Are Women Really Less Competitive Than Men?

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Abstract

This study investigates whether women are less willing to compete than men by conducting experiments utilizing math or word tasks and a winner-take-all tournament or ranked compensation payment. We find no gender difference in willingness to compete in word tasks. In the math exercises where there is some gender difference, confidence and stereotype bias are the primary determinants of the gender gap. We conclude that controlling for social preferences, confidence, and stereotype bias, women are equally likely to choose competition as men. This suggests that gender-based stereotypes and corresponding lower confidence may help explain the low representation of women in high-paying, competitive careers.

Are Women Really Less Competitive Than Men?

I. Introduction

According to conventional wisdom women are less willing to compete than men, and some recent experimental studies appear to support this view. In these studies, women are less likely than men to compete in winner-take-all tournaments (Niederle and Vesterlund, 2007) and to increase performance in response to competitive incentives (Gneezy et. al., 2003, and Gneezy and Rustichini, 2004). However, the issue of which sex is the more competitive is complex. Because competition and rewards are inextricably linked, different types of competition may attract people with different abilities, different levels of confidence, different tolerances for risk, and different views of fairness. In studies comparing competitiveness between men and women, the competitive payment system is often a winner-take-all tournament associated with solving arithmetic or maze exercises. In these experiments, stereotype bias, beliefs that men are inherently better than women at solving math or maze exercises, may boost a man's confidence while undermining a woman's, thus contributing to the different propensities to enter the tournament. Similarly, the lopsided compensation structure may offend an inequity averse individual while attracting a social surplus maximizer who anticipates larger total payoffs when only the winner is rewarded for the highest score. According to the social preference literature, women are more often inequity averters while men are more often social surplus maximizers (Andreoni and Vesterlund (2001), Fehr, Schmidt, and Nef (2006), and Kamas, Preston and Baum (2009)). Therefore, the use of a winner-take-all tournament may create a gender difference in the propensity to compete that is not observed under other competitive compensation systems.

The purpose of this study is two-fold. First, we investigate whether and in what situations women have less of a taste to compete by offering subjects the opportunity to compete in treatments where we vary the type of task and the compensation scheme. We run experiments similar to those of Niederle and Vesterlund (2007) comparing the proportion of participants who choose to be compensated under a competitive scheme or a piece-rate payment. However, while Niederle and Vesterlund utilized only a math task, here we compare two different tasks: one is a math task (adding two two-digit numbers) and the other is a word task (making as many words as possible out of an eight-letter word). While the tasks are quite simple and there is no reason to suppose one sex or the other is more capable at the tasks, we expect that men may feel more confident in the math task and women in the word task. We also provide two types of payoffs: a winner-take-all tournament (as in Niederle and Vesterlund) and a ranked compensation payoff where everyone is compensated but the pay rate per unit produced depends on one's ranking in the group. The latter compensation method is closer to many real-life reward systems in employment than is winner-take-all. For example, bonuses usually rise with performance but are rarely all or nothing, and wage rates are often linked to performance. More importantly, the ranked compensation payoffs are more equal than the winner-take-all payoffs, and they reduce the risk of competing because there is no chance of earning nothing while half of the players will see an increase in their payoff rate. Second, we examine the potential role played by social preferences, ability, confidence, and gender stereotypes in the decision to compete with others. We utilize a set of dictator allocations to categorize people's social preferences and then determine whether certain social preference types are more or less likely to compete. From exit survey data we get information on levels of confidence and the extent of stereotype bias.

II. Findings of Previous Studies

The seminal work in this area is Niederle and Vesterlund (2007). In their experiments, subjects were asked to solve as many two-digit addition problems as they could in five minutes. In the first task, they were paid a piece-rate of $0.50 per correct answer. In the second task, subjects competed in groups of two men-two women, and the person who scored highest was paid $2.00 per correct answer while the others received nothing. Note that, as structured, this winner-take-all payment scheme not only results in highly unequal payoffs, but it also increases the total size of the pot (i.e. social surplus) as long as the four scores are not equal. In the third task, participants are allowed to choose under which compensation system they will be paid, but if they choose competition, their scores in the third task will be compared with the second round scores of the others in the group. Each person chooses his or her own payment system so that the choice does not affect the payoffs of others, and social preferences should not affect the choice to compete. However inequity averters may still avoid competition if they do not think it fair to earn more than others, and, as noted above, the winner-take-all payment structure does increase the size of the total payoff making it attractive to social surplus maximizers.

In their experiments, Niederle and Vesterlund find that men (73%) are more than twice as likely as women (35%) to enter the competitive payoff system. They conclude that even after controlling for factors such as confidence, risk, and feedback aversion, there is a gender gap in "preferences for entering and performing in a competition." In a related study, Datta Gupta, Poulsen, and Villeval (2003) also find men (60%) are far more likely to choose competition in completing mazes than women (34%), and while both sexes increase their willingness to compete with higher payoffs, the gender gap persists. In comparing choices between a fixed sum payment and a variable payment scheme, Dohman and Falk (2006) also find that women (44%)

are less likely to choose the variable payment scheme than men (68%), but the difference is explained by differences in productivity and risk aversion. Gneezy, Leonard, and List (2009) compare decisions to compete in a matrilineal and a patriarchal society using a tennis ball throwing task. In the patriarchal society men (50%) were more likely to compete than women (26%), while in the matrilineal society women (54%) out-competed men (39%), suggesting that socio-cultural influences may be responsible for the gender differences found in some studies.

In comparing a winner-take-all competition to a proportional payment system, where the same dollar prize is divided among participants in proportion to their production, Cason, Masters, and Sheremeta (2009) find no significant difference between men and women in the choice to compete in the winner-take-all tournament. However, men (68%) are significantly more likely than women (52%) to choose the competitive compensation system in the proportional-prize treatments. Vandegrift and Yavas (2009) also compare entry into a winner-take-all and a "graduated-payment" tournament using a stock price forecasting task. In the graduated payment tournament the top three performers share the payoff with their prizes based on their ranking while the other 12 group members get nothing. Again, there is no significant difference in choices to compete for men and women in the winner-take-all tournament, but in the graduated payment competition, men's entry rate (45%) is significantly higher than women's entry rate (24%), even after correcting for forecasting skill.

Considering the role that social preferences might play in choices to compete, Bartling, Fehr, Maréchal and Schunk (2009) observe decisions to compete in addition tasks by mothers of pre-school children. Using dictator distribution decisions to classify social preferences, the authors find that the egalitarian subjects (55%) are less likely to choose to compete than the non-egalitarian subjects (77%). This lower willingness to compete is due to aheadness averse subjects rather than behindness averse subjects. Dohman and Falk (2006) find that subjects classified as reciprocal in a trust game are significantly less likely to choose a winner-take-all tournament than other subjects, but social preferences play no role in the choice between a fixed payment and either piece rate or equal sharing.

Some studies have examined the responses in performance of men and women to competitive incentives. Comparing mean scores of men and women, Gneezy, Niederle, and Rustichini (2003) and Gneezy and Rustichini (2004) find that men's performance increases more than women's under competitive incentives compared to piece-rate payment. However, Niederle and Vesterlund (2007) do not find a gender difference in changes in scores when measuring within-person change in performance.

In this study, we further investigate gender differences by comparing entry to winner-take-all and ranked compensation tournaments under two different tasks (math and word exercises). We evaluate the role played by social preferences, ability, confidence, and gender stereotypes in decisions to compete, and then look at within-person changes in performance between piece rate and tournament settings.

III. Experiment Design

There are four treatments in our experiments: either a math task or word task and either winner-take-all compensation (WTA) or ranked compensation (RC). In the math task, subjects are given two minutes to add as many two-digit numbers as they can. They are awarded one point per correct answer. In the word task, subjects are given two minutes to make words from letters provided in an eight-letter word, with one point per letter in each word (i.e. a three-letter word earns 3 points, a four-letter word earns 4 points, etc.). Under the piece-rate compensation system, participants are paid $0.20 per point they earn. In the winner-take-all treatment (WTA), the person in a group of four people who scores the highest is paid $0.80 per point and the others receive nothing. In the ranked compensation treatment (RC), the person who scores the highest in the group of four receives $0.35 per point, the second highest scorer earns $0.25 per point, the third highest receives $0.15, and the lowest gets $0.05 per point.

There are a number of exercises conducted in the experiments followed by an exit survey. The subjects are told that one of the exercises will be randomly chosen at the end of the session to be actually paid out (excluding the practice exercise) in addition to the $10 show-up fee that they receive. The experiment design is the following:[1]

1. Dictator allocation decisions to categorize social preferences – subjects are given ten dictator allocation choices to divide money between themselves and two other anonymous people in the room. These decisions allow us to categorize participants as self-interested, inequity averse, social surplus maximizers, or inconsistent.

2. Practice task (math or word) – subjects are given a two-minute practice to ensure that they understand the task and procedures. This also provides an opportunity to learn so that there will be smaller differences in performance due to learning in subsequent stages.

3. Piece-rate task – Subjects are told that they will be paid $0.20 per point earned in the task.

4. Competition task – Subjects are told that they will be paid according to the competitive compensation scheme in their treatment. In the winner-take-all treatment the person with the highest score receives $0.80 per point while the others receive nothing; in the ranked compensation treatment they are paid $0.35, $0.25, $0.15, $0.05 per point, depending on their ranking in their group.

5. Choose own compensation for next task – subjects choose how they want to be compensated in the following exercise, either piece rate or the competitive compensation where their score is compared to the performance of others in the previous exercise. Each person chooses his or her own compensation method and his or her decision does not affect payoffs to others since they are making their own decisions on how to be compensated.

[1] There were several additional exercises in the experiment where we asked subjects to choose between equally splitting the total payoffs among all members of the group for a future exercise as an alternative to the piece-rate or competitive payoffs. We also asked them to choose the payoff system for another group. These findings will be analyzed in a separate paper focusing on social preferences.

At the end of the experiment sessions, participants filled out an exit survey and provided demographic information.

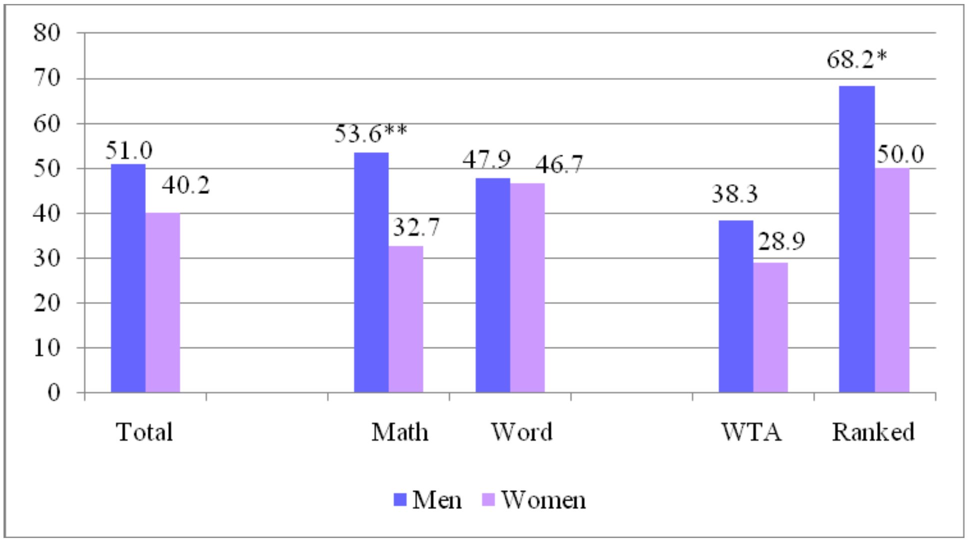
Students were recruited from classes and postings on campus offering a $10 show-up fee. The total number of subjects is 216, of whom 104 are men and 112 are women. Their majors are: 103 Arts & Sciences, 99 Business, and 11 Engineering. The sessions took about 45 minutes and total average earnings, including the show-up fee, were $21.06. Upon arrival to the classroom, the subjects were asked to sit in columns of seats and later told that people in their column would be in their group; they could look to see who was in their group but could not talk to them. An effort was made to form as many groups of two men and two women as possible (136 of 216 participants) to be consistent with the experimental design of Niederle and Vesterlund. While we present the results from the whole sample here, we also examined the subset of the two men-two women groups and the findings are substantially the same as those we provide.

IV. Results – Gender Differences in Choice to Compete

IV.A. Gender Differences by Types of Task and Competition

The percentages of men and women who choose to compete rather than be paid piece-rate in the math and word exercises and the winner-take-all and ranked compensation competitive systems are presented in Figure 1. For all four treatments, men (51.0%) choose to compete more than do women (40.2%), but the difference is much smaller than that found by Niederle and Vesterlund (73% of men and 35% of women) and is not statistically significant (with Pearson's chi-squared test). Men (53.6%) are significantly more likely to choose competition in the math task than women (32.7%), but the percentages who choose competition in the word tasks are almost the same for men (47.9%) and women (46.7%). Because we find

Figure 1
Percentages Choosing to Compete
By Type of Task & Type of Competition



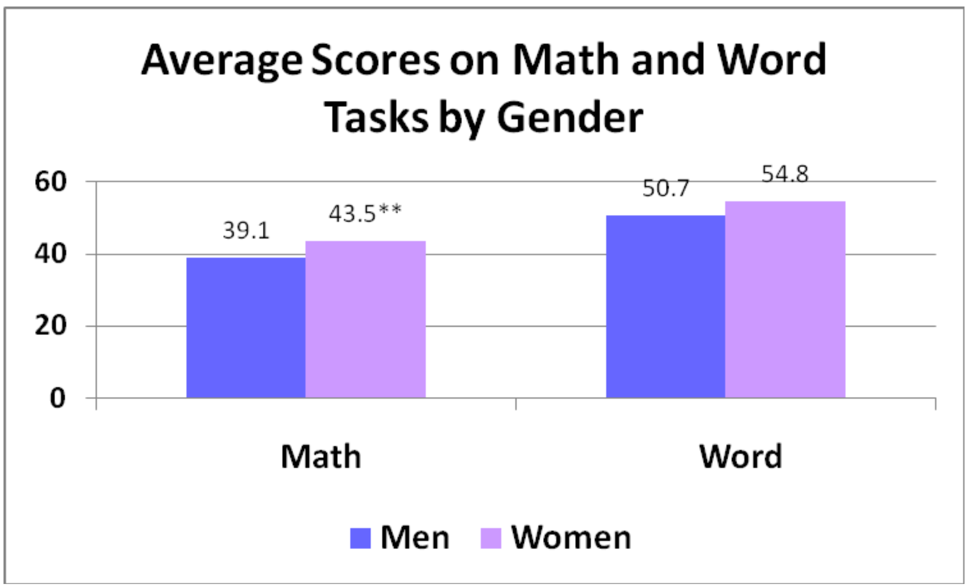
** Male percentage is significantly different thant the female percentage at the 0.05 significance level using Pearson's chi-squared test.
* Male percentage is significantly different thant the female percentage at the 0.10 significance level using Pearson's chi-squared test.

women as likely to compete in word search competitions as men, ability or self-confidence may be driving the results in other studies which use math based tasks.

When comparing across the types of competition, we find that men more likely than women to choose competition in both the winner-take-all (38.3% of men and 28.9% of women) and the ranked (68.2% of men and 50.0% of women) competitions, but the difference is far larger and significant at the 0.10 level for the ranked payment scheme. These results agree with those of Cason, Masters and Sheremeta (2009) and Vandegrift and Yavas (2009) who find that men's entry to competition increases more than women's when comparing ranked to winner-take-all payoffs, and only in the former are gender differences significant.

Because the propensity to compete is the highest for men and lowest for women in the math task, this difference might reflect differences in ability between men and women. Figure 2 presents average scores for men and women in the two tasks. Women score better than men in both tasks (43.5 v. 39.1 in the math exercise and 54.8 v. 50.7 in the word exercise), but only the difference in the math scores is significant at the 0.05 level. Therefore, the high propensity of men to compete in math tasks is not driven by extra special abilities.

Figure 2
Average Scores on Math and Word Tasks by Gender



** The male mean is significantly different than the female mean at the 0.05 significance level using a two tailed t-test.

IV.B. Risk-Aversion and Choice to Compete

Table 1 provides the percentages of men and women who choose to compete in the four treatments. As we move from column (1) (math task) to column (2) (word task) the level of confidence may change while the level of risk remains similar. On the other hand, moving from

Table 1
Percentages Choosing to Compete by Treatment

		→ Change in Confidence - Risk Similar	
		(1) Math	(2) Word
↓ Reduced Risk Confidence Similar (& More "Fair")	(1) WTA	Men^{++} 38.2 — Women$^{\# ++}$ 20.0	Men 38.5 — Women 40.9
	(2) RC	Men 77.3 — Women* 50.0	Men 59.1 — Women 50.0

* The female percentage is significantly different than the male percentage at the 0.10 level using Pearson's chi squared test.

$^{\#}$ The percentage for women in the math winner-take-all exercise is significantly different than the percentage for women in the word winner take all tournament at the 0.1 level using Pearson's chi squared test.

$^{++}$ The percentage in the math winner-take-all exercise for both sexes is significantly different than the percentage in the math ranked compensation exercise at the 0.05 level using Pearson's chi squared test.

row (1) WTA to row (2) RC holds the confidence level constant while changing the level of risk and the equality of payoffs.

Men choose to compete more than women in both math treatments, but using Pearson's Chi-squared test the difference is significant at the 0.10 level only in the math ranked compensation treatment. However, in the word task with winner-take all competition, women are slightly more likely, although not significantly, to choose the competitive payoff scheme than men, and there is just a small gender difference in the word ranked compensation exercise.

Moving from math to word exercises, we anticipate women's confidence levels will increase on average while men's will decreases. As expected, women significantly increase their willingness to compete in winner-take-all tournaments when the exercise is a word search (40.9%) rather than a math exercise (20.0%). However, they do not change their willingness to compete in the RC exercises comparing math to word. Men do not change entry rates moving from math to word in the WTA exercises but do reduce entry in the RC word exercises; however the change is not significant.

Both sexes increase entry to competition moving from winner-take-all to ranked compensation as risk is reduced and equity increased, but for both sexes the change is only significant in the math exercises. However, men's change is larger in magnitude for both tasks. Men appear to respond to the reduction of risk more than women suggesting that previous findings of a gender difference in willingness to enter competitive environments is not due to women being more risk averse.[2] The move from a WTA to a RC scenario also increases the equality of payoffs. Throughout the social preference literature, men tend to be less likely to be inequity averters, so it is unlikely that men's higher propensity to compete in the RC than the WTA tournament is due to increased fairness of compensation.

VI. C. The Influence of Social Preferences on the Choice to Compete

Other-regarding preferences may affect people's preferred compensation system and their willingness to compete. For example, people who are inequity averse may avoid competition because of the resulting inequality of payoffs. This may be particularly true for very unequal payoff schemes such as the winner-take-all. The ranked compensation payment system leads to less inequality and may be perceived to be fair since people are rewarded for performance (a type of just desserts), therefore, inequity averters may or may not avoid such payment mechanisms. Social surplus maximizers may choose competitive payoffs if they believe competition increases

[2] Cason et. al (2009) and Gneezy et. al. (2009) also find that risk aversion does not explain gender differences.

the size of total production or payoffs. Self-interest leads people to be willing to compete if expected payoff to self is high enough and risk aversion is low enough.

We use a set of ten dictator allocation decisions to categorize subjects as inequity averse, using the Fehr and Schmidt (1999) inequity aversion model, social surplus maximizers, or self-interested. The utility functions associated with the three types are:

Self Interested: $U_i(\pi) = \pi_i \, where \, \pi_i$ is payoff to self.

Inequity Averse: $U_i(\pi) = \pi_i - \alpha_i[\frac{1}{n-1}]\sum_{j \neq i} \max\{\pi_j - \pi_i, 0\} - \beta_i[\frac{1}{n-1}]\sum_{j \neq i} \max\{\pi_i - \pi_j, 0\}$

Social Surplus Maximizer: $U_i(\pi) = (1 - \lambda_{ii})\pi_i + \sum_j \lambda_{ij}\pi_j \, where \, \lambda_{ij} > 0$.

Because allocation choices are often consistent with more than one type of social preference while each category of preferences is often consistent with more than one allocation choice, the ten allocation exercise allows us to look for consistency of preferences across allocations and more precisely define social preferences.[3]

Figures 3A, 3B, and 3C illustrate utility to self as a function of payoff to other, π_j, given payoff to self is constant at π_i. In 3A, payoffs to others have no effect on own welfare to the self-interested, so the utility function is a horizontal line. In 3B, inequity averters see an increase in utility when those with income lower than their own increases but a decrease in utility when income to those with income higher than their own increases; conditional on own payoff, utility is maximized when the other is paid the same amount as self, the case at point B where $\pi_i = \pi_j$.

Social Surplus maximizers enjoy increased utility when the income of others increases, regardless of whether the other is better or worse-off than self because they value total surplus (not equity).

[3] See Kamas and Preston (2009) for a detailed explanation of the categorization methodology.

Figure 3A - Utility for Self-Interested

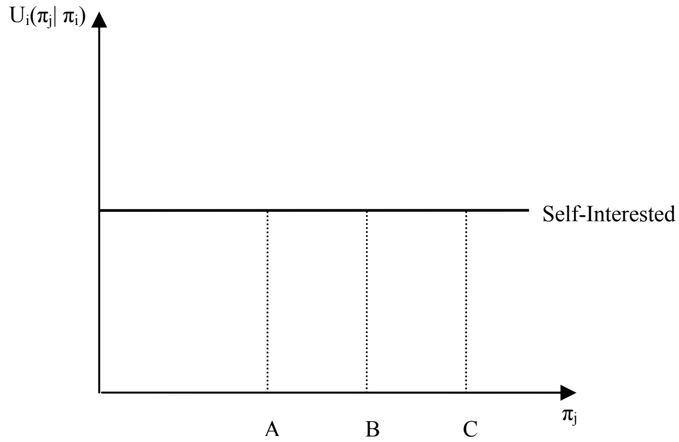


Figure 3B - Utility for Inequity Averters

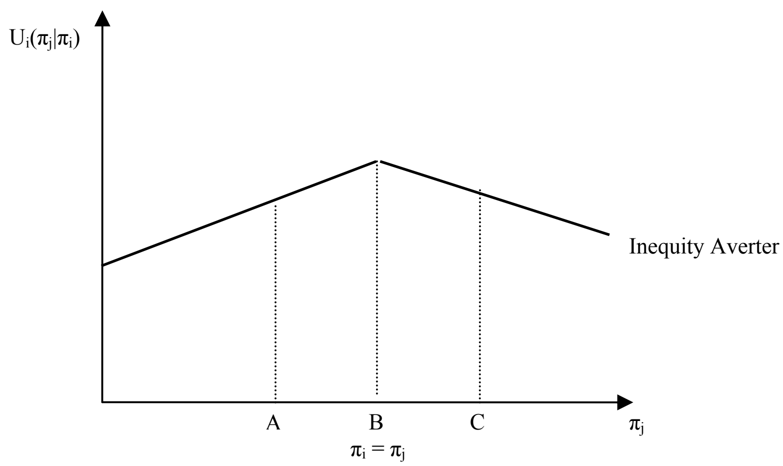


Figure 3C – Utility for Social Surplus Maximizers

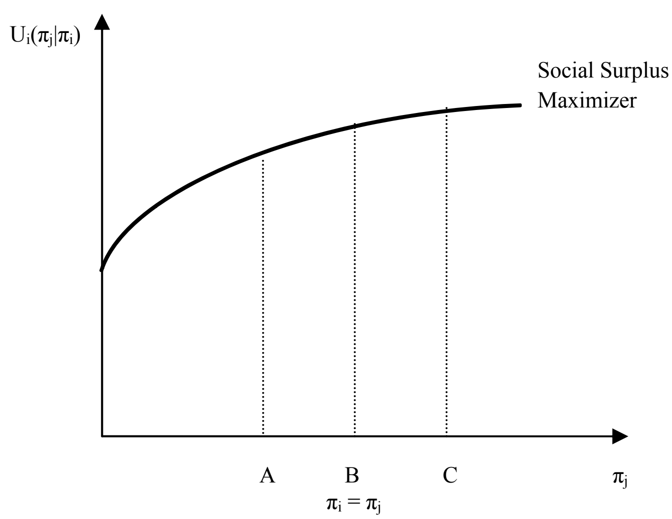


Table 2 provides an example of the allocation exercises and the full 10 questions are provided in the appendix. The participants are asked to choose allocation A, B, or C. The self-interested answer is A since it maximizes payoff to self. The inequity averse answer is B since there is perfect equity among participants, and the social surplus maximizing answer is C since it maximizes the size of the pie. However, because inequity averters and social surplus maximizers care about income to themselves as well as income to others, they may at some prices of giving or income gaps choose the self-interested answer A. The full ten questions vary the price of giving and the income gaps among participants, and we track within-person responses to carefully classify respondents. Within the ten questions there are five for which one of the responses gives more to self than others. If a subject always picks the self-interested response in these five questions, he or she is classified as self-interested. In order to be classified as inequity averse (or social surplus maximizing), a respondent must choose an unselfish allocation in one or more of these five exercises and then pick all other answers consistent with inequity aversion (or social surplus maximization).

Table 2
Sample Dictator Allocation Exercise

	Distribution				**Total Payoff**		**Category**
	X	**YOU**	**Z**				
A	**6**	**10**	**6**		**22**		**Self-Interest, IA, SSM**
B	**7**	**7**	**7**		**21**		**IA**
C	**8**	**7**	**8**		**23**		**SSM**

Table 3 gives the percentage of the respondents in each social preference category. Over the ten allocations, about a third are unclassified, meaning they act as social surplus maximizers in a subset of questions and as inequity averters in another subset. Therefore, they do not display consistent preferences across the ten questions. Of the classified respondents, 22.2% are self-interested, 29.2 % are social surplus maximizing and 16.2% are inequity averse. Turning to the distribution of social preferences by sex, men (35.6%) are more likely than women (23.2%) to be social surplus maximizers, and this difference is significant at the 0.05 confidence level (Pearson's chi-squared test).

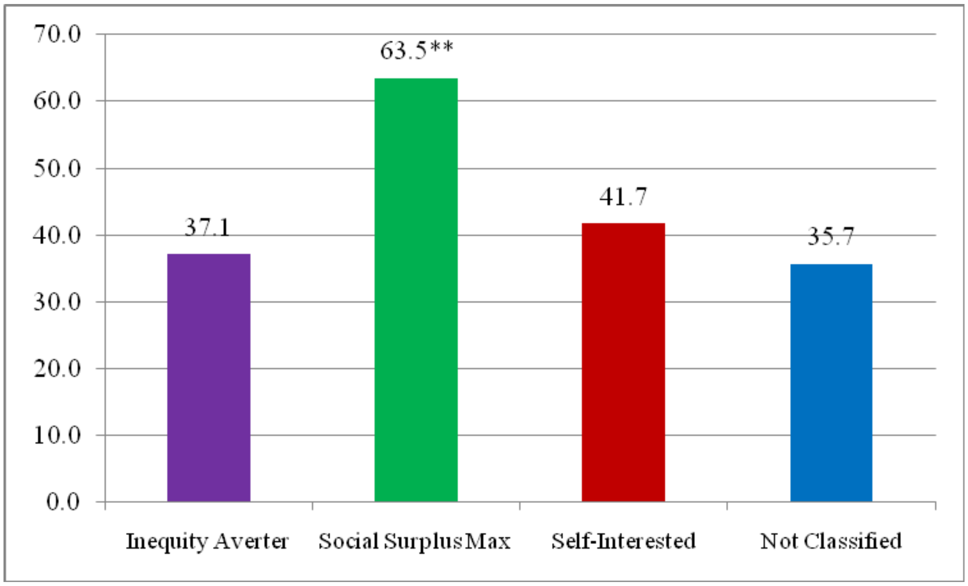
Table 3
Percentage of Respondents in Each Social Preference Category

	Social Surplus Maximizer	**Inequity Averse**	**Self-Interested**	**Unclassified**
	(1)	**(2)**	**(3)**	**(4)**
Total	29.2%	16.2%	22.2%	32.4%
Male	35.6%**	15.4%	20.2%	28.9%
Female	23.2%	17.0%	24.1%	35.7%

** Male percentage is significantly different than female percentage at the 0.05 level using a Pearson's chi-squared test.

Figure 4 gives the percentage of individuals who choose to compete by social preference type. We find that 63.5% of the social surplus maximizers choose to compete, more than 20 percentage points more than any other social preference classification. This significant difference in choosing to compete supports the hypothesis that social surplus maximizers may prefer competition since total payoff increases. It also may partially explain gender differences in choosing to compete since women are less likely than men to be social surplus maximizers.

Figure 4
Percentages Choosing to Compete
by Social Preference Category



**The percentage of social surplus maximizers is greater than the percentage of each of the other groups at the 0.05 level using Pearson's chi squared test.

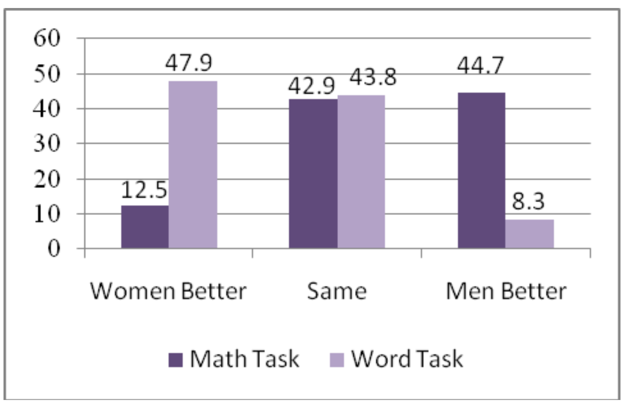
The percentages of those choosing competition in the other preference categories are similar to one another, with 37.1% of inequity averters, 41.7% of self-interested, and 35.7% of the unclassified entering competition. While inequity averters might have been expected to avoid competition because of the inequality in payoffs, under the experiment design their decisions do not affect the payoffs of others, effectively eliminating this rationale. Because those who are not classified choose to compete at rates similar to the inequity averters, they may be more motivated by equity concerns than surplus maximization.

VI.D. The Role of Stereotypes & Confidence in the Decision to Compete

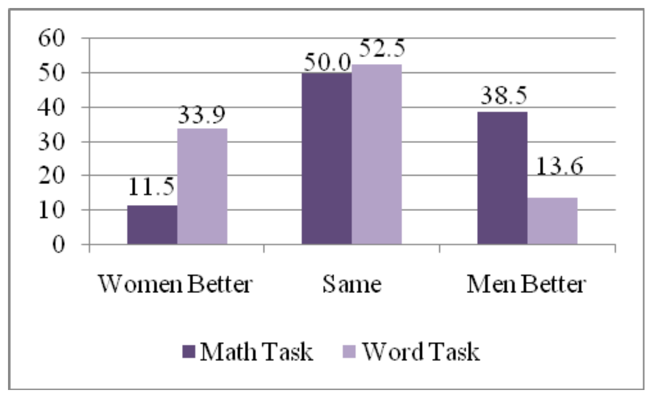
In order to gauge the effects of stereotypes of gender competency on willingness to compete, in the exit survey we asked the following question: "On a scale from 1 to 7, do you think male students would score lower on these exercises, the same, or higher than female students? (where 4 is men and women would score the same, 7 is men would score a great deal higher and 1 is men would score a great deal lower). The distributions of these responses are provided in Figure 5.

Figure 5
Percentages of Men and Women Who Believe Men or Women Will Score Higher in Word and Math Tasks
(Scale is 1-7 with 4 = perform the same; 1 to 3 = Women Better and 5 to 7 = Men Better)

Men's Expectations



Women's Expectations



Both men (44.7%) and women (38.5%) are more likely to think that men will score higher than women on the math task while only 12.5% of men and 11.5% of women think women will score higher on the math task. Opinions reverse for the word task, with 47.9% of men and 33.9% of women saying women will score higher while only 8.3% of men and 13.6% of women say men will score higher. Although this pattern confirms the existence of gender stereotypes on math and word task competencies, it contradicts the actual findings of little or no differences in performance on the tasks. Experiments that are designed to be "gender-neutral" in terms of competency may in fact be neutral yet subjects may wrongly believe that one sex or the other is more capable at the task. This erroneous belief can influence decisions as subjects incorrectly judge their competitors' capabilities.

We also asked subjects to indicate where they expected to rank in their group, where 1 refers to the highest scorer and 4 to the lowest. Table 4 presents the mean responses by sex. Men are significantly more confident overall than women, with a mean expected ranking of 1.76 compared to 2.13 for women. The difference is larger for the math task (1.70 compared to 2.14) than the word task (1.83 compared to 2.13), wholly because men have less confidence in the word than the math task and women's confidence levels do not vary across the two tasks.

Table 4
Expected Rank In Group
(1 is first ; 4 is last)

	Gender	
	Male	Female
Total Sample	1.76	2.13***
By Type of Task:		
Math	1.70	2.14***
Word	1.83	2.13 **
By Type of Competition:		
Winner-Take-All	1.75	1.94
Ranked Compensation	1.77	2.28***

*** The female mean is significantly different than the male mean at the 0.01 level using a two tailed t-test
** The female mean is significantly different than the male mean at the 0.05 level using a two tailed t-test

It is interesting to note that while men believe women in general are better at the word task than men (only 8.3% thought men would earn higher scores than women), on average men still think they personally will rank higher on the word task than their female competitors, and

Men (89.6%) are more likely than women (66.7%) to think they will be ranked either first or second on the word task. Overall, these results indicate men are more confident than women, even in tasks where they expect women perform better than men.

IV.E. Multivariate Analysis of Decision to Compete

Table 5 presents results of probit regressions estimating the probability of choosing to compete. The displayed values are the changes in the probability for a one unit change in the independent variable. In column (1) where the four treatments are not separated, women are 11 percent less likely to enter competition than men but this difference is not significant at conventional levels. In column (2) we include interaction dummies for gender, type of task, and type of competition (the excluded group is men in math winner-take-all tournaments). Women are much less likely to choose to compete in the math winner-take-all treatment than are men (coefficient is - 0.203) but this difference is not significant. As noted earlier in section IV.B, men are significantly more likely to enter the math ranked competition than they are to compete in the math winner-take-all tournament, but none of the other dummies is significant. However, we do find a significant difference between men and women's willingness to compete in the math ranked competition (bolded numbers); men are 25 percentage points more likely to enter this type of competition than women. Among all other treatments, there is no significant difference in the decision to compete between men and women.

In columns 3 through 7 we add variables representing social preferences, ability, stereotype bias, and confidence to determine whether any of these variables explain the gender difference in choosing to compete in the math ranked tournaments. Including the social preference dummy variables (with the unclassified the excluded group) results in a large and highly significant coefficient on social surplus maximizers who are 30 percentage points more likely than the unclassified to choose a tournament. There is little effect on the gender interaction terms. The coefficient on females in math winner take all tournaments falls in magnitude since women are less likely to be social surplus maximizers than men. The significant difference between men and women choosing ranked tournaments in the math task persists.

In order to control for ability we add the cumulative score on the first two exercises in column 4, and there is a significant positive effect of score on decision to compete. Interestingly, because women have higher scores than men, including the score results in significant gender differences in decisions to compete for both the math winner-take-all and the math ranked tournament. Therefore, controlling for ability men are more likely to compete in math tournaments.

In column 5, we add controls for stereotype bias, a dummy equal to one if the individual states that people of his or her sex perform better at the task (gender advantage) and a dummy equal to one if the individual states that people of his or her sex perform worse at the task (gender disadvantage). The coefficients have the expected signs, and while only the coefficient on gender advantage is significant, an F-test rejects the hypothesis that the coefficients are jointly equal to zero at the 0.05 level. More importantly, once we control for stereotype bias, there is no longer a gender difference in willingness to compete in the math task. This implies that gender stereotyping plays an important role in the gender gaps found in competitions involving math exercises.

Finally, in column 6, we add a measure of confidence, the expected rank in group, with one being the highest score and 4 the lowest. The coefficient on expected rank is negative, large, and significant. Changing one's expected rank in group from one to two results in a 39 percentage point reduction in the probability of choosing to compete. Controlling for

Table 5
Determinants of the Probability of Choosing to Compete in a Tournament[a]
(Coefficients give the change in probability with a one unit change in the variable; p values are in parentheses.)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Female	- 0.108 (0.112)						
Female x Math x Winner-take-all[a]		- 0.203 (0.111)	- 0.149 (0.264)	**-0.227* (0.115)**	-0.143 (0.128)	-0.111 (0.138)	- 0.014 (0.929)
Male x Math x Ranked		**0.384*** (0.004)**	**0.435*** (0.002)**	**0.398*** (0.106)**	0.408*** (0.106)	0.496*** (0.095)	0.551*** (0.000)
Female x Math x Ranked		**0.119 (0.386)**	**0.180 (0.203)**	**0.120 (0.139)**	0.238* (0.134)	0.409*** (0.117)	0.485*** (0.001)
Male x Word x Winner-take-all		0.002 (0.986)	0.067 (0.635)	-0.024 (0.132)	0.105 (0.138)	0.136 (0.141)	0.279* (0.068)
Female x Word x Winner-take-all		0.028 (0.842)	0.147 (0.312)	-0.111 (0.139)	0.040 (0.141)	0.155 (0.153)	0.241 (0.169)
Male x Word x Ranked		0.208 (0.127)	0.280** (0.047)	0.100 (0.147)	0.316** (0.123)	0.291** (0.135)	0.428** (0.009)
Female x Word x Ranked		0.119 (0.316)	0.193 (0.114)	0.051 (0.123)	0.159 (0.120)	0.369*** (0.117)	0.443*** (0.002)
Social Surplus Maximizers			0.296*** (0.001)				0.303*** (0.005)
Inequity Averters			- 0.020 (0.849)				0.034 (0.774)
Self-Interested			0.041 (0.864)				- 0.044 (0.697)
Actual score				0.003*** (0.001)			0.000 (0.714)
Individual feels at a gender disadvantage					-0.106 (0.086)		- 0.180* (0.070)
Individual feels at a gender advantage					0.177** (0.089)		0.083 (0.419)
Expected rank in group						-0.391*** (0.061)	-0.390*** (0.069)
Pseudo R^2	0.010	0.072	0.117	0102	0.096	0.235	0.289

Bold: Female coefficient is significantly different than male coefficient at the 0.10 level.
*** Coefficient is significant at the 0.01 level.
** Coefficient is significant at the 0.05 level.
* Coefficient is significant at the 0.10 level

confidence, there is no gender difference in choosing to compete within the separate tasks and tournaments. In fact within each tournament task grouping, the decisions by men and women to compete are remarkably similar. Column 7 adds all the controls simultaneously, and the controls all remain significant except for score. In this complete model, many of the gender interactions are significant since the winner-take-all tournaments are less likely to attract competitors than the ranked tournaments. Again, the propensity to compete within each tournament task is strikingly similar for men and women.

Social preferences and ability do affect the decision to compete, but neither can explain the gender differences found in the math ranked tournament. In fact, controlling for ability, the gender difference in winner-take-all math tournaments is also significant. However, once we include gender stereotype or confidence, we find no gender differences in choosing to compete.

V. Performance Response to Competition

Table 6 provides in row 1 the percentage change in individuals' scores from piece-rate payment to competitive payment for the exercise where competing was required, and in rows 2 and 3, the percentage change in individuals' scores from piece-rate payment to competitive payment for the exercise where the participants were allowed to chose their compensation method. We find that men increase their scores more than women in the competitive treatments (rows 1 and 3) with larger gender differences in the math exercises, but the male - female differences are not significant. We also ran regressions with various controls and, similar to Niederle and Vesterlund (2007), we find no gender differences in within-person changes in performance between piece-rate and competitive compensation systems.

Table 6
Within-Person Performance
Percentage Change of Score in Competitive Exercises Compared to Piece-Rate Exercise

Percentage Change of Score in Competition Exercise Compared to Piece-Rate Exercise Score					
	Math			**Word**	
	Male	**Female**		**Male**	**Female**
1) All Groups	3.0%	- 1.4%		13.8%	13.1%
Percentage Change in Score in Choice of Compensation Exercise Compared to Piece-rate Exercise Score Conditional on Choosing Piece-Rate or Competition					
	Math			**Word**	
	Male	**Female**		**Male**	**Female**
2) Choose Piece-Rate	5.9%	2.1%		27.6%	21.4%
3) Choose Competition	13.4%	6.0%		17.5%	15.2%

VI. Self-Reporting of Competitive Behavior and Motivation:

In the exit survey we asked several questions to gauge how the students would self-report their own competitive behavior. These results are provided in Table 7. In response to the question asking how important it was to them to score higher than others in the competitive exercise of the experiment, we find almost no difference in the mean responses, 5.05 and 5.02 for men and women respectively. Women (4.83 mean) are significantly more likely to respond that performing better than their peers is important than men (4.46), significant at the 0.05 level. Women (6.16) also place significantly more importance on doing tasks well at school or work than men (5.76). Finally, men are 7 percentage points more likely than women to say they compare their performance to others while women are 8 percentage points more likely to say they compare themselves to their own past performance, but these differences are not

Table 7
Self-Report of Competitive Behavior and Motivation

Exit Questions (1 low; 7 high)	**Total**	**Men**	**Women**
1. On competitive task in this study: How important was it to you to score higher than the other people?	5.03	5.05	5.02
2. When you undertake a task at school or work, in general, how important is it to you to perform better than your peers?	4.64	4.46	4.83**
3. When you undertake a task at school or work, in general, how important is it to you to do well?	5.96	5.76	6.16***
	Percentages		
4.Which of the following statements best describes you:	Total	Men	Women
A) I tend to compare my performance to other people and try to do better than they do.	38.9	42.3	35.7
B) I tend to compare my performance to how well I did in the past and try to improve my performance.	45.3	41.3	49.1
C) I try my best without making comparisons to others or to myself.	15.8	16.4	15.2

**The female mean is significantly different than the male mean at the 0.05 level using a two tailed t-test.
*** The female mean is significantly different than the male mean at the 0.01 level using a two tailed t-test

significant. Similar percentages of men and women say they try to do their best without making comparisons to others.

VII. Conclusion

The results from this paper do not support the conventional wisdom that women are less likely to compete than men, but rather gender differences in the propensity to compete change with the nature of the task and the specific type of competition. In four different treatments that vary the task from a word to a math exercise and the type of competition from a winner-take-all tournament to a ranked compensation scheme, men are significantly more likely to compete only in the math ranked compensation treatment. While point estimates reveal men more likely to compete in the math winner-take-all tournament, these estimates are not statistically significant. Rates of competition in the word tasks are very similar for men and women.

Examination of ability and confidence reveals that women score higher on both tasks than men and significantly so for math tasks, but men are more confident than women in predicting their rank in group for both types of tasks. In addition, both men and women exhibit stereotype bias in assuming that men on average perform better than women in math tasks and women perform better in word tasks. Further, men are more likely than women to be social surplus maximizers, and social surplus maximizers are more likely than individuals with all other social preferences to choose competitive tournaments. Multivariate analysis reveals that differences in confidence and stereotype bias are important determinants of gender gaps in willingness to compete; once these variables are included there is no gender difference in willingness to compete in either math or word tasks. These findings are important because they suggest that gender-based stereotypes and the corresponding relatively lower confidence of women may explain some women's preferences to avoid competition. Therefore, the elimination of gender stereotyping and strengthening of women's self-confidence may contribute to reducing gender gaps in high-paying, competitive professions.

APPENDIX B – Ten Allocation Exercises Used to Classify Social Preferences

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
	Distribution			Total Payoff	Diff. Self to X	Diff. Self to Z	1	2		3		
							Self-interested	Inequity Averse (IA)		Social Surplus Max (SSM)		
								(2A)	(2B)	(3A)	(3B)	
	X	YOU	Z					Competitive IA	Compassionate IA	Efficiency Max	Compassionate SSM	CATEGORY[a]
1												
A	6	6	5	17	0	1	C	A,C	A,B,C	B,C	B,C	**IA**
B	8	6	8	22	-2	-2						**SSM , Compass IA**
C	4	8	4	16	4	4						**Selfish, IA , SSM**
2												
A	4	7	4	15	3	3	A	A,B	A,C	A,C	A,C	**Selfish, IA , SSM**
B	8	6	5	19	-2	1						**Competitive IA**
C	9	6	6	21	-3	0						**SSM , Compass IA**
3												
A	10	6	5	21	-4	1	A,B,C	C	B	A	A,B	**SSM**
B	8	6	6	20	-2	0						**Compass SSM, Compass IA**
C	5	6	5	16	1	1						**Competitive IA**
4												
A	10	6	4	20	-4	2	A,B,C	C	C	A	A,B	**SSM**
B	7	6	6	19	-1	0						**Compass SSM**
C	6	6	6	18	0	0						**IA**
5												
A	9	7	3	19	-2	4	A,B,C	B	A	C	A,C	**Compass SSM, Compass IA**
B	7	7	1	15	0	6						**Competitive IA**
C	11	7	2	20	-4	5						**SSM**
6												
A	6	8	1	15	2	7	A	A,C	A,B,C	A,B	A,B	**Selfish, IA, SSM**
B	8	6	7	21	-2	-1						**SSM , Compass IA**
C	6	6	4	16	0	2						**IA**
7												
A	6	10	6	22	4	4	A	A,B	A,B	A,C	A,C	**Selfish, IA, SSM**
B	7	7	7	21	0	0						**IA**
C	8	7	8	23	-1	-1						**SSM**
8												
A	10	5	5	20	-5	0	A,B,C	C	A,C	B	A,B	**Compass SSM, Compass IA**
B	13	5	4	22	-8	1						**SSM**
C	4	5	4	13	1	1						**IA**
9												
A	5	5	5	15	0	0	A,B,C	A	A	B	B,C	**IA**
B	15	5	3	23	-10	2						**SSM**
C	10	5	5	20	-5	0						**Compass SSM**
10												
A	3	7	3	13	4	4	A	A,B	A,B,C	A,C	A,C	**Selfish, IA , SSM**
B	6	6	5	17	0	1						**IA**
C	9	6	8	23	-3	-2						**SSM, Compass IA**

[a] **IA refers to both competitive and compassionate inequity averters and SSM refers to both efficiency and compassionate social surplus maximizers**

References

Andreoni, James and Lise Vesterlund (2001). 'Which is the Fair Sex? Gender Differences in Altruism.' *The Quarterly Journal of Economics*, pp. 293-312.

Bartling, Björn, Ernst Fehr, Michel André Maréchal and Daniel Schunk (2009). 'Egalitarianism and Competitiveness,' manuscript, January.

Cason, Timothy N., William A. Masters, and Roman M. Sheremeta (2009). 'Entry into Winner-Take-All and Proportional-Prize Contests: An Experimental Study,' manuscript, June.

Datta Gupta, Nabanita, Anders Poulsen, and Marie-Claire Villeval (2005). 'Male and Female Competitive Behavior: Experimental Evidence.' Institute for the Study of Labor (IZA) Discussion Paper No. 1833, November.

Dohmen, Thomas and Armin Falk (2006). 'Performance Pay and Multi-dimensional Sorting: Productivity, Preferences and Gender.' Institute for the Study of Labor (IZA) Discussion Paper No. 1001, March.

Fehr, Ernst, Michael Naef, and Klaus M. Schmidt (2006). 'Inequality Aversion, Efficiency, and Maximin Preferences in Simple Distribution Experiments: Comment." *American Economic Review*, vol. 96, no. 5, December, 1912-1917.

Gneezy, Uri and A. Rustichini (2004). 'Gender and Competition at a Young Age.' *American Economic Review Papers and Proceedings,* May, 377-381.

Gneezy, Uri, Kenneth L. Leonard, John A. List (2009). 'Gender Differences in Competition: Evidence from a Matrilineal and a Patriarchal Society." *Econometrica*. vol. 77, no. 5, 1637-1664.

Gneezy, Uri, Muriel Niederle, and A. Rustichini (2003). 'Performance in Competitive Environments: Gender Differences.' *Quarterly Journal of Economics,* 118, 1049-1074.

Kamas, Linda and Anne Preston (2009). 'On Measuring Compassion in Social Preferences Do Gender, Price of Giving, or Inequality Matter? manuscript.

Niederle, Muriel and Lise Vesterlund (2007). 'Do Women Shy Away From Competition? Do Men Compete too Much?' *Quarterly Journal of Economics*, 122, 1067-1101

Vandegrift, Donald and Abdullah Yavas (2009). 'Men, Women, and Competition: An Experimental Test of Behavior.' *Journal of Economic Behavior & Organization,* v. 72, no. 1, October, 554-570.