DO WOMEN SHY AWAY FROM COMPETITION? DO MEN COMPETE TOO MUCH?*

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We examine whether men and women of the same ability differ in their selection into a competitive environment. Participants in a laboratory experiment solve a real task, first under a noncompetitive piece rate and then a competitive tournament incentive scheme. Although there are no gender differences in performance, men select the tournament twice as much as women when choosing their compensation scheme for the next performance. While 73 percent of the men select the tournament, only 35 percent of the women make this choice. This gender gap in tournament entry is not explained by performance, and factors such as risk and feedback aversion only play a negligible role. Instead, the tournament-entry gap is driven by men being more overconfident and by gender differences in preferences for performing in a competition. The result is that women shy away from competition and men embrace it.

I. INTRODUCTION

A series of psychology studies suggest that men are more competitive than women. While boys spend most of their time at competitive games, girls select activities where there is no winner and no clear end point. This difference increases through puberty, and by adulthood more men than women describe themselves as competitive (see Campbell [2002] for a review of the literature). The objective of this paper is to investigate whether men and women differ in their preferences for competition and how such differences impact economic outcomes. We study whether men and women differ in the type of compensation scheme they prefer to receive for their work when holding other job characteristics constant. Specifically we examine whether for a given performance level more women than men prefer to work under a noncompetitive piece rate than under a competitive tournament compensation scheme.

If women are less likely to compete, this not only reduces the number of women who enter tournaments, but also those who win tournaments. Hence, it decreases the chances of women

succeeding in competitions for promotions and more lucrative jobs. Bertrand and Hallock [2001] show that in a large data set of U. S. firms women only account for 2.5 percent of the five highest paid executives. Ability differences can only explain part of this occupational difference and it is commonly argued that preferences and discrimination can account for the remaining difference. Women may not select into top level jobs because they do not enjoy the responsibilities associated with a managerial position. Or they may avoid these jobs because they tend to have long work hours, which may conflict with the desire or necessity for child rearing. Second, discrimination or anticipated discrimination may cause women and men with equal abilities to hold different occupations.[1] Gender differences in preferences for competition may be an additional explanation for differences in labor market outcome; in particular, it may help explain the absence of women in top-level and very competitive positions.[2]

To study how gender differences in preferences for competition impact choices of compensation scheme, we want to eliminate other factors that may cause women to be underrepresented in competitive jobs. To do so, we use a controlled laboratory experiment to examine individual choices between competitive and noncompetitive compensation schemes in a nondiscriminatory environment. This environment enables us to objectively measure performance and secures that the time commitment is the same under both compensation schemes. Attaining measures of performance under both compensation schemes is crucial for determining the extent to which choices of compensation scheme are driven by differences in performance. Prior research suggests that performance measures are particularly important in this environment as men and women who perform similarly in noncompetitive environments can differ in their performance when they have to compete against one another (see Gneezy, Niederle, and Rustichini [2003], Gneezy and Rustichini [2004], and Larson [2005]).

We have groups of two women and two men perform a real task, namely adding up sets of five two-digit numbers for five minutes, a task where we expect no gender differences in performance. Participants first perform the task under a piece-rate

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1. See Black and Strahan [2001], Goldin and Rouse [2000], Altonji and Blank [1999], and references therein.
2. See Blau and Kahn [2004] for a general overview of gender differences in labor market outcomes.

compensation and then under a tournament. While they are informed of their absolute performance after each task, they do not receive any feedback on their relative performance. Having experienced both compensation schemes, participants then choose which of the two schemes they want to apply to their performance of the next task, either a piece rate or a tournament.

Despite there being no gender difference in performance under either compensation scheme, we find that twice as many men as women select the tournament. While 73 percent of men prefer the tournament, this choice is only made by 35 percent of the women. This gender gap persists when we compare the choices of men and women of equal performance. Compared to payoff-maximizing choices, low-ability men enter the tournament too much, and high-ability women do not enter it enough.

We consider a number of possible explanations to understand what may give rise to such gender differences in tournament entry. One explanation is simply that preferences for performing in a competitive environment differ across gender. Other more general explanations are that women have lower expectations about their relative ability, are more averse to risk, or are more reluctant to be in an environment where they receive feedback on their relative performance. We determine the extent to which these potential differences can explain the gender gap in tournament entry.

We find that men are substantially more overconfident about their relative performance than women and that the beliefs on relative performance help predict entry decisions. Although gender differences in overconfidence are found to play an important role in explaining the gender gap in tournament entry, these differences only account for a share of the gap.

To assess whether general factors, such as overconfidence, risk, and feedback aversion by themselves cause a gap in choices of compensation scheme, we also determine if, absent the thrill or fear of performing in a competition, a gender gap in choice of compensation scheme still occurs. We find that combined such factors cause men and women of equal performance to select different compensation schemes. This difference appears to be largely explained by gender differences in overconfidence, while risk and feedback aversion seem to play a negligible role.

Finally, controlling for gender differences in general factors such as overconfidence, risk, and feedback aversion, we estimate the size of the residual gender difference in the tournament-entry

decision. Including these controls, gender differences are still significant and large. Hence, we conclude that, in addition to gender differences in overconfidence, a sizeable part of the gender difference in tournament entry is explained by men and women having different preferences for performing in a competitive environment.

We first present a brief discussion of the factors that may cause women and men to make different choices over compensation schemes. We then present our experimental design. The empirical results are presented in Sections IV and V. In Section IV we determine if, conditional on performance, the choices of compensation scheme of women and men differ; then in Section V we consider alternative explanations for such differences. We report only the most important of our results and refer the interested reader to Niederle and Vesterlund [2005] for a more extensive analysis of the data. Finally, Section VI concludes and discusses the results in connection to the existing literature.

II. Theory

To determine what may cause women and men of equal ability to differ in their propensity to enter a competitive environment we consider four different explanations.

Explanation 1: Men enter the tournament more than women because they like to compete. Women may be more reluctant to enter a competitive environment simply because they dislike performing when they are competing against others. While the prospect of engaging in a future competition may cause women to anticipate a psychic cost and deter them from tournaments, men may anticipate a psychic benefit and instead be drawn to them.[3]

Nurture as well as nature may cause women to be relatively more reluctant to perform in a competition. First, we tend to raise girls and boys differently. Parents, teachers, and peers encourage gender-typed activities in children while cross-gender activities are discouraged. While boys are encouraged to be assertive, girls are encouraged to show empathy and be egalitarian [Ruble, Martin, and Berenbaum 2006]. Second, nature may also cause a gender difference in preferences for competition. Evolutionary psychology proposes two theories that suggest that men have

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3. While "psychic" costs and benefits of a tournament may affect entry, they need not affect tournament performance.

evolved to enjoy competition. Both of these are tied to the reproductive strategies of the two sexes. One argues that since men can have many more children than women the potential gain in reproductive success from winning a competition is much greater for men, and men have therefore evolved to be more competitive than women [Daly and Wilson 1983]. The second theory focuses on one gender being responsible for parental care. While a man's death does not influence his current reproductive success, a woman's death may cause the loss of her current offspring [Campbell 2002]. Thus differences in potential losses as well as potential gains from competition may make males more eager to compete.

In addition to suggesting that men hold a stronger preference for competition these evolutionary explanations are also used to explain why men often are more confident in their relative performance and less averse to risk. Such gender differences may also influence tournament-entry decisions.

Explanation 2: Men enter the tournament more than women because they are more overconfident. Psychologists often find that while both men and women are overconfident about their relative performance, men tend to be more overconfident than women (e.g., Lichtenstein, Fischhoff, and Phillips [1982], Beyer [1990], and Beyer and Bowden [1997]). Consistent with a greater male overconfidence, Barber and Odean [2001] show that in financial markets men trade more excessively than women. If in our experiment men are more overconfident about their relative performance, then the probability of selecting the competition is expected to be larger for a man than a woman with the same performance.

Note however that overconfidence as well as gender differences in overconfidence are task dependent. Studies have found that overconfidence is sensitive to how easy a task is [Moore and Small 2004], and the gender difference in overconfidence has primarily been found in masculine tasks. For example, Lundeberg, Fox, and Puncochar [1994] argue that the reason why some studies do not find gender differences in confidence on general knowledge is because it is not in the masculine domain. Thus, depending on the perception of our addition task, gender differences in overconfidence may or may not help explain potential gender differences in tournament entry.

Explanation 3: Men enter the tournament more than women because they are less risk averse. As tournaments involve uncertain payoffs, potential gender differences in risk attitudes are

likely to also affect the choice of compensation scheme. Studies examining gender differences in risk attitudes over monetary gambles find either that women are more risk averse than men or that there is no gender difference. Eckel and Grossman [2002a] summarize the experimental literature in economics and conclude that women exhibit greater risk aversion in choices. A summary of the psychology literature is presented by Byrnes, Miller, and Shafer [1999]. They provide a meta-analysis of 150 risk experiments and demonstrate that while women in some situations are significantly more averse to risk, many studies find no gender difference.

Explanation 4: Men enter the tournament more than women because they are less averse to feedback. One consequence of entering the tournament is that the individual will receive feedback on relative performance. The psychology literature suggests that men and women may respond differently to such feedback. First, there is evidence that women tend to incorporate negative feedback more than men (see, e.g., Roberts and Nolen-Hoeksema [1989]). Second, women, more than men, may view a negative signal as indicative of their self-worth rather than simply their one-time performance on a task. Women may therefore fall into "confidence traps" from which they do not recover easily (see, e.g., Dweck [2000] and references therein). If participants benefit from holding positive beliefs about themselves, then both of these factors may cause women to avoid environments where they receive feedback on relative performance.

Our experiment is designed to shed light on the role played by these alternative explanations. Of particular interest is whether a gender difference in tournament entry is explained by general factors such as overconfidence, risk, and feedback aversion (Explanations 2–4) or if part of such a difference is accounted for by preference differences for performing in a competition (Explanation 1). What distinguishes Explanation 1 from the other three is that it relies critically on the tournament-entry decision resulting in a subsequent competitive performance. The other explanations are more general and should be present in other decisions as well. To jointly determine the role played by these three general factors we consider an environment that is as close as possible to the tournament-entry decision, without involving an actual tournament performance. Specifically, we ask participants to choose between a competitive and noncompetitive compensation scheme for a past noncompetitive performance; that is,

the choice of tournament does not require participants to subsequently perform in a competition. While the potential thrill, anxiety, or fear of performing in a competition is absent from this choice, this decision will show whether general factors such as overconfidence, risk, and feedback aversion in and of themselves can cause a difference in choices of compensation scheme.

To determine whether a gender difference in preferences for competition (Explanation 1) plays a role when controlling for overconfidence, risk, and feedback aversion, we use the choice of compensation scheme for past performance along with the participants' beliefs on their relative performance ranking as controls in the tournament-entry decision.

III. Experimental Design

We conduct an experiment in which participants solve a real task, first under a noncompetitive piece-rate scheme and then under a competitive tournament scheme. Participants are then asked to select which of these two compensation schemes they want to apply to their next performance. This provides participants with experience of both compensation forms and enables us to determine if men and women of equal performance choose the same compensation scheme.

The task of our experiment is to add up sets of five two-digit numbers. Participants are not allowed to use a calculator, but may use scratch paper. The numbers are randomly drawn and each problem is presented in the following way, where participants fill in the sum in the blank box:

21	35	48	29	83	

Once the participant submits an answer on the computer, a new problem appears jointly with information on whether the former answer was correct.[4] A record of the number of correct and wrong answers is kept on the screen. Participants have five minutes in which they may solve as many problems as they can.

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4. The program was written using the software zTree [Fischbacher 2007].

The final score is determined by the number of correctly solved problems. We selected this five-minute addition task because it requires both skill and effort and because research suggests that there are no gender differences in ability on easy math tests.[5] This will enable us to rule out performance differences as an explanation for gender differences in tournament entry.

The experiment was conducted at the University of Pittsburgh, using standard recruiting procedures and the subject pool at the Pittsburgh Experimental Economics Laboratory (PEEL). Two or three groups of four participants participated in each session. Participants were seated in rows and informed that they were grouped with the other people in their row. A group consisted of two women and two men. Although gender was not discussed at any time, participants could see the other people in their group and determine their gender. A total of twenty groups participated in the experiment (forty men and forty women).

Each participant received a $5 show-up fee, and an additional $7 for completing the experiment. Participants were told that they would be asked to complete four tasks and that one of these tasks would be randomly chosen for payment at the end of the experiment. By paying only for one task, we diminish the chance that decisions in a given task may be used to hedge against outcomes in other tasks. Participants were informed of the nature of the tasks only immediately before performing the task. While they 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 and did not know if they performed better or worse than the other participants in their group. The specific compensation schemes and order of tasks were as follows.

Task 1—Piece Rate: Participants are given the five-minute addition task. If Task 1 is randomly selected for payment, they receive 50 cents per correct answer.

Task 2—Tournament: Participants are given the five-minute addition task. If Task 2 is randomly selected for payment, the participant who solves the largest number of correct problems in the group receives $2 per correct answer while the other partic-

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5. While males often score better on abstract math problems, there is no gender difference in arithmetic or algebra performance. Women tend to score better than men on computational problems (see Hyde, Fennema, and Lamon [1990] for a meta-analysis of 100 studies on gender differences in math performance).

ipants receive no payment (in case of ties the winner is chosen randomly among the high scorers).

The tournament is designed so that for a given performance a participant with a 25 percent chance of winning the tournament receives the same expected payoff from the tournament as from the piece rate.[6] In the third task participants once again perform the five-minute addition task but this time select which of the two compensation schemes they want to apply to their future performance, a piece rate or a tournament.

Task 3—Choice of Compensation Scheme for Future Performance: Before performing the five-minute addition task, participants select whether they want to be paid according to a piece rate, i.e., 50 cents for each correct answer, or a tournament. When the participant chooses the tournament she receives $2 per correct answer if her score in Task 3 exceeds that of the other group members in the Task-2 tournament they just completed; otherwise she receives no payment (in case of ties the winner is chosen randomly).

Winners of the Task-3 tournament are determined based on the comparison relative to the other group members' Task-2 and not their Task-3 performance. One can think of this as competing against other participants who already performed.[7] This has several advantages; first, the performance of a player who enters the tournament is evaluated against the performance of participants who also performed under a tournament compensation. Second, while beliefs regarding relative performance in a tournament may affect the decision to enter the tournament, beliefs regarding the choices of others will not. Thus, we avoid a potential source of error through biased beliefs about other participants' choices.[8] Furthermore, since a participant's choice does not affect the payment of any other participant we can rule out the possibility that women may shy away from competition because by winning the

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6. By paying the tournament winner per correct problem we avoid the problem of choosing a high enough fixed prize to ensure that even high-performing participants benefit from entering the tournament.

7. Many sports competitions are not performed simultaneously, e.g., downhill skiing.

8. For example, the odds of winning a simultaneous competition would be greatly changed if men believed that women would not enter the tournament, causing them to face only one rather than three competitors. Note that our design allows for the possibility that there is no winner among participants who choose the tournament (if none of those entering the tournament beat the high score of their opponents). Conversely, all participants can win the tournament if everyone increases their performance beyond the highest Task-2 performance in that group.

tournament they impose a negative externality on others.[9] Effectively in Task 3 participants face an individual decision problem, which depends only on their ability to beat the Task-2 performance of others and their preference for performing in a tournament.

To determine whether the gender gap in tournament entry is caused by gender differences in preferences for performing in a competitive environment, or if it is accounted for by general factors such as differences in overconfidence, risk, or feedback aversion, we present participants with one last task. Here participants face a choice similar to that of Task 3 but without using a tournament performance and having to subsequently perform in a tournament.

Task 4—Choice of Compensation Scheme for Past Piece-Rate Performance: Participants do not have to perform in this task. Rather, if this task is randomly selected for payment, their compensation depends on the number of correct answers they provided in the Task-1 piece rate. Participants choose which compensation scheme they want to apply to their past piece-rate performance: a 50 cent piece rate or a tournament. They win the tournament and receive $2 per correct answer if their Task-1 piece-rate performance is the highest of the participants in their group; otherwise they receive no payment (in case of ties the winner is chosen randomly). Before making their choice, participants are reminded of their Task-1 piece-rate performance.

As in the Task-3 choice, a participant's decision does not affect the earnings of any other participant, nor does it depend on the entry decisions of others. Thus Task 4 is also an individual-decision task. This final task allows us to see whether gender differences in choice of compensation scheme appear even when no future and past tournament performance is involved. That is, we can determine whether general factors such as overconfidence, risk, and feedback aversion (Explanations 2–4) by themselves cause a gap in tournament entry. While these effects can influence the Task-3 choice, they are not unique to the decision of performing in a competition; in particular, they are likely to affect the Task-4 choice as well.

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9. For a discussion on possible gender differences in altruism, see, e.g., Andreoni and Vesterlund [2001]. See Ledyard [1995] for gender differences in social dilemma and public good games, as well as Eckel and Grossman [2002b] and Croson and Gneezy [2004] for a review of gender differences in experimental settings.

Finally, we elicit the participants' beliefs on their relative performance to determine their relation to choices of compensation scheme. We elicit these beliefs both for performances in Task 1 and Task 2, where all participants had the same incentive scheme. These will help us determine whether gender differences in overconfidence about tournament performance affect the decision to enter a tournament, i.e., we can assess the role Explanation 2 plays in closing the gender gap.

Belief-Assessment Questions: At the end of the experiment participants are asked to guess their rank in the Task-1 piece rate and the Task-2 tournament. Each participant picks a rank between 1 and 4 and is paid $1 for each correct guess.[10]

To determine whether gender differences in preferences for competition (Explanation 1) cause a gender gap in the Task-3 tournament entry we include the elicited beliefs on tournament ranking and the Task-4 choice of compensation scheme to control for general factors such as confidence, risk, and feedback aversion.

At the end of the experiment, a number from one to four is drawn to determine which of the four tasks is selected for earnings. The experiment lasted about forty-five minutes, and participants earned on average $19.80.

IV. BASIC EXPERIMENTAL RESULTS

In this section we examine whether, conditional on ability, women and men differ in their preference for performing under a piece rate versus a tournament scheme. To eliminate ability differences as an explanation for potential gender differences in tournament entry, we selected a task for which we anticipated that women and men would have similar performances under the two compensation schemes. We start by confirming that we succeeded in selecting such a task. We then examine the participants' compensation scheme choices and determine whether they differ conditional on performance.

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10. In case of ties in the actual ranks, we counted every answer that could be correct as correct. For example, if the performance in the group was 10, 10, 11, 11, then an answer of last and third was correct for a score of 10, and an answer of best and second was correct for a score of 11.
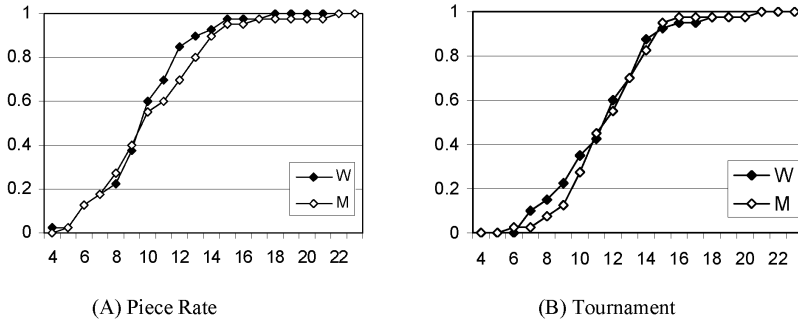
FIGURE I
CDF of Number of Correctly Solved Problems
Panel A: Piece rate (Task 1); Panel B: Tournament (Task 2)

IV.A. *Performance in the Piece Rate and the Tournament*

As expected we find no gender difference in performance under the piece rate or under the tournament. In the piece rate, the average number of problems solved is 10.15 for women and 10.68 for men. Using a two-sided t-test, this difference is not significant ($p = .459$). The gender difference in performance is also not significant in the tournament where, on average, women correctly solve 11.8 problems, and men 12.1 ($p = .643$). Throughout the paper the reported test statistics refer to a two-sided t-test, unless otherwise noted. The conclusions of the reported t-test do not differ from those of a Mann–Whitney test.

The cumulative distributions for the number of correct answers in the piece rate (Task 1) and the tournament (Task 2) are shown in Panels A and B of Figure I, respectively. For every performance level the graphs show the proportion of women or men who solved that many or fewer correct problems. In both tasks the performance distributions are very similar for women and men.

Although the piece rate and tournament performances are highly correlated (Spearman rank correlations of .69 for women and .61 for men), both genders perform significantly better under the tournament than the piece rate (one-sided $p < .01$ for each gender separately). This improvement may be caused by learning or by the different performance incentives

under the tournament.[11] The increase in performance varies substantially across participants. While noise may be one explanation for this variance, another may be that some participants are more competitive than others. The increase in performance from the piece rate to the tournament, however, does not differ by gender ($p = .673$).

The similar performances of men and women result in there being no gender difference in the probability of winning the Task-2 tournament. Of the twenty Task-2 tournaments, eleven were won by women and nine by men. To assess the probability of winning the tournament we randomly create four-person groups from the observed performance distributions. Conditioning only on gender, the probability of winning the tournament is 26 percent for a man and 24 percent for a woman; in a sample of forty men and forty women this difference is not significant ($p = .836$). Similarly there are no gender differences when we instead examine the probability of winning the tournament conditional on performance. For both men and women who solve thirteen problems the chance of winning the tournament is 26.6 percent. If instead they solve fourteen problems, the probability of winning increases to 47.8 percent for women and 47.7 percent for men. The change in the probability of winning is quite dramatic with the chance being less than 2 percent for those solving ten problems and more than 70 percent for those solving fifteen problems.[12]

Whether we use a piece-rate or tournament compensation scheme, our task is one for which there appears to be no gender differences in performance. After completing the first two tasks, women and men have therefore had similar experiences, and based on performance alone, we would not expect a gender difference in the subsequent Task-3 choice of compensation scheme.

11. DellaVigna, Malmendier, and Vesterlund [in preparation] have participants perform six rounds of three-minute tournaments and find a significant increase in performance from round one to round two but no significant increase in performance in subsequent rounds. This suggests that initial learning may have some effect.

12. For any given performance level, say fifteen for a woman, we draw 10,000 groups consisting of two men and one other woman, where we use the sample of forty men and women with replacement. We then calculate the frequency of wins. The exercise is repeated 100 times, and we report the average of these win frequencies. For more details on the probability of winning the tournament for a given performance, see Niederle and Vesterlund [2005].

IV.B. Gender Differences in Tournament Entry (Task-3 Choice)

Having experienced both the 50-cent piece rate and the $2 tournament, participants are asked which of the two they want to apply to their Task-3 performance. A participant who chooses the tournament wins the tournament if his or her number of correct answers in Task 3 exceeds the number of correct answers by the other three members in the group in the Task-2 tournament. Thus, choosing the tournament depends on beliefs regarding own ability and the other players' past tournament performance, but it does not depend on beliefs about the choice of compensation scheme of other participants.

For a given performance level a risk-neutral participant who only aims to maximize monetary earnings is indifferent between the two incentive schemes when the chance of winning the tournament is 25 percent. According to our analysis above, all players with a given performance of fourteen or more have higher expected monetary earnings from the tournament. If the participant's Task-3 performance is exactly like the Task-2 performance, this corresponds to 30 percent of the women and 30 percent of the men. When we include participants who solve thirteen problems—and are virtually indifferent between the two schemes—the percentages are 40 percent for women and 45 percent for men.

Despite the similar performances of women and men, their choices of compensation scheme are very different. While the majority of women prefer the piece rate, the majority of men prefer the tournament. Specifically, we find that 35 percent of women and 73 percent of men select the tournament. This observed gender gap in tournament entry is both substantial and significant (a Fisher's exact test yields $p = .002$).

IV.C. Tournament-Entry Decisions Conditional on Performance

To examine how performance affects the propensity of women and men to enter a tournament, we first compare the mean past performance characteristics of participants by choice of compensation scheme. Table I reports, by gender and the chosen compensation scheme, three performance measures; the average number of problems solved correctly under piece rate (Task 1) and tournament (Task 2), as well as the average increase in performance between the two.

For women there is no significant difference in perfor-

TABLE I
PERFORMANCE CHARACTERISTICS BY CHOICE OF COMPENSATION SCHEME (TASK 3)

		Average performance		
	Compensation scheme	Piece rate	Tournament	Tournament–piece rate
Women	Piece rate	10.35	11.77	1.42
		(0.61)	(0.67)	(0.47)
	Tournament	9.79	11.93	2.14
		(0.58)	(0.63)	(0.54)
Men	Piece rate	9.91	11.09	1.18
		(0.84)	(0.85)	(0.60)
	Tournament	10.97	12.52	1.55
		(0.69)	(0.48)	(0.49)

Averages with standard errors in parentheses. Sample is forty women and forty men.

mance between those who do and do not enter the tournament ($p \geq .35$ for each of the three performance measures). For men, only the tournament performance is marginally higher for those who enter the tournament ($p = .14$ for the Task-2 tournament). Conditional on the choice of compensation scheme, there is, however, no gender difference in Task-1 and Task-2 performance or in the increase between the two ($p \geq .28$ for each of the six tests).

A probit regression reveals that while the participant's performance under the two compensation schemes does not significantly affect the decision to enter the tournament, the participant's gender does. The reported marginal gender effect of $-.380$ in Table II shows that a man with a performance of thirteen in

TABLE II
PROBIT OF TOURNAMENT CHOICE IN TASK 3

	Coefficient	*p*-value
Female	−.380	.00
Tournament	.015	.41
Tournament–piece rate	.015	.50

Dependent variable: Task-3 choice of compensation scheme (1-tournament and 0-piece rate). Tournament refers to Task-2 performance, tournament–piece rate to the change in performance between Task 2 and Task 1. The table presents marginal effects of the coefficient evaluated at a man with thirteen correct answers in the tournament and twelve in the piece rate. Sample is forty women and forty men.

the tournament (and twelve in the piece rate) would have a 38 percentage point lower probability of entering the tournament if he were a woman. Thus, controlling for past performance, women are much less likely to select a competitive-compensation scheme.[13]

A possible explanation for the observed gender difference in choice of compensation scheme may be that there is a gender difference in performance following the choice—and that our participants correctly anticipate such a difference. However, this does not appear to be the case, as the results from the Task-3 performance parallel those of the tournament performance. Conditional on gender, the performance in Task 3 does not differ between those who do and do not enter the tournament ($p \geq .288$). Similarly, the participants who enter the tournament do not have a significantly different increase in performance in the choice task (Task 3) relative to the former (Task 2) tournament ($p \geq .88$). Thus, not only is it not true that only participants with a high past performance enter the tournament, it is also not true that those who entered the tournament performed better than those who did not. We find that performance in Task 3 cannot explain the gender gap in tournament entry just like the performance before the tournament-entry decision.[14]

Figure II shows the proportion of women and men who enter the tournament conditional on their performance quartile in Task 2 (Panel A) and Task 3 (Panel B). In both cases, performance has at most a small effect on tournament entry, and for every performance level, men are more likely to enter the tournament. Furthermore, in each case, we see that even women in the highest performance quartile have a lower propensity to enter the tournament than men in the lowest performance quartile.

Among participants who for a given performance have higher expected earnings in the tournament than the piece rate (i.e., those solving thirteen or more problems) significantly more men than women enter the tournament (a two-sided Fisher' exact test yields $p = .004$ and .015 for Tasks 2 and 3, respectively). Similarly

13. Probit regressions show the p-value associated with the coefficient. However, to ease interpretation, we do not show this overall coefficient, but rather the marginal effect at a specific point. This evaluation point is selected because a risk-neutral individual solving thirteen problems in the tournament is indifferent toward entering the tournament. The average piece-rate performance for this group was twelve.

14. A probit analysis of the tournament-entry decision yields marginal effects $-.357$ on female ($p = .00$) and .015 on Task-3 performance ($p = .31$) evaluated at a man with thirteen correct answers in Task 3.
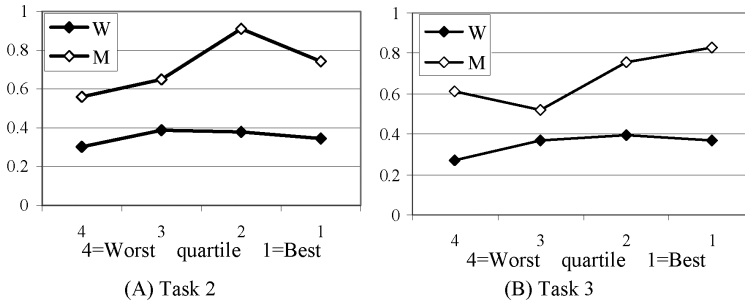
FIGURE II
Proportion of Participants Selecting Tournament for Task 3 Conditional on
Task-2 Tournament Performance Quartile (Panel A) and Task-3 Choice
Performance Quartile (Panel B)

men are more likely to enter the tournament among participants whose expected earnings are lower in the tournament (a two-sided Fishers exact test yields $p = .15$ and $p = .05$ for Tasks 2 and 3, respectively). Thus, whether we use the Task-2 or Task-3 performances, from a payment-maximizing perspective, low-performing men enter the tournament too often, and high-performing women enter it too rarely.

Before evaluating possible explanations for gender differences in tournament entry, it is worth considering the magnitude of the gap we are trying to explain. For example, it is easily seen that a gender difference in risk aversion alone is an unlikely explanation for the observed tournament-entry gap. Consider participants with fourteen or more correct answers in the Task-2 tournament who have a 47 percent or higher chance of winning the tournament. Ignoring performance costs and presuming that one knows the performance distribution and maintains the exact same performance in Task 3, the decision to enter the tournament is a gamble of receiving, per correct answer, either $2 with a probability of 47 percent (or more), or receiving 50 cents for sure. For participants who have fourteen correct answers, that means a gamble of a 47 percent chance of $28 (i.e., an expected value of $13) versus a sure gain of $7. Of the participants who solve fourteen problems or more, eight out of twelve of the women and three out of twelve of the men do not take this or a better gamble. This difference is marginally significant with a two-sided Fisher's exact test ($p = .100$). Similarly, for participants who have eleven or fewer correct answers, the chance of winning the tournament is 5.6 percent or less. Thus, entering the tournament

means receiving $2 per correct answer with a probability of 5.6 percent (or less) versus receiving 50 cents for sure. For participants who solve eleven correct answers, this is a choice between a 5.6 percent chance of winning $22 (i.e., an expected value of $1.23) compared to receiving $5.5 for sure. Of the participants, who solve eleven problems or less, eleven out of eighteen of the men and only five out of seventeen of the women take this or a worse gamble. This difference is marginally significant with a two-sided Fisher's exact test ($p = .092$). To explain these choices, women would have to be exceptionally risk averse and men exceptionally risk seeking. We are not aware of any studies that find such extreme gender differences in risk attitudes.

To further assess the magnitude of the gap in tournament entry, we determine the costs associated with payoff-inferior choices of compensation scheme. To do so, we ignore performance costs (which we cannot measure) and assume that performance is independent of the chosen compensation scheme. The expected costs of over- and under-entry into the tournament are the difference between the potential earnings under the two incentive schemes. We calculate the expected monetary losses using either performance in Task 2 (as earlier) or in Task 3. Table III, columns (1) and (2) report the costs for women and men using the Task-2 performance as a predictor of future performance. We can think of this as reporting the ex-ante costs. Columns (3) and (4) report instead the costs based on the actual Task-3 performance; this corresponds to the *ex-post* costs. In each case we also report the number of people who, for a given performance, in expectation would have been better off making a different choice.

While the magnitude of the costs is sensitive to the precise assumptions we make, the qualitative results are not. More women than men fail to enter when they should, and more men than women enter when they should not. The total cost of under-entry is higher for women, while the cost of over-entry is higher for men. Since over-entry occurs for participants of low performance and under-entry for those with high performance, by design the cost of under-entry is higher than that of over-entry. So, although the number of men and women who make payoff-inferior decision is the same, the total costs of doing so are higher for women than for men.

TABLE III

EXPECTED COSTS OF OVER- AND UNDER-ENTRY IN TASK-3 TOURNAMENT

	Calculation based on Task-2 performance		Calculation based on Task-3 performance	
	Women	Men	Women	Men
Under-entry				
Number who should enter	12	12	9	20
Of those how many do not enter	8	3	6	4
Expected total cost of under-entry	99.4	34.5	84.6	49.6
Average expected cost of under-entry	12.4	11.5	14.1	16.5
Over-entry				
Number who should not enter	24	22	24	19
Of those how many do enter	9	14	8	12
Expected total cost of over-entry	32.9	56.5	28.9	43.8
Average expected cost of over-entry	3.7	4.0	3.6	3.6
Total expected costs	132.3	91.0	113.5	93.3

Participants solving fourteen or more problems should enter the tournament, and those with twelve and fewer problems should select the piece rate. Participants with thirteen problems (who are virtually indifferent between the two compensation schemes) are not included in the analysis.

V. EXPLANATIONS FOR THE GENDER GAP IN TOURNAMENT ENTRY

Our results thus far show that men and women with similar performances differ substantially in their tournament-entry decisions. While women shy away from competition, men are drawn to it. From a payoff-maximizing perspective, high-performing women enter the tournament too rarely, and low-performing men enter the tournament too often. In this section we try to determine the causes for these differences in tournament entry. We start in Section V.A by examining the possibility that greater overconfidence of men can cause a gender gap in tournament entry.

We then examine the broader set of explanations from Section II. Specifically, we use Task 4 to distinguish between the role played by gender differences in preferences for performing in a competition, and the more general explanations such as gender differences in overconfidence and risk and feedback aversion. In Task 4 participants choose between a competitive and a noncompetitive compensation scheme for their past Task-1 piece-rate

performance. Although this choice is very similar to that of Task 3, it eliminates the prospect of having to subsequently perform in a competition. Thus, while general factors can influence the compensation choices in Tasks 3 and 4, only in Task 3 can preference differences for performing in a competition play a role.

In Section V.B we use Task 4 to simultaneously assess whether gender differences in general factors such as confidence and risk and feedback aversion by themselves cause differences in compensation scheme choices. In Section V.C we then determine if the act of performing in a competition creates a gap in tournament entry that cannot be explained by these general factors. To do so we use the elicited beliefs as well as the Task-4 decision as controls in the Task-3 tournament-entry decision. This helps us determine whether an explanation for the tournament-entry gap may be that women, relative to men, are more averse to choices that require a future performance in a competitive environment.

V.A. Does Greater Male Confidence about Relative Performance Explain the Tournament-Entry Gap?

To elicit participants' beliefs on their relative tournament performance we asked them at the end of the experiment to guess how their performance in Task 2 ranked relative to the other members of their group. Participants received $1 if their guess was correct, and in the event of a tie they were compensated for any guess that could be deemed correct.[15]

We first examine whether men and women of equal performance have different beliefs about their relative performance. We then investigate whether conditional on these beliefs there is a gender gap in tournament entry. That is, we determine the extent to which gender differences in confidence can account for the gender gap in tournament entry.

Given the absence of a gender difference in performance, the distributions of relative performance ranks within actual groups as well as expected rank within randomly formed groups are the same for men and women. Accounting for rewards in the event of ties, this implies that participants who know the performance distributions of men and women will maximize their payoffs by

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15. While the payment for the guessed rank is not very high, it still offers participants the opportunity of using their guess as a method of hedging against their tournament-entry decision. The strong positive correlation between elicited ranks and tournament entry (Figure III) suggests that hedging was not a dominant motive.

TABLE IV
DISTRIBUTION OF GUESSED TOURNAMENT RANK

	Men		Women	
	Guessed rank	Incorrect guess	Guessed rank	Incorrect guess
1: Best	30	22	17	9
2	5	3	15	10
3	4	2	6	5
4: Worst	1	1	2	1
Total	40	28	40	25

guessing that they ranked second or third.[16] However, participants believe that they are ranked substantially better than that. Table IV shows the participants' believed rank distributions and the number of incorrect guesses.

Relative to their actual rank, both men and women are overconfident. A Fisher's exact test of independence between the distribution of guessed rank and actual rank yields $p = .00$ for both men and women. However, men are more overconfident about their relative performance than women. While 75 percent of the men think they are best in their group of four, only 43 percent of the women hold this belief. The guesses of women and men differ significantly from one another, a Fisher's exact test of independence of the distributions for men and women delivers $p = .016$.

An ordered probit of the guessed rank as a function of a female dummy and performance shows that, conditional on performance, women are significantly less confident about their relative ranking than men and that participants with a higher tournament performance think they have higher relative performance (see Table V).[17]

Can the greater overconfidence by men explain why, conditional on performance, they enter the tournament more fre-

16. Based on 10,000 artificially generated groups, the likelihood of a woman being ranked first is .223, second .261, third .262, and last .255; the corresponding probabilities for a man for first is .243, second .288, third .278, and last .199. For more details, see Niederle and Vesterlund [2005].

17. We eliminate guessed ranks of four, as we have only one man and two women with such guesses. The results are similar when we code guesses of three and four as guesses of rank three. Furthermore, the results are also similar when we include the guesses of four.

TABLE V
ORDERED PROBIT OF GUESSED TOURNAMENT RANK

	Coefficient	Standard error	p-value
Female	.75	0.30	.01
Tournament	−.19	0.06	.00
Tournament–piece rate	−.08	0.07	.27

Ordered probit of guessed rank for guesses of ranks 1, 2, and 3. Sample is thirty-eight women and thirty-nine men.

quently than women? Figure III shows for each guessed rank the proportion of women and men who enter the tournament.[18] While tournament entry-decisions are positively correlated with the participants' beliefs on relative performance, there are still substantial gender differences. Looking at the more than 80 percent of participants who think they are first or second best in their group, there is a gender gap in tournament entry of about 30 percentage points.

The probit regression in column (2) of Table VI shows that conditional on actual performance, participants who are more confident about their relative tournament performance are more likely to enter the tournament.[19] Furthermore, women remain significantly less likely to enter the tournament when controlling for both absolute and believed relative performance.

How important are gender differences in overconfidence in explaining the gender gap in tournament entry? Evaluated at a man who solves thirteen problems in the tournament and twelve in the piece rate, we previously found that controlling only for performance, the gender effect was 38 percentage points (column (1)). Column (2) shows that including a control for guessed tournament rank, the gender effect reduces to 28 percentage points. That is, about 27 percent of the gender gap in tournament entry can be attributed to men being more overconfident than women, with a remaining 73 percent of the overall gender effect being unaccounted for.

18. Note that a participant with a point prediction of a guessed rank of 2 may still optimally choose to enter the tournament if, for example, the participant believes that she has a 40 percent chance of being best, and a 60 percent chance of being second.

19. The two performance measures are included in the regression because we are interested in examining gender differences in tournament entry conditional on performance. The results in column (1) correspond to those of Table III with the exception that guesses of four are not included.
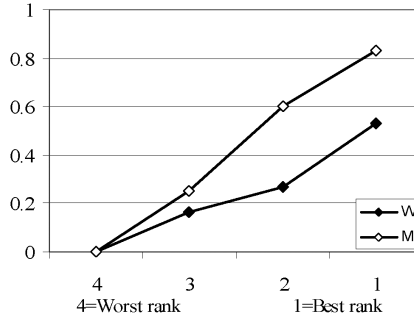
FIGURE III

Proportion Selecting the Tournament for Task 3 Conditional on Guessed Rank

While greater male overconfidence helps explain why equally able women and men select different compensation schemes, the majority of the gender gap remains.

V.B. Do General Factors Cause Gender Differences in Choice of Compensation Scheme?

To better understand the gender gap in tournament entry we need to consider the other explanations we proposed in Section II. We start by determining the effect general factors such as over-confidence and risk and feedback aversion have on the tourna-

TABLE VI
PROBIT OF TOURNAMENT-ENTRY DECISION (TASK 3)

	Coefficient (p-value)	
	(1)	(2)
Female	−.379	−.278
	(.01)	(.01)
Tournament	.015	−.002
	(.39)	(.90)
Tournament–piece rate	.008	−.001
	(.72)	(.94)
Guessed tournament rank		−.181
		(.01)

Dependent variable: Task-3 choice of compensation scheme (1-tournament and 0-piece rate). The table presents marginal effects evaluated at a man with a guess of one and who has thirteen correct answers in the tournament and twelve in the piece rate. Guesses of four are eliminated, resulting in a sample of thirty-eight women and thirty-nine men.

ment-entry decision. We use Task 4 to examine whether a gender gap in compensation scheme choices still is observed when the tournament choice does not require a subsequent competitive performance. Participants in Task 4 select one of two compensation schemes for their past piece-rate performance (Task 1), either the 50-cent piece rate or the $2 tournament. If the tournament is chosen, the piece-rate performance is submitted to a competition against the piece-rate performances of the other participants in the group (independent of their choice of compensation scheme). A tournament is won if an individual's performance exceeds that of the other three players.

Before examining the participants' choices, we use the Task-1 performance to determine the performance level at which participants have higher monetary earnings from submitting the piece rate to a tournament scheme. In the piece rate men and women have similar but not exactly the same probability of being the highest performer in a randomly drawn group of two men and two women. While the chance of having the highest piece-rate performance is 29 percent for a man, it is 21 percent for a woman.[20] In our twenty groups, eleven women and eleven men were the highest performers in their group (including two cases of ties). The gender differences are also small when we examine for each gender the probability of winning the tournament conditional on performance. While women who solve eleven problems have a 21.6 percent chance of wining, the chance for men is 24.4 percent. When solving twelve problems, the chances are 33 and 39.3 percent for women and men respectively.[21] Thus, the per-problem compensation under the two schemes implies that for a given performance, individuals who solved twelve or more problems have higher expected earnings from submitting to a tournament. This corresponds to 30 percent of the women and 40 percent of the men. Including participants who solve eleven problems—and are virtually indifferent between the two schemes—the percentages are 40 percent for the women and 45 percent for the men.

The actual difference in compensation scheme choices is substantially larger. With 25 percent of the women and 55 percent of

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20. This difference is not significant in a sample of forty men and forty women ($p = .408$).

21. For any given performance level, say fifteen for a woman, we draw 10,000 groups consisting of two men and one other woman, where we use the sample of forty men and women with replacement. We then calculate the frequency of wins. The exercise is repeated 100 times, and we report the average of these win frequencies. For details, see Niederle and Vesterlund [2005].
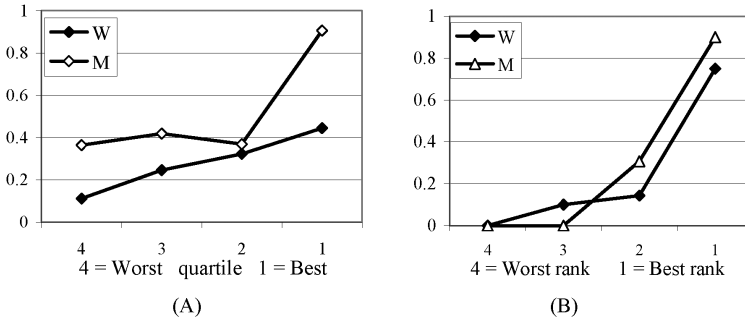
FIGURE IV
Proportion of Participants Who Select Tournament for Task 4 Conditional on
Task-1 Performance Quartile (Panel A) and Guessed Piece-rate Rank (panel B).

the men submitting their piece-rate performance to the tournament, we find a significant gender difference (p-value = .012 by Fisher's exact test).[22] That is, men and women differ in their compensation scheme choices even when the decision does not involve the prospect of having to subsequently perform in a competition. Next we examine if this difference remains when we condition first on performance and then on beliefs about relative piece-rate performance. By controlling for beliefs we can determine the extent to which the gap in compensation scheme choices is accounted for by overconfidence versus risk and feedback aversion.

There is no significant difference in the piece-rate performance of the women who do versus do not submit the piece rate (10.7 vs. 10.0 problems, p = .48). In contrast, men who submit to the tournament solved significantly more problems (12.05) than those who did not submit to the tournament (9), p = .004. Figure IV panel A shows the propensity of women and men to submit to the tournament for each piece-rate performance quartile. While for men a higher piece-rate performance is correlated with a higher propensity to submit to a tournament, this is not the case for women. The gender gap in choice of compensation scheme is largest among participants in the top performance quartile. Of the participants who have about equal or higher expected earn-

22. While participants seem more reluctant to submit the piece rate result to a tournament than they were to enter a tournament and then competing, these differences are not significant either for women (a Fisher's exact test yields p = .465) or for men (a Fisher's exact test yields p = .162).

ings from submitting to the tournament (eleven or more correct answers), significantly more men (fourteen out of sixteen) than women (three out of twelve) select the tournament (Fisher's exact test $p = .001$). Of those who have lower expected earnings from the tournament (less than eleven correct answers) there is no significant difference in the proportion of men and women who submit to the tournament (eight out of twenty-two and five out of twenty-two, respectively) (Fisher's exact test $p = .33$).

A probit regression confirms that participants with a higher performance are more likely to submit to the tournament and that conditional on piece-rate performance men are more likely to do so than women.[23] The significant gender difference in choices of compensation scheme seems driven by high-performing participants with twelve or more correct answers. While the female dummy is significant in a probit regression on this subsample of participants, it is not significant in the subsample of participants with a performance of ten or less.[24] Absent future competition we see that gender differences in general factors such as confidence, risk, and feedback aversion cause a gap in choice of compensation scheme among high performing participants.

To distinguish the impact of confidence from that of risk and feedback aversion we elicited the participants' beliefs on relative performance in the piece rate. The characteristics of the elicited beliefs on relative performance in the Task-1 piece rate are very similar to what we found for the Task-2 tournament. Both women and men are overconfident and their believed rank distributions differ significantly from the actual rank distributions (a Fisher's exact test of independence yields $p = .00$ for men and for women). As for the tournament performance, men are significantly more confident about their relative performance than women (a Fisher's exact test yields $p = .02$). An ordered probit of guessed piece-rate rank as a function of the piece-rate performance and a

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23. A probit regression of decision to submit the piece rate to a tournament yields marginal effects of $-.31$ on female ($p = .01$) and .06 on piece-rate performance ($p = .01$), evaluated at a man with eleven correct answers in Task 1 (this is the performance at which the expected payoff is the same from the piece rate as from the tournament).

24. A probit regression of the decision to submit to a tournament on the piece-rate performance and a female dummy yields, for participants who solve ten or less in the piece rate, a coefficient on the piece rate of .03 ($p = .60$), and on the female dummy of $-.17$ ($p = .23$) evaluating the marginal effects at a man who solves ten problems. For participants who solve twelve or more, the coefficient on the piece-rate performance is .03 ($p = .42$) and on the female dummy $-.63$ ($p = .002$) evaluated at a man who solves twelve.

female dummy confirms that women are significantly less confident than men and that participants with a higher absolute performance think they have a higher relative performance.[25]

Even though we find a gender gap in beliefs about the relative piece rate performance, this gap is less substantial than the gap we found when women and men rank their tournament performance. Beliefs on relative performance in the piece rate and tournament are correlated, but beliefs in the piece rate cannot fully explain those in the tournament. While men are more overconfident than women about their piece-rate performance, the difference in overconfidence is even greater when it comes to the tournament performance.[26] This could be because of a stereotype that women are not so competitive or that women may be more stressed during the tournament [Steele 1997].[27]

While the characteristics of the elicited beliefs for Task 1 are similar to those of Task 2, the effect of beliefs on choice of compensation scheme is very different. Panel B of Figure IV shows, for each guessed piece-rate rank, the proportion of women and men that submits their piece-rate performance to a tournament. In contrast to our Task-3 choice of compensation scheme, the gender gap in the Task-4 decision is very small when we condition on the participant's believed ranking. More confident participants are much more likely to submit to the tournament, and women and men are both about 60 percentage points more likely to submit to a tournament when they think they are the highest performer in their group, rather than the second highest.

The probit analysis in Table VII confirms that, conditional on performance and guessed rank, the gender gap in choice of compensation scheme is small. While gender plays a substantial and significant role when controlling only for piece-rate performance

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25. An ordered probit of guessed piece-rate rank yields coefficients of .77 on female (SE 0.27, $p = .01$) and $-.19$ on piece-rate performance (SE 0.05, $p = .00$). Guesses of four are eliminated, leaving thirty-nine women and thirty-eight men.

26. The result of an ordered probit of relative tournament rank generates the following coefficients: .74 on female (SE 0.33, $p = .03$), $-.07$ on tournament (SE 0.09, $p = .35$), $-.25$ on tournament-piece rate (SE 0.09, $p = .00$), and .82 on guessed piece rate rank (SE 0.28, $p = .00$). The six participants who guessed a rank of four in either the tournament or the piece rate are omitted leaving thirty-seven men and thirty-seven women.

27. Stereotype threat theory suggests that stereotyped individuals (e.g., women who are supposed to be poor competitors) who find themselves in a situation where they run the risk of confirming the stereotype (i.e., in a tournament where they may lose) may feel additional performance anxiety for fear of confirming the stereotype. This additional threat may harm female performance, as they may "choke" under the pressure.

TABLE VII

PROBIT OF DECISION TO SUBMIT THE PIECE RATE TO A TOURNAMENT (TASK 4)

	Coefficient (p-value)	
	(1)	(2)
Female	−.327	−.13
	(.01)	(.21)
Piece rate	.05	.00
	(.02)	(.80)
Guessed piece rate rank		−.32
		(.00)

Dependent variable: Task-4 choice of compensation scheme (1-tournament, 0-piece rate). The table presents marginal effects evaluated at a man with a guess of one and eleven correct answers in Task 1. Excluding guesses of 4, the sample is thirty-nine women and thirty-eight men.

(column (1)), this effect is to a large extent accounted for by gender differences in overconfidence (column (2)). When the compensation scheme choice does not require that participants subsequently perform in a competition, the relative overconfidence of men appears to explain most of the gender difference. Thus, conditional on beliefs, general factors such as risk and feedback aversion have a negligible effect on the Task-4 choice of compensation scheme.

V.C. Do Preferences for Performing in a Competition Cause Gender Differences in Choice of Compensation Scheme?

The decision to submit a past piece-rate performance to a tournament (Task-4 choice) and the decision to enter a tournament and perform in a competition (Task-3 choice) have similar characteristics. In both cases the choice is between a piece rate versus a tournament payment, and in both cases the decision depends on the participants' beliefs about their relative performance. Furthermore, in both cases a choice of tournament will provide participants with feedback on their relative performance. The difference between the two decisions is that only when participants enter the tournament do they have to perform subsequently in a tournament. In this section we determine whether gender differences in tournament entry are driven largely by general factors or if there are additional gender differences when it comes to entering a tournament. Specifically, is the tournament-entry gap in part explained by different preferences for

TABLE VIII

PROBIT OF TOURNAMENT-ENTRY DECISION (TASK 3)

	Coefficient (*p*-value)		
	(1)	(2)	(3)
Female	−.379	−.278	−.162
	(.01)	(.01)	(.05)
Tournament	.015	−.002	−.009
	(.39)	(.90)	(.42)
Tournament–piece rate	.008	−.001	.011
	(.72)	(.94)	(.44)
Guessed tournament rank		−.181	−.120
		(.01)	(.01)
Submitting the piece rate			.258
			(.012)

Dependent variable: Task-3 compensation scheme choice (1-tournament and 0-piece rate). The table presents marginal effects evaluated at a man with thirteen correct answers in the tournament and twelve in the piece rate, who submits to the tournament, and with a guess of one in the Task-2 tournament. Guesses of four are eliminated, resulting in a sample of thirty-eight women and thirty-nine men.

performing in a competition or is it fully accounted for by gender differences in general factors such as confidence and risk and feedback aversion?

Our results thus far suggest that the decision to submit a past performance to a tournament differs from the decision to enter the tournament and then perform. While for high-performing participants there is a significant gender difference in the rate by which participants submit to the tournament, these differences are not significant among low-performing participants. In contrast, the gender difference in tournament entry is independent of performance. Furthermore, while gender differences in beliefs about relative piece-rate performance are sufficient to eliminate the gender gap in the decision to submit to a tournament, beliefs on tournament performance only account for part of the gender gap in tournament entry.

To account for gender differences in general factors such as overconfidence and risk and feedback aversion, we use the participants' guessed tournament ranks along with their Task-4 choice as controls in the tournament-entry decision (see column (3) of Table VIII).[28]

28. We omit the three participants who guessed a rank of four in the tournament, leaving thirty-nine men and thirty-eight women.

As anticipated, we see that participants who are confident and who submit to a tournament (Task 4) are significantly more likely to enter a tournament (Task 3). However, despite these controls, a significant and large gender gap in tournament entry still remains. While controlling for beliefs on relative performance reduced the gender gap in tournament entry from 37.9 to 27.8 percentage points (columns (1) and (2)), this gender effect is reduced to 16.2 percentage points when controlling for the decision to submit the piece rate (column (3)). This decrease may be explained both by the control for risk and feedback aversion and by the fact that the decision to submit the piece rate serves as an additional measure of the individual's general degree of confidence. It is therefore not surprising to see that the coefficient on guessed tournament rank decreases as we move from column (2) to column (3).

Overall, we find that about 57 percent of the original gender effect can be accounted for by general differences in overconfidence and risk and feedback aversion while the residual "competitive" component is 43 percent. This makes clear that the gender gap in choice of compensation scheme is exacerbated when individuals subsequently have to perform under the selected compensation scheme. Controlling for the Task-4 decision as well as believed tournament rank, the marginal effect of gender on the decision to enter the tournament is still 16 percent. This suggests that the gender gap in tournament entry is influenced by men and women differing in their preference for performing in a competitive environment.

VI. Conclusion and Discussion

This paper contributes to a literature that tries to understand why women are underrepresented in many high-profile jobs and across whole professions. While gender differences in preferences and ability or discrimination are likely to play an important role in answering this question, we argue that another reason may be that men and women respond differently to competitive environments.

Past research on gender differences toward competition has shown that in some mixed gender competitions women do not perform as well as men. For example, Gneezy, Niederle, and Rustichini [2003] examine performances when participants are asked to solve mazes for fifteen minutes. Although men and

women perform equally well in a piece-rate scheme, there are large gender differences in performance in a tournament. While a few women perform extremely well, many women do poorly, and the bottom performance quintile is almost entirely comprised of women. Gneezy and Rustichini [2004] and Larson [2005] find similar gender differences in competitive performance.

Rather than examining gender differences in performance under an exogenously given incentive scheme, the focus of this paper is instead one of self-selection. For a given performance we examine whether men and women are equally willing to select into a competition. Since an inferior performance of women may make them more reluctant to compete, we chose a task for which, even in tournaments, men and women perform equally well. Specifically we selected a short task, where men and women are thought to have the same abilities, a task that is not exciting, but rather requires participants to be very careful not to make simple mistakes. Our study demonstrates that despite there being no gender differences in performance, men are more than twice as likely to enter the tournament.

Combined, these studies on gender differences in competitive environments suggest that there may be two additional reasons why women may not be well represented in competitive jobs. First, in mixed-gender competitions there are circumstances where the performance of men is superior to that of women. Second, even when women and men are equally successful in the competitive environment, when given a choice, women may not enter the competition at the same rate as their male counterparts.

We find that the gender gap in tournament entry is primarily caused by two factors. One is that men are substantially more overconfident than women, and the other is that men and women differ in their preferences for performing in a competition. To identify the preference for performing in a competition, we examine the decision to perform in a tournament when controlling for gender differences in general factors such as overconfidence, risk and feedback aversion. Specifically we regress the tournament entry decision on performance, belief on tournament ranking, and the decision to submit a past performance to the tournament. As the decision to submit a past performance to a tournament is very similar to the decision to enter a tournament and then performing, this decision serves as a control for gender differences in general factors such as overconfidence and risk and feedback aversion. Although the believed ranking and the decision to submit a past performance both

have explanatory power, a substantial portion of the gender gap in tournament entry remains. We interpret this unexplained gender gap as evidence that men and women differ in their preferences for entering and performing in a competition.

A few words of caution are warranted when assessing the effect gender differences in preferences for competition may have on tournament entry. First, while we use Task 4 to control for the role played by gender differences in risk and feedback aversion, these factors may play an even larger role when it comes to performing in a competition. For example, if the gender difference in feedback aversion is larger when actively competing, then the Task-4 choice of compensation scheme does not fully account for that gender difference. As a result, the additional gender difference in feedback aversion in competitive environments, which is present in Task 3 will be attributed to gender differences in preferences for performing in a competition.

Second, the effect of gender differences in preferences for competition may be overestimated if men are relatively more optimistic about their future performance. For example, women may act differently than men for a given believed Task-2 ranking if they differ in how good a predictor they feel their past performance is for a future performance. Indeed, women are more prone to attribute past successes to luck than to inner attributes (and past failures less to bad luck) while men do the opposite.[29] However, as we saw in Table II, there is no evidence that participants view an increase in prior performance as indicative of a future performance. Rather, the increase in performance between Task 1 and Task 2 has no effect on tournament entry. While we cannot rule out that women feel that their past performance is a bad predictor of their future performance, actual performance increases do not predict tournament entry. Furthermore, with 75 percent of men thinking they are best in Task 2, this proportion will only increase marginally if men expect future performances to be even better. However to the extent that there are gender differences in the participants' beliefs about their future performance and that these influence tournament entry, our study incorrectly attributes such an effect to men and women having different preferences for performing in a competition.

Our finding that men and women differ in their choice of compensation scheme appears to be a rather robust one, and it

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29. Beyer [1990] and Felder et al. [1994].

has been demonstrated by other researchers as well. For example, Gneezy and Rustichini [in progress] and Gupta, Poulsen, and Villeval [2005] have similar findings. Both papers focus on performance of participants after their choice of incentive scheme and replicate our finding that, conditional on a chosen incentive scheme, there are no large gender differences in performance. In contrast to our study, they do not assess performances prior to the participants' compensation scheme choice; thus, they cannot predict the choices of participants based on performance and are unable to determine payoff-maximizing choices.

While these laboratory studies replicate our general finding, there is also evidence to suggest that gender differences in behavior under competition may extend to other domains. For example, Babcock and Laschever [2003] explore the possibility that gender differences in labor market outcomes may arise because women are poor negotiators and generally dislike the process of negotiating. To the extent that a negotiation can be seen as a two-person competition, their results appear consistent with those on competition. Once again there are two effects: of women first avoiding the competitive scheme altogether and when forced to do so, sometimes failing to compete.

Further evidence that our findings in the laboratory may extend to the real world is that the factors that we identify as causing women to shy away from competition correspond to those emphasized by women in these environments.[30] For example, a report entitled "Women's Experiences in College Engineering" writes that the exit of many young women is not driven by ability but rather that this decision is influenced by women negatively interpreting their grades and having low self-confidence. Furthermore these women mention that negative aspects of their schools' climate, such as competition, lack of support and discouraging faculty and peers, cause them to reevaluate their field of study (Goodman, Cunningham, and Lachapelle [2002] and Felder et al. [1994] find similar effects).

It is generally agreed that ability alone cannot explain the absence of women in male-dominated fields. In natural settings,

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30. While it is not always easy to directly measure external validity, our results seem to have struck a chord and are used as arguments for workplace adjustments. For example, our paper has been cited in a Submission to the Senate's Employment, Workplace Relations and Education Legislation Committee's Inquiry into the Workplace Relations Amendment (WorkChoices) Bill 2005 in Australia (see http://www.hreoc.gov.au/legal/submissions/workplace_relations_amendment_2005.html).

issues such as discrimination, the amount of time devoted to the profession, and the desire for women to raise children may provide some explanation for the choices of women. However, in this paper we have examined an environment where women and men perform equally well and where issues of discrimination or time spent on the job do not have any explanatory power. Nonetheless we find large gender differences in the propensity to choose competitive environments. It appears that these differences are driven by gender differences in confidence and preferences for entering and performing in a competition. These differences seem sufficiently strong to call for greater attention of standard economics to explanations of gender differences that so far have mostly been left in the hands of psychologists and sociologists. Much may be gained if we can create environments in which high-ability women are willing to compete.

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