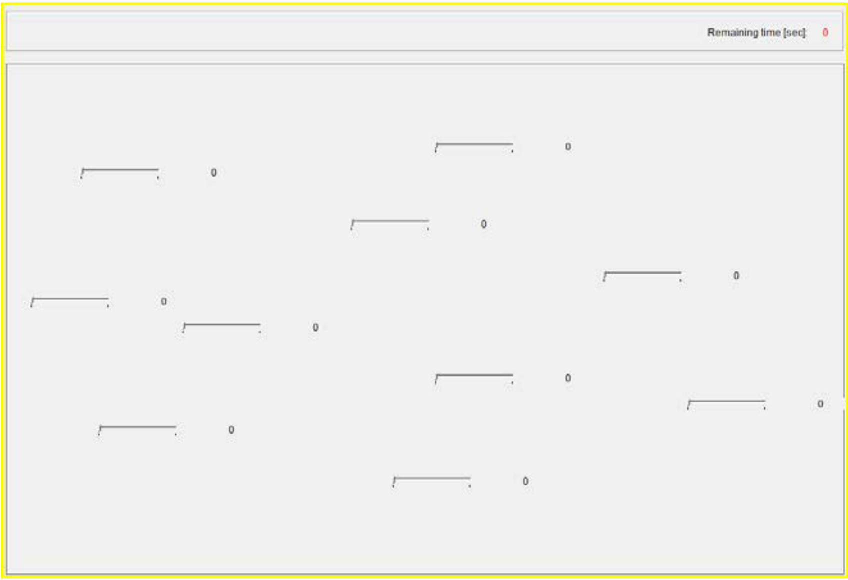
Instructions on paper (common to all treatments – translated from German)

Instructions

Welcome! You are participating in a study in which you will earn some money. For your participation, you will receive a show-up fee of €2 and you have the chance to earn more depending on your decisions. Your total earnings will be paid to you in cash at the end of today's session. Please read the instructions carefully. If you have any questions please raise your hand and an experimenter will come to your desk and answer it in private.

The task

In this study, we will ask you to perform a task. The task will consist of a screen with a number of sliders as shown by the screenshot below.



Each slider is initially positioned at 0 and can be moved as far as 100. Each slider has a number to its right showing its current position. You can use the mouse and the keyboard to move each slider. You can readjust the position of each slider as many times as you wish. **Each screen you encounter will be completed only if you correctly position all the sliders at exactly 50.**

Tip: the fastest way to position a slider at 50 is to click on the slider bar until you get an even number and then move the slider with the keyboard arrows until you reach 50. In Part 1 of the experiment you have the opportunity to practice this in a practice round.

For today's experiment, the higher the number of screens you complete the higher your earnings can be. There will be two types of players in this experiment that we will call **white** and **blue** players. The difference between the players is in the number of sliders per screen: blue players will have to position **8 sliders** to complete each screen, while white players will have to position **4 sliders** to complete each screen. Whether you are a white or a blue player will be determined at the beginning of the experiment.

This experiment consists of several parts. Each part will be introduced by an instruction screen on your monitor. These screens will explain in detail what the respective part of the experiment is about. Please follow the onscreen instructions carefully. If you have any questions please let us know by raising your hand.

Instructions on screen for Parts 1, 2 and 5 (common for all treatments - translated from German)

Part 1 – Instructions

This part is a practice part. You will face a number of sliders in each screen and you can practice by positioning the sliders at 50. When you will have positioned all the sliders at 50 you can progress to a new screen. You have 5 minutes to complete as many screens as you like, after which, you will progress to Part 2. You will not receive any payment for this part, Try to do this task as fast as you can to practice for later parts of the experiment. We suggest to use both keyboard and mouse as described in the instructions on paper as this will considerably increase your speed.

Part 2 – Instructions

In this part, you will be given **5 minutes** to complete as many screens as you like. You will earn **€0.10** for each screen you complete. When you are ready, please click "Continue".

Part 5 – Instructions

This Part concerns the choice between a lottery and a safe payment.

On the following screen, 15 situations will be displayed. The lottery is the same in each situation, but the safe payment varies.

In the lottery you get €4 with 50 percent probability and €0 with 50 percent probability (determined by a random draw of the computer).

The following screen will present the 15 situations. Please decide in each situation whether you opt for the lottery or for the safe payment.

Once you have made a choice in each situation, the computer will randomly draw one situation.

In accordance with your choice in that situation you will either take part in the lottery or you will receive the safe payment.

When you are ready to start Part 5, click "Continue".

Instructions on screen for Parts 3 and 4 (different across treatments - translated from German)

BASE

Part 3 – Instructions

In this part, you have been matched with other three participants to form a group of four. Participants in the group will be identified either as Player A, B, C or D. You are **Player "."**.

As before you will have **5 minutes** to complete as many screens as you like. However, this time you will not be paid for the number of screens you complete, but you will be competing against the other three participants for a prize of **€10**.

Your chances of winning the prize will depend on how many screens you have completed and the total number of screens completed in your group.

If nobody in your group completes any screen, none of you will win the prize.

Otherwise, the probability that you win the prize is equal to the number of screens you have completed divided by the total number of screens completed in your group.

For example, if you complete 15 screens and if the other three participants in your group complete 16, 10 and 9 screens, then the probability that you win the prize will be 15/(15+16+10+9)= 15/50 that is 0.30 or 30% chance of winning.

Like any probability it will lie between 0 and 1 and the sum of the probabilities in your group will be equal to 1.

Hence, the person in the group that completes the highest number of screens has the highest probability of winning the prize, while the one that completes the least number of screens has the lowest probability of winning the prize.

Your earnings for this part will be either €0 (if you do not win the prize), or €10 (if you win the prize).

When you are ready to start Part 3, click "Continue".

Part 4 – Instructions

In this part, you are matched with the same other three participants of Part 3.

At the beginning of this part you will have to choose whether you want to play a TOURNAMENT or be paid according to a PIECE-RATE.

All the other participants in your group also will choose whether to participate in the TOURNAMENT or be paid according to a PIECE-RATE.

If you choose PIECE-RATE, you will gain **€0.10** for each screen you complete like in Part 2. You will be given **5 minutes** of time to complete as many screens as you like.

If you choose TOURNAMENT, you will have **5 minutes** to complete as many screens as you like. **You will be competing for a prize of €10**. This is similar to Part 3 except that this time if you choose TOURNAMENT, you will be competing only against the players who choose TOURNAMENT as well.

Similarly as before, the probability that you will win the prize is equal to the number of screens that you have completed divided by the total number of screens completed by other participants who choose TOURNAMENT.

Hence, the person that completes the highest number of screens has the highest probability of winning the prize, while the one that completes the least number of screens has the lowest probability of winning the prize.

Your earnings for this part will be either €0 (if you do not win the prize), or €10 (if you win the prize).

When you are ready to start Part 4, click "Continue".

AA

Part 3 – Instructions

In this part, you have been matched with other three participants to form a group of four. Participants in the group will be identified either as Player A, B, C or D. You are **Player ".".**

As before you will have **5 minutes** to complete as many screens as you like. However, this time you will not be paid for the number of screens you complete, but you will be competing in a tournament against the other three participants in your group.

In this tournament there are two prizes. All group members are eligible for a first prize of €8.

Your chances of winning the €8 prize will depend on how many screens you have completed and the total number of screens completed in your group.

If nobody in your group completes any screen, none of you will win the prize.

Otherwise, the probability that you win the prize is equal to the number of screens you have completed divided by the total number of screens completed in your group.

For example, if you complete 15 screens and if the other three participants in your group complete 16, 10 and 9 screens, then the probability that you win the prize will be 15/(15+16+10+9)= 15/50 that is 0.30 or 30% chance of winning.

Like any probability it will lie between 0 and 1 and the sum of the probabilities in your group will be equal to 1.

Hence, the person in the group that completes the highest number of screens has the highest probability of winning the prize, while the one that completes the least number of screens has the lowest probability of winning the prize.

[ADVANTAGED The second prize of €2 is reserved to the two the blue players. (You are not a blue player and thus you are not eligible for this prize).**]**

[DISADVANTAGED The second prize of €2 is reserved to the two the blue players. (You are a blue player and thus you are eligible for this prize).

The probability that you win the €2 prize is equal to the number of screens you have completed divided by the number of screens completed by you and the other blue player.**]**

When you are ready to start Part 3, click "Continue".

Part 4 – Instructions

In this part, you are matched with the same other three participants of Part 3.
At the beginning of this part you will have to choose whether you want to play a TOURNAMENT or be paid according to a PIECE-RATE.
All the other participants in your group also will choose whether to participate in the TOURNAMENT or be paid according to a PIECE-RATE.
If you choose PIECE-RATE, you will gain **€0.10** for each screen you complete like in Part 2. You will be given **5 minutes** of time to complete as many screens as you like.
If you choose TOURNAMENT, you will compete only against the players who choose TOURNAMENT. You will have **5 minutes** to complete as many screen as you like.
The number of prizes in the TOURNAMENT depends on who chooses TOURNAMENT.
If at least one of the blue players chooses TOURNAMENT, there will be two prizes. All the group members who choose TOURNAMENT will compete for a €8 prize and there will be an additional €2 prize reserved for the blue players, given that at least one of them chooses TOURNAMENT.
If none of the blue players chooses TOURNAMENT, there will be just one prize of €10.
[ADVANTAGED: You are not a blue player. Hence, if you choose TOURNAMENT, you will compete for a €8 prize if at least one of the blue players chooses TOURNAMENT or for a €10 prize if none of the blue players chooses TOURNAMENT.**]**
[DISADVANTAGED: You are a blue player. Hence, you are eligible for both the €8 and €2 prizes if you choose TOURNAMENT.**]**
When you are ready to start Part 4, click "Continue".

AA-RET

Part 3 – Instructions

In this part, you have been matched with other three participants to form a group of four. Participants in the group will be identified either as Player A, B, C or D. You are **Player ".".**
This part consists of two stages

STAGE 1

As before you will have **5 minutes** to complete as many screens as you like. However, this time you will not be paid for the number of screens you complete, but you will be competing in a tournament against the other three participants in your group.
In this tournament there are two prizes. All group members are eligible for a first prize of €8.

Your chances of winning the €8 prize will depend on how many screens you have completed and the total number of screens completed in your group.

If nobody in your group completes any screen, none of you will win the prize.

Otherwise, the probability that you win the prize is equal to the number of screens you have completed divided by the total number of screens completed in your group.

For example, if you complete 15 screens and if the other three participants in your group complete 16, 10 and 9 screens, then the probability that you win the prize will be 15/(15+16+10+9)= 15/50 that is 0.30 or 30% chance of winning.

Like any probability it will lie between 0 and 1 and the sum of the probabilities in your group will be equal to 1.

Hence, the person in the group that completes the highest number of screens has the highest probability of winning the prize, while the one that completes the least number of screens has the lowest probability of winning the prize.

[ADVANTAGED The second prize of €2 is reserved to the two the blue players. (You are not a blue player and thus you are not eligible for this prize).**]**

[DISADVANTAGED The second prize of €2 is reserved to the two the blue players. (You are a blue player and thus you are eligible for this prize).

The probability that you win the €2 prize is equal to the number of screens you have completed divided by the number of screens completed by you and the other blue player.**]**

STAGE 2

For Stage 2 you will be given an additional endowment of €0.50.

After everyone has made a choice and performance in Stage 1, you will be informed about the TOURNAMENT prizes.

You will be also informed of the probabilities for each player to win the respective prizes.

With the additional €0.50, you will be able to reduce one or both prizes at your own cost. For each 10 cents you spend, you can reduce one prize by 20 cents.

You will have to indicate which prize, if any, you want to reduce and how much of your €0.50 you want to spend.

When you are ready to start Part 3, click "Continue".

Part 4 – Instructions

In this part, you are matched with the same other three participants of Part 3.

This part consists of two stages

STAGE 1

At the beginning of this part you will have to choose whether you want to play a TOURNAMENT or be paid according to a PIECE-RATE.
All the other participants in your group also will choose whether to participate in the TOURNAMENT or be paid according to a PIECE-RATE.
If you choose PIECE-RATE, you will gain **€0.10** for each screen you complete like in Part 2. You will be given **5 minutes** of time to complete as many screens as you like.
If you choose TOURNAMENT, you will compete only against the players who choose TOURNAMENT. You will have **5 minutes** to complete as many screen as you like.
The number of prizes in the TOURNAMENT depends on who chooses TOURNAMENT.
If at least one of the blue players chooses TOURNAMENT, there will be two prizes. All the group members who choose TOURNAMENT will compete for a €8 prize and there will be an additional €2 prize reserved for the blue players, given that at least one of them chooses TOURNAMENT.
If none of the blue players chooses TOURNAMENT, there will be just one prize of €10.
[ADVANTAGED: You are not a blue player. Hence, if you choose TOURNAMENT, you will compete for a €8 prize if at least one of the blue players chooses TOURNAMENT or for a €10 prize if none of the blue players chooses TOURNAMENT.**]**
[DISADVANTAGED: You are a blue player. Hence, you are eligible for both the €8 and €2 prizes if you choose TOURNAMENT.**]**

STAGE 2
For Stage 2 you will be given an additional endowment of €0.50. There are two possible cases.
CASE A: if you have chosen PIECE-RATE in Stage 1, you will simply keep this additional €0.50.
CASE B: if you have chosen TOURNAMENT in Stage 1, you will be able to keep this additional €0.50 or to spend it.
After everyone has made a choice and performance in Stage 1, you will be informed of the number of prizes in the TOURNAMENT. As explained above, there will be either two prizes by €8 and €2 or just one of €10 depending on who chose TOURNAMENT.
You will be also informed of the probabilities for each player to win the respective prizes.
With the additional €0.50, you will be able to reduce one or both prizes at your own cost. For each 10 cents you spend, you can reduce one prize by 20 cents.
You will have to indicate which prize, if any, you want to reduce and how much of your €0.50 you want to spend.
When you are ready to start Part 4, click “Continue”.

BASE-RET

Part 3 – Instructions

In this part, you have been matched with other three participants to form a group of four. Participants in the group will be identified either as Player A, B, C or D. You are **Player “.”**.

This part consists of two stages

STAGE 1

As before you will have **5 minutes** to complete as many screens as you like. However, this time you will not be paid for the number of screens you complete, but you will be competing against the other three participants for a prize of **€10**.

Your chances of winning the prize will depend on how many screens you have completed and the total number of screens completed in your group.

If nobody in your group completes any screen, none of you will win the prize.

Otherwise, the probability that you win the prize is equal to the number of screens you have completed divided by the total number of screens completed in your group.

For example, if you complete 15 screens and if the other three participants in your group complete 16, 10 and 9 screens, then the probability that you win the prize will be 15/(15+16+10+9)= 15/50 that is 0.30 or 30% chance of winning.

Like any probability it will lie between 0 and 1 and the sum of the probabilities in your group will be equal to 1.

Hence, the person in the group that completes the highest number of screens has the highest probability of winning the prize, while the one that completes the least number of screens has the lowest probability of winning the prize.

Your earnings for this part will be either €0 (if you do not win the prize), or €10 (if you win the prize).

When you are ready to start Part 3, click “Continue”.

STAGE 2

For Stage 2 you will be given an additional endowment of €0.50.

After everyone has made a choice and performance in Stage 1, you will be informed about the probabilities for each player to win the prize TOURNAMENT prize.

With the additional €0.50, you will be able to reduce the prize at your own cost. For each 10 cents you spend, you can reduce the prize by 20 cents.

You will have to indicate how much of your €0.50 you want to spend to reduce the prize.

When you are ready to start Part 3, click “Continue”.

Part 4 – Instructions

In this part, you are matched with the same other three participants of Part 3.

This part consists of two stages.

STAGE 1

At the beginning of this part you will have to choose whether you want to play a TOURNAMENT or be paid according to a PIECE-RATE.

All the other participants in your group also will choose whether to participate in the TOURNAMENT or be paid according to a PIECE-RATE.

If you choose PIECE-RATE, you will gain **€0.10** for each screen you complete like in Part 2. You will be given **5 minutes** of time to complete as many screens as you like.

If you choose TOURNAMENT, you will have **5 minutes** to complete as many screens as you like. **You will be competing for a prize of €10**. This is similar to Part 3 except that this time if you choose TOURNAMENT, you will be competing only against the players who choose TOURNAMENT as well. Similarly as before, the probability that you will win the prize is equal to the number of screens that you have completed divided by the total number of screens completed by other participants who choose TOURNAMENT.

Hence, the person that completes the highest number of screens has the highest probability of winning the prize, while the one that completes the least number of screens has the lowest probability of winning the prize.

Your earnings for this part will be either €0 (if you do not win the prize), or €10 (if you win the prize).

When you are ready to start Part 4, click "Continue".

STAGE 2

For Stage 2 you will be given an additional endowment of €0.50. There are two possible cases.

CASE A: if you have chosen PIECE-RATE in Stage 1, you will simply keep this additional €0.50.

CASE B: if you have chosen TOURNAMENT in Stage 1, you will be able to keep this additional €0.50 or to spend it.

After everyone has made a choice and performance in Stage 1, if you have chosen TOURNAMENT you will be informed of the of the probabilities for each player to win the prize in the TOURNAMENT.

With the additional €0.50, you will be able to reduce the prize at your own cost. For each 10 cents you spend, you can reduce the prize by 20 cents.

You will have to indicate how much of your €0.50 you want to spend to reduce the prize.

When you are ready to start Part 4, click "Continue".