Gender Differences in Competitiveness: The Role of Prizes

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Abstract:
Gender differences in competitiveness have been suggested as an explanation for the observed dearth of women in highly-ranked positions within firms. In this paper we ask: could a price mechanism be used to achieve gender balance? Our results show that if the rewards to competition are sufficiently large, women are willing to compete as much as men and will win as many competitions as men. Nonetheless, while entry increases, it is not enough to reduce average wage cost. Given the proportion of men and women willing to enter the competition at various prizes, firms whose objective is to minimize their costs would not voluntarily chose prizes which allow them to attract a balanced workforce. Hence markets forces would not be sufficient to achieve gender parity. Our experimental design also allows us to propose a new measure for competitiveness that incorporates the fact that incentives change participants' willingness to compete, namely the minimum prize at which participants chose to enter a tournament. We find that women choose to enter at significantly higher minimum prizes and that only a small fraction of the initial gender gap can be attributed to performance, beliefs, and general factors such as risk and feedback aversion. Thus, even though for some prizes women behave as competitively as men, women nevertheless are less competitive than men.

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1. Introduction

Men and women tend to work in different occupations and within occupations hold different positions. For instance, men hold a larger portion of the high-ranking (corporate-leadership) positions in firms (Bertrand, 2009; Blau, Farber, and Winkler, 2010; Bertrand and Hallock, 2001; Wolfers, 2006), otherwise known as the "the glass ceiling effect." To attain these kinds of positions, potential candidates need to enter a tournament and compete, and recent findings suggest that women are less likely to do so than men (see Niederle and Vesterlund, 2011, for an excellent survey of the literature on gender differences in competitiveness). If promotions and salaries are the outcome of a tournament, then this aversion to competition might help explain the existence of a glass ceiling as well as the residual gender gap in wages.[1] Indeed, that women tend to avoid competition suggests that their (psychic and monetary) expected returns from participating in tournaments may be too low for them to consider entering, not that women are less ambitious than men per se. Thus, it is possible that a change in the expected returns, like a higher prize for winning, might encourage more women to enter and narrow the observed differences in choices.

Indeed, previous findings hint that an increase in tournament prizes and more generally in the (perceived) expected returns to participation in a competition might attract more women to competitive environments. For example, Goldin and Rouse (2000) suggest that blind auditioning in a philharmonic orchestra (that should be perceived as increasing the chances a female musician earns a position) expanded the pool of female applicants. Mulligan and Rubinstein (2008) suggest that the increase in earnings inequality in the 80s and early 90s attracted high ability women with higher earnings potential to the labor market and that this selection is responsible for narrowing the gender gap in earnings in the last decades. Flory, Leibbrandt and List (forthcoming) find that the degree to which women are less likely than men to apply for a job involving a tournament depends on the attractiveness of the tournament relative to the local labor market conditions. In a laboratory setting, researchers find that women can be enticed to compete more when there is an affirmative action policy in place that favors them (see Niederle,

[1] This does not mean that the other factors such as discrimination, preferences differences for child rearing, or other factors are not important. On the contrary there are multiple evidence that they are (see Blau, Farber, and Winkler, 2010 for an excellent review of the literature).

Segal and Vesterlund, 2013 and Balafoutas and Sutter, 2012). However, such evidence, while allowing for the possibility that women can be enticed by higher prizes to take part in competitions, does not show that this is indeed the reason. Our paper directly and systematically investigates whether a change in tournament prize can affect the gender gap in entry. Moreover, whether firms would be willing to engage in offering such prize increases to attract women is still an important open question, which our paper is the first to address.

The gender gap in tournament entry has been found under certain expected returns (Niederle and Vesterlund, 2011), however, the question still remains if men are more competitive than women under a wider range of circumstances.[2] Most studies on tournament entry employ one prize, such that the expected earnings from winning the tournament equal the earnings of the alternative if the winner is chosen at random. It is not clear, however, if the gender gap persists at lower or higher tournament prizes, or more generally at different expected gains from winning.[3] Firms can raise or lower the returns to any workplace tournament, so it is natural to ask how men and women respond to changes in these prizes, holding their outside option fixed. Moreover, if an increase in prizes results in increased entry, then it may be cost effective to raise them. Therefore, this paper examines how the gender gap in entry varies with different tournament prizes, the cost effectiveness for firms to offer these various wages and whether a price mechanism would emerge to support a gender-balanced workforce.

Because the observed gender difference in competitiveness could be due to innate differences or low returns to tournament entry, we first examine whether higher tournament wages eliminate the gender gap. Then, we investigate whether firms would willingly offer these wages. If men are

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[2] There is evidence that this gender gap in competitiveness might not always hold. Nurture as well as nature plays a role in determining competitive behavior. For example, Gneezy, Leonard and List (2009) find no gender gap in matrilineal societies. Zhang (2013) finds no residual gender gap among Han Chinese who were targeted by the communist reforms. Gender differences in competitiveness do not exist prior to puberty in patriarchal societies (Anderson et al, 2013). Leibbrandt, Gneezy, and List (2013) document that male competitiveness emerges in relationship to the type of job an individual does (individualistic vs. collective). Booth and Nolan (2012) document that girls in same-sex schools are more competitive than those in mixed-sex schools. In addition, while women are typically found to negotiate worse outcomes for themselves relative to men, when negotiating for others, women can be as effective as men (Bowles, Babcock and McGinn, 2005; Amanatullah and Morris, 2009).

[3] When researchers change the rules of the tournaments to favor women, the gender gap in tournament entry seems to disappear. Thus, for example, Niederle, Segal and Vesterlund (2013) show that the gender gap in tournament entry reverses when women need to be one of the two winners in a tournament of 6 individuals. Balafoutas and Sutter (2012) show additionally that the gap disappears when women's performances are increased by the experimenter.

hyper competitive, even at low wages, then firms whose sole goal is to minimize costs would offer low wages and hire mostly men. If women need more compensation to enter a tournament than men, and they are no more productive, the wages that might encourage women to compete would not be observed in the marketplace. Firms could hire men for cheap because of men's preference for competition, so the dearth of women in tournament environments may merely be the result of the wages not being high enough to compensate them for their aversion to competition.

We turn to laboratory experiments to examine these observations. This environment allows us to explore the robustness of the gender gap in competition for a range of tournament prizes, especially for ones that might not manifest in a market equilibrium. We have several key findings. First, the gender gap in tournament entry disappears at prizes larger than those previously used in the literature (for a summary of many of the results in this literature, see Niederle and Vesterlund 2011). We are able to replicate the direction and significance of the gender gap at the prize used in previous studies and find that at lower prizes it still exists. However, we document that for sufficiently high prizes women are as competitive as men.

Second, given that higher prizes can be sufficient to achieve a more gender-balanced workplace, we ask whether it would be rational for cost minimizing firms to increase the tournament prize. We find that it is not, given our environment and the measured distribution of tournament entry at various prizes. Due to the strong preference by men to compete across the range of prizes, and over-confidence, firms are better off offering the lowest prize possible. Men are willing to enter the tournament for cheap, and firms lower their costs, and maintain the same level of production, by offering low tournament wages. This result is similar in flavor to the one obtained by Larkin and Leider (2012) who suggest that firms may be able to reduce their costs by offering convex incentives schemes that take advantage of workers' over-confidence. In our case, the low-prize tournament environment takes advantage of workers' over-confidence and competitiveness. Achieving a gender-balanced workplace through a market mechanism would require that entry behavior by low-performing workers be more rational at low prizes and (somewhat) more irrational by all workers at high prizes.

Finally, we propose a new measure of competitiveness that incorporates entry decisions at a range of tournament prizes: the minimum prize at which an individual is willing to enter the competition. Using this measure, we find that women have significantly higher entry threshold prizes than men. The median woman requires a tournament prize that is 20% higher than that required by the median man to be willing to compete rather than take a fixed piece rate wage. We find that while ability, beliefs, and risk aversion play a role in the decision to enter the tournament, these factors only explain a small portion of the gender gap in minimum prize required for tournament entry. Controlling for these factors, women still require higher minimum prizes to perform in a competition. Thus, our results imply that even though women behave as competitively as men at high tournament prizes, women are less competitive than men.

Our results suggest that the decision to compete depends on the expected returns from entering the competition and when women perceive these returns as high enough, they will chose to compete as often as men. However, in a particular situation (i.e., at a given tournament with certain outside option, rules, and prizes) women may or may not choose to compete. Thus, our results highlight the fact that observing women competing as much as men in one situation does not mean that women are as competitive as men all the time. Conversely, observing women choosing to compete less in another situation does not imply that women avoid all competitions. One needs to take a range of circumstances into account. When we do that, we find that women indeed shy away from competition more often than men. Our results suggests that, in field data, the exact setting, and in particular the perceived expected returns, may be crucial as to whether women will appear less competitive than men, as competitive as men or even more competitive than men. Indeed, the only paper that, to our knowledge, uses field data to examine tournament entry in the context of the labor market, i.e., Flory, Leibbrandt and List (forthcoming), has results consistent with this explanation.[4]

Recently there has been an interest in continuous measures of competitiveness. Gneezy, Pietrasz and Saccardo (2013) treat the choice between piece rate and tournament as an investment

[4] In a non-labor market setting, Garrett, Weinberger and Johnson (2013) show that in naturally-occurring field data from a running race, high prizes were enough to attract young women who were very likely to win and eliminate the gender gap in entry in this category. It was not enough, however, to eliminate the gender gap for slightly worse runners or older runners.

problem. In that paper, participants decide what proportion of their endowment they would like to invest in each payment scheme with a fixed piece rate and tournament prize. The paper finds that women tend to invest less in the tournament. This is similar to our finding (and others' findings as well) that women are less competitive than men, however it does not speak to whether this is robust to changes in prices. Our first result suggests that it may not be. Ifcher and Zarghamee (2014) examine a continuous measure based on a fixed tournament prize and changing piece rates, and report results which could be consistent with both preferences and anchoring.[5, 6] Our approach differs in that we take the piece rate prize as given by the environment and change the tournament prize since this is the variable that firms can affect. This allows us to explore whether firms would be willing to increase tournament prizes to achieve gender equality among tournament entrants and winners. Our results point to women's preferences as the reason why much higher tournament returns are needed to be willing to compete and suggest that cost minimizing firms may not be willing to increase tournament prizes to achieve gender equality. Freeman and Gelber (2010) allocate a single amount between varying number of winners and thus change the expected returns from winning the tournament. In accordance with tournament theory, the paper finds that, as long as the prize was related to performance, the increase in the number of winners increased performance and more so when low-performing individuals did not know their relative ranking. The variable of interest is the effort invested by the participants and therefore all participants had to compete, thus it is hard to make comparison between our paper and this one.

Several papers have demonstrated that that there are mechanisms that could help reduce (or even) eliminate the gender gap in tournament choice. For example, Wozniak, Harbaugh and, Mayr (2014) and Ertac and Szentes (2011) show that providing feedback to subjects eliminates

[5] In the main experimental task in Ifcher and Zarghamee (2014), the tournament prize is fixed and participants are offered the choice between 21 different piece rates. Prior to this task, participants performed and made choices for one of these piece rates ($0.50). Consistent with anchoring, the modal piece rate switch point of the participants is the $0.50 piece rate. In our design, we avoid anchoring with respect to the tournament prize -- participants competed in the tournament or made choices between compensation schemes knowing that one of the possible prizes would be chosen for them but not which one. We find the model minimum prize for which participants chose to enter the tournament is $0.75. This modal choice is different from a more obvious focal point of choosing the prize where the expected earnings from winning the tournament equals the earnings of the alternative if the winner is chosen at random ($1.50).

[6] Dohmen and Falk (2011) find that when faced with hypothetical choices, participants are more likely to choose the piece rate when the piece rate prize increases.

the gender gap in tournament entry. Booth and Nolan's (2012) results suggest that girls from same-sex schools are more competitive. Balafoutas and Sutter (2012) and Niederle, Segal, Vesterlund, (2013) show that affirmative action eliminates and even reverses the gender gap in tournament entry. However, most of these mechanisms operate via reducing entry of low-performing men and increasing entry of high-performing women. While this is desirable from the individual welfare point, this may be costly from the firms' perspective as it likely to increase the set of people the firm needs to pay without increasing output. Hence, even if these mechanisms would have worked at the low tournament prizes, it is not clear that firms would be willing to implement them.

Our results may help shed light on the recent experiences regarding gender equality on corporate boards in Europe. Several European countries (including the European commission) have implemented or suggested to implement a legal binding quota for females on boards of directors after failed voluntary attempts.[7] While one interpretation is that firms were discriminating against women, our results suggest that this is not necessarily the case. It could be that companies were unable to attract women at the prevailing compensation rates and unwilling to do so if it meant that they needed to raise compensations for all directors. Nevertheless, once the expected returns have changed (given the binding quota), women were applying and getting the job.

The paper is organized as follows. The next section explains the experimental design. Section 3 describes the results, and Section 4 concludes.

2. Experimental Design

Participants are asked to perform a real-effort task under various compensation schemes that include piece rate and tournament payments. To be able to compare our results to the literature

[7] Viviane Reding, the Vice-President of the European Commission, identifies the lack of cooperation from companies as the reason for the suggestion to implement a 40% binding quota of females on corporate boards in all EU member countries (http://europa.eu/rapid/press-release_SPEECH-12-678_en.htm?locale=FR): only 24 companies across Europe have signed the voluntary pledge to increase the share of women in the 12 months since it was suggested (http://ec.europa.eu/commission_2010-2014/reding/multimedia/ news/2012/03/ 20120305_en.htm). For the case of Norway that successfully implemented a 40% quota after failed voluntary attempts see Matsa and Miller (2013).

we deviated as little as possible from the Niederle and Vesterlund (2007) design, which is the most commonly used in this literature. Therefore, in our task participants are asked to add up as many five two-digit numbers as they can in five minutes. The appeal of using this real-effort task to test for gender differences in competitive preferences is that there are typically small differences in performance across men and women (see Niederle and Vesterlund, 2011, for a survey) so ability will not play a large role in explaining gender differences in tournament entry choices.

In the real-effort task, participants are presented with five randomly chosen two-digit numbers and are asked to add them up. The numbers are shown on the participant's computer screen, and the participant enters the answer by typing the sum in a box on the screen and clicking submit. Once submitted, a new set of five numbers appears along with information on whether the past answer was correct or not. Participants are not allowed to use a calculator but are provided with scratch paper and a pen. Once the five minutes are up, no additional answers can be entered, and the total number of correct and incorrect problems is displayed on the screen.

Each participant is asked to complete a sequence of five of the real-effort tasks. The instructions for each task are presented before its undertaking, and participants do not know what the nature of the subsequent task is before completing the current one. One task out of the five is randomly chosen for payment, and everyone knows this before completing any of the tasks.

In Task 1 (Piece rate), the participant is paid a piece rate of $0.50 per correct problem solved in the five minutes. Each participant knows his own performance but not the performance of anyone else in the experiment.

In Task 2 (Tournament), if the participant's performance is among the top two in a group of six, then the participant receives a payment per correct problem. Otherwise he receives no payment. Each participant is competing against five other randomly selected participants in the room. The composition of each participant's group is fixed for the duration of the experiment, however the groups are not necessarily unique.[8] As in Task 1, the participant knows his own performance but does not know the performance of anyone else in his group or the experiment. Also, he does not know if he won the tournament until all the tasks are completed.

To prevent anchoring, the tournament payment is randomly drawn from seven possible prizes ($0.75, $1, $1.25, $1.5, $1.75, $2, $2.25), thereby giving an expected prize of $1.5. Tasks 1 and 2 serve as our basic ability measures.

It is important to note that the prizes used in the experiment were chosen such that, the expected prize is equal to the piece rate divided by the share of winners in the group. In our tournament, there are two winners out of six, so the expected tournament prize is $1.5.[9] This expected prize is equal to the tournament prize that is typically used in the gender competition literature (Niederle and Vesterlund, 2011).

In Task 3 (Choice), for each of the seven tournament prizes of $0.75, $1, $1.25, $1.5, $1.75, $2, $2.25, each participant chooses whether he wishes to be paid with a piece rate of $0.50 or the tournament prize. These decisions are elicited using the strategy method (Mitzkewitz and Nagel, 1993) in which the participant makes seven decisions between the piece rate and tournament for each prize. One prize is randomly drawn, with all prizes having the same probability of being chosen. Each participant gets a different random draw,[10] and the decision the participant made for that prize (piece rate or tournament) is implemented. Before he adds up numbers for five minutes, the participant is notified which prize has been selected and his choice for that prize. If the participant chose the piece rate, he is paid $0.50 per correct problem. If he chose the tournament, his performance is compared to the Task 2 performance of the five other group

[8] Each group is composed of six people in the experimental session so that each participant faces five competitors in the room. Because the number of participants in each session was not necessarily a multiple of six, we allowed participants to be members of more than one group. This means that while a participant's performance might affect the payments of others in more than one group, the participant's own earnings is only determined by the performance of the members of his group. Each session has about the same proportion of men and women, so any subject can expect to be competing against both men and women.

[9] Having two winners out of six in the tournament was also used in Niederle, Segal and Vesterlund (2013)

[10] The reason was to help estimate whether prizes affected effort, see the discussion below. The information that not all participants get the same prize was never made public in the experiment. This was to avoid a possible discouragement effect due to comparison to others (see Bracha, Gneezy and Loewenstein, forthcoming).

members. If the Task 3 performance exceeds the Task 2 performance of at least four other group members, he receives the prize per correct problem. If not, he receives zero.

This competition set up ensures that if a participant chooses to compete, he would do so against players who were also competing (in Task 2) and that the size of the competitive group does not depend on the entry choices of other group members. This also means that, in our environment, participants should have only one cutoff prize at and above which they would choose to compete and that prize would depend on beliefs regarding the Task 2 performance of other participants.

In Task 4 (Choice 2), the participant is asked to add up numbers for another five minutes under a second randomly-chosen prize, as he did in Task 3. Again, before beginning the task, the participant is notified which prize was selected for him and his choice for that prize. If the participant chose the piece rate, he is paid $0.50 per correct problem. If he chose the tournament for that prize, he receives the prize per correct problem if his Task 4 performance exceeds the Task 2 performance of at least four other group members. If not, he receives zero.

It is important for us to know whether the size of the prize affects performance, as this would affect our analysis of costs. Specifically, if performance is affected by prizes, then, to compute the costs per correct problem associated with a certain prize, we could only use the Task 3 performance of individuals who competed for that prize and not the whole distribution of performances. To figure out whether effort depended on prizes we wanted to have for each participant multiple observations on their performances under different prizes. Therefore, we added Task 4 to the experimental design. We chose to draw for each participant a prize for these two tasks to increase the variability of the observations. To ensure that a different prize would be chosen in Tasks 3 and 4 we did the following. If a low prize ($0.75, $1, $1.25 or $1.5) is chosen in Task 3 then a high prize ($1.75, $2, or $2.25) would be chosen in Task 4 and vice versa. Indeed, as we discuss in Section 3.3, our results show that prizes do not affect performance,[11] however, performance improves between Tasks 3 and 4.

[11] This is not a surprising result. Gneezy and Rustichini (2000) show that as long as participants are paid "enough" an increase in the piece rate payment does not result in an increase in performance. Larkin and Leider (2012) document sorting effects of incentives but no effect of the incentive scheme on performance when comparing externally and randomly imposed piece rate and convex incentive schemes. Bracha, Gneezy and Loewenstein

In the final Task 5 (Submit the Piece Rate), the participant is not asked to add up numbers. Instead, for each of the seven tournament prizes of $0.75, $1, $1.25, $1.5, $1.75, $2, $2.25, each participant chooses whether he wishes to be paid with a piece rate of $0.50 or the tournament prize for the number of problems correctly solved in Task 1. The strategy method is used again in this task to elicit choices for each of the seven prizes. If he chooses the piece rate, he earns $0.50 per problem correctly solved in Task 1. If he chooses the tournament, he is paid the prize per correct problem if his Task 1 performance is one of the best two in the group. Otherwise, he earns zero.

Because the tournament entry choice in this task does not involve adding up numbers, it controls for factors that may affect the choice but have nothing to do with performing in a competition (like risk aversion, feedback aversion, etc.).

Following the completion of the five tasks, the participant answers two belief elicitation questions. The first asks him to state whether he was among the top two performers in the group, the middle two or the bottom two in Task1 and in Task 2. The participant earns $1 for each correct answer. This is a discrete measure reflecting the belief of one's rank. The second belief elicitation question asks the participant to state his belief of the probability that he is among the top two performers in his group in Task 1 and Task 2. The measure is incentive compatible and based on that used in Mobius et al, (2013).[12] The advantage of using this continuous measure of beliefs in our setting is that for different prizes it implies different behaviors (for example, a risk neutral person who thinks she has a 51% chance of winning the tournament, should enter the tournament when the prizes exceeds $1, but not for lower prizes). Both types of measures have

(forthcoming) document that doubling the piece rate size does not increase the time participants chose to work on a task (as long as they are not aware of the piece rate of other participants). Actually, it seems that when payments are very high, it has a detrimental effect on effort. This was found in laboratory experiments (see Ariely et al., 2009) and in field data. Paserman (2010) shows that professional tennis players of both genders experience a significant (and similar) reduction in their performances when the stakes are high. Thus, it seems to be important to set tournament prizes high enough to ensure maximal effort, but low enough not to have detrimental effects.

[12] Specifically, the participant states the percentage chance he is ranked among the top two performers in his group (x%). A number is then randomly drawn between 0 and 100 (y). If the number is less than the participant's guess (i.e., $y < x$), he earns $3 if he was among the top two performers. Otherwise he gets nothing. If the number is greater than or equal to the participant's guess (i.e., $y \geq x$), he earns $3 with a y% chance. To determine whether the participant won the $3, there is a second random draw, z, between 0 and 100. If $z \leq y$, then the participant earns $3. Otherwise, he gets nothing.

been used in the literature. We use the continuous measure in our analysis, though all our results remain the same is we instead use the binary measure.

Finally, each participant completes a demographic survey and is then shown earnings in all of the five tasks plus any money earned in the beliefs questions. One of the five tasks is randomly chosen for payment, and participants learn final earnings.

The experiments were conducted at the Economics Lab at University of California-San Diego in Fall 2013. There were 164 individuals (89 men and 75 women) who participated over seven sessions. The number of participants in each session ranged between 21-24, and a similar number of men and women were in each session (the share of women in each session ranged between 0.4-0.5). Each session lasted one hour, and average participant earnings were $24.45 (s.d. $9.73).

3. Results

We now turn to the experimental results. We first examine the gender gap in tournament entry, then ask whether a cost-minimizing firm would offer higher wages and finally introduce and discuss our new measure of competitiveness.

3.1. Is the Gender Gap in Tournament Entry Responsive to Incentives?

We start by examining the entry decisions our participants made. Figure 1 depicts for each of the possible prizes the fraction of men and women who chose to enter the tournament at that prize as well as minus the gender gap that, following the convention in the literature, is defined as the difference between these two numbers.[13] There are several things to note in the figure. First, both male and female participants increase their entry as tournament prizes rise. While men seem to

[13] Not all participants were monotonic in the tournament entry decision as the prize increased. Because the set of competitors and their performance is constant across prizes, a consistent pattern of behavior would be to enter the tournament when the prize was sufficiently high and then continue to choose the tournament for any prize higher than the threshold prize. There were 11 inconsistent choices in Task 3 (tournament choice) and 5 in Task 5 (submit the piece rate) made by 14 participants. While the choice patterns are not consistent, we include these participants in our data analysis. If we were to drop them or make their choices consistent, all the main results in the paper still hold both qualitatively and quantitatively. Details on how our main results change under various assumptions of how to handle the inconsistent subjects are outlined in Appendix B.

more consistently do so throughout the prize range, women only marginally increase their entry rates for prizes above $1.75. Nevertheless, we still find that even at the highest prize offered (i.e., $2.25) 19.1% of the men and 26.7% of the women did not choose the tournament. This alleviates the concern that it is our elicitation method, and not participants' preferences, that caused the gender gap to disappear by enticing participants to choose the tournament for one of the prizes we offered.

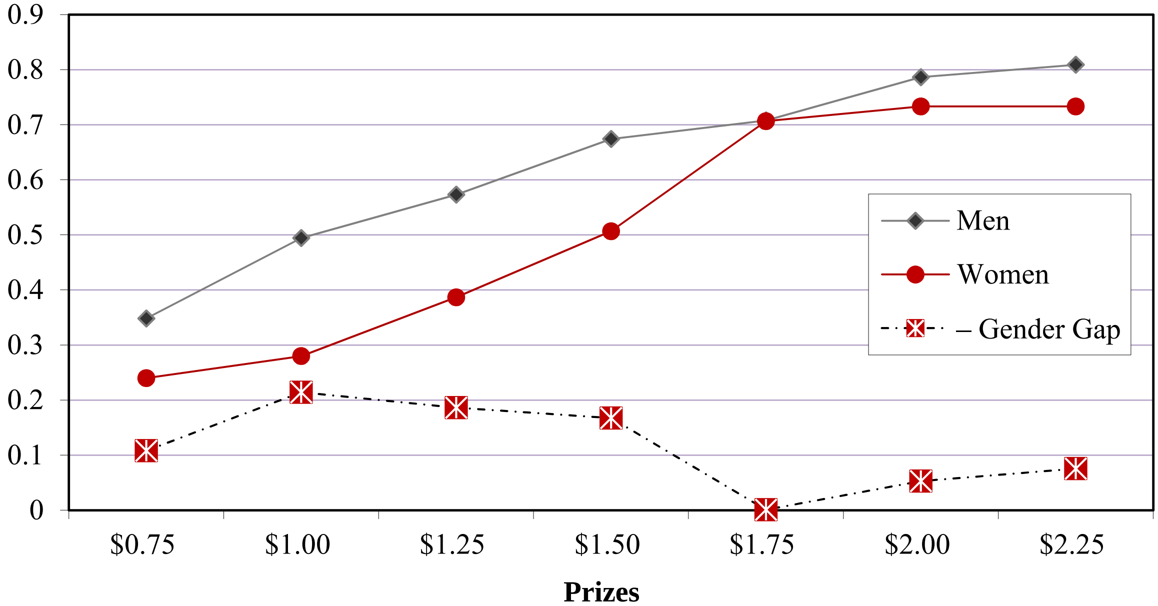


Figure 1: Fraction Entering the Tournament by Gender and Prize and the Gender Gap

Second, there is a significant gender gap in entry at the low prizes, i.e., all prizes below $1.75, including the prize for which most previous studies document a gender gap (in our case it is $1.50). However, there is a range of prizes ($1.75 and above) for which the gender gap disappears.[14] Meaning, for the highest set of prizes, women make the same choices as men. Moreover, when we divide the prizes into these two respective ranges, we find a significant reduction in the gender gap between the prizes below $1.75, in which we find a significant gender gap in entry, and the prizes sized $1.75 and above, in which the gender gap in entry is insignificant. When we run regressions which allow the gender gap to be different between the

[14] The regression results depicting the raw gaps for each of the prizes can be found in Table 4 and in Appendix B Table B3 for the various ways we handle the inconsistent individuals. The raw differences can be found in Table B1 in Appendix B. The one-sided Fisher exact tests yield the following *p*-values: 0.090, 0.004, 0.013, 0.022, 0.561, 0.270, and 0.167 for the prizes $0.75, $1, $1.25, $1.5, $1.75, $2, and $2.25, respectively. Taken together, there is no gender gap in entry for prizes above $1.50 (the one-sided Fisher exact test yields $p = 0.159$), but there is one for prizes sized $1.5 and below (the one-sided Fisher exact test yields $p < 0.001$). Regression results that account for the multiple observations per person confirm these results.

two prize ranges (clustering the standard errors on the individual) we find that the gap at the lower prize range is -0.169 and highly significant (p = 0.008), the gap in the higher prize-range is -0.043 and insignificant (p = 0.498) and the difference between the two is positive and significant (p = 0.054).[15]

To examine how responsive men and women are to prizes, we estimate the entry decision as a continuous flexible function of tournament prizes. For men we find that the entry decision is quadratic in prizes: $0.65TP - 0.11TP^2$ and for women it is cubic: $-2.5TP + 2.18TP^2 - 0.50TP^3$, where TP stands for tournament prize. Using these estimates to calculate the prize responsiveness of men and women, we find that women are more responsive to tournament prizes when the tournament prize lies between \$1.05 and \$2 and men are more responsive to tournament prizes when tournament prizes are below \$1.05 or above \$2.[16]

In sum, we find that men and women increase entry in the tournament as the returns to winning increase. Also, while there is a significant gender gap in entry at low prizes, the gap disappears at higher prizes and women's entry behavior is as competitive as men's.

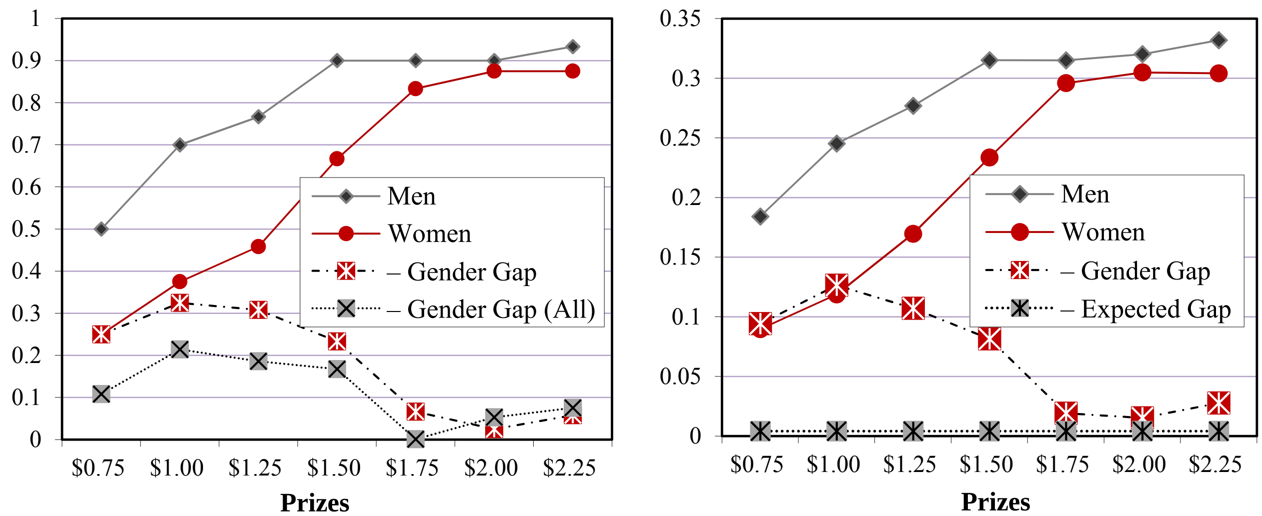
3.2 Gender Gap among Tournament Winners

Having seen that the gender gap in entry disappears for sufficiently high prizes, the next question to ask is what happens to the gender gap in tournament winners. This will be determined by several factors. First, it depends on the performance of men and women. In particular, if participants of a certain gender perform better, then they should be over represented among the winners. In our sample, there is no significant gender gap in performance between men and women. The average performance of a women (men) in the Task 1 (piece rate) is 10.2 (10.3) and in Task 2 (tournament) is 12.3 (12.4). Two-sided Mann-Whitney tests show that there are no significant gender differences in the distributions ($p = 0.77$ and $p = 0.67$, respectively). There are also no gender differences in performance for Task 3, where the performance of women and men

[15] In addition, if we exclude the lowest prize of \$0.75 because the gender gap at that prize is only marginally significant, we find similar results. The gender entry gap for the prize levels of \$1-\$1.5 is 0.189 and highly significant (p = 0.006), the gap in the higher prize-range is -0.043 and insignificant (p = 0.498) and the difference between the two is positive and significant (p = 0.022).

[16] Andreoni and Vesterlund (2001) find men to be more responsive than women to prices of giving in dictator games.

is 12.5 and 12.8, respectively (and the two sided Mann-Whitney test yields $p = 0.997$). Second, the gap depends on entry decisions. We have already seen that there is a large overall gender gap in entry. However, the relevant information here is not whether there is an overall gap in entry, but rather whether there is a gap among those who are likely to win (i.e., whether those in the top third of the performance distribution decide to enter). Figure 2 Panel A displays the gender gap in entry among the top performers, i.e., individuals with a Task 3 performance of 15 and above. The figure clearly shows that the gender gap in entry among top performers mirrors the gender gap in entry for all participants (also displayed in Panel A). The gap is significant and large for prizes of \$1.50 and below and it disappears for prizes sized \$1.75 and above. The gap for tournament winners is larger than the gap for all participants, and, indeed, it too disappears once prizes are high enough (i.e., \$1.75 and above).



Panel A: Fraction of Task 3 Top Performers Entering the Tournament by Gender and Prize and the Gender Gap

Panel B: Fraction Winning the Tournament by Gender and Prize and the Gender Gap

Figure 2: Gender Gaps among Top Performers and Tournament Winners

Figure 2 Panel B shows (in an analogous manner to Figure 1) the fraction of men and women who are winners of the tournament and minus the gender gap in tournament winners. Since the actual status of a winner in the experimental data depends on the exact group that was drawn for each participant, we use simulations to calculate these numbers.[17] Since it seems that the

[17] The simulations draw with replacement a group of 24 participants (i.e., a "session") from the experimental sample. Then, as in the experiment, a group consisting of 5 individuals is drawn without replacement for each participant. We then compare the results of the participant's Task 3 performance to the Task 2 performance of her

performance of men might be slightly better at the high end of the distribution, the figure also reports (minus) the expected winner gap between men and women if all participants would have chosen to enter the tournament.[18] As predicted, once the prize levels is high enough (i.e., $1.75 and above) the gender gap in winners is miniscule.[19]

These results suggest that, not only will the workforce among firms that offer tournament incentive schemes with high enough prizes have gender balance, the promoted workforce will be balanced as well.

3.3. Would Cost Minimizing Firms be willing to Increase Tournament Prizes to Achieve Gender Equality?

In the previous sections we saw that with high enough prizes, firms can achieve gender balance among their workforce (tournament entrants) and among their promoted workers (tournament winners). In this section, we ask whether cost-minimizing firms would be willing to increase tournament prizes.

To think about this issue, first note that while the firms benefit from the work produced by all the tournament entrants, they only have to pay the winners. Therefore, if only individuals who are very likely to win enter the tournament, then the average cost per correct problem will be very close to the tournament prize. However, if, for the same prize, individuals who are unlikely to win also enter, then the average cost per correct problem that the firm will have to pay would be significantly less than the tournament prize. Therefore, it is possible to construct scenarios in which firms would find it beneficial to increase prizes in order to reduce average cost. These scenarios will all involve a significant increase in entry at higher prizes of individuals who are very unlikely to win, while at low prizes only individuals with high chances of winning enter. Put differently, at lower prizes everyone enters rationally (i.e., according to their objective

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simulated group members and determine whether she is a potential winner. We then incorporate the participant's entry decision for each prize to determine the actual winners. For each "session" we then sum up the fraction of men and women winners. We repeat this process 100,000 times.

[18] This number was also calculated using simulations as described above.

[19] Given that these numbers are based on 100,000 simulations all differences are significant.

chances of winning), while at higher prizes those who (objectively) stand to lose enter nevertheless.

Table 1 illustrates this point. Since the actual costs in the experimental data depend on the exact groups that were drawn for each participant, in this section, we use simulations to calculate average cost per correct problem (given the distribution of Task 3 performances in our experiment).[20] The first line in Table 1 depicts the cost if all participants would have entered. The second line displays the average cost if only those who stand to gain (for whom the objective probability of winning × tournament prize > piece rate) would have entered the tournament. When we move from the second line to the first, at least for some range, we can see a reduction in average cost when prizes are increasing. For example, if at prizes lower than $1.25 only those who stand to gain enter, and starting at prizes of $1.25 everyone enters, firms will minimize their cost by choosing a tournament prize of $1.25.

Table 1: Average Cost per Correct Problem for Possible Prizes (Given Task 3 Performance): Hypothetical Entry Scenarios

	$0.75	$1.00	$1.25	$1.50	$1.75	$2.00	$2.25
All Enter	0.359	0.478	0.598	0.718	0.837	0.957	1.076
Stand to Gain Enter	0.695	0.871	0.993	1.192	1.297	1.482	1.668

Note: Results are based on simulations as discussed in the text.

Implicit in our cost calculations is the assumption that we can use the distribution of Task 3 performances in our experiment to calculate the average cost at each prize. That is, performance is not affected by the prize chosen. In order to test this hypothesis, we included Task 4 in our design. Using Task 3 and Task 4 performances we can check whether this assumption is correct controlling for individual ability. Using individual fixed effects regressions (in which we cluster standard errors on the individual) and restricting attention to the 71 participants who chose to compete in both tasks, we find no relationship between prize and performance (the coefficient on

[20] As we discussed in footnote 17, the simulations draw with replacement a group of 24 participants (i.e., a "session") from the experimental sample. For each participant we draw without replacement a group consisting of 5 other "session" participants and we determine their potential winner status by comparing their Task 3 performance to the Task 2 performance of the other group members. For each prize and "session" the group of winners are the potential winners who decided to enter at that prize and the entrants are those who decide to enter. We then calculate the average costs per correct problem, in the "session", by dividing the payment to the winners (i.e., the performance of the winners times the prize) by the total entrants performance. We repeat this process 100,000 times.

the variable tournament prize is 0.45 and the standard error is 0.54).[21] As we mentioned above (in footnote 11), this result is consistent with other findings in the experimental literature that prices do not interact with performance as long as they are sufficiently high but not too high. Therefore, we confirm our assumption and continue using the distribution of Task 3 performance for each of the prizes.

Given that it might be beneficial for a cost-minimizing firm to raise tournament prizes, we now examine how average cost changes given the entry patterns observed in the experiment. Table 2 Panel A clearly shows that the average cost is increasing with the prize. Using simulations, we can ask: for the same group of 24 participants could a firm lower its cost if it increases prizes by the marginal prize increase in our experiment, i.e., by $0.25? The second line in Table 2 answers this question. We see that this is possible, but mostly unlikely given the empirical entry patterns. It is most likely to happen for an increase of the prize from $1.50 to $1.75, where we observe the largest increase in entry of individuals who are unlikely to win, and even there the probability of reducing cost (by any amount) is only 12.1%. In all other cases, cost reduction happens with a probability of less than 10%.[22]

Table 2: Simulated Average Cost per Correct Problem (Given Task 3 Performance)

Simulated Average Cost Given Experimental Entry

Prize	$0.75	$1.00	$1.25	$1.50	$1.75	$2.00	$2.25
Average Cost	0.424	0.568	0.699	0.848	0.948	1.041	1.177
% of "Sessions" in which a $0.25 Prize Increase Results in Lower Cost	5.31	8.52	4.94	12.09	7.54	0.85	

Notes: Results are based on simulations as discussed in the text.

Thus, firms would minimize cost by offering the lowest prize ($0.75). In our environment, even though gender balance is achieved through higher prizes, the market would not offer these prizes because it is too costly. While participants who are unlikely to win do enter more as the prize

[21] However, in the same regressions we find that between Task 3 and Task 4 our participants improved significantly their performance by almost one correct answer (the coefficient on the dummy variable that equals 1 if it was Task 4 is 0.94 with standard error of 0.4). Similar individual FE regression indicates that there is no significant increase in performance between Task 2 and Task 3.

[22] Table B2 in Appendix B reports the results for the different ways we can "correct" the inconsistencies in choices. As is clear from that table, the inconsistencies in choices displayed by some of our participants are not the driving force behind this result.

increases, this entry is never enough to compensate for the higher cost of the prize and the additional entry by high-scoring participants.

Table 3: Simulated Average Cost per Correct Problem (Given Task 3 Performance): Experimental Entry and Alternative Entry Patterns.

Prize	$0.75	$1.00	$1.25	$1.50	$1.75	$2.00	$2.25
Panel A: Simulated Average Cost Given Experimental Entry							
Average Cost	0.424	0.568	0.699	0.848	0.948	1.041	1.177
Panel B: Simulated Average Cost for "Corrected" Experimental Entry: Only Those who Have *Objective* Probability of Winning Consistent with Standing to Gain Enter if Entered at the Prize							
Average Cost	0.721	0.856	1.008	1.207	1.330	1.517	1.701
Panel C: Simulated Average Cost for "Corrected" Experimental Entry: Only Those who Have *Subjective* Probability of Winning Consistent with Standing to Gain Enter if Entered at the Prize							
Average Cost	0.496	0.612	0.729	0.878	0.979	1.083	1.207

Notes: Results are based on simulations as discussed in the text.

Given that the observed entry patterns and performance from our experiment do not support firms voluntarily offering high prizes, we ask whether firms would be willing to increase prizes if participants' entry decisions had been more rational at low prizes. Panel B of Table 3 investigates this issue (Panel A repeats the results of the first row of Table 2 to make comparisons within the table easier). For each tournament prize, it depicts the average cost to the firm if the only entrants were those who (a) stand to gain (i.e., whose objective probability of winning × the prize > piece rate) *and* (b) decided to enter at that prize in the experiment. We can see that cost can be reduced when prizes increase if we move from an entry pattern that includes only such entrants to the experimental entry pattern (i.e., moving from Panel B to Panel A). Thus for example, if the entry pattern was as follows: for prizes below $1.25 only those who stand to gain (and who also chose to enter in the experiment) enter and starting at $1.25 we have the experimental entry pattern. Then, cost minimizing firms will set the tournament prize at $1.25, because the average cost at this prize is 0.699 (see Table 3 Panel A) and it is lower than the average cost at lower prizes (see first two columns of Table 3 Panel B). Nevertheless, note that even if up to the prize of $1.75 only those who stand to gain enter, cost-minimizing firms would still not be willing to increase prizes if there is any entry at prizes below $1.25. Only if no one entered the tournament at prizes below $1.25 and only those who stand to gain enter for the $1.25 and $1.50 prizes would cost-minimizing firms be willing to offer the $1.75 prize and then achieve gender equality among their workforce and promoted workers. In this case, average cost would be 0.948.

Finally, what may be most relevant for understanding entry patterns is not the objective probability of winning, but rather the subjective one. This reflects the confidence a participant has in winning the tournament. Panel C of Table 3 depicts the average cost if the only entrants are those who (a) have a *subjective* probability of winning (i.e., the beliefs that they will win the Task 2 tournament) × the prize > piece rate *and* (b) decided to enter at that prize in the experiment. Thus, we restrict attention to the *entrants* in the experiment whose subjective probability of winning implies that they stand to gain from choosing the tournament instead of the piece rate. This panel shows that average cost is so low that there is no range of prizes for which switching to the actual experimental entry results is a cost reduction (i.e., any increase in prizes also increases cost in the move from Panel C to Panel A). This says that our participants are so over-confident and competitive that firms would minimize average cost by offering the lowest prize.

In sum, while there are hypothetical scenarios under which a cost-minimizing firm could have an incentive to offer higher prizes, and thereby achieve a gender balanced workforce, the over-confidence and competitiveness displayed by the participants in our experiment would never result in cost reduction at higher prizes. Faced with a population such as in our experiment, a firm would minimize cost by offering the lowest possible tournament prize ($0.75). That is, while higher prizes do entice more women to enter the tournament such that the gender gap in entry seen at lower prizes disappears, cost-minimizing firms would never be willing to offer such a wage.

3.4 A New Measure of Competitiveness: Minimum Entry Prize

Given that participants' entry behavior depends on the magnitude of the tournament prizes, a measure that records their decision only at one value will miss a lot of information. A better one would take into account the range of decisions that the individual makes. We propose a new measure that does just that: the minimum prize at which an individual decides to enter the tournament.[23] The gender gap in entry displayed in Figure 1 (coupled with the information that 91.5% of our participants displayed consistent behavior) shows that women choose the tournament for higher minimum prizes than men. Indeed, the median woman requires a prize of at least $1.5 to enter the tournament while the median man requires a prize of at least $1.25, i.e., a 20% difference.[24] Moreover, the distribution of minimum prizes for women first order stochastically dominates that of men.[25]

Next we ask what factors can explain the gender gap in minimum prizes. The first obvious one is performance. As we have seen, there is no difference in performance between men and women, but there is a substantial gender gap in entry among the top-performing participants (Figure 2 Panel A). Therefore, we expect that performance will not be able to explain the gender gap. To test this rigorously we run regressions. Here one needs to note that for participants who always chose the piece rate (or the tournament), we do not know what is the minimum prize at which they will be willing to enter the tournament. Therefore, in the regressions we use Tobit specifications in which these observations are considered censored.[26] We assigned the value of 0.75 for the participants who always chose the tournament and the value 2.5 for participants who always chose the piece rate.[27] The marginal effects, calculated at the sample means, of these Tobit regressions are displayed in Table 4.[28] Column 1 confirms the non-parametric results. The minimum prize for which women are willing to enter the tournament is almost half a dollar

[23] In the analysis that follows, we assign each participant the lowest prize for which he or she chose the tournament as his/her minimum prize regardless of whether the participant's decisions are consistent. If we restrict the sample to the individuals who made consistent decisions or change the decisions to be consistent (as discuss in Appendix B), the results are qualitatively and quantitatively the same. Table B3 in Appendix B displays the main results of Table 4 for the different ways to define consistent individuals.

[24] The Mann-Whitney test for equality of the distributions yields $p = 0.071$. If we assign the value of $2.5 for those who always chose the PR then the means for men are 1.36 and 1.52 for women.

[25] While we cannot reject the hypothesis that the distribution of minimum prizes of women first order stochastically dominates the distribution of minimum prizes of men (the kolmogorov-smirnov test yields $p = 0.97$), we can reject the converse hypothesis (the kolmogorov-smirnov test yields $p = 0.057$).

[26] If we run OLS regressions, the results are qualitatively similar and none of the conclusions will change.

[27] Given our design, if we would have added another prize, it would have been $2.5. So, we will not be able to distinguish between minimum prizes that are higher than $2.25 and lower or equal to $2.5.

[28] Unless otherwise noted, all regressions include dummies for inconsistent choice in Task 3 and in Task 5, two dummies for race (white and non-white non-Asian where the omitted category is Asians), four major dummies (natural sciences, social sciences, physical sciences, other, and the omitted category is economics). We always estimate robust standard errors. The full regression results can be found in Table A1 in Appendix A.

larger than that for men. In column 2 we add performance controls: Task 2 performance (which was known at the time the choice was made) and the change in performance between Task 1 and Task 2. As expected, performance does not help explaining the gender gap in minimum prizes. Nevertheless, those with higher performance have on average lower minimum prizes.

Table 4: Gender Gap in Minimum-Entry Prizes for Task 3: Marginal Effects after Tobit Regressions

	(1)	(2)	(3)	(4)
Female	0.468***	0.457***	0.486***	0.408***
	[0.158]	[0.149]	[0.148]	[0.140]
Task 2 Performance		-0.084***	-0.061**	-0.028
		[0.025]	[0.026]	[0.025]
Task 2 –Task 1 Performance		0.003	0.027	-0.041
		[0.034]	[0.034]	[0.037]
Subjective Probability Task 2 Wins Tournament			-0.010**	-0.007*
			[0.004]	[0.004]
Minimum Piece Rate Prize:				
$1.00				-0.515
				[0.384]
$1.25				0.652***
				[0.248]
$1.50				0.414
				[0.257]
$1.75				0.379
				[0.298]
$2.00				0.797**
				[0.316]
$2.25				0.724***
				[0.264]
Always Piece Rate				0.772***
				[0.256]
Observations	164	164	164	164

Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1
All regressions include dummies for inconsistent choice in Task 3 and in Task 5, 2 dummies for race (white and minority where the omitted category is Asians), 4 major dummies (natural sciences, social sciences, physical sciences, other, and the omitted category is economics). Full results can be found in Table A1 in Appendix A.

The next factor we consider is beliefs. If men and women have very different beliefs regarding their chances of winning the tournament then this may help explain the gender differences in minimum entry prizes. We use the continuous belief measure to examine this.[29] In our sample,

[29] While the frequently used binary belief measure will retain the same value for all prizes, the continuous belief measure of the probability of winning the tournament allows us to distinguish optimal behavior at different prizes. None of the reported results change if we use the binary measure.

men and women have similar beliefs regarding the likelihood that their performance is among the best two in their group, i.e., that they win the tournament. Figure 3 (Panel A) displays the mean of the subjective probability of winning of participants with similar objective Task 2 probabilities of winning.[30] The figure also displays the linear regression line for each gender separately and the 45-degree line. The figure clearly shows that both men and women are over-confident. On average, most participants (82.67% of the women and 80.9% of the men) have estimated that their probability of winning the tournament is higher than the actual probability.[31] Nevertheless, the performance is positively related to the estimated probability of winning for both genders (the coefficient on the objective probability of winning is 0.23 for women and 0.37 for men, and both are significant at the 0.01 level). Moreover, women are no less overconfident than men. In regressions using all participants, the coefficient on the female dummy is 3.15 and insignificant ($p = 0.358$), however, the coefficient on the objective probability of winning equals 0.33 and is highly significant ($p < 0.01$).[32]

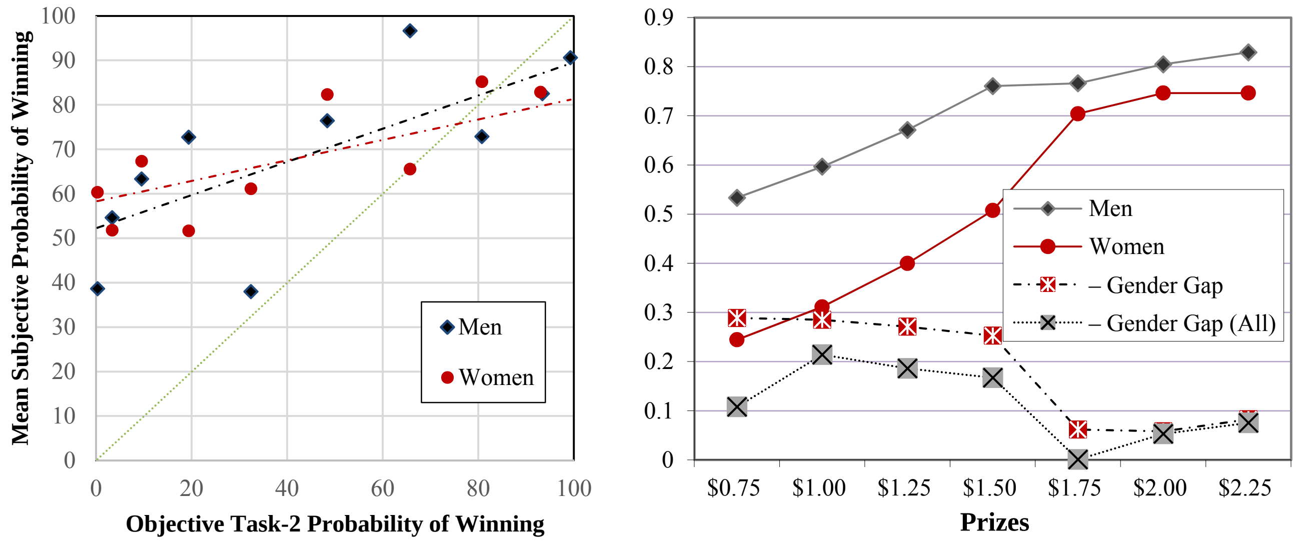
Figure 3 (Panel B) displays the entry behavior of participants whose subjective probability of winning suggests that they stand to gain from entering the tournament (i.e., for them, the subjective probability of winning × tournament prize > piece rate). Even though there are no gender differences in beliefs, there are gender differences in how men and women with the same subjective beliefs behave. Even among those participants whose beliefs are consistent with a gain by entering the tournament, we see the same patterns as the gender gap for all the participants (also displayed on the graph) – it exists only for prizes below $1.75. Thus, we expect that the gender gap in minimum entry prize will not be explained by the gender gap in beliefs. Indeed, when we examine Column 3 of Table 4, we see that adding the subjective probability of winning as a control does not reduce the gender gap in minimum entry prizes. If anything, it increases it a

[30] To plot the graph we bunched together performances of less than 10 that had less than 1% chance of winning, performances of 17-19 that had 90.8%-97.3% chance of winning, and performances of 20 and above that had at least 98% chance of winning. To calculate the objective probability of winning for each performance we drew with replacement 100,000 groups consisting of 5 participants using the performance distribution of the participants in our experiment. We then calculate the frequency of wins in this set of simulated groups.

[31] The difference between men and women is not statistically significant (a fisher exact test yields $p = 0.841$).

[32] When we use the binary measure (i.e., whether a participant guessed that his/her performance was among the best two in the group) or the full ranking measure (that separate also between the performance being the 3rd or 4th best or among the bottom two performances) we find similar results. Meaning, higher Task 2 objective probability of winning significantly predicts better ranking by the participants, but there are no gender differences in the ranking.

bit. Nevertheless, as we expect, individuals with higher subjective probability of winning tend to have lower minimum prizes.



Panel A: Beliefs as a Function of Actual Probability of Winning the Tournament

Panel B: Fraction Entering the Tournament: Stand to Gain (According to their Beliefs)

Figure 3: Beliefs

One point to note is that while we find no difference in beliefs of men and women, this is not a common finding in the literature regarding competitiveness (see the survey by Niederle and Vesterlund, 2011) or in the literature regarding general gender differences (see Croson and Gneezy, 2009 and Bertrand, 2011). To shed some light on the possible reasons, we compare the guessed rankings of tournament performance of our participants to those of the participants in Niederle, Segal, and Vesterlund (2013), NSV, who also used groups of 6 with 2 winners and asked their participants to guess their rank.[33] Since the two designs diverge on almost every other point, one needs to interpret these comparisons cautiously. Our female participants rank themselves significantly higher than female participants in NSV and this is true even conditioning on their objective probability of winning the tournament. However, our female participants are more likely to rank themselves among the best two performers in their group only if we do not control for their objective probability of winning. The men in our experiment seem to rank themselves somewhat lower than the men in NSV. However, this difference is no

[33] Niederle, Segal, and Vesterlund (2013) did not elicit the probability of winning, hence we need to use the ranking measure. We converted the 1-6 ranking in Niederle, Segal, and Vesterlund to our ranking by assigning rank 1 to ranks 1-2, rank 3 for the 3-4 ranks and rank 5 for the 5-6 ranks.

longer significant when we control for the objective probability of winning. The gender differences in beliefs is significantly smaller in our sample, regardless of the way we measure it. Thus, it seems that the lack of gender differences in beliefs is mostly coming from our female participants being relatively more (over)confident than similar student samples. This may help explain why the measured raw gap in our data for the $1.5 prize (i.e., the "usual prize" in the literature) is relatively small in comparison to the literature (NSV find a raw gap of 42%).[34]

The last factor that may explain the gender gap in minimum entry prizes is risk and feedback aversion, which may cause women to choose the piece rate for low prizes even conditional on their beliefs. We use the decisions in Task 5 (i.e., the decision whether to submit the Task 1 performance to the tournament at different prizes) to shed light on this issue. As we did with Task 3 choices, we assign to each participant the minimum prize for which he/she is willing to submit their Task 1 performance to the tournament.[35] Table 5 Column 1 shows that there is an initial gender gap in minimum submission prizes, with women choosing to submit their Task 1 performance to the tournament at higher prizes.[36] Column 2 suggests that the gap cannot be explained by differences in Task 1 performance (that by itself is negatively and significantly related to minimum submission prizes, as expected). Lastly, Column 3 suggests that the gender gap cannot be explained by beliefs regarding Task 1 performance (though, individuals who believe that their chances to be among the top two performers are higher submit their Task 1 to the tournament for lower prizes).[37] Thus, we find that there is a persistent gender gap in minimum submission prizes. The interpretation is that there is a gender gap in factors (such as risk and feedback aversion) that are not directly related to performance in a competition, with women more risk and/or feedback aversion.

[34] While in Niederle, Segal, and Vesterlund (2013) only 31% of women chose to enter, in our sample for the $1.5 prize 50.67% of the women chose to enter. This difference is significant, Fisher exact test yields $p = 0.052$. At the same prize, 67.4% of our male participants chose to enter the tournament while 73.8% of the male participants in NSV did so, that difference is not significant (Fisher exact test yields $p = 0.544$).

[35] As we have done before, we assign the minimum prize regardless of whether the participant's decisions are consistent. If we restrict the sample for the individuals who made consistent decisions or change the decisions to be consistent (as discuss in Appendix B), the results are qualitatively and quantitatively the same. Additionally, we assigned, as before, a minimum submission prizes of $0.75 and $2.5 for participants who always chose the tournament or the piece rate, respectively.

[36] The full regression results can be found in Table A2 in Appendix A.

[37] Again, we find that both men and women are as over-confident in their beliefs regarding the probability of their Task 1 performance being among the best two in their group. In regressions, the coefficient on the female dummy is 1.75 and is insignificant ($p = 0.702$), the coefficient on the objective probability of winning equals 0.14 and is highly significant ($p = 0.019$).

Table 5: Gender Gap in Minimum-Submission Prizes for Task 5: Marginal Effects after Tobit Regressions

	(1)	(2)	(3)
Female	0.709**	0.607**	0.688**
	[0.039]	[0.041]	[0.013]
Task 1 Performance		-0.294***	-0.166***
		[0.000]	[0.001]
Subjective Probability Task 1 Wins Tournament			-0.028***
			[0.000]
Observations	164	164	164

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.1
All regressions include dummies for inconsistent choice in Task 3 and in Task 5, 2 dummies for race (white and minority where the omitted category is Asians), 4 major dummies (natural sciences, social sciences, physical sciences, other, and the omitted category is economics). Full results can be found in Table A2 in Appendix A.

The findings summarized in Table 5 suggest that differences in risk and feedback aversion may help explain the gender gap in tournament entry. In Column 4 of Table 4, we add the minimum submission prize in Task 5 to the regressions. As we already discussed, for individuals who always chose the piece rate or the tournament we do not know what the minimum submission prize is. Therefore, and to avoid the linearity assumption, we created a series of dummy variables to indicate each possible minimum submission prize and use those as controls.[38] We find that those who require higher minimum prizes to submit their Task 1 performance to the tournament are in general more likely to require higher minimum prizes to perform in a competition. However, while the differences noted above in the behavior of men and women can explain part of the gender gap in minimum prizes to enter a tournament, about 87% of the original gap remains.

To compare our findings more directly to the literature, we investigate the entry decision in Task 3 for each of the tournament prizes separately. For each tournament prize, we ran four different Probit regressions analogous to the regressions reported in Table 4. Figure A1 in Appendix A summarize the main results with respect to the gender gap in entry. For each prize, the figure displays the coefficients and the 90% robust confidence intervals on the dummy variable female in these four regressions. As is clear in the figure, we confirm the results in Section 3.1. There is

[38] The results are very similar when we use instead of the series of indicators the linear variable minimum Task 1 submission prize.

a significant raw gender gap for low prizes that disappears once the prize reaches $1.75. Adding the performance controls (i.e., Task 2 performance and the difference in performance between the first two tasks) reduces these gaps slightly, and adding the subjective probability that the Task 2 performance is among the best two in the group increases the gaps somewhat. Lastly, when we add a dummy variable indication whether a person chose to submit their Task 1 performance to the tournament for the given prize, there is some reduction in the gender gap, but it is very similar to the original one. For prizes of $1.5 and below, we find that there is a significant gender gap even after controlling for all these variable (the *p*-value on the coefficient female for the $0.75 prize is 0.102). For prizes of $1.5 or below, women are averse to performing in a competition. In contrast, for prizes above $1.5, women are as competitive as men. Had we only examined choices for the $1.5 prize, as is common in the literature, we would have concluded that women dislike competition. In contrast, had we only examined the choices for a higher prize, say $2, we would have concluded that women are as competitive as men. This underscores the importance of observing tournament entry decisions for a range of prizes.

In sum, we see that both beliefs and risk aversion (and possibly feedback aversion) play a role in the decision to enter the tournament. Individuals who are more confident and are less risk and feedback averse are more likely to enter. Nevertheless, these factors only explain a small portion of the gender gap in tournament entry (13%) and women still require higher minimum prizes to perform in a competition. Thus, our results imply that even though women behave as competitively as men at high tournament prizes, women shy away from competition more than men.

4. Conclusions

In this paper, we asked whether the observed gender difference in competitiveness is robust across a range of tournament wages. If women are indeed averse to competition, this may merely mean they need larger compensation to be enticed into higher-payoff tournaments in the workplace. To observe entry choices at wages that may not be offered in the market, we use a laboratory experiment to create the necessary counterfactuals. In doing so, we obtain entry decisions over a range of tournament prizes, examine the feasibility of firms offering the prizes at which men and women would enter at the same rate, and propose a new measure of competitiveness that captures the differential compensation needed by men and women to be willing to enter a tournament.

We have three main results. First, the gender gap in tournament entry is responsive to the size of the prize, and for sufficiently large prizes, the gender gap disappears. Women can behave as competitively as men. Not only do women enter at the same rate as men, top-performing women enter such that the resulting workforce of tournament winners is equal in terms of men and women. Second, while offering higher returns to tournaments can achieve gender balance with no further intervention, it is cost prohibitive for firms to do so. In our environment, the participants are too overconfident and competitive and hence enter too much at low prizes to make offering any prize higher than the lowest prize possible cost effective for firms. Finally, our new measure of competitiveness, the minimum prize at which a participant would be willing to enter the tournament, shows that women require a significantly higher minimum prize than men. These differences are mainly attributed to differences in competitiveness and not in ability, confidence, or aversion to risk and feedback.

Our results suggest that it is possible for firms that use tournament compensation schemes to achieve gender balance even among their highly ranked workers provided that they set high enough tournament prizes. However, as far as our sample is representative of the over-confidence and competitiveness that exists in the workplace, costs are minimized when tournament prizes are much lower than the ones needed to achieve such an outcome. Of course, some firms may gain specific benefits from employing and promoting women (for example, because their customers like to interact with female employees or are willing to pay higher prices for products produced by women). For such firms, the increase in costs associated with higher tournament prizes may be offset by an increase in benefits. Nonetheless, our results suggest that firms that do not obtain such benefits will not be willing to increase tournament prizes.

Further implications are that gender parity in upper management may not be solved through a market mechanism, so it is perhaps not surprising that men dominate these tournament environments. Barring a substantial change in preferences and confidence of workers or an increased desire by firms to promote women, policy interventions then would be needed to change the gender composition of these higher-wage positions that are gained through tournaments. Thus, for example, given the current debate over weak take-up of voluntary quotas of women on corporate boards in Europe, interventions may indeed be the option the European Commission will need to adopt in order to achieve more equal gender representation on companies' boards.

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