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How Costly Is Diversity? Affirmative Action in Light of Gender Differences in Competitiveness

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Affirmative action is often criticized for causing reverse discrimination and lowering the qualifications of those hired under the policy. However, the magnitude of such adverse effects depends on whether the best suited candidate is hired absent the policy. Indeed affirmative action may compensate for the distortion discrimination imposes on the selection of candidates. This paper asks whether affirmative action can have a similar corrective impact when qualified individuals fail to apply for a job. We evaluate the effect of introducing a gender quota in an environment where high-performing women fail to enter competitions they can win. We show that guaranteeing women equal representation among winners increases their entry. The response exceeds that predicted by the change in probability of winning and is in part driven by women being more willing to compete against other women. The consequences are substantial as the boost in supply essentially eliminates the anticipated costs of the policy.

Key words: gender differences; competitiveness; affirmative action
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1. Introduction

Affirmative action has been hotly debated since its introduction following the passage of the landmark Civil Rights Act of 1964. These debates have resulted in some states banning the policy. The main arguments against affirmative action are that it results in reverse discrimination and lowers the qualifications of those selected under the policy. Whereas the policy is costly when it distorts the selection of the best qualified individual, this need not be the case when the initial selection is suboptimal. If the best qualified candidates fail to be selected or fail to apply, then the introduction of affirmative action may reduce if not eliminate these costs. Indeed the policy has been used to reduce the distortion that discrimination has on the selection of candidates.[1] This paper asks whether affirmative action can have a similar corrective effect when the decision to apply for a position is not payoff-maximizing.

We examine whether affirmative action can encourage applications in an environment where "minority" candidates otherwise fail to apply for positions they are qualified for. To emphasize the supply side, we ignore distortions that arise from those who select candidates. Thus we study a setting where absent the policy the most qualified applicant is selected. This and other abstractions imply that our study is not intended to measure the actual costs of the policy. Rather the objective is to demonstrate that affirmative action can affect the application decision and thereby mitigate the expected costs of the policy.

To study the decision to apply for a job or a promotion, we conduct a controlled laboratory experiment where participants decide whether to enter a competition. Recent research documented that individuals fail to make payoff-maximizing tournament-entry decisions, and that these decisions vary by gender.[2] For example, Niederle and Vesterlund (2007),

[1] For a survey on the literature, see Holzer and Neumark (2000). Biases in hiring can occur even when there are no fundamental differences between two groups; see, e.g., Coate and Loury (1993) and Mailath et al. (2000).

[2] See Croson and Gneezy (2009) and Niederle and Vesterlund (2011) for reviews of the literature on gender differences in willingness to compete. Closely related is the underperformance of women in competitive environments (Gneezy et al. 2003).

henceforth NV (2007), studied a case where participants perform under a noncompetitive piece rate and a competitive tournament. Although they found no gender differences in performance, they documented substantial differences in the choice of compensation scheme: the majority of men selected the tournament and the majority of women selected the piece rate. Specifically, high-performing women compete too little, causing few women to succeed in and win the tournament. Despite there being no gender differences in performance, the decision to opt out of competitions places women in the minority among the set of winners. It has been argued that this gender difference in willingness to compete can help explain why men are disproportionately allocated to professional and managerial occupations.[3]

Suboptimal entry by high-performing women can be particularly costly for firms, as reluctance to apply prevents them from hiring the best available candidates.[4] The president of the University of Illinois, B. Joseph White, explains, "Getting more women into MBA programs means better access to the total talent pool for business" (*The University Record* 2000). Furthermore, the lower entry by women reduces diversity, which in and of itself may harm the firm (Page 2007, Weber and Zulehner 2010).

Our study asks whether affirmative action can encourage more high-performing women to enter competitions. We focus not only on determining how the policy changes the decision to compete, but also on how it changes the gender composition of the pool of competitors. Accounting for changes in entry, we ask how costly it is to secure that women be equally represented among those who win competitions. How much lower will the performance be for winners under the policy? How many better performing men will have to be passed by to secure equal representation of those hired?

We find that affirmative action changes tournament entry substantially. The entry of women increases, that of men decreases, and the response exceeds that predicted by changes in the probability of winning. This larger than expected response has important implications when assessing the cost of the policy. Ignoring the change in entry, it is anticipated that equal representation of women will decrease performance of winners and result in reverse discrimination. However, the change in tournament entry increases the number of high-performing women in the applicant pool, and as a result it is not difficult to secure equal representation; in fact, under the policy the performance requirement is found to be the same for women and men. Our results suggest that when high-performing women fail to enter competitions they can win, then affirmative action can have a larger than expected effect on applications, and this response can reduce, if not eliminate, the anticipated cost of achieving a more diverse set of winners.

To understand how affirmative action changes the tournament-entry decision, we focus on the factors that have been found to cause the gender gap. Specifically, the study by NV (2007) found that the gender gap in tournament entry was caused by men being more overconfident than women and by women being more averse to performing in a mixed-sex competition. Affirmative action has the potential to influence both of these factors.[5] Consider for example a quota that requires that out of two winners of a tournament at least one must be a woman. Such a quota will not only change the probability of winning, but will also introduce a more gender-specific competition. In particular, the best performing woman is guaranteed to win the affirmative action competition. Both confidence and attitudes toward competition may change in such a setting.

We find that indeed this larger than expected response to the policy is partially explained by the competition becoming more gender specific. The gender gaps in confidence and in willingness to perform in a competition are reduced under affirmative action.

In the next section we describe our experimental design and explain how it helps us investigate the potential effects of affirmative action. We introduce our analysis by first showing that we replicate the previous finding that many high-performing women fail to enter the tournament. This suggests

[3] For example, Bertrand and Hallock (2001) found that women account for only 2.5% of the five highest paid executives in a large sample of U.S. firms. Women are also underrepresented among people who have the training frequently required for senior management. Only 30% of students at top tier business schools are women, and, relative to their male counterparts, female MBA's are more likely to work in the nonprofit sector, work part time, or drop out of the work force (e.g., Hewlett and Luce 2005, Blau and Kahn 2006). Although the competitive pressure of upper management may cause women to opt out, factors such as discrimination, preference differences for child rearing, and ability differences also play a role (see, e.g., Altonji and Blank 1999, Black and Strahan 2001, Goldin and Rouse 2000).

[4] This conclusion relies on the assumption that performance rather than competitiveness is the dominant trait necessary for job success.

[5] Affirmative action programs in the United States have historically been of two forms: preferential treatment and quota. Quotas have recently been used throughout Europe to improve the representation of women in both the corporate and political arenas; see Fréchette et al. (2008) and Jones (2004). For a debate on quotas, see also Fryer and Loury (2005). Our quota study was initially reported in Niederle et al. (2008). A recent study by Balafoutas and Sutter (2012) uses our design and replicates the quota results reported. They also examined affirmative action with preferential treatment. An examination of a preferential treatment by Niederle et al. (2012) found results similar to those shown here. Preferential treatment was also studied by Calsamiglia et al. (2010) in the context of advantaged and disadvantaged students.

that a requirement of equal representation may have a significant impact in our environment. We proceed by determining the effect of affirmative action on entry and by examining how changes in tournament entry mitigate the anticipated costs of affirmative action. Finally, we conclude by asking whether the more gender-specific competition can account for these changes.

2. Experimental Design

The experiment was conducted at the Harvard Business School using students from the subject pool from their Computer Lab for Experimental Research (CLER). Although the design builds on that of NV (2007), we had to make various changes to implement the affirmative action treatment. Because these changes may alter the decision of participants, and because we want to compare behavior across environments, some tasks follow closely the NV (2007) design.[6] Groups of six participants, three women and three men, participated in each session. The gender composition of the group was made clear to participants as they were seated in the laboratory, and they were shown who the other five members of their group were. Fourteen groups participated in the experiment for a total of 42 men and 42 women.[7]

Participants were asked to perform a real effort task under varying compensation schemes. The task was to add up sets of five two-digit numbers. Participants were not allowed to use a calculator, but could use scratch paper. The numbers were randomly drawn and each problem was presented in the following way:

21	35	48	29	83	

For each problem participants were asked to fill in the sum in the blank box. Once the participant submitted an answer on the computer, a new problem appeared jointly with information on whether the former answer was correct.[8] A record of the number of correct and incorrect answers was kept on the screen. Participants had five minutes to solve as many problems as they could. A stop watch was shown at the front of the room via a projector and a buzzer would go off at the end of the five minutes. The participant's final score was determined by the number of correctly solved problems.

Participants were told that they had to complete six tasks, one of which was randomly chosen for payment at the end of the experiment. In addition to their payment for performance each participant also received a $10 show-up fee and an additional $5 for completing the experiment. Participants were informed of the nature of a task only immediately before performing the task. Although participants knew their absolute performance on a task, i.e., how many problems they solved correctly, they were not informed of their relative performance until the end of the experiment. The specific compensations and order of tasks were as follows.

Task 1—Piece Rate. Participants are given the five-minute addition task and receive 50¢ per correct answer.

Task 2—Tournament. Participants are given the five-minute addition task. The two participants among the three women and three men who provide the largest number of correct answers in the group each receive $1.50 per correct answer. The other participants receive no payment.[9]

In the third task participants also perform the five-minute addition task, but this time they select which of the first two compensation schemes they want to apply to their future performance, piece rate or tournament. We refer to the tournament as a standard (ST) tournament. A participant with a given performance has higher expected earnings in the tournament when the chance of winning exceeds 33%. The first two tasks not only familiarize subjects with the incentive schemes, but also provide performance measures, which we can use to determine whether men and women of equal performance make similar choices.[10]

[6] Tasks 1, 2, 3, and 5 mimic NV (2007) with some modifications required to implement the affirmative action tournament. First, participants in this experiment were informed that groups were gender balanced. Second, we examine groups of six individuals with two winners, rather than groups of four with one winner. Third, our return from winning is $1.5 per problem, rather than $2. Fourth, we used students from the Harvard Business School CLER subject pool, rather than the PEEL subject pool at the University of Pittsburgh. Finally, show-up and completion fees varied between the two studies.

[7] In one session (two groups) the stop watch malfunctioned for the fourth task. This session is excluded from our analysis. The behavior and performance prior to the fourth task resembles those of the other sessions.

[8] For the instructions, see http://www.pitt.edu/~vester/AAInstructions.pdf (accessed August 21, 2012). The program was written using the software zTree (Fischbacher 2007).

[9] In the event a tie in a competitive task, the winner was chosen randomly among the high scorers.

[10] There are a number of reasons women may enter competitions less. Both nurture and nature may cause men to be more competitive (e.g., Daly and Wilson 1983, Campbell 2002, Ruble et al. 2006, Gneezy et al. 2009, Sutter and Rützler 2010). If women anticipate a psychic cost from competing and men anticipate a psychic benefit, then fewer women will compete. The same prediction results from the finding that men are more overconfident than women (e.g., Lichtenstein et al. 1982, Beyer 1990, Beyer and Bowden 1997, Niederle and Vesterlund 2007, Mobius et al. 2011). Similarly the finding that women are more averse to risk (e.g., Eckel and Grossman 2008, Croson and Gneezy 2009, Byrnes et al. 1999) and respond more to negative feedback (e.g., Roberts and Nolen-Hoeksema 1989, Dweck 2000) suggest less willingness to compete. As noted by NV (2007), the submit-piece-rate decisions (our Tasks 5 and 6) help control for differences in risk and feedback aversion.

Task 3—Choice. Before performing the five-minute addition task, participants select whether they want to be paid according to a piece rate, i.e., 50¢ per correct answer, or a tournament. A participant who selects the tournament wins the tournament and receives $1.50 per correct answer if the participant's Task 3 performance exceeds that of at least four of the other group members in Task 2; otherwise the participant receives no payment.

Winners of the Task 3 tournament are determined by comparing their Task 3 performance to the Task 2 performance of the other group members. Thus they compete against the past performances of others, and the Task 3 decision is effectively an individual decision problem.[11]

Next we examine entry into an affirmative action (AA) tournament. In the AA tournament at least one of the winners will be a woman.[12] To avoid any effect due to simply mentioning gender, we mentioned the group's gender composition at the beginning of the experiment.

Task 4—Affirmative Action Choice. Before performing the five-minute addition task, participants select whether they want to be paid according to a piece rate, i.e., 50¢ per correct answer, or an AA tournament. A participant who selects the AA tournament receives $1.50 per correct answer when winning the tournament and $0 otherwise. The two winners are the highest-performing woman and the highest performer of the remaining five participants; that is, a woman wins the AA tournament if her Task 4 performance *either* exceeds the Task 2 performance of the two other women in the group or exceeds that of at least four other group members. A man wins the AA tournament if his Task 4 performance *both* exceeds the Task 2 performance of the two other men in the group and exceeds that of at least four other group members.[13]

To evaluate the extent to which gender differences in entry into the ST and AA tournaments are caused by differences in willingness to perform in a competition, we present participants with two additional decisions that mimic the entry decisions in Tasks 3 and 4, without the choice resulting in a competitive performance. Specifically they are asked to select a compensation scheme for their past noncompetitive Task 1 performance. First, participants choose between an ST tournament and a noncompetitive piece-rate compensation. Second, they choose between an AA tournament and a noncompetitive piece-rate compensation. Because no performance is required for these choices, the potential thrill, anxiety, or fear of performing in a competition is absent. The difference in those final two choices, after controlling for the probability of winning and subjective beliefs about winning the respective tournament, is a measure of the effect of mentioning affirmative action.[14] Therefore, by controlling for these decisions we can determine the extent to which the gender gap in entry is explained by an aversion to performing in a competition and whether mentioning affirmative action gives rise to an excessive response. Participants are reminded of their Task 1 piece-rate performance prior to their choice of compensation scheme.

Task 5—Submit Piece Rate to a Tournament. Participants do not have to perform in this task. They choose which compensation scheme they want to apply to their past Task 1 piece-rate performance: a 50¢ piece rate per correct answer or a tournament. A participant who enters the tournament receives $1.50 per correct answer if the participant's piece-rate performance is among the two highest in the group of three women and men; otherwise no payment is received.

Task 6—Submit Piece Rate to AA Tournament. Participants do not have to perform in this task. They choose which compensation scheme they want to apply to their past Task 1 piece-rate performance: a 50¢ piece rate per correct answer or an AA tournament. A participant who selects the tournament receives $1.50 per correct answer when winning the tournament and $0 otherwise. The two winners are the highest-performing woman and the highest performer of the remaining five participants.

Just like for Tasks 3 and 4, a participant's decision does not affect the earnings of any other participant,

[11] This has several advantages: Participants are competing against competitive performances of others, the tournament-entry decision depends only on beliefs about one's relative performance and not on the expected tournament-entry decisions of others, and a participant's choice does not impose any externalities on others. Thus gender differences in altruism cannot influence behavior (e.g., Andreoni and Vesterlund 2001).

[12] Sensitivity to gender composition is documented by Gneezy et al. (2003) and emphasized by advocates of single-sex schooling. It may be that girls do not dislike competition per se, but rather that they dislike competing against boys, i.e., girls in all-girl schools may be more competitive (e.g., Harwarth et al. 1997, Booth and Nolen 2012).

[13] The probability of men and women winning the affirmative action tournament is sensitive to the performance distribution. If one man and one woman are the two highest performers in the group, then only these two will win the tournament by entering.

[14] The tournaments in which women had favorable treatment were called "affirmative action tournaments," which allows us to identify the effect that arises from using these words. Had we just implemented a favorable treatment to women without mentioning the words affirmative action, some participants may have thought about affirmative action while others may not, and we could not separate the two effects. A response to the existence of affirmative action may not be restricted to the lab. It is possible that women (and men) respond to workplaces just having an affirmative action policy in a similar manner to which they react to the mention of affirmative action in the lab (i.e., women will be overly eager to apply).

Table 1 Probability of Winning the Task 2 Tournament Conditional on Task 2 Performance

	8	9	10	11	12	13	14	15	16	17	18	19	21	22	25	28	29	35
Women	0	0.1	0.6	2.5	8.6	21.8	40.7	58.1	71.4	80.2	87.1	92.2	—	96.2	—	—	—	—
Men	0	0.1	0.7	2.8	11.0	28.2	48.7	65.8	77.8	85.6	91.1	—	96.6	98.1	99.2	99.6	99.9	100

Table 2 Probability of Winning the Task 4 Tournament Conditional on Task 2 Performance

	9	10	11	12	13	14	15	16	17	18	19	21	22	25	28	29	35
Women	1.8	4.9	10.5	25.3	46.9	64.6	77.3	85.7	91.1	94.7	97.3	—	99.3	—	—	—	—
Men	0.1	0.4	1.6	5.5	14.2	26.8	39.6	50.6	58.6	66.8	—	75.3	79.6	84.0	88.5	93.0	97.6

nor does it depend on the entry decisions of others. Hence Tasks 5 and 6 are also individual decision tasks.

Finally, at the end of the experiment participants were asked to guess their rank in the Task 1 piece rate and Task 2 tournament both within the whole gender balanced group of six participants and within their own gender. Each participant picked a rank between 1 and 6 and between 1 and 3, respectively, and was paid \$1 for each correct guess.[15] This allows us to determine whether beliefs on relative performance differ in single- versus mixed-gender groups, and whether such differences affect tournament entry.

An attraction of the five-minute addition task is that performance does not appear to respond to the incentives we consider.[16] The focus of our analysis is therefore on the decisions to enter a competition. Given the performances in Tasks 1 and 2, the decision in Task 3 will establish whether high-performing women avoid the competition. Suboptimal entry by women suggests that affirmative action imposed after the entry decision would be very costly because there are only few high-performing women in the applicant pool. Task 4 allows us to assess the effect of affirmative action on the supply side and helps us determine whether this potential increase in entry causes the costs of affirmative action to be lower than anticipated.

3. Tournament Entry With and Without Affirmative Action

We start by characterizing the tournament-entry decisions prior to the introduction of affirmative action. We then examine the effect of affirmative action on tournament entry.

3.1. Entry into the Standard Tournament

The average number of correctly solved problems in the piece rate is 10.3 for women and 12.9 for men, and in the tournament it is 12.3 for women and 14.8 for men. Two-sided Mann–Whitney tests show that both of these gender differences are significant ($p = 0.03$ and $p = 0.06$, respectively).[17] To assess the probability of winning the tournament, we randomly created six-person groups from the observed performance distributions and determined the two winners. Table 1 shows the probability of winning conditional on performance.[18]

After the 50¢ piece rate and the \$1.50 tournament, participants were asked which of the two they wanted to apply to their Task 3 performance. Table 1 shows that the probability of winning is higher than one-third for participants who solve 14 or more problems; thus this group has higher expected earnings in the tournament. If their performance in Task 3 is exactly as in Task 2, this corresponds to 28.6% of women and 50% of men benefitting from the tournament. The observed gender gap in tournament entry is even greater: 31% of women and 73.8% of men select the tournament. This gender gap is significant ($p < 0.01$) and greater than expected ($p = 0.04$).[19] Whereas men enter significantly more than predicted ($p = 0.042$),

[15] In the event of ties in actual rank, we counted every answer that could be correct as correct. For example, if the performance in the group was 10, 10, 11, 12, 13, and 13, then an answer of fifth and sixth was correct for a score of 10, and an answer of first and second was correct for a score of 13.

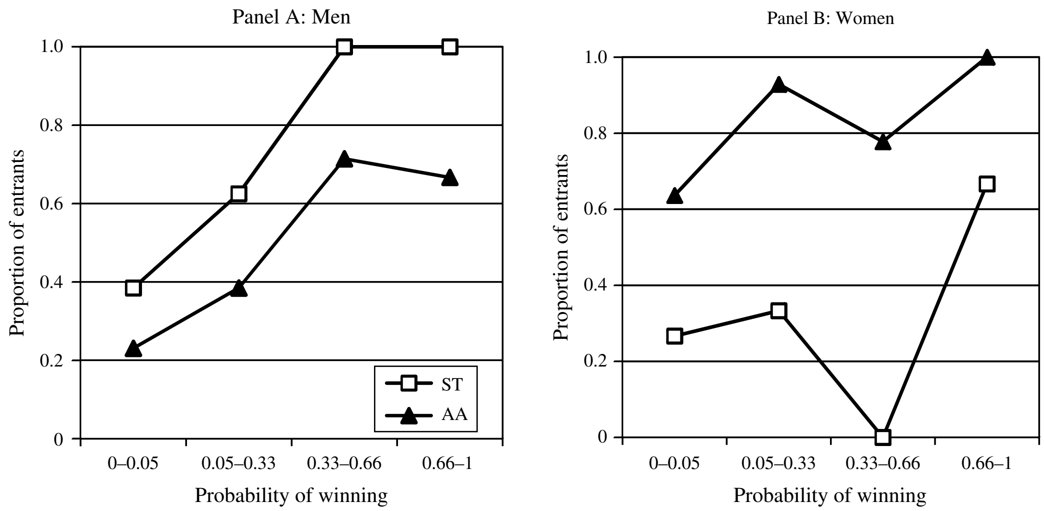
[16] Although there is an initial learning effect, performance seems to stabilize quickly at or near the participants' maximum capacity to perform.

[17] As noted by NV (2007), the increase in performance from the piece rate to the tournament is most likely due to learning. In contrast to the results here, NV (2007) did not find a gender gap in performance; it is not surprising that this result may vary by population. Performance is controlled for throughout our analysis to account for any differences.

[18] For any given performance level, say, 15 for a woman, we draw 1,000,000 groups consisting of 3 men and 2 women, using the performance distribution of the 42 men and 42 women with replacement. We then calculate the woman's frequency of wins in this set of simulated groups.

[19] Unless noted otherwise, the reported test statistics henceforth refer to a two-sided Fisher's exact test. For the final comparison, we calculate the difference between expected and actual gender gaps in the tournament entry decision for 1,000,000 simulations where we draw the 42 women and 42 men with replacement (using thresholds implied by Table 2). The reported p-value is the percentage of strictly positive differences.

Figure 1 Proportion of Participants Entering the ST and the AA Tournaments Conditional on the Probability of Winning It Given Their Task 2 Performance



Notes. The bin size was chosen to secure similar numbers of participants in each bin, and such that the earnings are maximized if the top two bins enter the tournament while the others do not. The number of individuals in each bin is as follows: In panel A, in the standard tournament the numbers are 13, 8, 8, and 13. In the AA tournament there are 13, 13, 7, and 9, with 13 in 0–0.05. In panel B, the numbers are 15, 15, 6, and 6, and 11, 14, 9, and 8, respectively.

women do not ($p = 1.0$). The gender gap in tournament entry is greatest among those who have higher expected earnings in the tournament than in the piece rate; among these, 100% of the men and only 33.3% of the women enter the tournament. Thus the entry by high-performing women is suboptimal in terms of maximizing earnings.

3.2. Entry into the Affirmative Action Tournament

The introduction of an affirmative action quota increases the probability of winning the tournament for women while decreasing it for men. The probabilities of winning the AA tournament conditional on gender and performance are reported in Table 2. Participants with a 33% or higher chance of winning have higher expected earnings from the AA tournament than the piece rate. This corresponds to women with a performance of 13 or more and men with a performance of 15 or more.[20] Thus affirmative action decreases the performance at which it becomes profitable to enter the tournament by one for women, while increasing it by one for men.

The payoff-maximizing entries in the AA tournament correspond to 40.5% of women and 38.1% of men if the participant's Task 4 performance is the same as in Task 2. In sharp contrast, 83.3% of women and 45.2% of men enter the AA tournament. Whereas the entry by women is greater than predicted, that by men is not ($p < 0.01$ and $p = 0.66$, respectively). The resulting gender gap in entry into the AA tournament is significant ($p < 0.01$) and differs from that predicted ($p < 0.01$).

Panel A of Figure 1 shows the proportion of men who enter the ST and AA tournaments conditional on their probability of winning each tournament. Panel B of Figure 1 shows the corresponding figure for women. Both figures use performance prior to the entry decision (i.e., Task 2) to determine the probability of winning. The figures are similar if we instead use ex post performance (i.e., Tasks 3 and 4).

Figure 1 shows that affirmative action reduces entry by men, and increases it for women beyond what is warranted by changes in the probability of winning. Otherwise, the proportion of entrants would coincide for the ST and AA tournaments. The overreaction by women is particularly large. Moreover, women who stood to gain from entering the standard tournament (participants with a Task 2 performance of at least 14) all chose to enter the AA tournament, whereas only a third of these women entered the standard tournament. This increase in female entry rates is significant ($p = 0.001$).[21]

In Table 3 we present probit regressions of the decision to enter a tournament on the probability of winning as well as an affirmative action dummy. For each individual we use both the decision to enter the ST tournament and the decision to enter the AA tournament. We condition the entry decision on the probability associated with winning the tournament in question (*Tournament*) and on the change in

[20] Using the Task 2 performance, five more women and five fewer men have higher expected earnings from entering the AA tournament compared to the standard tournament.

[21] Among women who gain from entering the AA tournament, i.e., those with a performance of 13 or higher, 88.2% entered the tournament. This is a significant increase in the entry rates of women compared to the case when there was no affirmative action ($p = 0.01$).

Table 3 Probit of Tournament Choice (Task 2 Performance)

	Men	Women	All
Female			−0.37
			(0.00)
Female × *AA*			0.26
			(0.00)
AA	−0.29	0.51	−0.27
	(0.01)	(0.00)	(0.01)
Tournament	0.90	0.28	0.64
	(0.00)	(0.28)	(0.00)
Tournament–piece rate	−0.35	0.30	−0.09
	(0.22)	(0.25)	(0.61)
Observations	84	84	168

Notes. The table presents marginal effects evaluated at the level of an individual (a man in the last column) in the standard tournament, with a probability of winning the tournament (*Tournament*) of 0.33 and a change in the probability of winning (*Tournament–piece rate*) of 0.16. We clustered the standard errors at the participant level. The p-values of the underlying coefficients are in parentheses.

the probability of winning when using tournament rather than piece-rate performance (*Tournament–piece rate*). We cluster on the participant to account for the lack of independence between the two individual observations. If entry decisions depend solely on the probability of winning the tournament, then the marginal coefficient on the affirmative action dummy (*AA*) should be zero. Consistent with Figure 1 we see that the effect of the policy on entry is negative for men and positive for women.[22] In the pooled regression the significant female and affirmative action interaction term demonstrates that changes in the probability of winning do not fully account for the change in the gender gap induced by affirmative action.

4. How Costly Is Affirmative Action

A concern when introducing affirmative action is how costly it will be to achieve a more diverse set of winners. Looking directly at the performance of those who enter and win the tournaments, we do not see deterioration in performance. The average performance by actual winners of the ST tournament is 19.2, whereas that of winners in the AA tournament is 18.7. This difference is not significant ($p = 0.79$) and suggests that, in contrast to expectations affirmative action need not decrease performance. Although it is tempting to focus solely on the performance of actual winners, it is important to note that whether an individual is or is not identified as a winner depends on the performance of the group she is randomly assigned to. Thus, examination of actual winners only provides limited insight on the effect of affirmative action.

To assess the cost of the policy we view all the participants in the experiment as (potential) candidates and those who enter competitions as applicants for jobs. We ask what the minimum performance requirement would be if a firm wanted to hire a certain number of applicants and wanted to secure that only the best available applicants were hired. We then ask how much lower the requirement has to be if we want to hire the same number of applicants under the equal representation rule. To evaluate the degree of reverse discrimination, we determine how many strictly better performing men will be passed by to secure that women are at least equally represented among those hired. Passing by better performing applicants is inequitable and costly for the firm, as it no longer can hire the best available applicants. Crucial for assessing these two adverse effects is the performance and gender composition of those who decide to enter the competition.

We measure the performance of entrants after their compensation choice. Because the performance in Task 4 is slightly higher than in Task 3, we will throughout this section rely on the Task 3 performance to not bias the costs of affirmative action downward.[23] Panel A of Figure 2 shows the proportion of participants with a given Task 3 performance who choose to enter the ST or AA tournament.

Although affirmative action increases entry for those who solve 13 problems or less, the proportion of participants who enter is, although slightly higher, not affected for those with a superior performance.[24] This finding is confirmed by Panel B of Figure 2, which shows the number of entrants who have performances at or above a certain level.[25] At high performance levels, we do not see substantial changes in the number of entrants. In both the ST and AA tournaments we have slightly more than 20 entrants who solved 15 or more problems in the Task 3 tournament.

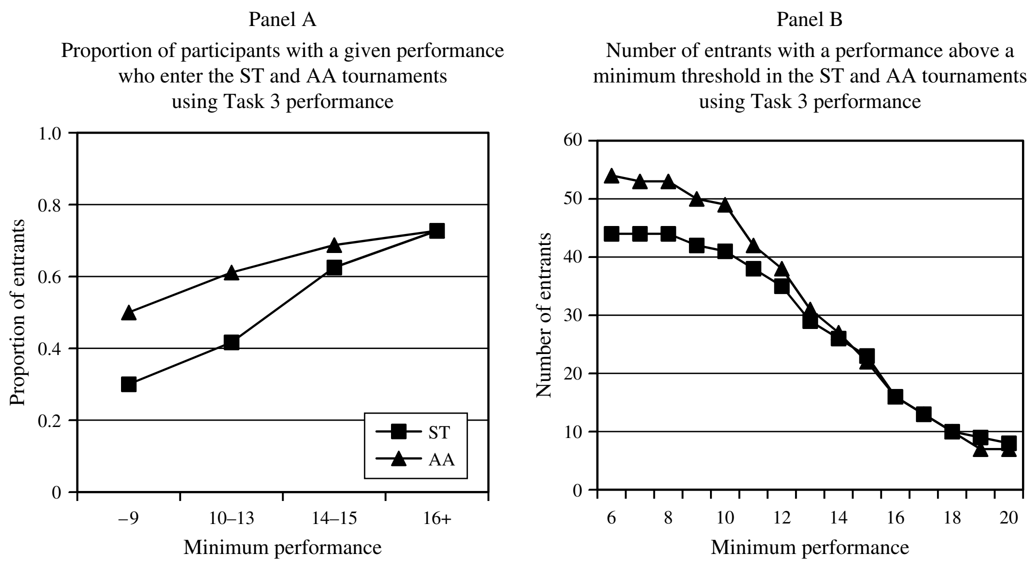
[22] The result is the same if we condition on the probability of winning after the entry decision, i.e., on Tasks 3 and 4.

[23] To understand the behavior of participants, we focus on Task 2, the performance before they made choices. When considering the effect on outcomes, focusing on the performance after the choice seems more natural. However, the results are similar when we use performances in Task 2 or Task 4, or if we use performance in Task 3 for entrants in the standard tournament and in Task 4 for entrants in the AA tournament. This is due to the fact that performance is largely not affected by the incentive scheme, just as in NV (2007). However, given the higher Task 4 performance, this latter comparison would bias the results in favor of affirmative action.

[24] A two-sided Mann–Whitney test for the equality of the distribution of entrants in the two treatments yields $p = 0.26$. (When using Tasks 3 and 4 or Task 2 performances, it yields $p = 0.88$ and $p = 0.24$, respectively.)

[25] Because fewer than 10% of participants solved more than 20 problems, we focus the analysis on groups with minimum performances of 20 and lower.

Figure 2 Performance of Entrants



Affirmative action has however a large effect on the gender composition of the pool of entrants. Figure 3 shows the proportion of women among entrants whose performance is at or above a specified performance level. For example, among entrants with a performance of 15 and higher, only 26% are women in the ST tournament; in contrast, 50% of these are women in the AA tournament.

The extent to which affirmative action lowers performance of the winners and results in reverse discrimination can be assessed both ex ante and ex post. The ex ante evaluation considers the expected effect of affirmative action if it were implemented without women and men changing their behavior. Hence the cost is assessed by employing affirmative action guidelines to the entrant pool of the ST tournament. We will denote the outcome of this analysis by ST w AA. The ex post assessment instead evaluates realized costs of affirmative action, which occur after affirmative action is announced and individuals have responded to the change in policy. The ex post effect can be assessed by imposing affirmative action restrictions on participants who decided to enter the AA tournament. We denote the outcome of this exercise by AA w AA.

Panel A of Figure 4 shows based on ex ante entry, for each minimum performance requirement, how many participants can be hired with and without affirmative action. Panel B of Figure 2 shows that the ST tournament has 23 applicants (entrants) who solve 15 problems or more. Figure 3 documents that only 26% of them are female. Taken together, these figures imply that if we maintain the performance requirement of 15 problems and require equal representation, then only 12 instead of 23 applicants can be hired. The number of applicants that a firm can expect to hire under affirmative action (given its current applicant pool) is shown by the ST w AA line in Panel A of Figure 4. This figure also shows that ex ante, the firms who want to hire the same number of participants (23) after introducing affirmative action would have to lower the minimum performance requirement from 15 to 10. Thus the expected effect of affirmative action on qualifications is substantial when we ignore that women and men respond to the policy by changing their entry decisions.

The assessment of performance costs is, however, quite different when we account for the suboptimal initial entry and the greater than expected response to the policy. Panel B of Figure 4 shows that when affirmative action is announced, 22 participants with

Figure 3 Gender Composition: Proportion of Tournament Entrants Above a Minimum Performance Who Are Women in the ST and AA Tournaments

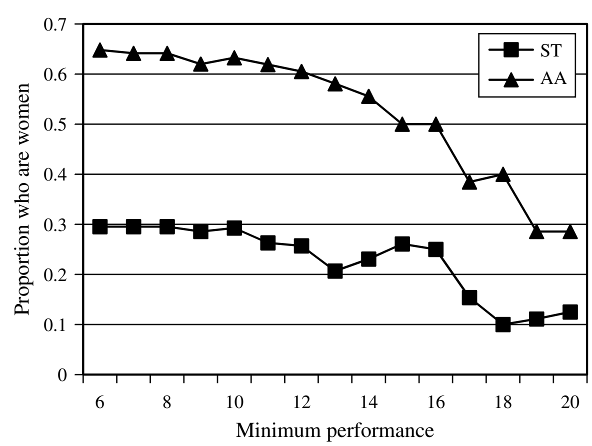
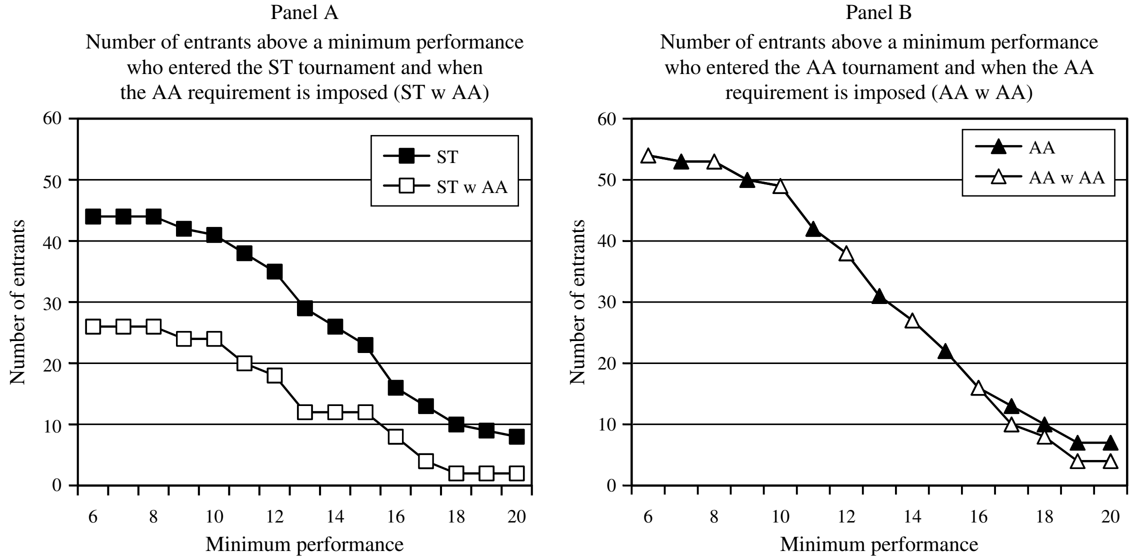


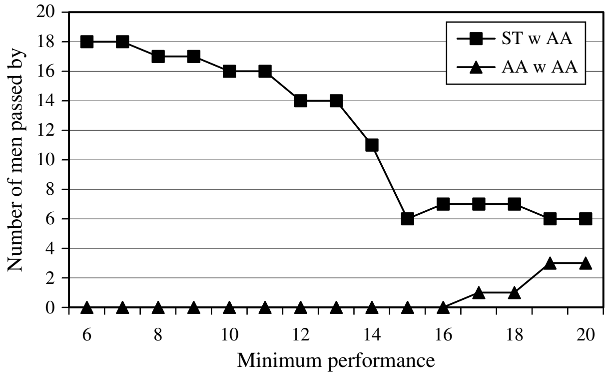
Figure 4 **Cost of Affirmative Action: Lowering Performance Standards**



performance 15 and above enter the affirmative action tournament. Because half of these entrants are women (see Figure 3), it will not be necessary to lower the performance requirement to secure that women are equally represented among those hired. Under an AA requirement, we can hire 22 participants with a minimum performance of 15 (AA w AA). The number of candidates that a firm can actually hire under affirmative action (given the changed applicant pool) is shown by the AA w AA line in Panel B of Figure 4. Thus the naively calculated expected performance costs greatly exaggerate the actual realized cost of the policy.

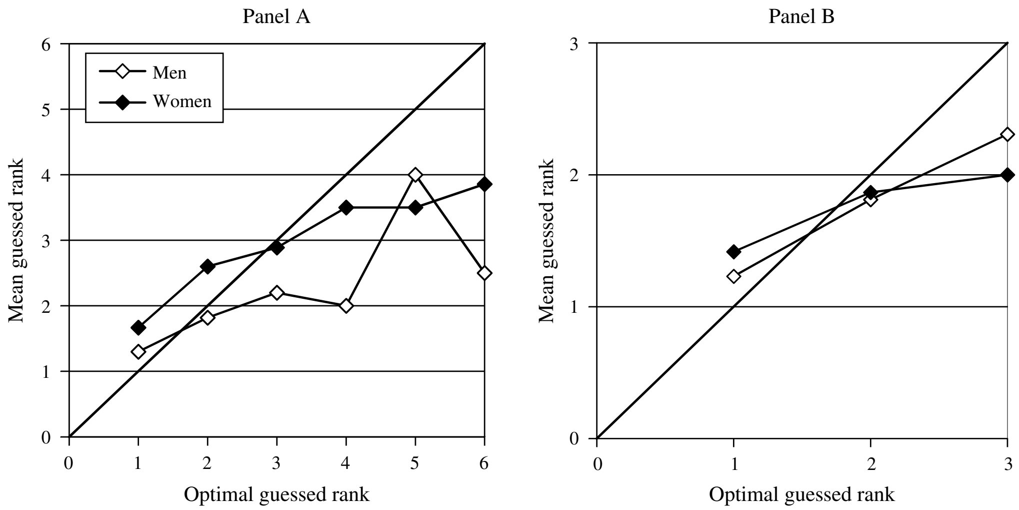
Next we examine the extent to which the policy gives rise to reverse discrimination. Figure 5 shows the number of strictly higher-performing men that are passed by when hiring a woman at a particular performance level, while satisfying the affirmative action requirement. Once again we assess the costs both ex ante and ex post. The expected ex ante costs do not take into account the changes in entry that may result from the policy (ST w AA), although this response is accounted for in the ex post assessment (AA w AA). Entry into the ST tournament predicts substantial reverse discrimination. For example, recall that under the equal representation requirement we can only hire 12 of the 23 entrants who entered the standard tournament and solved 15 and more problems. As shown by the ST w AA line in Figure 5, this implies passing by six men who have a performance in excess of the required performance minimum of 15 for women. The introduction of affirmative action, however, causes women to be better represented among the set of entrants, and instead an equally representative pool of 22 people with a minimum performance of 15 can be hired. Thus ex post there is no reverse discrimination at this performance level.

Figure 5 **Cost of Affirmative Action: Number of Better Performing Men Passed by to Secure Equal Representation of Women Given the Entrants to the Standard Tournament (ST w AA) and the Entrants to the AA Tournament (AA w AA)**



The substantial difference between ex ante and ex post costs of affirmative action implies that it may be very expensive, in terms of performance loss and reverse discrimination, to apply an affirmative action rule "secretly" or to introduce affirmative action after individuals have decided to enter a standard tournament. Furthermore, perceived inequity and performance costs may be vastly overestimated, if we fail to take into account that the pool of entrants changes along with a well-announced introduction of affirmative action. Because many more women, and in particular many high-performing women, enter the AA tournament, the gender composition of tournament entrants is very different under affirmative action. These changes in entry mitigate the cost of the policy. Thus our results demonstrate that when high-performing candidates initially fail to apply, then it need not be that costly to secure a more diverse set of winners through affirmative action.

Figure 6 **Average Guessed Rank as a Function of Optimal Guessed Rank in the Group of Six Participants (Panel A) and Among the Three Group Members of One's Gender (Panel B)**



5. The Effect of Affirmative Action on Tournament Entry

In this section we ask why the observed response to affirmative action is greater than predicted. We first examine the extent to which the initial gender gap is caused by gender differences in confidence and attitudes toward competition, as in NV (2007), and then whether affirmative action influenced these gender differences.

5.1. Gender Differences in Tournament Entry

To analyze the gender gap in entry into the ST tournament, we first examine the role played by gender differences in beliefs. To assess the effect of confidence, we compare beliefs conditional on the participant's optimal guessed rank. This is the guessed rank that, conditional on gender and performance, would maximize earnings.[26] Panel A of Figure 6 shows participants' guessed rank conditional on the optimal guessed rank. A perfectly calibrated participant would lie on the 45° line. Overconfidence is seen by guessed ranks below the 45° line. Whereas men are significantly overconfident, women are not, and the gender difference is significant.[27]

A method for summarizing beliefs which will prove helpful in our affirmative action analysis is to determine whether the participant's guessed rank is consistent with the belief that he or she will win the tournament; we refer to this measure as GuessWin. The results on beliefs are qualitatively the same when we use this binary belief measure.[28] To examine the effect on tournament entry in Table 4, column (1), we first regress the compensation choice on the probability of winning the Task 2 tournament (*Tournament*) and on the change in the probability of winning a Task 2 tournament between using the individual's Task 2 performance and their Task 1 performance (*Tournament–piece rate*).[29] Conditional on performance, we find a significant gender gap of 36 percentage points.[30] As seen in column (2), this gap reduces to 25 percentage points when we control for the participants' imputed beliefs on winning the tournament. Thus the overconfidence by men helps account for

[26] For a given performance level, say 15, for a woman, we draw 1,000,000 groups consisting of 3 men and 2 women, sampling with replacement from the performance distribution of the 42 men and 42 women. We then determine the woman's rank in each of these groups, and the optimal guessed rank is the mode of these ranks.

[27] For men, testing whether the distribution of guessed ranks is independent of that of optimal guessed ranks yields $p = 0.04$. For women, the comparisons of guessed ranks to optimal guessed ranks yields $p = 0.37$. An ordered probit regression of the guessed tournament rank yields coefficients of 0.39 on the optimal guessed rank ($p < 0.01$) and 0.66 on a female dummy ($p = 0.01$).

[28] In the AA tournament, GuessWin is a gender-neutral summary of beliefs, whereas guessed rank is not. A probit regression of the guess of winning the ST tournament yields marginal coefficients of -0.3 on female ($p = 0.01$), and 0.45 on optimal GuessWin ($p < 0.01$), evaluated at the level of a man whose optimal guess is winning. Testing whether the distribution of GuessWin differs from that of optimal GuessWin yields $p = 0.07$ for men and $p = 0.48$ for women.

[29] The change in the probability of winning the tournament when using the Task 2 rather than Task 1 performance is given by p_T (*Task* 2) $-$ p_T (*Task* 1), where $p_T(x)$ denotes the probability of winning the tournament with a performance of x (note that $p_T(x)$ may differ by gender). Prior to the affirmative action analysis, it is largely inconsequential to condition on the probability of winning rather than actual performance; however, this distinction is important when we study the AA tournament, where $p_T(x)$ differs by gender.

[30] The marginal effect is evaluated at the point where a participant is indifferent toward entering the tournament, i.e., the probability of winning is 0.33. This corresponds to having a performance between 13 and 14. For these participants p_T (*Task* 2) $-$ p_T (*Task* 1) $=$ 0.16 on average; thus, we assess the marginal effect at this point.

Table 4 Probit of Tournament-Entry Decision (Task 3)

	(1)	(2)	(3)
Female	−0.36	−0.25	−0.17
	(0.00)	(0.03)	(0.04)
Tournament	0.79	0.45	0.22
	(0.00)	(0.02)	(0.08)
Tournament–piece rate	−0.29	−0.31	−0.11
	(0.27)	(0.15)	(0.45)
GuessWin		0.35	0.25
		(0.01)	(0.01)
Submit the piece rate			0.15
			(0.10)
Observations	84	84	84

Notes. The dependent variable is Task 3 compensation choice (1 for tournament and 0 for piece rate). The table presents marginal effects evaluated at the level of a man with a 0.33 probability of winning the tournament (*Tournament*), a 0.16 change in probability of winning (*Tournament–piece rate*), who submitted his piece rate to the tournament (column (3)), and thinks (columns (2) and (3)) that he wins the tournament (i.e., ranks first or second in his group of six). We clustered the standard errors at the participant level. The p-values of the underlying coefficients are in parentheses.

about one-third of the gender difference in tournament entry.

To determine the importance of attitudes toward the active competitive performance, we control for the Task 5 compensation choice where participants choose between a competitive and a noncompetitive compensation scheme for their past Task 1 piece-rate performance. This decision is similar to the decision to enter a tournament and perform in a competition (Task 3). The difference between the two is that only in Task 3 do they subsequently have to compete. Thus only in Task 3 can differences in preferences for performing in a competition play a role.

As seen in Table 4, the gender gap is further reduced to 17 percentage points when controlling for the decision to submit the piece rate (column (3)). This decrease may in part be explained by the submit-piece-rate decision serving as an additional measure of the individual's degree of confidence. The reduction in the GuessWin coefficient in column (3) is consistent with this interpretation. We attribute the remaining gap to women being more averse to choices that require a future performance in a competitive environment.

Although our design differs from that of NV (2007), the relevant findings are qualitatively and quantitatively similar.[31] High-performing women fail to enter the competition, and the substantial gender gap in tournament entry is explained by gender differences in beliefs and attitudes toward performing in a competition.

5.2. The Effect of Affirmative Action on Tournament Entry

The affirmative action requirement was that at least one of two winners must be a woman. This institution gives rise to a more gender-specific competition, which may influence the two factors that reduced entry for women: the gender gap in confidence and attitudes toward competition. In addition to these changes, behavior may also be influenced by us mentioning affirmative action.

5.2.1. The Effect of Beliefs. To assess the extent to which beliefs can account for changes in entry in the AA tournament, we analyze beliefs on relative performance within gender in the Task 2 tournament. As before we calculate the optimal guess, i.e., the money-maximizing guess given individual performance, however neither women nor men are found to be overconfident. The distributions of guessed ranks within gender are not significantly different from optimal guessed ranks ($p = 0.21$ for women, and $p = 0.45$ for men). Ordered probit regressions show that the guessed ranks in single-sex groups are correlated with optimal guesses, and women are as confident in their relative performance among women as men are among men.[32] Figure 6 shows for each optimal guessed rank the average guessed rank of women and men. Whereas panel A shows the guessed ranks among all six participants, panel B shows guessed ranks within one's gender. Although men are significantly more confident than women when assessing relative ability in a mixed-sex group, there is no gender difference in beliefs in single-sex groups.

To evaluate the impact of beliefs on the AA tournament entry decision we construct participants' beliefs on whether they would have won the Task 2 tournament under AA rules (GuessAAWin). A woman wins the AA tournament if she is *either* the best performing woman or among the two best performing participants in the group. A man, on the other hand, wins the AA tournament if he is *both* the best performing man and among the top two performers overall. As expected we find that relative to the standard tournament fewer men and more women think

[31] To conform to the procedures of the present study we reran the regression in NV (2007) including all participants and controlling for the probability of winning and participants' GuessWin. The NV (2007) gender gap in tournament entry is 38 percentage points controlling only for performance. Controlling also for beliefs on winning this gap reduces to 26 percentage points, finally adding the decision to submit the piece rate reduces the gap to 14 percentage points.

[32] An ordered probit regression of guessed rank on optimal guessed rank in single-sex groups yields coefficients of 0.99 ($p < 0.01$) for men and 0.46 ($p = 0.04$) for women. Pooling all 42 women and 42 men yields coefficients of −0.04 on a female dummy ($p = 0.87$), and 0.70 on optimal guessed rank ($p < 0.01$).

Table 5 Probit of Tournament Choice (Task 2 Performance)

	Men	Men	Women	Women	All	All
Female					−0.37	−0.29
					(0.00)	(0.01)
Female × AA					0.26	0.18
					(0.00)	(0.00)
AA	−0.29	−0.23	0.51	0.40	−0.27	−0.18
	(0.01)	(0.04)	(0.00)	(0.00)	(0.01)	(0.07)
Tournament	0.90	0.70	0.28	0.06	0.64	0.40
	(0.00)	(0.00)	(0.28)	(0.83)	(0.00)	(0.00)
Tournament–piece rate	−0.35	−0.38	0.30	0.23	−0.09	−0.15
	(0.22)	(0.15)	(0.25)	(0.41)	(0.61)	(0.31)
GuessWin		0.19		0.38		0.27
		(0.16)		(0.00)		(0.00)
Observations	84	84	84	84	168	168

Notes. The table presents marginal effects evaluated at the level of an individual (a man in the last two columns) in the standard tournament with a 0.33 probability of winning the tournament (*Tournament*) and a change in the probability of winning (*Tournament–piece rate*) of 0.16, with a guess of winning (in the second, fourth, and sixth columns). We clustered the standard errors at the participant level. The *p*-values of the underlying coefficients are in parentheses. Note that GuessWin refers to the relevant tournament (ST or AA).

that they will win the AA tournament.[33] We compare GuessAAWin to the belief of winning that is consistent with the participant's optimal guessed rank (optimal GuessAAWin). Similar to our guessed-rank results in single-sex groups, conditioning on the optimal guess, neither women nor men are overconfident, and there is no gender difference in GuessAAWin.[34] This result contrasts that of the standard tournament, where, conditional on the optimal GuessWin, men are significantly more likely to believe that they will win.

To determine the impact of beliefs on changes in tournament entry induced by affirmative action we condition on the relevant guesses-to-win measures (see Table 5). For easy comparison the first column in each category reports the results of Table 3. Controlling for performance, the first four columns show that individuals who have beliefs consistent with winning are more likely to enter the tournament; however, in a two-sided test this effect is only significant for women. Nonetheless, as seen by the coefficient on the AA dummy, for both men and women, including beliefs on winning reduces the change in entry induced by AA by approximately 20%.

GuessWin is significant in the pooled regression and reduces the change in the gender gap induced by affirmative action.[35] An explanation is that the gender gap in beliefs is substantially smaller in the AA tournament. The change in beliefs results from women being more likely to win the AA tournament, and from men being more overconfident in mixed- than single-sex competitions. However, note that, controlling for beliefs, the coefficient on the female and affirmative action interaction term remain significant. Hence changes in beliefs and in the probability of winning cannot fully account for the change in the gender gap in tournament entry induced by affirmative action.

5.2.2. Mentioning Affirmative Action and Attitudes Toward Competition. Next we examine whether mentioning affirmative action influences behavior. We use the decisions to submit the piece-rate performance to the ST or AA tournament to examine this effect. We then determine the extent to which this accounts for the response to the policy and the extent to which changes in tournament entry can be attributed to attitudes toward competition changing in more gender-specific groups.

We first compare the decisions to submit the piece rate to the ST versus the AA tournament (Task 5 versus Task 6). Affirmative action may affect the decision to submit the piece rate through changes in the probability of winning, differences in beliefs on relative performance between mixed- versus single-gender groups, and the effect of mentioning affirmative action. The probit regression in Table 6 shows that controlling both for beliefs and the probability of winning, affirmative action has at best a small effect on men's decision to submit the piece rate to a tournament. Women, on the other hand, are 28 percentage points more likely to submit their piece rate when we introduce affirmative action. In the pooled analysis, the coefficient on the female and affirmative action interaction is significant, demonstrating that the gender gap in submitting the piece rate differs significantly between the ST and AA tournaments. These findings suggest that whereas mentioning affirmative action has a limited effect on men, it does affect women.

[33] In the standard tournament, 30 men (70%) report guesses consistent with winning the tournament, compared to 17 (40.5%) in the AA tournament. The numbers for women are 15 (35.7%) in the standard tournament and 20 (47.6%) in the AA tournament. The expected change is −3 for men and +4 for women.

[34] On average, the GuessAAWin is not significantly different from the optimal GuessAAWin ($p = 1.0$ for men, and $p = 0.49$ for women). A probit regression of GuessAAWin for the 84 participants delivers the following marginal effects evaluated at the level of a man with an optimal guess of winning: 0.08 for female ($p = 0.43$); 0.40 for the optimal GuessAAWin ($p < 0.01$). Examining men and women separately yields coefficients on the optimal GuessAAWin of 0.53 ($p < 0.01$) for men and 0.27 ($p = 0.12$) for women.

[35] The coefficient on the female–affirmative action interaction does not capture the change in the gender gap between the standard and AA tournaments. The change in the gender gap is given by $[\Pr(AA = 1, F = 1, AA \cdot F = 1; X) - \Pr(AA = 1, F = 0, AA \cdot F = 0; X)] - [\Pr(AA = 0, F = 1, AA \cdot F = 0; X) - \Pr(AA = 0, F = 0, AA \cdot F = 0; X)]$. Conditioning only on the probability of winning, the change in the gap equals 0.76. The additional control for beliefs reduces the gap to 0.59.

Table 6 Probit of Submitting the Piece Rate

	Men	Women	All
Female			−0.17
			(0.11)
Female × AA			0.10
			(0.00)
AA	−0.04	0.28	−0.06
	(0.12)	(0.00)	(0.17)
Piece rate	0.04	0.35	0.17
	(0.52)	(0.10)	(0.06)
GuessWinPR	0.83	0.55	0.72
	(0.00)	(0.00)	(0.00)
Observations	84	84	168

Notes. The marginal effects are evaluated at the level of an individual (a man in the last column) in the ST tournament with a probability of winning (*Piece rate*) of 0.33, with a guess of winning (*GuessWinPR*). We clustered the standard errors at the participant level. The *p*-values are in parentheses.

Note that the decisions in Tasks 5 and 6 and differences in those decisions are not affected by the eagerness to perform and compete in single- or mixed-gender groups. To isolate the effect of a competitive performance, we control for Tasks 5 and 6 when examining changes in the decision to enter a tournament induced by affirmative action.

Table 7 examines changes in tournament entry under affirmative action, when we control for the probability of winning, beliefs, and the decision to submit the piece rate to the relevant tournament. Conditioning on these factors, affirmative action decreases the probability that a man enters a tournament by 9 percentage points. For women, the remaining effect of affirmative action is a 25 percentage point increase in tournament entry. Pooling men and women, we see that the decision to submit the piece rate to the AA tournament helps explain the change in the gender gap; however, the female and affirmative action interaction term remains significant. Thus the gender gap in tournament entry differs between the AA and ST tournaments.[36] We ascribe this remaining difference to the competition being more gender specific under affirmative action. Men may feel more pressure to compete when the fraction of male competitors increases, whereas the fear of competing may diminish when women are in all-female groups.

Our results suggest that the excessive response to affirmative action in part can be attributed to the gender gap in beliefs and attitudes towards competition

Table 7 Probit of Tournament Choice (Task 2 Performance)

	Men	Women	All
Female			−0.18
			(0.02)
Female × AA			0.07
			(0.00)
AA	−0.09	0.25	−0.09
	(0.09)	(0.00)	(0.11)
Tournament	0.19	−0.09	0.13
	(0.01)	(0.71)	(0.03)
Tournament–piece rate	0.01	0.43	0.06
	(0.92)	(0.11)	(0.42)
GuessWin	0.05	0.35	0.12
	(0.39)	(0.01)	(0.02)
Submit piece rate	0.30	0.29	0.24
	(0.00)	(0.07)	(0.00)
Observations	84	84	168

Notes. The marginal effects are evaluated at the level of an individual (a man in the last three columns) in the standard tournament with a probability of winning the tournament (*Tournament*) of 0.33 and a change in the probability of winning (*Tournament–piece rate*) of 0.16, who submitted the piece-rate performance to the tournament with a guess of winning. We clustered the standard errors at the participant level. The *p*-values of the underlying coefficients are in parentheses.

being smaller in the more gender specific competition. Thus affirmative action influences both of the factors that initially caused women to opt out of the competition.

6. Conclusion

There is a substantial literature that aims to understand how costly it is to increase the representation of minorities. Of recent concern has been whether it is possible to improve the representation of women in high-profile and very competitive jobs. Although discrimination and gender differences in preferences and ability help explain the absence of women in these positions, another explanation may be that men and women respond differently to competitive environments, with high-performing women shying away from competition. Our study contributes to this literature by asking whether an affirmative action requirement of equal representation of women can entice more women to compete, and thereby mitigate the expected costs of such an institutional change.

We introduce an affirmative action quota into an environment where women fail to enter competitions they can win. The quota requires that for every man at least one woman has to be a winner. This affirmative action quota is expected to affect tournament entry through changes in the probability of winning; however other factors could influence entry as well. In particular the competition is more gender specific under the quota, and this may affect the two factors that caused women to avoid the competition in the first place. A more gender-specific competition can

[36] The change in the gender gap is given by $[\Pr(AA=1,\ F=1,\ AA\cdot F=1;\ X)-\Pr(AA=1,\ F=0,\ AA\cdot F=0;\ X)]-[\Pr(AA=0,\ F=1,\ AA\cdot F=0;\ X)-\Pr(AA=0,\ F=0,\ AA\cdot F=0;\ X)]$. Conditioning only on the probability of winning, the change in the gap equals 0.76. The additional controls for beliefs and the decision to submit the piece rate reduces the gap to 0.31; thus 41 percent of the change in the gap is not accounted for.

affect tournament entry by reducing gender differences in beliefs about relative performance, and by reducing gender differences in the willingness to compete. Finally, merely mentioning affirmative action may affect entry as well.

We find that affirmative action causes a large increase in the tournament entry by women and a decrease in the entry by men. This change in behavior goes beyond changes warranted by the different probability in winning, and we find that the factors listed above all help explain the excessive response to the policy.

Prior to affirmative action, women, including high-performing women, fail to enter the competition. Despite there being no discrimination, very few women win the tournaments. Using this initial applicant pool, the requirement that at least one woman must be hired for every man implies that to hire the same number of applicants, as without the quota restriction, the minimum standard of performance has to be lowered for women, and reverse discrimination is predicted. The expected costs of affirmative action would be substantial even if individuals responded to the change in the probability of winning under affirmative action. However, we show that the response is greater than that predicted. Although some high-performing men drop out of the competition, many women come in, and the overall number of high-performing participants in the entry pool is barely affected. This change in the gender composition of the applicant pool causes the ex post performance costs to be substantially smaller than predicted ex ante. In fact the performance requirements for men and women are essentially the same under affirmative action, and there is limited or no reverse discrimination. This difference in ex ante and ex post costs of implementing an affirmative action quota implies that applying such a policy secretly or without allowing for adjustment in behavior may be particularly expensive, as the response to the policy helps adjust for existing inefficiencies.

In the presence of suboptimal entry it may be unlikely that the behavioral response generally eliminates the anticipated costs of the affirmative action policy. However, it seems very likely that it can reduce the costs substantially.[37] Our results demonstrate that the costs of affirmative action are sensitive to the indirect effects that occur through self-selection into competitions. Specifically, the effects of affirmative action on the set of applicants may be large when entry decisions are not payoff maximizing. If changes in behavior are not accounted for, then we will exaggerate the costs of the policy. It is important to note that we are demonstrating the corrective feature of affirmative action in an environment where there is no discrimination; this suggests that may be circumstances where affirmative action can be justified absent discrimination.

Research on affirmative action has mostly examined the consequences of changing the demand side of the market (see Holzer and Neumark 2000 for an overview); that is, the focus has been on determining the consequences for diversity, performance, and reverse discrimination of altering the rules for admission and hiring. A small literature has focused on the effect of affirmative action on the supply side, as we do. For theoretical papers, see, for example, Coate and Loury (1993) and Mailath et al. (2000). They show that inequality can arise endogenously as long as otherwise (ex ante) identical agents have some identifiable characteristic. They also discuss the potential positive and corrective effects of affirmative action. Coate and Loury (1993) emphasized that the success of affirmative action depends on the extent to which the policy causes employers to update their assessment of the minority candidate. Of particular concern is whether the policy lowers the performance requirement for minority candidates. A lower performance requirement for minorities may cause them to acquire less human capital and further strengthen the negative stereotype. In this light it is significant to note that we find very limited reverse discrimination. For recent empirical work on a potential supply effect of affirmative action, see papers by Long (2004) and Card and Krueger (2005), who examined how the elimination of the affirmative action policy in California and Texas influenced college applications. Long (2004) found that fewer minority students send their SAT scores to top-tier colleges, whereas Card and Krueger (2005) showed that the policy does not influence the decisions of highly qualified minorities. Because the University of California and University of Texas systems rely on percentage rules whereby the top 4% and 10%, respectively, of any graduating high school class are guaranteed admission, these analyses unfortunately do not enable us to determine whether absent such programs we may observe "suboptimal" application decisions from highly qualified applicants.[38]

While our study demonstrates substantial supply-side effects from the introduction of affirmative

[37] The response to the policy is likely to be sensitive to both the policy and the initial distortion of the market. It is reassuring that the results documented here have been replicated in subsequent studies using both quota and preferential versions of affirmative action (Niederle et al. 2012, Balafoutas and Sutter 2012).

[38] See also Fryer and Loury (2005, p. 153), who comment on Card and Krueger (2005): "A more persuasive test of this hypothesis would examine the impact of affirmative action on the grades and attendance patterns of high school students. These outcomes are elastic with respect to effort, and are likely to vary with changes in students' perceptions of college opportunities."

action, the long-run effects may be even greater. Increasing the representation of women may improve mentoring possibilities (see, e.g., Allen 1995, Athey et al. 2000), and change the perception of a woman's ability to hold a high-ranking position. Perceptions can be those of women about their own aspirations or abilities or those of others.[39] For example, Beaman et al. (2009) examined the effect of introducing affirmative action quotas in Indian village councils. They found that the quota system reduces the stereotypes about gender roles and eliminates negative bias in the assessment of the effectiveness of female leaders.[40]

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[39] Chung (2000) noted that merely increasing the representation of women through affirmative action will not enable subsequent minority candidates to update their belief on own ability in the profession. As emphasized by Coate and Loury (1993), affirmative action may have permanent effects when it causes employers to update their assessment of the candidate.

[40] For a discussion about possible cultural changes, and how perceptions correlate with female performance in math, see Pope and Sydnor (2010) and Niederle and Vesterlund (2010).

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