Do Affirmative Action Policies Help Reducing Gender Discrimination and Enhance Efficiency? A New Experimental Evidence

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Abstract

Our paper investigates experimentally the impact of quota policies on gender discrimination in hiring decisions. Precisely we test whether such policies help increasing women employment rate. We also measure the perverse effect of affirmative actions in term of reverse discrimination against men and losses of economic efficiency. Our experiment consists of three treatments. In the baseline treatment, employers make their hiring decisions based on information regarding the candidates' characteristics including gender, years of study and fields of study. The two remaining treatment are similar to the baseline except that a quota system is introduced such that at least half of employees must be women. In case of non-respect of the law that guarantee that at least half of the employees hired to be females, the firm has to pay a penalty. We vary the level of the penalty by running two variant of this treatment: a low and a high penalty level. Our findings indicate that affirmative action programs succeed in increasing the women employment rate. Discrimination against women is completely removed when quota are implemented. We also observe the existence of reverse discrimination. However we find no evidence of a negative impact of affirmative action programs on firms' efficiency.

Keywords: real effort experiment; performance; affirmative-action; gender differences; money burning

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1. Introduction

While gender differences in educational attainment no longer exist in most of developed countries, there still exists a persistent gap in wages between males and females. Empirical studies show that this gender gap remains significant after controlling for occupation[1], part-time work or work experience, which may be partly explained by discrimination (Blau, 1998; Altonji and Blank, 1999; Goldin and Rouse, 2000).[2] However gender differences in the labor market do not only concern wages but also hiring decisions. Indeed audit experiments have also provided clear evidence of hiring discrimination against women (e.g., Bendick, *et al.*, 1994; Fix and Struyk, 1993; Kenney and Wissoker, 1994; Neumark, 1996; Goldin and Rouse, 2000).[3] These studies have shown that the magnitudes of the gender difference in the probabilities of receiving job offers generally range from 5-20 percentage points.

For decades, Governments in many countries have spent considerable resources to implement anti-discrimination programs such as the affirmative action programs that aim at increasing the representation of women in firms, politics or education.[4] A strong variant of affirmative action programs may require that a firm hires one female for every two employees. In practice, many European parliaments have quotas on parliamentary seats that are reserved for women. Preferential treatments have also been observed for the selection of Ph.D. students in

[1]Differences in occupations may reflect both horizontal and vertical segregation. Horizontal segregation refers to the fact that women are more likely to hold lower-paying jobs like teaching, clerical, social work or nurturing jobs, which may partly explain the wage gender gap. These differences in occupation may be potentially due to gender differences in the choice of college major. Indeed, several studies have shown that females are more likely to major in health, social sciences or humanities whereas males are more likely to major in business, sciences or engineering (see e.g.Turner and Bowen, 1999; Zafar, 2009; Beffy *et al.*, 2012). Vertical segregation reflects the fact that relatively few women hold top positions (Bertrand and Hallock, 2001).

[2] A common approach to isolate the role of discrimination from other factors consists in distinguishing between explained and unexplained components. This methodology is called the "Oaxaca–Blinder" decomposition method. For instance, in France Meurs and Ponthieux (2006) report that after controlling for occupation, part-time work and work experience the initial gender gap of 25% reduces to 6.9%. According to the authors this residual gap may be attributed do discrimination. More recently, developments in experimental economics have also explored the role played by another (unobservable) factor, namely the gender differences in attitudes toward competition (Gneezy *et al.*, 2003; 2009; Gneezy and Rustichini, 2004; Vandegrift and Brown, 2005; Bartling, *et al*, 2009; Niederle and Vesterlund, 2007; 2010; Croson and Gneezy, 2009; Datta Gupta *et al.*, 2013). As a consequence of gender differences in competitive behavior, women may get fewer promotion opportunities and subsequently receive lower wages than men.

[3] Audit experiment consist in sending matched CVs that vary in only one variable (for example the gender) to employers in response to job advertisements.

[4] Historically, the United-States were the pioneer country in implementing affirmative action programs. The idea of using affirmative action to reestablish equal opportunities emerged in 1961 with the *Kennedy Executive Order 10925*.

United-States in favor of women (Attiyeh and Attiyeh, 1997).[5] The effects of affirmative action have been heavily studied by economists (Ashenfelter and Heckman, 1976; Goldstein and Smith, 1976; Heckman and Wolpin, 1976; Leonard, l984; Rodgers and Spriggs, 1996; Holzer and Neumark 1999). Most of these studies conclude that affirmative action programs are successful in increasing the employment of minorities and women. However research provides much less consensus on the question of whether affirmative action programs improve or impede overall efficiency (Holzer and Neumark, 1999). The main reason is that affirmative action programs may have important potential drawbacks. For instance, it is often argue that affirmative action may be discriminatory by nature: if women may gain through affirmative action programs reverse discrimination against males may also occur. For instance Holzer and Neumark (1999) found that if affirmative action increased employment of white females and black males, the employment of white males in the firms that practice affirmative action was lower by roughly 10-15%. It may also be argued that affirmative action programs may be inefficient in assigning the best available candidates to a particular job and may raise labor costs of the firms (Fryer and Loury, 2005; Griffin, 1992). For instance, Griffin (1992) found that the constraints imposed on the labor demand choices of contractors raised their labor costs by roughly 6.5% relative to those of non-contractors.

In this current paper we attempt to contribute to the existing literature by experimentally investigating the effectiveness of affirmative action programs. Using controlled laboratory experiments allows circumventing some difficulties attributed to other empirical methodologies. For instance results from survey may be plagued by some statistical questions, including difficulties to identify firms that practice affirmative action. Furthermore it may be difficult using survey data to get precise measures of individual performance. In contrast to survey studies, our analysis relies on real effort level instead of subjective reported performance. Our experiment consists of three treatments. In the baseline treatment, employers make their hiring decisions based on information regarding the candidates' characteristics including gender, years of study and fields of study. The two remaining treatment are similar to the baseline except that a quota system is introduced such that at least half of employees must be women. In case of non-respect of the law that guarantee that at

[5] More broadly, Affirmative Action programs have been implemented to increase the representation of all minorities. For instance, in several States in the US, quotas have been imposed for the recruitment of black people in municipal police departments (McCrary, 2007; see also Holzer and Neumark, 2000, for a survey.).

least half of the employees hired to be females, the firm has to pay a penalty. We vary the level of the penalty by running two variant of this treatment: a low and a high penalty level.

Our aim in this study is twofold. First we investigate whether introducing quota helps increasing the share of women in total employment. This is done by comparing employment of women in our baseline treatment with similar measures in the treatments with quota. We also check whether the effectiveness of affirmative action is influenced by the size of the penalty in case of non-respect of the law. The second aim of this study is to investigate the potential drawbacks of affirmative action by testing whether implementing quota induce reverse discrimination against males and to what extent this may impact negatively the firms' performance.

Our paper is closely related to Niederle *et al.* (2013). The authors experimentally investigate whether introduction of quota affects women' decision to enter a tournament. Specifically, the authors consider a quota system which requires that out of two winners of a tournament at least one be a woman. They find that gender quotas indeed encourage women to enter competitions more often, and that gender gap in willingness to perform in a competition diminishes. Our paper is also closely related to Balafoutas, and Sutter (2012) who measure the effect of affirmative action programs for women in the labour market, and analyze changes in performance induced by these policies. Compared with no intervention, the authors observe that affirmative action programs encourage women to enter competitions more often, and performance is at least equally good, both during and after the competition.

Our paper differs from these studies in many respects. Contrary to Niederle *et al.* (2013) and Balafoutas and Sutter (2012), we investigate the effects of affirmative action in a context of hiring decisions and focus our attention on the impact of affirmative action on the employer's hiring decision. Furthermore we also investigate the potential perverse effects of affirmative action programs.

To anticipate our findings, we observe a significant gender gap in the baseline treatment where no intervention is possible. On average female workers are ranked worse than other participants. The introduction of quota systems reduces discrimination significantly. Our findings also indicate that the firms' performance is not negatively affected by affirmative action programs.

The rest of our paper is organized as follows. Section 2 describes our experimental design and procedures. Section 3 discusses the behavioral hypotheses that we propose for evaluation. Section 4 reports the results from the different treatments of our design. Section 5 discusses our main findings and their interpretations and concludes the paper.

2. The Experiment

The experiment consists of three treatments that are described in detail below. The differences across treatments are whether i) a quota system is implemented and if so ii) how large is the penalty in case of non-respect of the quota.

2.1. The treatments.

Our experiment consists of a between-matching design. At the beginning of the experiment groups are formed of 8 participants composed of two employers and six potential job candidates.

2.1.1. The baseline treatment (no intervention treatment)

The baseline treatment (henceforth BT) consists of two stages. In a first stage (called *hiring* stage), each employer has to hire two employees among a list of six employees. The information available to the employer during this hiring stage consists of some workers' demographics including the level of education, field of study and gender. Employers have no information regarding the workers' potential ability and therefore employers can only form beliefs about each worker's performance based on these observed individual characteristics. After observing the individual characteristics of other participants the employer is asked to rank them from her most preferred to her least preferred (See figure A1 in Appendix). To do this, each *employer* had to rank each *employee*, from 1 to 6 ("1" is the preferred employee, "6" the less preferred). Once all employers have submitted their rankings, firms composed of an employer and two employees are formed using a two-step mechanism similar to the one suggested by Bogomolnaia and Jackson, (2002). This mechanism is incentive compatible (Bogomolnaia and Jackson, 2002; Castillo and Petrie, 2010; Masclet *et al*., 2014). In step one, the first employer (called A1) is randomly chosen by the computer and is matched with her two preferred employees based on her ranking. Then, a first firm is formed with this employer and her two best ranked workers (called worker B1 and B2). In a second step, the second employer is matched with her two preferred employees (called B3 and B4) among the remaining four participants who have not yet been assigned to a first in step one. At the end of

this step, two firms are composed. The two participants who have not been assigned to a firm are assigned the role of unemployed workers (unemployed worker C1 and unemployed worker C2 respectively). The two *unemployed workers* in each group do not take part to Stage 2 of the game and receive a fix payment of 40 ECU (Experimental Currency Units) corresponding to unemployment insurance.

In a second stage (called *tournament* stage), workers within each firm have to perform a decoding task under a tournament scheme. Precisely participants are asked to decode sets of numbers into letters from a grid of letters that is displayed on their computer screen during three minutes (see figure A2 in Appendix A). The decoding task adopted in our study is the same as that in Charness *et al.* (2013).[6] Once the three minutes have elapsed, each worker's performance is compared with the performance of a worker from the other firm. The winner of the tournament receive 300 ECU while each looser earned 100 ECU[7]. Each employer's payoff function correspond to the sum of the performance of the two employees of the firm. For instance if the two employees won the tournament the employer's earnings are (300+300) = 600 ECU.

2.1.2. The treatments with quota

The quota treatments are identical to the baseline treatment except that a quota is introduced. Specifically, in these treatments, *employers* are told that they have to hire at least one woman. If they do not fulfill this constraint, they have to bear a penalty which varies across our quota treatments. The penalty is set at 10 ECU in Low Penalty Treatment (henceforth LPT) and at 110 ECU in in the High Penalty Treatment (henceforth HPT). The comparison between our baseline and the other treatments allows us to test whether affirmative action leads to less discrimination. See Table 1 for a summary of treatments implemented in our experiment.

[Table 1: about here]

[6] We have chosen a fastidious and boring task to induce sufficient disutility to the participants. However we have deliberately selected a simple task such that level of education or academic field should not influence performance during the task.

[7] After Stage 2, a money-burning stage (Stage 3) was played only by unemployed workers. The unemployed workers had the opportunity to reduce the remuneration of all other members of their group, by assigning points to each (from 1 to 10). Money-burning was costly: each assigned point had a cost of 1 ECU and decreased remuneration of targeted participant by 5 ECU. Instructions of Stage 3 were distributed after Stage 2. Participants did not have any information about this stage until the end of Stage 2. However, results of money-burning stage are not reported in this paper.

2.2. Procedures and parameters

2.2.1. Information and parameters

The experiment consists of 7 sessions conducted at the CREM-CNRS (LABEX-EM) institute of the University of Rennes 1, France. Summary information about the 7 sessions is shown in Table 2.

[Table 2: About Here]

A total of 152 undergraduate students in business, economics, law and engineering have been recruited via the ORSEE software (Greiner, 2004). Regarding gender 43 percent of participants are females. Average age is 19 years (S.D. 1.4 years). Participants earned on average 15.9€, including a show-up fee of 3€. During the experiment, all payments were expressed in experimental currency units (ECU), and are converted to Euros at a predetermined conversion rate of 65 ECU = 1 Euro. Some of the participants may have participated in experiments before, but none have experience in any experiment similar to ours. No individual participated in more than one session of this study. On average, sessions lasted about 90 minutes including instructions and payment of participants. The experiment has been computerized using the Z-tree software package (Fischbacher, 2007).

Preliminary phase

Before playing the experiment, subjects were asked to participate in a preliminary phase. This preliminary phase consists of two parts. In the first part of the preliminary phase, participants had to play three successive games to collect measures of their individual and social preferences. We elicited a measure of risk aversion based on Holt and Laury's (2002) lottery choice experiment. Our risk aversion indicator corresponds to the normalized number of "safe choices". Our inequality aversion measures are based on the procedure provided in Blanco *et al.* (2011). Precisely measures of disadvantageous inequality aversion correspond to the respondent's decision in an ultimatum game. The advantageous inequality aversion indicator is based on a modified dictator game. More detailed information on these games and the computational methods used is available in Appendix A. All these preliminary measures are incentivized[8]. To avoid any wealth effect, participants are however not informed of the issue of these games until the end of the experiment.

[8] More specifically, in each preliminary game, one row of the payoff matrix is randomly selected to determine the payoffs for the selected option.

During a second part of this preliminary phase, participants were asked to perform decoding tasks under different remuneration scheme. These tasks allow us to elicit some measures of individual's ability and degree of competitiveness. In a first game (tournament) (henceforth Game1-PP), participants were asked to decode sets of numbers into letters from a grid of letters during three minutes under a tournament scheme. The winner of the tournament earns 300 ECU and the looser earns 100 ECU. The second game (henceforth Game2-PP) consisted of two stages. In stage one, participants are asked to choose their preferred remuneration scheme (i.e. either a piece rate or a tournament). In stage two, participants perform the decoding task under the chosen scheme.[9]. The winner earns 300 ECU and the looser of the tournament receives 100 ECU. Concerning the piece-rate, a subject who has chosen this type of remuneration earned 5 ECU per task, independently of the performance of others.
To avoid any wealth effect, participants were not informed about the issue of each game before the end of the experiment. Instructions for each game were distributed at the end of each game and read aloud to participants.

3. Behavioral hypotheses

To illustrate what we expect to happen in our experiment, we present in this section our behavioral hypotheses.

Let's present first our conjectures regarding gender differences in competitiveness and performance. Concerning the degree of competitiveness, several studies have shown that women shy away from competition while men are more eager to choose the tournament scheme. Previous studies have found that males are more likely to choose a tournament than a piece-rate scheme (Gneezy *et al.*, 2003; Gneezy and Rustichini, 2004; Vandegrift and Brown, 2005; Niederle and Vesterlund, 2007; Datta Gupta *et al.*, 2013). Based on these findings, we conjecture that men may be more likely than women to choose the tournament scheme.

Regarding performance under a tournament scheme, previous evidence on the existence of a gender gap in performance in a competitive environment is not clear-cut. Some studies have found a significant gap in performance within competitive environments (e.g. Gneezy *et al.*,

[9] If a subject chooses the tournament, his performance in Stage 2 is compared to performance in Game1-PP of another participant The main advantage of doing this is that the decision to select tournament rather than piece-rate only rests on beliefs of one's relative performance, and not on beliefs about decision of others participants.

2003; Gneezy and Rustichini, 2004; Shurchkov, 2012), while others have not observed any differences (Niederle and Vesterlund, 2007; Günther *et al.*, 2009)[10]. Some authors explain this discrepancy by the fact that males may be more motivated to perform better when the tasks are "stereotypical-male tasks", like those requiring spatial or math skills (Günther *et al.*, 2009). It would therefore seem that the nature of the task may indeed matter. In this current study we replicate previous studies using a different task, i.e. a decoding task. Based on this existing literature, we conjecture that if a gender gap in performance under a tournament exists, it should be relatively weak. Our conjecture regarding gender differences in remuneration choice and performance is summarized in H1.

H1. a) Women are more likely to choose the piece rate scheme than men. b) Men exert weakly more effort compared to women under the tournament scheme.

Our second conjecture concerns how males and females will differ in their rankings. If employers have no stereotypes on particular groups, they should consider demographics as irrelevant information and should consequently assign ranks randomly. However previous studies have shown that in absence of relevant information about performance, the employers may rely on (erroneous) stereotypes that some workers belonging to some specific groups (females) are less performing on average than others (Phelps, 1972; Arrow, 1973). For instance employers may consider that females are less competitive than males. Several experimental studies have provided support in favor of statistical discrimination in different contexts including trust games (Fershtman and Gneezy, 2001; Falk and Zehnder, 2007; Burns 2012)[11], public good games (Castillo and Petrie, 2010)[12], battle of the sexes games (Holm,

[10] Niederle and Vesterlund (2007) find no gender differences in performance under a tournament scheme. Günther *et al.* (2009) obtain results similar to those by Gneezy *et al.* (2003) for a "male" task but observe no gender differences for a neutral task.

[11] Using an experimental approach to study ethnic discrimination in Israeli Jewish society, Fershtman and Gneezy (2001) found that both Ashkenazic and Eastern males invest less money if their opponent is an Ashkenazic male, which suggests that discrimination is not due to in-group favoritism but due to statistical discrimination ((mistaken) ethnic stereotypes). Burns (2011) found a systematic pattern of distrust towards black partners, even by black proposers, largely attributable to mistaken behavioral stereotypes, and also inconsistent with out-group bias. Falk and Zehnder (2007) performed a citywide trust experiment to explore how ethnic diversity in a city district impacts trustworthiness between inhabitants. They found evidence of statistical discrimination against minorities in addition to some in-group favoritism.

[12] Using a public good game experiment, Castillo and Petrie (2010) observed that racial discrimination tends to disappear when information on performance is provided, which is consistent with statistical discrimination.

2000) or real-effort games (Anderson and Haupert, 1999; Rödin and Özcan, 2011).[13] Based on these previous findings on statistical discrimination, we may conjecture that employers may attribute a better rank to males. Our conjecture is summarized below in H2:

H2: Employers should assign better ranks to males if they have (erroneous) stereotypes that females are less performing or less competitive on average than males.

Our third hypothesis concerns the impact of quota systems on the relative share of employment of males and females. Previous studies have shown that affirmative action programs are successful in increasing the employment of women (Leonard, l984; Rodgers and Spriggs, 1996; Holzer and Neumark 1999).[14] However studies have also shown that affirmative action programs may lead to reverse discrimination against males (Holzer and Neumark, 1999). Holzer and Neumark, (1999) found that the employment of white males in the affirmative action firms was lower by roughly 10- 15%, which was redistributed mostly to white females and black males. Based on these findings we conjecture that affirmative action will increase the employment of women but will also induce reverse discrimination against males. This is stated in hypothesis H3.

H3: a) *Introducing quotas increases the employment of women. b) Quota systems induce reverse discrimination against males.*

Our fourth hypothesis concerns the effect of quota systems on the firm's performance. Regarding the effects of affirmative action programs on firms' performance, there has been a great deal of debate about the economic impact of affirmative action programs in the economy. On the one hand, affirmative action programs may be profitable for the firms by

[13] Other studies have attempted to test experimentally different aspects of statistical discrimination such as the effects of the relative sizes of "majority" and "minority" populations (Davis, 1987) or second-moment statistical discrimination (Dickinson and Oaxaca, 2009).

[14] Most of these studies use federal EEO-l data on contractors and noncontractors involving some comparison of the shares of employment between establishments that practice affirmative action and those that do not. A notable exception is Holzer and Neumark (1999) that uses micro-level employer data from other sources. For instance Leonard (1984) compared changes in employment shares of different demographic groups over the period 1974 to 1980 between contractor and non-contractor establishments. The author found that the shares of employment for women and minorities rose at contractor establishments, while those accounted for by white males declined. However the author found that these effects were only moderate in size. Comparing EEO-l data between 1979 and 1992, Rodgers and Spriggs (1996) report that differences in females employment between contractor and non-contractor establishments were smaller in magnitude in the latter year. Holzer and Neumark (1999) find that the employment of white males in the affirmative action firms is lower by roughly 10- 15%, which is redistributed mostly to white females and black males.

increasing their performance because discrimination is costly for the firms (Becker, 1957). Indeed in Becker model, discrimination is not profitable for firms due to the fact that discriminatory firms go with their "feelings" and thus ignore the underlying economic fundamentals. Consequently, affirmative programs that force the discriminatory firm to hire more females should be economically profitable by leading the firm to a more efficient allocation of resources.

On the other hand, it is often argued that affirmative action programs are inefficient in assigning the best available candidates to a particular job when several candidates compete for it (Fryer and Loury, 2005). The reason is that affirmative action programs are also discriminatory by nature and such preferential treatment may for instance imply discrimination against better-performing men. For instance, if on average it is not erroneous that men are more competitive and perform better under a tournament, then one may reasonably conjecture that introducing a quota may be detrimental to the firm's performance.

Previous empirical studies on the effects of affirmative actions on firms' performance have yielded ambiguous evidence. Using estimation of the production function of firms with data from the Census of Manufacturers and the Annual Survey of Manufacturers in the l970s, Leonard (1984, 1989) found no negative effects on productivity of the presence of affirmative action. In contrast, Griffin (1992) found that the constraints imposed on the labor demand choices of contractors raised their labor costs by roughly 6.5% relative to those of non-contractors. More recently Holzer and Neumark (1999) used performance ratings of white male and minority/female employees in establishments that do and do not practice affirmative action. The authors found little evidence of lower performance ratings of women/minorities in establishments using affirmative action.

As is clear from the above discussion, the previous studies on the effect of affirmative action programs on performance are mixed. One potential reason is that it may be difficult to get a precise measure of performance using survey data. Using laboratory experiments should allow circumventing this difficulty. Our conjecture is summarized in H4:

H4. Affirmative action programs will reduce firms' performance if they imply too much reverse discrimination against better-performing men.

4. Results

In section 4.1, we check whether there exist any gender differences in our experiment in term of performance and competitiveness. In section 4.2 we investigate ranking decisions in the BT, and we then focus on the effect of quota on rankings in section 4.3. Finally section 4.4 investigates the impact of quota program on firms' performance.

4.1. Gender gap in remuneration choice and performance

Let's consider first the effort level put forth in the tournament compensation scheme during the preliminary phase. Figures 1 and 2 show the distribution of effort for males and females in the exogenous and endogenous tournament games (Game 1 and 2 of the preliminary phase), respectively. Our data indicate that men performed on average 42.24 decoding tasks (S.D: 6.41) while women performed on average 40.41 decoding tasks (S.D: 6.71) in the exogenous tournament game. This gender difference is borderline significant (Mann-Whitney pairwise statistical test, z = -1.691; p = 0.0908). On average, women who chose the tournament performed 42.61 decoding task (S.D 7.05), and men 45.19 decoding task (S.D 6.53). The gender gap in performance in Game2-PP for participants who chose the tournament is statistically significant at 10% level (Mann Whitney pairwise statistical test, z = -1.911; p = 0.056).

[Figures 1 and 2: about here]

To provide a more formal proof of this finding we ran random effect GLS models on the determinants of performance. These findings are shown in the left part of Table 3 that displays the results of several estimates of the determinants of effort under the tournament scheme (both endogenous and exogenous tournament games). Estimates indicate that there is a borderline significant difference in performance under the tournament between men and women. We also observe that participants performed better in the exogenous tournament (Game1-PP) than in the endogenous tournament (Game2-PP).

The right panel reports estimates on the probability of choosing the tournament scheme during the choice game (Game2-PP). Regarding gender differences in competitiveness, 60% of women chose the tournament against 70.11% for men. This difference is not statistically significant (Mann-Whitney pairwise statistical test, z = -1.296; p = 0.1949). However our

estimates show different findings. Column (4) of Table 3 indicates that men are significantly more likely to choose tournament than women. Note however that this gender effect disappears when one's controls for overconfidence, suggesting the gender differences in competitiveness are mainly driven by differences in overconfidence (see column (5).[15] Our estimates also indicate that over-confident participants are more likely to choose the tournament scheme. These findings are consistent with the existing literature that indicates that men are more likely to choose a tournament scheme than women, in an environment where participants can choose his remuneration scheme and that such gender effect seems to be mainly due to differences in overconfidence (Gneezy *et al*. 2003).

[Table 3: about here]

Result 1. *a) There is a (borderline) significant difference in performance under the tournament between men and women. b) Males are more competitive than females due to overconfidence.*

4.2. Discrimination and average ranking in the *baseline* treatment

Let's now investigate whether there are gender gap in hiring decisions approximated in our experiment by ranking decisions. Recall that, each *employer* in each group had to rank the six employees of their group, from 1 (the preferred) to 6 (the less preferred). In the BT, females are ranked on average 1.41 higher than males. A Mann Whitney test shows that this difference is statistically significant (z=3.448; p=0.0006). Only 12,5% of employees selected (i.e. ranked '1' or '2') by employers in the BT are women. These findings are summarized in result 2.

Result 2. *In the baseline treatment, females are ranked worse than males.*

Support for result 2. Table 4 reports the results of estimates of the determinants of the employer's ranking decision. The dependent variable mean rank corresponds to the mean rank

[15] To measure overconfidence, we asked participants if they think they will win the tournament in Game1-PP. To ensure that participants revealed their real beliefs, participants received 65 ECU if the prediction they expressed was proven correct. 28.3% of our participants are categorized as over-confident (34.5% of men and 20% of women), and only 9.2% as under-confident (5.7% of men and 13.8% of women). This difference is statistically significant (Mann-Whitney pairwise statistical test, z = -1.955; p = 0.0506).

each employee *i* is assigned from the employers. The independent variables include employee *i*'s demographics (gender, years of education, field of study). To take into account that proportion of both gender was not necessarily constant in groups, we also ran estimates of the determinants of the employee's ranking level, using a variable (standardized male) that takes into account these proportions[16]. These estimates are reported in the fourth last columns in Table 4. Columns (1) and (5) of Table 4 confirm our previous findings showing that (fe)male are assigned a lower (higher) rank.

[Table 4: about here]

4.3. The Effect of Affirmative Action Policies on Discrimination

We now turn to examine the effect of affirmative action programs on discrimination. Figure 3 shows the proportion of women selected by employers (i.e. ranked '1' or '2'), in each treatment.

[Figure 3: about here]

We observe an important increase in the employment rate of women in the treatment with quota (from 12,5% in the BT to 45.8% in the LTP, and to 60.7% in the HPT). The difference between the BT and the LPT is statistically significant (Mann Whitney pairwise statistical test, $z = -7.239$; $p = 0.000$), as well as between the BT and the LPT ($z = -11.155$; $p = 0.000$); and between the LPT and the HPT ($z = -3.733$; $p = 0.000$). Estimates shown in Table 4 report similar findings. Precisely columns (2) and (3) as well as columns (6) and (7) of Table 4 indicate that the gender variable is no more significant when a quota system is implemented. Interestingly it seems that in the quota treatment, the gender is no more used by employers and that such information is replaced by another one, namely the level of education. Indeed the variable "level of education" is now significant in the quota treatments while it was not in the baseline treatment. This result may be interpreted in the light of the signaling theory according to which employers may interpret the signal of a higher education level as correlated with a greater ability even if education does not necessarily increase the individual

[16] Specifically the "standardized male" variable was constructed as follow: "Male × proportion of females". This variable put higher weigh on males belonging to a population with a majority of females.

productivity (Spence, 1973). In other words, even if education here does not contribute to the worker's productivity in the decoding task, it could still have value to the employer as it may reveal some intrinsic ability.

Our estimates on pooled treatments confirm the existence of two opposite effects of quota systems: they increase the employment of females compared to females in the baseline while at the same time they decrease the employment of male compared to females in the baseline. This latter finding indicates that quota programs induce reverse discrimination against men. These findings are stated in result 3.

Result 3. *a) The employment of women is increased when a quota system is introduced. b) Quota systems induce reverse discrimination against men.*

4.4 Do Quota Policies Affect Firm performance?

Since our findings showed the existence of weak but significant differences in performance and competitiveness between males and females, one may reasonably conjecture that implementing a quota system that reduces the share of men in the total employment should negatively impact firms' performance. To check this, we compared overall firm's performance across our three treatments. We approximated firm's performance by measuring the sum of the effort level of the two employees of the firm during the tournament in Stage 2 of the game. Our finding indicate that the average performance in the BT is 92.6 decoding task (S.D: 7.50). This performance amounts to 89.42 tasks in the LPT (S.D: 11.89), and 88.5 tasks in the HPT (S.D: 18.43). If the average effort seems to be lower when a quota is implemented these differences are however not statistically significant (BT vs LPT: z = 0.0000; p = 1.0000; BT vs HPT: z= -0.464; p = 0.6430; LPT vs HPT: z = -0.052; p = 0.9589).[17] Table 5 provides more formal evidence of these findings. It shows the results from estimates on the overall performance of firms (the unit of observation is the firm). The independent variables include dummies for treatment as well as a variable that takes into

[17] We checked that these (absences of) differences across treatments did not reflect individual heterogeneity by comparing effort level in the tournament scheme during the preliminary phase. The insignificant coefficients associated to the treatment variables in Table 3 confirm that there was no significant individual differences across treatments.

account the share of women in the firm. These estimates confirm our previous findings that the introduction of affirmative action programs do not affect significantly firms' efficiency. These findings are stated in result 4.

Result 4. *Quotas policies do not negatively impact firms' performance.*

5. Conclusion and discussion

In this paper, we investigated experimentally the impact of affirmative action on discrimination, and on firms' efficiency. This is done by comparing a benchmark situation where an employer has to hire two employees based on their characteristics (gender, years of study, field of study) with treatments where quota systems are introduced such that one of the two employees hired must be female. Our findings are fourfold.

First, regarding performances of men and women, our first hypothesis H1 is confirmed, since we observe a significant gender gap in average performance under the tournament remuneration scheme. Besides, males are more competitive than females and this gender difference is mainly driven by differences in overconfidence.

Second, we observe a significant gender gap in rankings in the baseline treatment where no intervention is possible. On average female workers are ranked worse than other participants.

Third, the introduction of quota systems reduces discrimination against women significantly: the employment of females increases. However, our findings also indicate that reverse discrimination against men occurs when quota programs are implemented.

Fourth, our findings indicate that firms' efficiency is not affected by quota programs.

To sum up, our findings show that introduction of quota programs in favor of women reaches his main goal, since the share of women employment is enhanced compared to situation where no intervention is implemented without negatively impacting overall performance.

A natural extension of this work may consist in investigating whether such affirmative action programs still remain efficient in absence of penalties or when penalty are non-monetary, i.e. symbolic penalties.

One limitation of this study is that it does not take into account the possible complementarities between men and women. Indeed another benefit of affirmative actions that has not been considered in this current study is that such programs may be profitable for the firm because they increase diversity which constitutes an important factor of success for the firm (Weber and Zulehner, 2010). Weber and Zulehner, 2010 have shed light on the importance of having a gender diversity in a firm. Using the Austrian Social Security Database the authors show that having women among the first hired employees in a firm influence the development of Human Resources and could also affect the firm survival. Introducing complementarity in production may constitute an interesting extension of this work.

Another limitation of our study is that we do not consider an important issue, namely the fact that affirmative action programs could reduce incentives for effort in the targeted group. The reason is that such programs could make effort less important for achieving successful outcomes (Fryer and Loury, 2005). This may also constitute an interesting extension.

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Figures

Figure 1: Distribution of effort by gender in the exogenous tournament (Game1-PP)

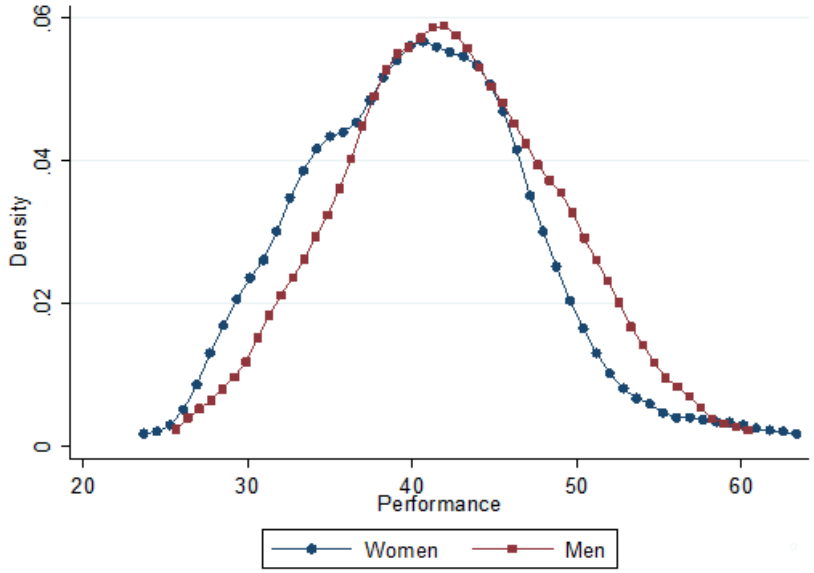


Figure 2: Distribution of effort by gender in the endogeneous tournament (Game2-PP)

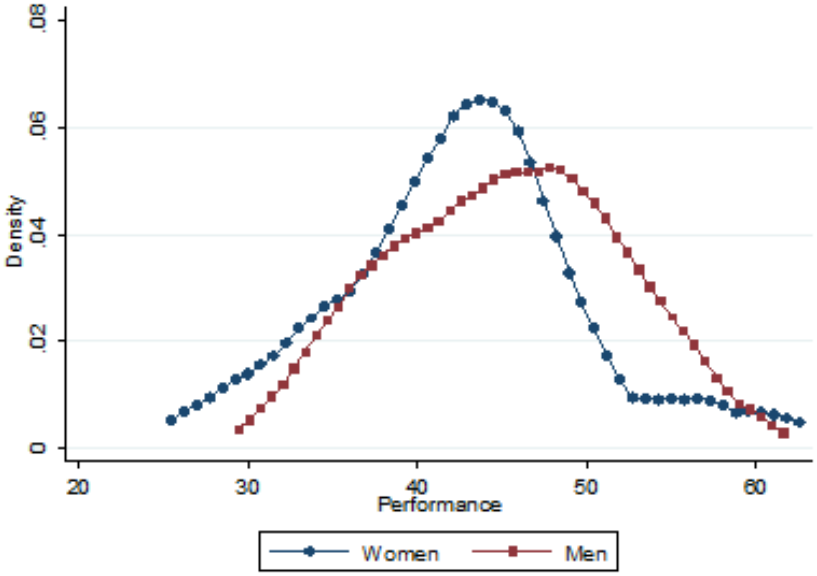
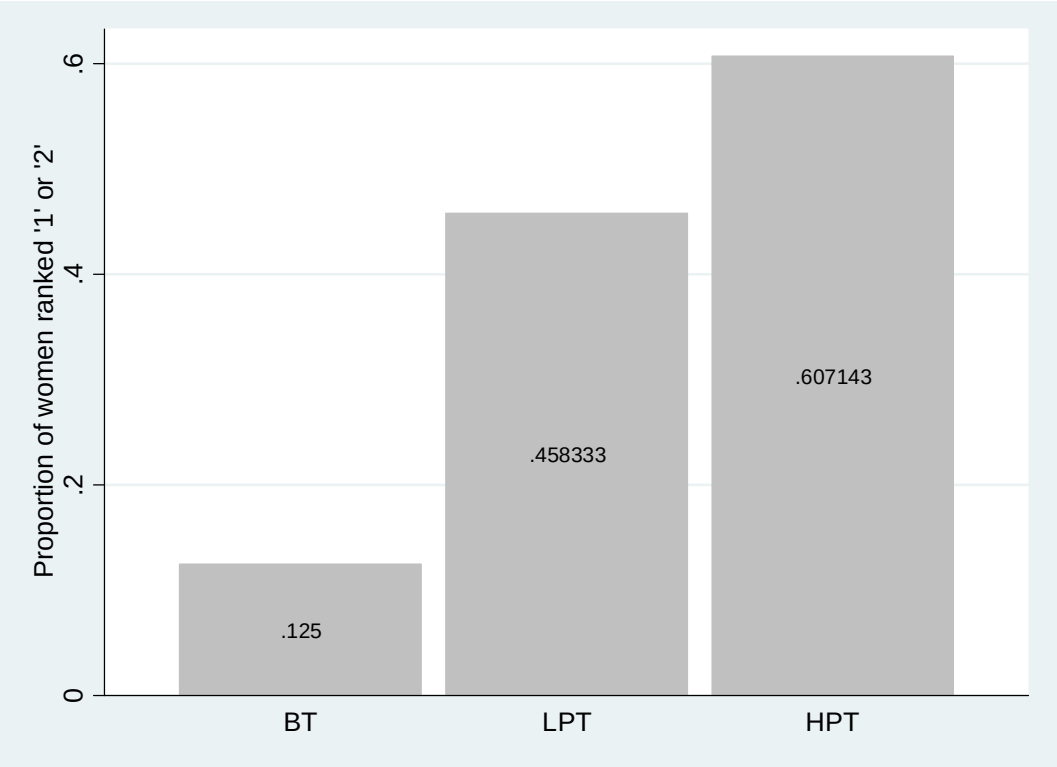


Figure 3: Proportion of women ranked ‘1’ or ‘2’, by treatment



Tables

Table 1: The experimental design. Each subject played only one treatment.

Treatments	**Description**
BT	No Quota
LPT	Low-Penalty Quota : A penalty of 10 ECU is paid by the employer who does not hire at least one woman
HPT	High-Penalty Quota A penalty of 110 ECU is paid by the employer who do not hire at least one woman

Table 2: Summary of the experimental sessions.

Session Number	Number of participants	Treatments
1	8	HPT
2	24	BT
3	24	HPT
4	24	BT
5	24	HPT
6	24	LPT
7	24	LPT
Total	152	

Table 3: Determinants of performance and likelihood of selecting tournament.

Dep. Var.	GLS-RE Performance			PROBIT Prob. of choosing the tournament		
	(1)	(2)	(3)	(4)	(5)	(6)
Endogenous tournament	3.210***	3.253***	3.254***			
	(0.000)	(0.000)	(0.000)			
Male	1.429	2.091	2.236*	0.319*	0.218	0.220
	(0.366)	(0.126)	(0.091)	(0.059)	(0.173)	(0.170)
Over confidence		-3.513***	-3.591***		0.651**	0.652**
		(0.000)	(0.000)		(0.034)	(0.037)
LPT			-0.423			0.152
			(0.596)			(0.186)
HPT			1.018			0.0828
			(0.492)			(0.706)
Demographics	Yes	Yes	Yes	Yes	Yes	Yes
Measure of risk[1]	Yes	Yes	Yes	Yes	Yes	Yes
Measure of inequality aversion[1]	Yes	Yes	Yes	Yes	Yes	Yes
Constant	58.16***	57.07***	56.00***	3.123	3.513*	3.432*
	(0.000)	(0.000)	(0.000)	(0.154)	(0.077)	(0.056)
Observations	252	252	252	152	152	152
Number of identifiant	152	152	152			
R squared	0.137	0.187	0.193			
Pseudo R squared				0.050	0.081	0.082

* Significant at 10%; ** significant at 5%; *** significant at 1%, Standard errors are clustered at the session level.
Robust pvalues in parentheses
[1] The variable of risk aversion and of inequality aversion are not significant or not robust

Table 4: Determinants of ranking in each treatment (Ordered Probit Models).

Dep. Var. Mean Rank	(1) BT	(2) LPT	(3) HPT	(4) All Treat.	(5) BT	(6) LPT	(7) HPT	(8) All Treat.
Male	-0.909***	0.439	0.300	-0.927***				
	(0.006)	(0.172)	(0.267)	(0.001)				
Male standardized					-2.312***	1.028	0.438	-2.241***
					(0.002)	(0.209)	(0.383)	(0.000)
Level of education	-0.363	-0.512***	-0.482***	-0.392***	-0.357	-0.523***	-0.492***	-0.415***
	(0.130)	(0.002)	(0.005)	(0.000)	(0.154)	(0.003)	(0.003)	(0.000)
LPT * Female				-0.693***				
				(0.007)				
LPT * Female standardized								-1.195**
								(0.020)
HPT * Female				-0.846***				
				(0.000)				
HPT * Female standardized								-1.959***
								(0.000)
LPT * Male				0.605***				
				(0.003)				
LPT * Male standardized								1.549***
								(0.001)
HPT * Male				0.492***				
				(0.008)				
HPT * Male standardized								1.362***
								(0.001)
Demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Measure of risk[1]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Measure of inequality aversion[1]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant cut1	-4.001***	-3.886***	-2.393***	-3.455***	-3.851***	-3.892***	-2.432***	-3.594***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Constant cut2	-3.361***	-3.256***	-1.801***	-2.848***	-3.198***	-3.262***	-1.843***	-2.973***
	(0.003)	(0.000)	(0.001)	(0.000)	(0.006)	(0.000)	(0.000)	(0.000)
Constant cut3	-2.834**	-2.748***	-1.333***	-2.361***	-2.657**	-2.755***	-1.377***	-2.475***
	(0.012)	(0.002)	(0.008)	(0.000)	(0.021)	(0.002)	(0.006)	(0.000)
Constant cut4	-2.302**	-2.239**	-0.872*	-1.877***	-2.108*	-2.245***	-0.916*	-1.983***
	(0.037)	(0.011)	(0.076)	(0.000)	(0.062)	(0.009)	(0.061)	(0.000)
Constant cut5	-1.648	-1.620*	-0.287	-1.276***	-1.437	-1.624*	-0.332	-1.375***
	(0.123)	(0.055)	(0.540)	(0.003)	(0.189)	(0.051)	(0.476)	(0.001)
Observations	72	72	84	228	72	72	84	228
Pseudo R squared	0.091	0.077	0.047	0.059	0.102	0.078	0.045	0.0678

* Significant at 10%; ** significant at 5%; *** significant at 1%, Standard errors are clustered at the employers' id level.
Robust pvalues in parentheses
[1] The variable of risk aversion and of inequality aversion are not significant or not robust

Table 5: Determinants of firms' performances (OLS estimates).

Dep. Var. *Firms' performances*	(1) All Treatments	(2) All Treatments
LPT	-3.250	-2.474
	(0.427)	(0.611)
HPT	-4.167	-3.044
	(0.445)	(0.690)
Number of women in firms		-1.164
		(0.796)
Constant	92.67***	92.96***
	(0.000)	(0.000)
Observations	38	38
R-squared	0.018	0.020

* Significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are clustered at the employers' id level. Robust pvalues in parentheses

APPENDIX A

Figure A1: Screenshot of the hiring stage:

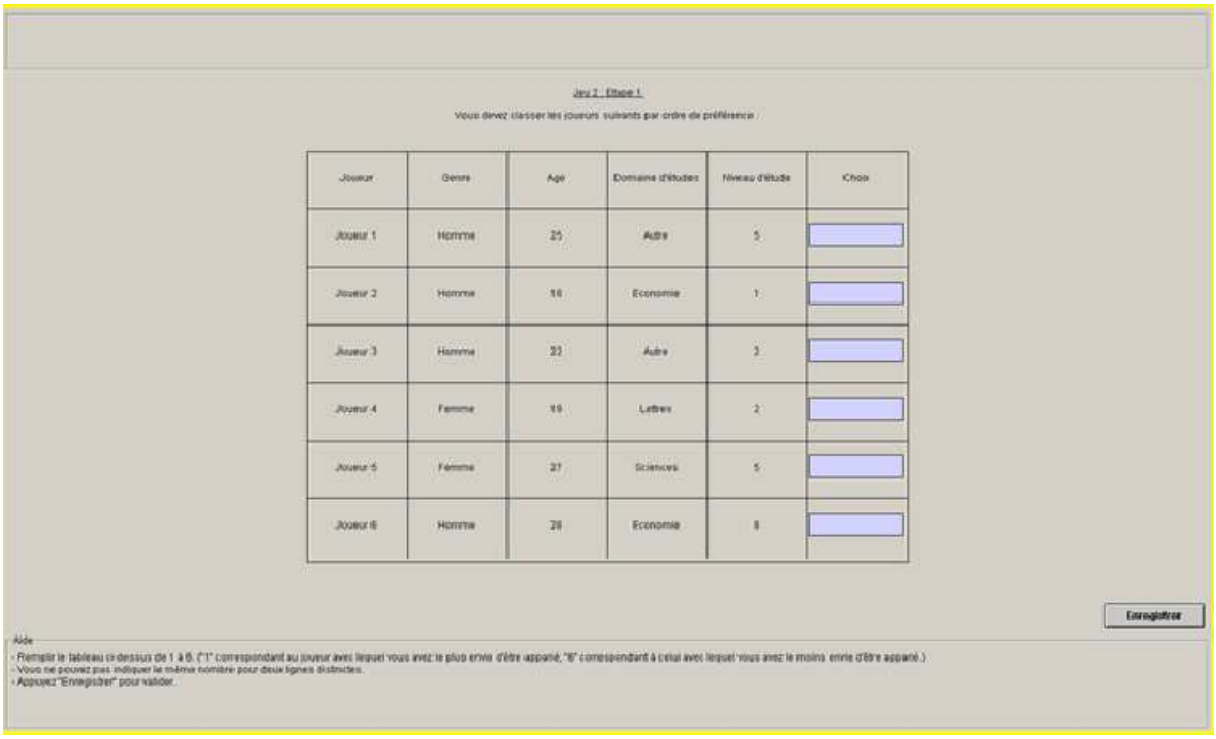
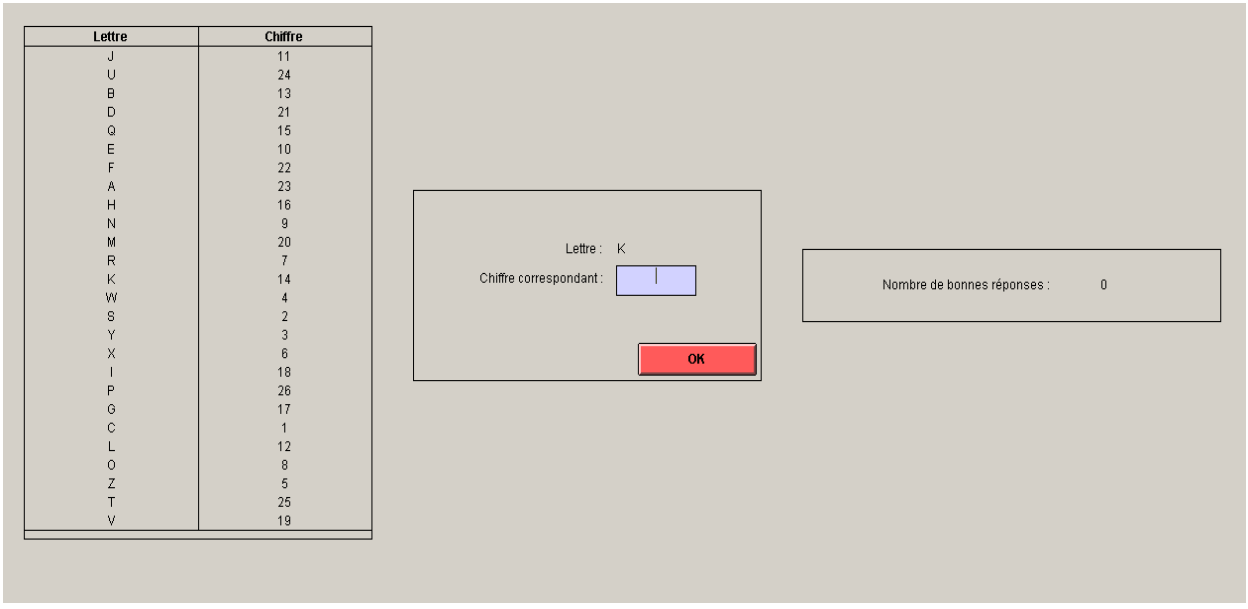


Figure A2: Screenshot of the decoding task:



Preliminary measures

Measure of risk aversion (seeking): Holt and Laury's procedure

We elicited a measure of risk aversion using a simple lottery choice experiment that replicates Holt and Laury's (2002) design. Our procedure is a replication of their "low real payoff" treatment, in which we merely substituted Euros (€) for Dollars ($). We selected this well-known random lottery procedure for measuring risk aversion due to its widespread use in decision-making research. According to the original design, participants are faced with ten choices between two bets yielding positive outcomes: R is a risky bet with payoffs of $3.85 and $0.10, while S is a safe bet with payoffs of $2 and $1.60. Probabilities for higher payoffs are equal with both bets (p) and vary by steps of 0.10 from 0.10 to 1.00. Participants should normally switch only once from S to R, for an intermediate value of this probability, with this value determining their level of risk aversion in simple terms. The crossover, or equivalent discrete probability index of risk aversion, can then be converted into a CRRA interval. This crossover probability is unique for consistent participants and assumes a value of between 0.10 and 1.00. Our risk aversion indicator corresponds to the normalized number of "safe choices".

(In)equality aversion: the ultimatum game and modified dictator game

We elicited measures of inequality aversion using the procedure developed by Blanco *et al.* (2010). Inequality aversion indicators are built from two simple games: a modified dictator game, and an ultimatum bargaining game. We used data from the modified dictator game (hereafter MDG) to obtain information on advantageous inequality aversion. In MDG, players must choose between an advantageous non-egalitarian distribution (20;0) and a totally egalitarian distribution (x;x). This choice is repeated 21 times, with x varying from 0 to 20. More specifically, the dictator must decide how much of the initial pie of 20 ECU he is willing to sacrifice in order to achieve an equal distribution of payoffs. We computed a measure of the advantageous (in)equality aversion indicator based on the switching point between non-egalitarian and egalitarian distributions. The computation methodology is the same as that presented in Blanco *et al.* (2010). To produce a measure of disadvantageous inequality aversion, we used data from the respondent's decisions in the ultimatum game (hereafter UG). In a traditional UG, the proposer offers x to the respondent, in keeping 20-x for himself; the respondent can then accept or reject the offer. In the case of rejection, both players earn zero ECU. If the respondent accepts, each player receives the proposed outcome, i.e. 20-x and x respectively. Under the UG presented in this paper, each participant makes a decision in both roles according to the strategy method, with x varying from 0 to 20. Following the lead in Blanco *et al.* (2010), we built an indicator of disadvantageous inequality aversion based on the respondent's decision in the ultimatum game, in which participants must decide whether to accept or reject their partner's offer for each potential amount ranging from 0 to 20 ECU (see Table A3 in online appendix A). Moreover, the disadvantageous inequality aversion indicator is generated from the first distribution that a respondent is willing to accept.