Option to Cooperate Increases Women's Competitiveness and Closes the Gender Gap

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Abstract. We advance the hypothesis that women are not less competitive than men in tournament settings once the incentives for winning include social components in addition to the standard monetary rewards. Specifically, allowing top performers an opportunity to divide the winnings with the bottom performers has gendered consequence on individual behavior. An incentivized experiment ($N = 438$) provides confirming evidence for our hypothesis: while we observe a 26% gender performance gap when participants compete in a standard winner-take-all tournament, once we add a final sharing option to an otherwise identical incentive scheme, female performance increases significantly to levels indistinguishable from males. Including socially-mediated rewards to contracts (like team bonuses) offers a new policy tool, less controversial than quotas, with the potential to close the gender gap in labor markets.

JEL codes: C90, D90, D91, J16

keywords: competition, tournament, gender differences, social reward

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1 Introduction

Economists have advanced the idea that women are less competitive, less risk tolerant, and less ambitious than men. A recent line of research has found that women underperform relative to men when placed under competitive pressure (Gneezy et al., 2003; Gneezy & Rustichini, 2004; Shurchkov, 2012; Backus et al., 2016) and women avoid high-risk, high-return environments, preferring to self-select into pay schemes that offer lower, more predictable returns (Niederle & Vesterlund, 2007; Dohmen & Falk, 2011; Flory et al., 2014). These sets of results are about different but related ways of "being competitive". The first is about competitive *performance*: in competitive tournament-style settings women underperform relative to men. The second is about competitive *attitudes*: women opt in to competitive, tournament-style payoff mechanisms at a lower rate relative to men. In this paper, we focus on competitive performance; in related work we explore how our hypothesis relates to competitive attitudes (Cassar & Rigdon, 2020).[1]

Sex differences in both competitive performance and competitive attitude are important for economics as they are systematically used to explain many gaps, among them the gender-wage gap (since competitive fields tend to be the most lucrative) and why, in general, there is less representation of women among holders of socioeconomic power. Yet, research in evolutionary psychology, anthropology, and biology has started to question the less-competitive-female paradigm and demonstrated that, at least in certain contexts, females are just as competitive as males, but exhibit it differently (Hrdy, 1981, 1999; Clutton-Brock, 2007; Stockley & Bro-Jorgensen, 2011). Given different roles in reproduction, males and females were subjected to different evolutionary histories with plausible consequences for the expression of a trait, like competitiveness, into different behaviors, depending on the specifics of the biological and socioeconomic context an individual is in. Once one considers the cost-benefit implications of a trait, a behavior adaptive in males may not be equally beneficial for females, for whom a different competitive strategy may be preferable.

We hypothesize that the gender gap in competitiveness generally observed in tournament experiments derives from the one dimensional, money-only payoff structure traditionally implemented. We claim that such a protocol is ideally suited to register a trait the way it is typically expressed by males, ignoring its female variation. If, instead, the incentive to compete is socially mediated, as when the prize in a tournament is both a resource and the ability to allocate part of it to others, women will reveal competitive traits similar to men. Here we provide motivation based on evolutionary reasoning

[1] For an extensive overview of the research, see Croson & Gneezy (2009) and Niederle & Vesterlund (2011).

and some initial empirical evidence.

2 Motivation

There is no ex ante reason to expect that men and women are motivated in the same ways by the same incentive structures when performing real-effort tasks. For instance, Cassar et al. (2016) using a subject pool in China find that women who are parents opt in to a tournament environment at the same rate as men if the payoffs are book vouchers rather than money and Healy & Pate (2015) find that women choose team-based incentives over individual incentives in a real-effort task at higher rates than men. Similarly, recent findings suggest that the effort-task also matters, with women responding to competitive incentives as much as men when the task is "female-oriented" (Gunther et al., 2010; Iriberri & Rey-Biel, 2012; Shurchkov, 2012; Lezzi et al., 2015).

From an evolutionary perspective, winning competitions and securing high status positions in social groups can bring many benefits. Some benefits are common to both males and females (access to resources, deference, and freedom from harassment) while others are sex-specific. To males, the main benefit of achieving high status is gaining access to more resources,because those resources (whether in the form of wealth, prestige, or power (von Rueden et al., 2010; Hill et al., 1993; Henrich & Gil-White, 2001)) award the winner higher reproductive opportunities (Campbell, 2013; von Rueden et al., 2010; Cheng et al., 2013).

Being a high-status female is also advantageous, but in importantly different ways. It confers a continuous and permanent priority access to resources like quality food (Stockley & Bro-Jorgensen, 2011; Campbell, 2013) and dominant females are more likely to have allies who will support them in a dispute, their infants are less likely to be kidnapped or killed by other adults, and such strong female bonds give them power to contest male control and coercion (Campbell, 2013; Kano, 1992). Despite high-status being geared in males and females towards the same fitness enhancing end, the means to reach it may differ depending on the reproductive role: for males it is the direct acquisition of resources that ensures higher reproductive opportunities; for females it is resources plus social support that ensures the thriving of her offspring. Hence, this raises the possibility that we need to find better ways to measure how competitiveness is expressed in females (Hrdy, 1981, 1999; Brown & Lewis, 2004). Appendix A provides a more extensive framework of the evolutionary theory at the base of our hypothesis.

Against this backdrop, it is easy to see why when we think about incentives, we treat resources

(monetary payoffs) as apt for inducing competitiveness. If competition is competition for high status and high status is desirable because it secures resources, then we can measure competitiveness by tracking performance in a real-effort task when there is a winner-take-all monetary prize. But this does not necessarily include what matters for measuring the competitive performance of women. If high-status for females is equally desirable as for males, but entails social consequences not found for males, then measuring competitiveness by tracking performance in a real-effort task when there is a winner-take-all monetary prize with no social dimension will lead to underestimation.

3 Framework

Typically, an incentive or prize of size m is assumed to be valued by an agent i directly by her utility $u_i(m)$ of m, with the result that any incentive or prize of size m is equally valued by her. So if she is comparing two tasks, each of which offers an incentive of m, then ceteris paribus she is equally motivated in those two tasks.

Our hypothesis is that this assumption fails: women may value incentives based on more than the size of the incentive and, in particular, may value incentives which are *socially mediated* more than direct and unmediated incentives. In this paper we focus on a tournament setting in which agents compete by performing a real-effort task: those who win, get a prize and those who lose do not.

The matrix search task is a series of $n \times m$ matrices with a decimal number in each cell and such that exactly two of the numbers sum to a specific target τ (Mazar et al., 2008; Ariely et al., 2009; Rigdon & D'Esterre, 2015, 2017).[2] The solution to a matrix consists in identifying the cells that sum to τ. We focus on 4×3 matrices where $\tau = 10$. The matrix in Figure 1 is an example.

A matrix search tournament is a competitive environment where j agents compete to solve more matrices than $k < j$ of their competitors solve in a specific time frame t to win a (monetary) prize m. We focus on tournaments where $j = 4$ and $k = 2$ and $t = 2$ minutes where the prize $m = \$6$.

We assume that the effort to solve all available matrices is strictly less than the prize m. Still, effort is in this task is non-zero so a rational agent should only aim to solve one more matrix than the k lowest solvers in the tournament. But since she has no information about the other agents' abilities, she should aim to solve as many as she can.

Below, we call this environment *Money Prize* since it is a tournament in which the incentive is simply a monetary reward for competitive performance.

[2] Our series allows for solving up to 20 matrices, but in practice this upper bound is never close to being met.

3.05	1.69	5.19
2.91	4.57	6.36
4.67	6.95	5.06
1.82	4.28	5.82

Figure 1: Real-effort Task: Select 2 Numbers that Sum to 10

We operationalize socially mediated incentives by embedding the prize m of a matrix tournament in a dictator game (DG). For a set $n = \{a, b\}$ of agents let a DG g is a pair $\langle m, c\rangle$ where:

1. $m > 0$ is the total allocation; and
2. $c \subseteq \{0, \ldots, m\}$.

We take a to be the dictator so for $x \in c$:

$$\pi_a(x) = m - x \qquad \text{and} \qquad \pi_b(x) = x$$

When m is mediated by a DG, we mean that the top $\frac{k}{n}$ solvers in a tournament earn the right to be a dictator (paired with a tournament loser) in a DG with an allocation of m. Below, we call this environment *Influence Prize* since the winner earns the right to non-trivially reallocate her resources. This models a type of influence: the power over the allocation of resources.

Note that *unmediated* or *direct* incentives are a special case: m is a direct prize if winners earn the right to be a dictator in a game $g = \langle m, c\rangle$ where $c = \{0\}$. In that case, there is no choice but to keep m. Below, we call this environment *Money Prize* since the winner earns the prize without any ability to non-trivially reallocate it.

Of course for self-interested maximizers, whether m is socially mediated or not does not matter. Rational dictators always choose $x = 0$ so the possible profits at stake are always the same and so the utilities of those profits are equal, too.

However, it is easy to make room for the difference to make a difference by allowing utilities to be

sensitive to the properties of a dictator game g. In particular, for agent 1:

$$u_a(\pi_a(x)) = \pi_a(x) - \gamma F(g)$$

where $0 \leq \gamma \leq 1$ and $F(g)$ is some measure of the contribution being in g makes. We don't take a stand on what F is here, but note two things. First, agents who do not care about the difference between mediated and direct incentives are those for whom $\gamma = 0$. Second, F can be specified by repurposing any number of theories that model social preferences (Fehr & Schmidt, 1999; Falk & Fischbacher, 2006; Fehr & Schmidt, 2006). For example, here is a simple implementation based on inequity aversion:

$$F(g) = \alpha \max\{x - m, 0\} + \beta \max\{m - x, 0\}$$

where $\beta \leq \alpha$ and $0 \leq \beta \leq 1$. Inequity averse agents can easily place higher value on an incentive where they can share some portion of it to one in which they cannot. We stress that we are not committing to this particular implementation. Our interest in the current paper is not in what, precisely, F may be but in whether there is empirical evidence to explore it.

4 Experimental Design and Hypotheses

Our design varies the compensation schemes in the winner-take-all matrix tournament implementing a *Money Prize* environment and an *Influence Prize* environment.

We employ a between-subject design in which each participant is randomly assigned to either *Money Prize* or *Influence Prize*. In both treatments, each participant is randomly and anonymously matched with three other participants. The top 2 solvers in the tournament are winners. Under *Money Prize* winners earn $m = \$6$. Under *Influence Prize* winners are dictators in a DG with endowment $m = 6$ where they are paired with a low-solver.[3] See Table 1 for a summary of the values of the tournament parameters.

The variable of interest is competitive performance as measured by the score of the participant in the real-effort task, i.e. the number of correctly solved matrices.

Our main hypothesis is three-fold: (1) we will observe gender differences in effort in the standard

[3] After completing the real-effort task, participants learn their rank. Then the performer ranked 1st is a dictator, paired with the performer ranked 3rd as recipient and the performer ranked 2nd is a dictator, paired with the performer ranked 4th as recipient. This is common information.

Solvers	$j = 4$
Win threshold	$\frac{k}{j} = \frac{2}{4}$
Prize	$m = \$6$

Table 1: Tournament Parameters

winner-take-all incentive scheme, in accordance with the previous literature, (2) when women are provided the opportunity to earn a property right in a subsequent dictator game, women will be motivated to increase their effort, and (3) this will close the gender gap. Specifically:

Hypothesis 1 *In the Money Prize treatment, performance by women is significantly lower than performance by men.*

Hypothesis 2 *In the Influence Prize treatment, when winners are given the opportunity to share part of the gains with the losers, performance by women increases.*

Hypothesis 3 *The Influence Prize incentive scheme closes the gender gap in competitiveness.*

We now turn to describing our procedures and reporting our results.

5 Methods

The experiment was conducted on Amazon Mechanical Turk (MTurk) to gather a sample of participants from different life stages, more representative of the adult population than the traditional subject pool of undergraduate students (Molnar, 2019). A total of 438 MTurk workers, 261 men and 177 women, participated.[4] See Table 3 and Appendix B.1 for a description of the subjects' characteristics and a balance check across treatments. Our participants were recruited with the offer of a \$1.50 show-up payment plus the opportunity to earn additional money based on the decisions they and others would make in the experiment.[5] The experiment consisted of (1) a real-effort task tournament, (2) a risk preference assessment[6], and (3) a short survey.[7] On average, participants earned \$4.79 for a

[4] Overall, we completed 9 sessions between September 2018 and September 2019.

[5] Participants began by reading a consent form that had been approved by the Rutgers University Arts and Sciences Institutional Review Board and by the University of San Francisco Institutional Review Board. All workers offered the opportunity to participate assented.

[6] Appendix B reports the gamble measure used to elicit risk preferences following the experimental task (Eckel & Grossman, 2008).

[7] Appendix B reports the survey question participants answered, including a series of standard demographic questions and attitudinal questions on a Likert scale.

15-minute session ($3.05 in the real-effort task and $1.74 in the gamble task).[8].

6 Results and Discussion

Figure 2 depicts our main result.[9] First, women perform significantly worse than men in *Money Prize*: the average score is 2.63 compared to 3.32 for men (t-test $p = 0.017$). Second, the gender gap is closed with women exerting significantly more effort in *Influence Prize*: the average score is 3.41 for women compared to 3.30 for men (t-test $p = 0.704$). When the prize is mediated by a DG, females significantly increase their performance from 2.63 to 3.41 (t-test $p = 0.006$) to levels indistinguishable from males', whose performance stays unchanged (3.32 to 3.30, t-test p=0.957). As a result, in *Money Prize*, the condition that replicates the standard tournament used in laboratory experiments, we observe a significant 26% gender gap in performance. In *Influence Prize*, the gap vanishes to -3%.

A possible confounding factor contributing to our result could be a difference in the subjects' ability levels which, through sampling error, may have drawn a significantly higher proportion of high ability women in the *Influence Prize* condition. While our one-round between-subjects design doesn't allow a direct test of this hypothesis by controlling in the analysis for each subject's ability, we gathered indirect evidence that sampling error based on ability is not likely to have driven our result. First, the large sample utilized in this experiment ($N = 438$: 261 men, 177 women) and the random treatment assignment give us confidence that the likelihood of sampling error having generated our results is very low. Second, we run the same experiment on a separate subject pool under a different incentive scheme, a $1.25 piece-rate payment, and found that women also perform significantly worse than men (3.72 for men ($N = 71$) vs. 2.68 ($N = 47$) for women, t-test $p = 0.0069$). Third, we notice that even for this piece-rate condition, it may be misleading to equate performance with ability, as also this result is produced by the joint concurrence of both a specific task and a particular payment scheme. This implies that we do have additional evidence that the matrix task may be male-biased: women tend to do significantly worse than men also under a less competitive payment scheme which still retains the non-socially mediated characteristic of the traditional experiment. This consideration gives further strength to our finding since the specific task we chose, the matrix task, effectively bias our analysis

[8]The average hourly payment in our experiment ($\approx$ $20/hr) is well above what workers typically earn completing tasks on MTurk. In an analysis of more than 2,676 workers performing 3.8 million tasks Hara et al. (2018) find that workers earn on average $\approx$ $2/hr with only 4% of workers earning more than $7.25/hr. For an overview of the potential of MTurk for conducting behavioral experiments in psychology and other social sciences, see Buhrmester et al. (2011); Horton et al. (2011); Rand (2012); Paolacci & Chandler (2014); Arechar et al. (2018).

[9]Table 4 in the Appendix B.7 reports the average effort by gender and treatment including the statistical t-tests on the differences in average effort.

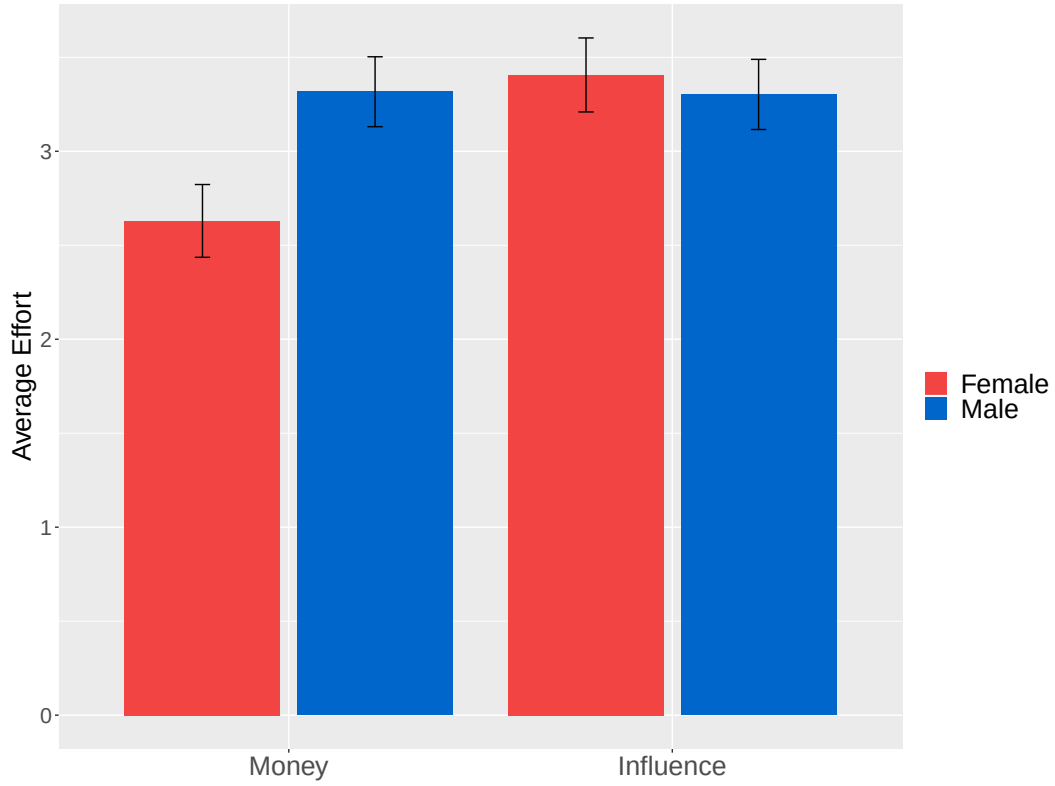

Figure 2: Task performance. Bars represent the average number of correct matrix problems solved by male (blue) and female (red) participants by treatment. Error bars represent mean +/- SE. Women, on average, scored significantly lower than men in the *Money Prize* treatment (2.63 vs. 3.32, t-test p=0.017), but indistinguishable from men under *Influence Prize* (3.41 vs. 3.30, t-test p=0.704). Furthermore, while male performance remains unchanged (3.32 vs. 3.30, t-test p=0.957), women's performance significantly increases (2.63 vs. 3.41, t-test p=0.006).

against us finding a closure of the gender gap. Yet our result suggests that, even with a male-preferred task, females significantly increase their performance and close the gender gap when the incentives are socially mediated.

Table 2 reports our main regression results. The OLS regression specification on our dependent variable of interest, Effort (i.e., number of correctly solved matrices):

$$\mathsf{Effort}_i = \beta_0 + \beta_1(\mathsf{Female}) + \beta_2(\mathsf{Influence}) + \beta_3(\mathsf{Female} \times \mathsf{Influence}) + \epsilon$$

where $\mathsf{Female} = 1$ if female (0 if male), $\mathsf{Influence} = 1$ if *Influence Prize* (0 if *Money Prize*), and $\mathsf{Female} \times \mathsf{Influence}$ is the interaction effect between Female and Influence.[10]

[10]Ordered Logit specifications generate nearly identical results to those reported here.

	(1)	(2)	(3)
Female	-0.69**	-0.61**	-0.62**
	(0.28)	(0.29)	(0.29)
Influence	-0.01	-0.02	-0.03
	(0.25)	(0.25)	(0.26)
Female × Influence	0.79**	0.73*	0.69*
	(0.40)	(0.40)	(0.41)
Control I		Yes	Yes
Control II			Yes
Constant	3.32***	3.37***	3.15***
	(0.17)	(0.43)	(0.51)
N	438	437	422
R-squared	0.02	0.04	0.05

Standard errors in parentheses

Control I (2): Risk, Age, White, Parent, Married

Control II (3): Control I, Highschool, Fulltime, Income

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2: OLS Estimates Regressed on Effort

The coefficient on Female is negative and highly significant, indicating that females have lower effort all else equal ($p = 0.015$). Importantly, the interaction of female and the treatment condition is positive and highly significant ($p = 0.046$), providing evidence that females increase competitive performance when incentives are socially mediated. These results are robust to a progressive inclusion of controls as we show in the detailed econometric analysis presented in Appendix B.3 and Table 6.

Next we look at how the gap in performance in *Money Prize*, and the increase in performance in *Influence Prize*, translates to representation of women in top positions. In our sample, given the randomness in subject recruitment, women ended up in different proportion in each treatments: in *Money Prize*, the percentage of female participants was 36%, whereas in *Influence Prize*, the percentage of female participants was 45%. If each gender had an equal probability to reach a top position (rank 1 or rank 2), we would expect women to be represented in top positions consistent with their representation in the sample. In *Money Prize*, instead, we observe only 30.7% of women reaching the top, a 5% gap. On the other hand, in *Influence Prize*, we observe 46.6% of women reaching the top, virtually indistinguishable from their representation in the sample.

Our study was designed to test whether adding a socially-mediated incentive to an otherwise identical winner-take-all tournament increases competitive performance in women. The answer is a resounding yes. A further question is why women are motivated by influence over resources.

Likely, there are multiple factors at work. One factor is that the cost of competition is not equal across genders. As highlighted earlier, there are strong reasons, rooted in our evolutionary framework, to expect that women are more responsive to repairing post-competition relationships. Not creating loser resentment and nurturing allies are fundamentally adaptive strategies for women who have to walk a thin line between competition and cooperation with other members of the group (Moscovice, 2013). Raising children would not have been possible without the substantial help of allomaternal care (Hrdy, 2009). Given that such help cannot always be monitored, it is hard to elicit it through coercion and force, as it may result in substandard care at best and harm of one's offspring at worse. At the same time, the benefits to high rank are so tangible, that female-female competition has always been intense (Hrdy, 1981, 1999). One way to facilitate cooperation within one's group, to minimize the costs associated with agonist encounters and to create the basis for risk sharing, while still getting the benefit of high rank is for winners of status competitions not to alienate the losers completely. Thus, sharing some of the gains fosters the cultivation of allies and engenders crucial help they come with. Higher egalitarianism discourages further contests attempting to renegotiate power, which allows for

a certain stability that would be fitness-enhancing for all women involved.

In our experiment, the possibility to repair the damage immediately following a competition by restoring some egalitarianism between players becomes a strategy especially valuable to those interested to nurture cooperation (Benenson et al., 2019). Some women make use of this opportunity. Figure 3 displays the kernel density plots for the amounts transferred by the winners in *Influence Prize* by gender.[11] The population distributions are indeed different. The distribution for women, but not for men, is bi-modal with significant density around just above \$0 and between $\$2 - 3$.

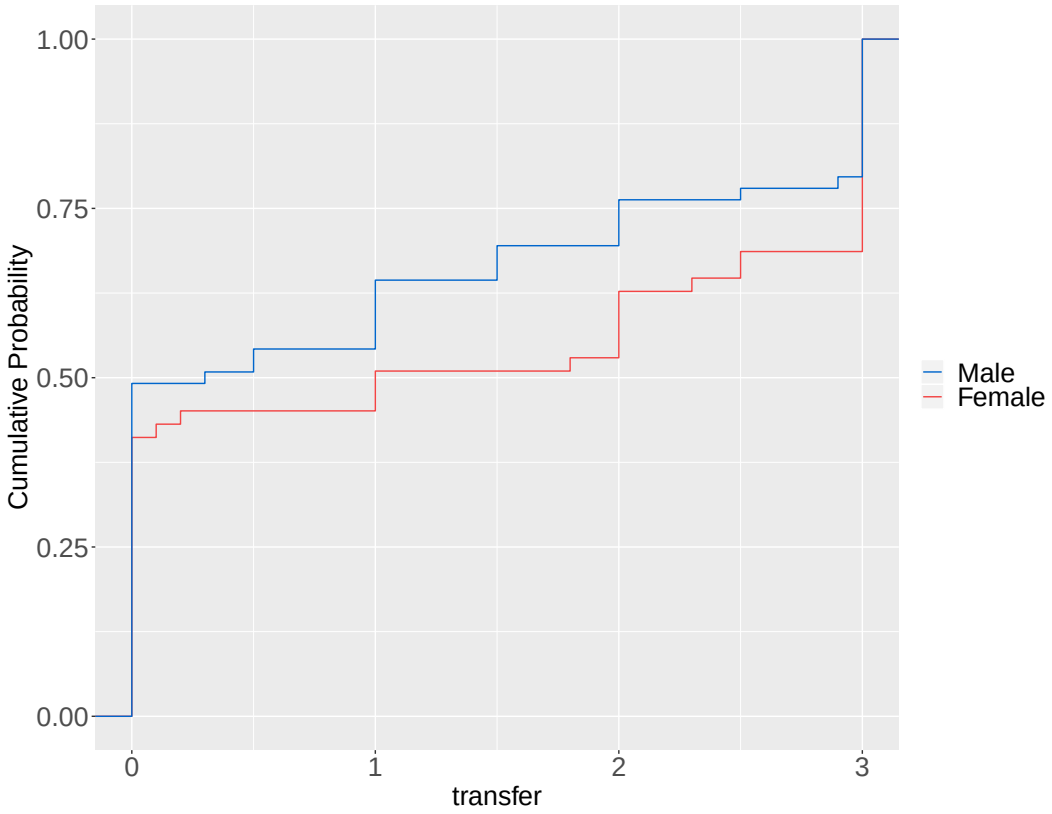

Figure 3: Cumulative distribution of dictator transfer by males (blue) and females (red) in the *Influence Prize* condition.

Still, pro-social or seeking-to-mend motivations do not appear to be the whole story. Transfers are, in aggregate, not significantly different across genders (men: \$1.03 vs. women: \$1.38; t-test= 0.122; KS= 0.262). In general, these transfers are quite low: in standard anonymously paired one-shot dictator environments, dictators routinely transfer half of the available pie. The transfer amounts we

[11] Figure 7 in Appendix B.6 displays the distribution of transfers by gender.

observe here are instead consistent with the results in property-right treatment games, where dictators earn the right to divide the pie via several types of mechanisms (Hoffman et al., 1994, 1996; Oxoby & Spraggon, 2008; Schurter & Wilson, 2009). Transfer results suggest that another factor is at work: some women place an intrinsic value on having control over resources, regardless of any desire to share those resources substantially more than men. While women report enjoying competition less than men and think they are less good at it (see Figure 10 in Appendix B.6), in the presence of a socially-mediated incentive their performance in a competitive tournament is no different from men's. Having the option to share a resource is powerful, even if that option doesn't get exercised (at least in this anonymous setting, although we suspect that anonymity is itself not gender neutral in this context).[12]

7 Conclusion

We posit that having an option available to cooperate may be a competitive strategy for women, although most of the laboratory games prevent it by design. In general, our work demonstrates that the way in which gendered preferences are elicited in experiments critically affects what level of competitive performance is observed. The theoretical expectation that males are more competitive than females has produced laboratory tools fine-tuned to record a competitiveness trait as it gets expressed in males, but not in females, whose motivation to compete would get under-estimated when factors that matter to females are not included in the experiment. Furthermore, emerging literature has started to show that lower female competitiveness is not even a universal trait, but rather the result of participants being drawn from Western, Educated, Industrialized, Rich, and Democratic (WEIRD) societies for which sex differences in personality traits tend to be much more pronounced. Specifically, individualistic, gender-egalitarian societies, once greater availability of material and social resources removes the gender-neutral goal of subsistence, create the scope for gender-specific ambitions and desires whereas more gender-equal access to those resources may allow women and men to express preferences independently from each other (Giudice, 2015). Moreover, preferences such as risk, patience, altruism, positive and negative reciprocity, and trust have also been found to be positively associated with economic development as well as gender equality in a society (Falk & Hermle, 2018). The gender stereotype that women are less competitive or less economically driven is costly, both to individual women who may be under-placed and under-paid and to society at large erroneously looking disproportionately to men for leadership (Eagly et al., 1992; Rudman & Glick, 1999). Our work offers important implications for

[12] We explore this question further in other work.

how we study incentivized behavior: equal-seeming incentives can be structured differently — by being socially-mediated — and women and men may respond differentially to this structure. Understanding these differences is important for designing institutional mechanisms and contracts that promote the reduction of inequalities (e.g., by structuring individual bonuses to include resource reallocation to team members). It also offers important implications for the gender wage-gap, since alleged gender differences in competitiveness cannot be appealed to.

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A Evolutionary Framework

From an evolutionary standpoint, winning competitions and securing high status positions in social groups can bring many benefits. Some benefits are common to both males and females (access to resources, deference, and freedom from harassment) while others are sex-specific. To males, the main benefit of achieving high status is gaining access to more reproductive opportunities, even when it does not necessarily translate into an increased number of offspring (Campbell, 2013; von Rueden et al., 2010; Cheng et al., 2013). Winners of male-male competitions can dominate rivals in directly acquiring females, as females in most species have shown a preference for highly ranked males, affording the opportunity of increased reproductive success (Ellis, 1995; Clutton-Brock & Huchard, 2013). Women from traditional small scale societies to large and economically advanced societies have been shown to be attracted to high-status men (von Rueden et al., 2010; Buss, 1989; Fisher, 2013). In humans, status is determined by natural abilities, determination, and intelligence, and is measured through the accumulation of wealth, prestige, and power in economic and public organizations (von Rueden et al., 2010; Hill et al., 1993; Henrich & Gil-White, 2001). In addition to good genetic material, a woman's preference may be based on a man's resource-holding potential which indicates his ability to provide for the woman and any offspring.

Scientists used to hypothesize that females were not interested in competing to achieve high-status, given the rarity of observing status communication via physical fights (de Waal, 1989). Recently, evidence is emerging that high status significantly increases female reproductive success as well (de Waal, 1989). First, it confers a continuous and permanent priority access to quality food, a key to greater reproductive success (Stockley & Bro-Jorgensen, 2011; Campbell, 2013). Second, dominant females are not subjected to harassment, rather they inflict it on others to induce reproductive suppression (Young et al., 2006). Third, dominant females are more likely to have allies who will support them in a dispute, their infants are less likely to be kidnapped or killed by other adults, and such strong female bonds give them power to contest male control and coercion (Campbell, 2013; Kano, 1992). Critical differences with males are that high-ranking females do not necessarily attract more or better quality partners as males do not seem to show a systemic preference for them, and despite the clear benefits conferred by high-status, physical force is rarely seen used by females as a mother's death has been found more detrimental for offspring than a father's (Hrdy, 1981, 1999; Kahlenberg et al., 2008; Hrdy, 2009).

Fundamental to our hypothesis is that, for women, winning competitions involves trade-offs not

found for men. Despite the evidence that maternal high status provides substantial benefits to her children's well-being, gaining powerful positions in society has not been shown to increase women's success with mates (Buss, 1989; Fisher, 2013). Studies of men's mating preferences show that women who acquire power and status do not necessarily see these gains directly translated in better quality males (Buss, 1989) or in higher success among men (Fisher, 2013; Brown & Lewis, 2004; Fisman et al., 2006). Evidence has emerged that women who compete and win get punished: political victories and promotions to high-executive positions significantly increase the divorce rate for females but not for males (Folke & Rickne, 2016) and women who earn more than their partners report lower marital satisfaction and higher divorce rates (Bertrand et al., 2015). Research reports that, as a result, women strategically downplay their economic aspirations, especially when such aspirations are observed by single male peers (Bursztyn et al., 2017), and when the woman in the household earns more, respondents in the U.S. Census survey are more likely to under-report the woman's earnings and over-report the man's earnings (Murray-Close & Heggeness, 2018).

Furthermore, more for women than for men, being at the top comes at the price of potentially alienating others, crucial allies for allomaternal help and assistance in general, and of losing their support with serious costs to them and their children's well-being from group exclusion (Hrdy, 2009; Campbell, 2013). Behavioral differences, rooted in both biological factors and furthered encultured by society, emerge in childhood when girls seem less interested in overtly competitive games (Strube, 1981), prefer collaborative interchanges to domineering exchanges, and are concerned with group cohesion (Campbell, 2013). Girls have been found to form small groups (cliques, dyads or triads in which hierarchy is harder to discern) characterized by strong egalitarianism (Campbell, 2013). Girls dislike others who are egotistical and view themselves as "superior" (Eder, 1990). Young girls and women have been found to show a reluctance to appear superior to friends, avoid bragging about accomplishments, fearing jealousy, hostility, and losing friends. Also unlike males, they've been shown to prefer status structures more like webs, striving to be the "center of attention", where most of the social, material and reproductive benefits are found (Liesen, 2013). Establishing the nature of a female's rank is more difficult because women's preferred form of aggressiveness (indirect, through exclusion, gossiping, etc.) is less visible than men's direct physical and verbal forms (Giudice, 2015).

In conclusion, women benefit greatly from high-status but recognize the costs of reaching overt dominant positions. However, instead of concluding that status is less important for women than for men, or that women are less competitive, this raises the need to find better ways to measure how

competitiveness is expressed in females (Hrdy, 1981, 1999; Brown & Lewis, 2004).

B Supporting Information

B.1 Sample

Our sample consists of 438 participants - 261 men, 177 women - Amazon Mechanical Turk (MTurk) workers. The experiment was advertised on the MTurk online platform to workers with the project name "Interactive Study" and we provided a short description: "Study with interaction, 10-15 minutes, \$1.50 guaranteed + BONUS up to \$6".

Table 3 depicts summary characteristics of the participants. On average, the subjects were 35 years old, 35% were married and 37% declared having children. Our sample included adults with a level of education similar to the average respondent of the 2018 U.S. Census (27% of our sample gained up to a secondary education, 26% in the census obtained a high school diploma); comparably white (76% identified as white both in our sample and in the Census); higher frequency of those reporting working full time (nearly 70% in our sample vs. 51% from Bureau Labor Statistics) with an average per-capita income of $\$3,000$/month which is close to the national level of $\$2,600$/month.

B.2 Materials and Methods

We employ a between-subject design where participants complete a real-effort task, the matrix-search task, under one of two different compensation schemes called *Money Prize* and *Influence Prize*. Participants are shown a series of 4×3 matrices, each consisting of a set of 12 three-digit numbers with two decimals. The task is to search the matrix to find the two numbers that sum to 10. Participants are asked to solve as many as possible (up to 20 matrices total). The number solved is the participant's performance (or effort). The time allotted for the task is two minutes. Our design varies the compensation schemes in the winner-take-all tournament. In both treatments, each participant is randomly and anonymously matched with three other participants. Under *Money Prize*, the incentive for winning is a fixed monetary prize of \$6. Under *Influence Prize*, the incentive for winning is the same fixed monetary prize of \$6 and earning the right to be a dictator, who then decides how much of the prize to keep and how much to share with a loser of the tournament.

Participants earned a \$1.50 show-up payment and had the opportunity to earn additional money based on the decisions they and others made in the experiment. Each session lasted 10-15 minutes.

Participants were told that the study "involves a real-time interaction with other MTurkers", that the "interaction will be anonymous" and that their "MTurk ID (or any other personal information) will NOT be disclosed to others". They were also told how long the study would take and to please proceed only if they could "dedicate the next 10-15 minutes without interruption". They then read a consent form that had been approved by the Rutgers University Arts and Sciences Institutional Review Board and by the University of San Francisco Institutional Review Board. Participants were provided two choices: to assent to participation, in which case they continued, or not in which case the program would close. All participants who were given the opportunity assented to participate in the study. They were then asked for their gender (male, female or other) and assigned a unique ID number randomly generated for each participant; hence, data collection was completely anonymous.

Participants were given instructions explaining the matrix-search task and the compensation mechanism (see below for details by treatment). They were told they would see 20 matrices and were shown an example matrix (Figure 1). Participants were told that they should "look for a set of two numbers that sum to 10", were provided a demonstration of how to select the two numbers and click 'Submit'.

When the two minutes were up, participants were informed of their score, their relative performance (i.e., their rank where rank 1 and 2 are top performers and rank 3 and 4 are bottom performers) and their earnings from the task. In *Money Prize*, the top two performers earned \$6 and the bottom two performers earned \$0; this was the end of the experimental portion. In *Influence Prize*, the two top performers earned \$6 and the right to be the dictator in a subsequent dictator game; they were then asked how they would like to "allocate the \$6 between yourself and Person B". See Figure 5 for a screenshot of what the dictators saw. Dictators were able to drag the blue bar to make their allocation decision and clicked 'Submit' when they wanted to finalize their decision. The bottom two performers earned \$0 from the task and any amount allocated to them as a recipient in the dictator game. Participants then completed an instrument eliciting their risk tolerance. See Figure 6. Participants chose which of six 50/50 gambles they wished to play. The gambles include one sure thing; the remaining five increase (linearly) in expected payoff and risk. Gamble 1 is a sure lottery: choosing it guarantees the participant will earn 14 experimental points. Gamble 2 is a coin flip lottery with 50% chance of paying 12 experimental points and a 50% chance of paying 18 experimental points. Gamble 6 is the riskiest option: the lowest payoff with 50% chance and the highest payoff with 50%. Participants were paid \$1 for every experimental point they earned. Finally, participants were asked to answer demographic and socio-economic questions as well as a series of questions about their views

toward competition (see B.5). This completed their participation in the study. On average, participants earned $4.79 with $3.05 in the real-effort task and $1.74 in the gamble task for 15-minutes.

B.3 Supplementary Analysis

In this section we (1) describe the series of regressions presented in Table 6 showing how socially-mediated incentives can close the gap in competitive tendencies between men and women and present robustness checks showing that our findings are not due to other factors such as risk preferences, education, income, or marital status, and (2) describe the gamble choices made by participants by gender as well as the attitudinal characteristics of the sample.

Table 6 reports OLS regression results on our dependent variable of interest, Effort (i.e., number of correctly solved matrices).[13] Column (1) reports our main result that was described in the main text:

$$\text{Effort}_i = \beta_0 + \beta_1(\text{Female}) + \beta_2(\text{Influence}) + \beta_3(\text{Female} \times \text{Influence}) + \epsilon$$

where Female = 1 if female (0 if male), Influence = 1 if *Influence Prize* (0 if *Money Prize*), and Female × Influence is the interaction effect between Female and Influence.

The coefficient on Female is negative and highly significant, indicating that females have lower effort all else equal ($p = 0.015$). Importantly, the interaction of female and the treatment condition is positive and highly significant ($p = 0.046$), providing evidence that females increase their effort when incentives are socially mediated. Columns (2) and (3) report the Effort regression results with a series of controls including risk preferences, age, ethnicity, whether or not the participant is a parent, marital status, highest degree obtained, employment status, and income. Importantly, these specifications indicate that our results are robust when controlling for a wide-variety of participant characteristics. Columns (4) – (7) report results separately by treatment. Notice that the coefficient on Female is negative and highly significant in the baseline condition, *Money Prize*, and nearly zero and not significantly different in the treatment condition, *Influence Prize*. Finally, columns (8) – (10) report regression results separately by gender. Notice that the coefficient on Influence is nearly zero for men with and without controls and positive and significantly different in the treatment condition, *Influence Prize*, for women with and without controls. Overall these regression results strongly support the main findings reported in Table 4.

Figure 8 displays the distribution of gamble choices made by females (red) and males (blue) in the

[13] Ordered Logit specifications generate nearly identical results to those reported here.

risk elicitation task. The least risky choice is 1 where participants choosing this option are guaranteed a sure outcome of 14 experimental points which equals \$1.40. The most risky outcome is 6 where participants choosing this option have a 50% chance of earning 1 experimental point and a 50% chance of earning 35 experimental points, which equals \$3.50. The two distributions of choices are not significantly different (K.S. test, $p = 0.068$). This is true for the baseline condition ($p = 0.387$) and the treatment condition ($p = 0.124$).

Figure 9 displays the coefficient plots for OLS estimation in several regressions in which the dependent variable is the participant's degree of agreement with several statements for women only. The point estimates and confidence intervals show that women report that they are more patient and are most risk averse than men. The gamble choice by women confirms both of these as women select the safer option significantly more than men do.

Figure 10 displays the coefficient plots for an OLS estimation regressing each participant's attitudinal survey answer on gender and age. For example, the coefficient on gender when regressing answers to the survey question "I enjoy competing" is -0.054, which is significantly lower for females than for males. Similarly for answers to "I am good at competing" and "I believe that money (having resources) is very important for finding a long-term partner." The other attitudinal survey answer that is different between gender is "Competition brings out the worst is people." with women scoring higher on the scale on the men.

B.4 Experimental Instructions

***Money Prize* Instructions**

This is an experiment in economic decision making. You will be matched with THREE other workers to form a group of FOUR people. You will not be told who they are during or after the experiment, and they will not be told who you are either during or after the experiment.

The matrix search task

In this task each of you will be presented 20 matrices as the one below:

[See Figure 1]

For each matrix you should look for a set of two numbers that sum up to 10. When you find these two numbers, select them as in the example below, then click "Submit":

[See Figure 4]

Your score

You get a score of one point per each matrix you correctly solve, **You will have TWO minutes** to solve as many matrices as you can.

The top half of scorers (top TWO people) will be paid $6 for the task and the bottom half of scorers (bottom TWO people) will be paid $0 for the task.

Please click "Next" to begin the experiment.

***Influence Prize* Instructions**

This is an experiment in economic decision making. You will be matched with THREE other workers to form a group of FOUR people. You will not be told who they are during or after the experiment, and they will not be told who you are either during or after the experiment.

In your group of four people, two of you will be person As, and the other two will be person Bs. Each person A will be paired with a person B. The experimenter has allocated $6 to each pair. An A will decide how to divide the $6 between A and his or her counterpart B.

The positions of A and B will be determined by ranking your scores on a matrix search task. Each of you will be asked to solve the same set of 20 matrices.

The top half of scores will be person As and the bottom half of scorers will be person Bs. So the lower-ranking half will be the Bs, and the higher-ranking half the person As.

The matrix search task

In this task each of you will be presented 20 matrices as the one below:

[See Figure 1]

For each matrix you should look for a set of two numbers that sum up to 10. When you find these two numbers, select them as in the example below, then click "Submit":

[See Figure 4]

Your score

You get a score of one point per each matrix you correctly solve, **You will have TWO minutes** to solve as many matrices as you can.

The top half of scorers (top TWO people) will earn the right to be person As and the bottom half of scorers (bottom TWO people) will be person Bs. Each A will decide how to divide the $6 between A and his or her counterpart B.

Please click "Next" to begin the experiment.

B.5 Survey Instrument

We would like to ask you a few questions about yourself.

- This information will be used to better understand the determinants of behavior.
- Your name will not enter in our dataset. Your information will be identified just by an ID number.
- Only the main researchers in this study will have access to this information.
- Your responses will be kept private and secure.
- The information will not be used for a discriminatory purpose.

If you agree, please respond to the following questions as accurately as possible. You can always select "I prefer not to answer" if you prefer not to answer some of the questions below.

1. How old are you?
   [I prefer not to answer, 18, 19, ... 99]
2. What is your highest level of education?
   [None, Informal schooling, Primary, Secondary/High School, Post-secondary training other than University, University undergraduate degree, Graduate degree or more completed, I prefer not to answer]
3. Please indicate your ethnicity (ethnicity describes feeling of belonging and attachment to a distinct group of a larger population that shares their ancestry, color, language or religion):
   [Caucasian, Latino/Hispanic, Middle Eastern, African, Caribbean, South Asian, East Asian, Mixed, I prefer not to answer]
4. What is your marital status (select ALL that apply)?
   [Single (never married), Single (divorced), Single widow/er (surviving spouse), Single (any above reasons) with partner, Not formally married, but with partner living in separate houses, Not formally married, but with partner living together, Married living together, Married living apart in separate house, I prefer not to answer]
5. Do you have any children?
   [Yes [if yes: 5b. How many children do you have?], No, I prefer not to answer]

6. You are currently working (select all that apply):

   [Full-time, Part-time, Seasonal, Occasional jobs, Homemaker, Not working but looking for a job, Not working and not looking for a job, Other, I prefer not to answer]

7. What would you say your monthly household income (before paying taxes) is?

   [below $500, $500-$1000, $1000-$1500, $1500-$2000, $2000-$2500, $2500-$3000, $3000-$3500, $3500-$4000, $4000-$4500, $4500-$5000, $5000 or above, I prefer not to disclose]

8. Please read the statements below and indicate whether you agree or disagree with them.

   [Strongly disagree, Somewhat disagree, Neutral, Somewhat agree, Strongly agree]

   (a) I believe that if I work hard, I will be successful.

   (b) I believe that money (having resources) is very important for finding a long-term partner.

   (c) If a woman earns more money than her husband, it's almost certain to cause problems.

   (d) Men and women should do the same amount of work in the household.

   (e) Competition brings out the worst in people.

   (f) I am good at competing.

   (g) I enjoy competing.

9. Please read the statements below and indicate how concerned you are about each of the statements. If you don't have any children, just imagine the situation.

   [1-5; Not concerned at all to Very concerned, I prefer not to answer]

   (a) Your female child might not have a successful marriage.

   (b) Your male child might not have a successful marriage.

   (c) Your female child might not have a steady job.

   (d) Your male child might not have a steady job.

   (e) Your female child might not be able to make enough money on her job.

   (f) Your male child might not be able to make enough money on his job.

10. Overall, how patient would you describe yourself as?

    [Very patient, Patient, Neither patient or impatient, Impatient, Very impatient, I prefer not to answer]

11. How do you see yourself: are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?

    [Very unwilling to take risks, Somewhat unwilling to take risks, Neither willing or unwilling to take risks, Somewhat willing to take risks, Very willing to take risks, I prefer not to answer]

B.6 Figures

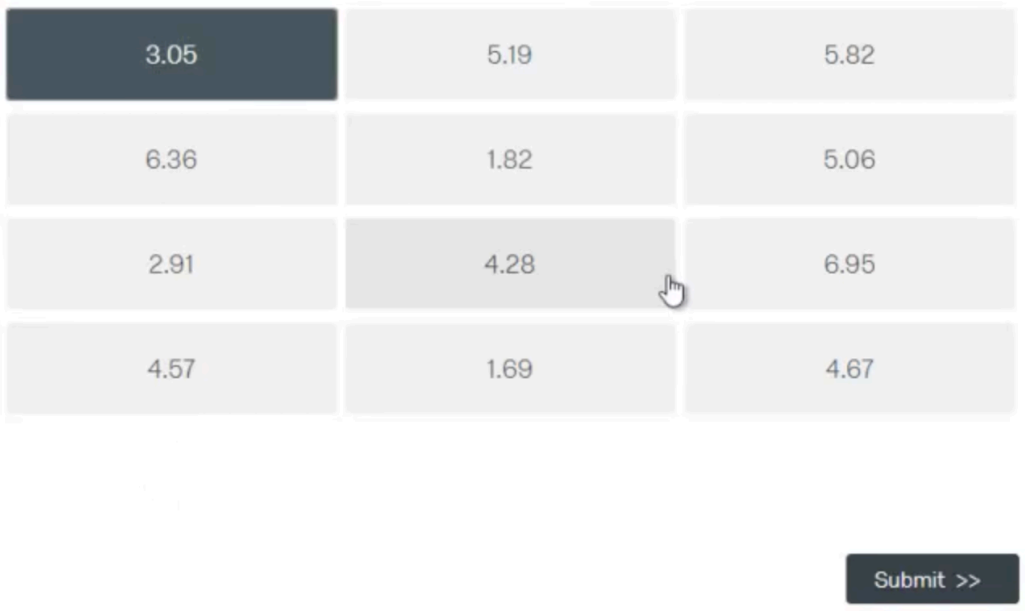

Figure 4: Example Shown to Participants

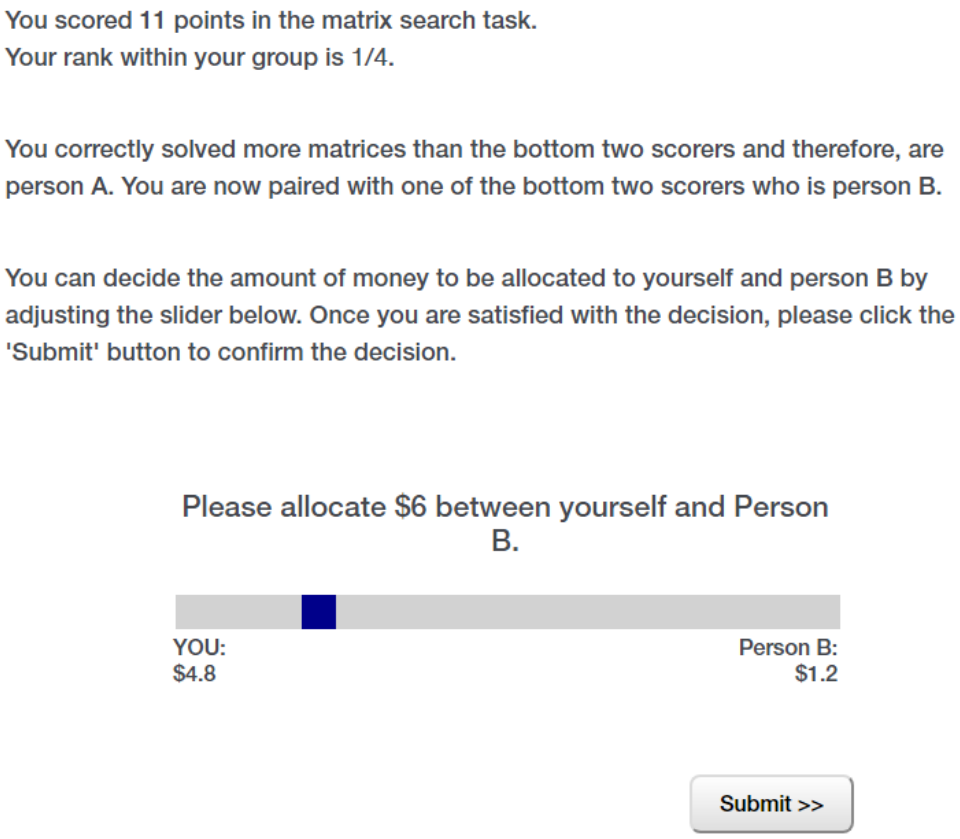

Figure 5: Screen of Dictator's Allocation Decision

You will be paid $1 U.S. dollar for every 10 experimental points you earn in this task.

Please make your choice now in the table below:

Gamble 1

Roll	Payoff	Chances
LOW (1, 2, or 3)	14	50%
HIGH (4, 5, or 6)	14	50%

Gamble 4

Roll	Payoff	Chances
LOW (1, 2, or 3)	8	50%
HIGH (4, 5, or 6)	26	50%

Gamble 2

Roll	Payoff	Chances
LOW (1, 2, or 3)	12	50%
HIGH (4, 5, or 6)	18	50%

Gamble 5

Roll	Payoff	Chances
LOW (1, 2, or 3)	6	50%
HIGH (4, 5, or 6)	30	50%

Gamble 3

Roll	Payoff	Chances
LOW (1, 2, or 3)	10	50%
HIGH (4, 5, or 6)	22	50%

Gamble 6

Roll	Payoff	Chances
LOW (1, 2, or 3)	1	50%
HIGH (4, 5, or 6)	35	50%

Figure 6: Screen for Gamble Choice: 1 Least Risky to 6 Most Risky

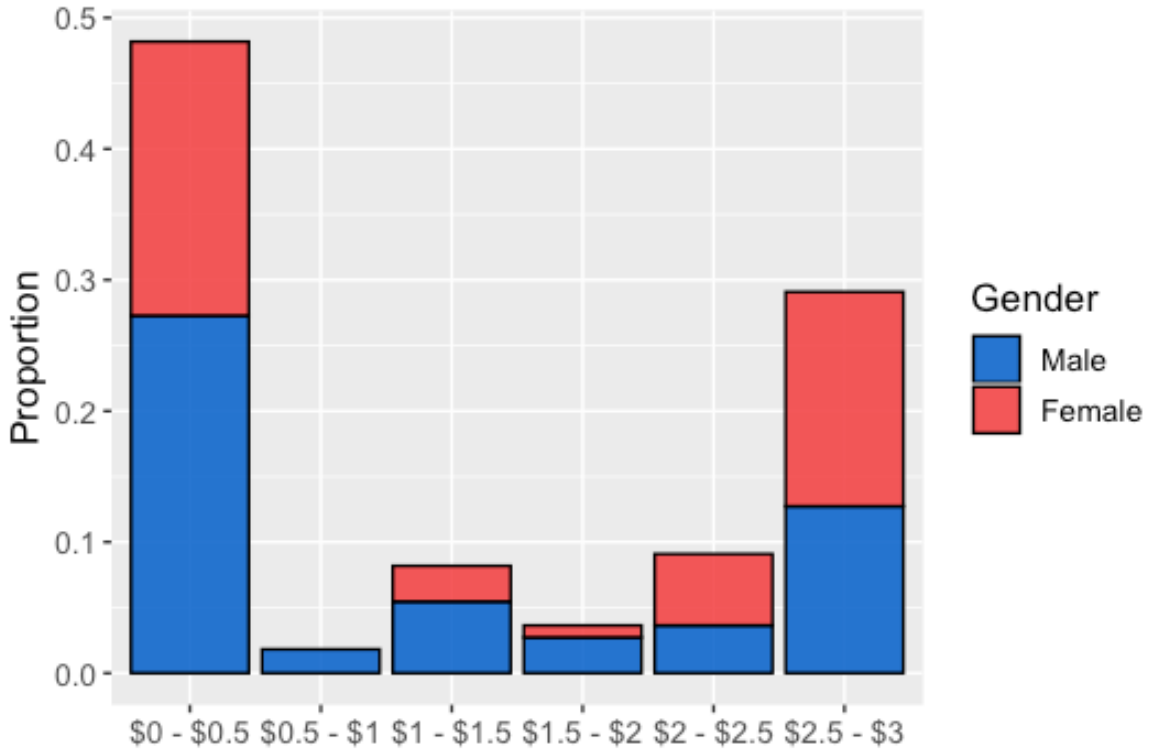

Figure 7: Distribution of Transfers Made by Dictators by Gender

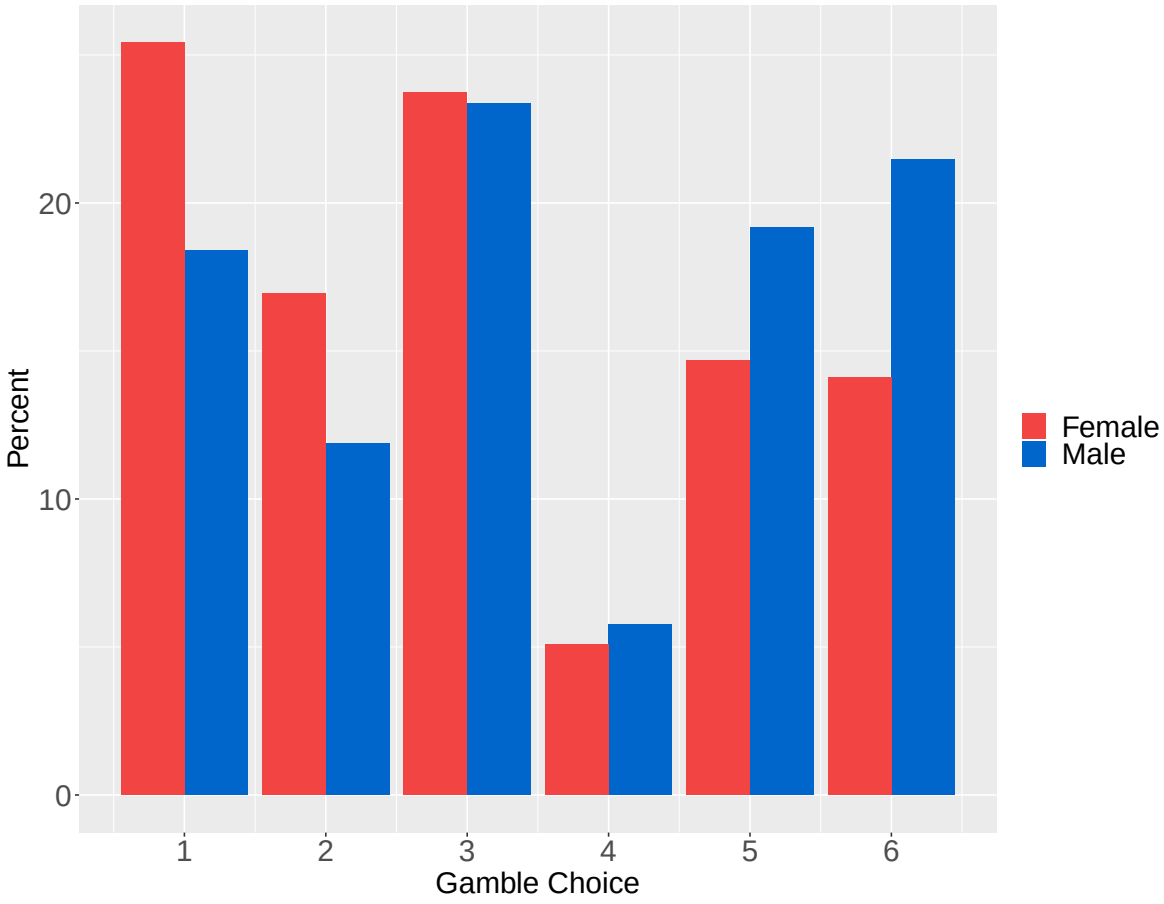

Figure 8: Choices Made by Gender in Risk Elicitation Task

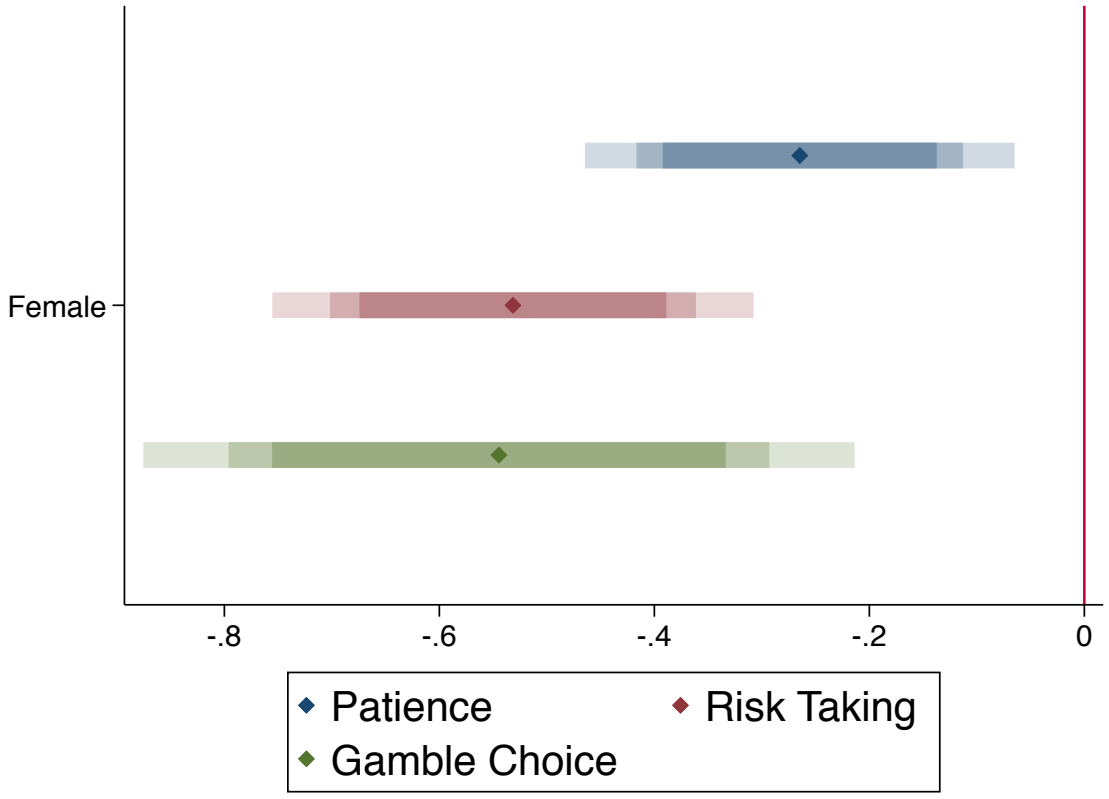

Figure 9: Coefficient Plots of Patience and Risk Preferences by Gender

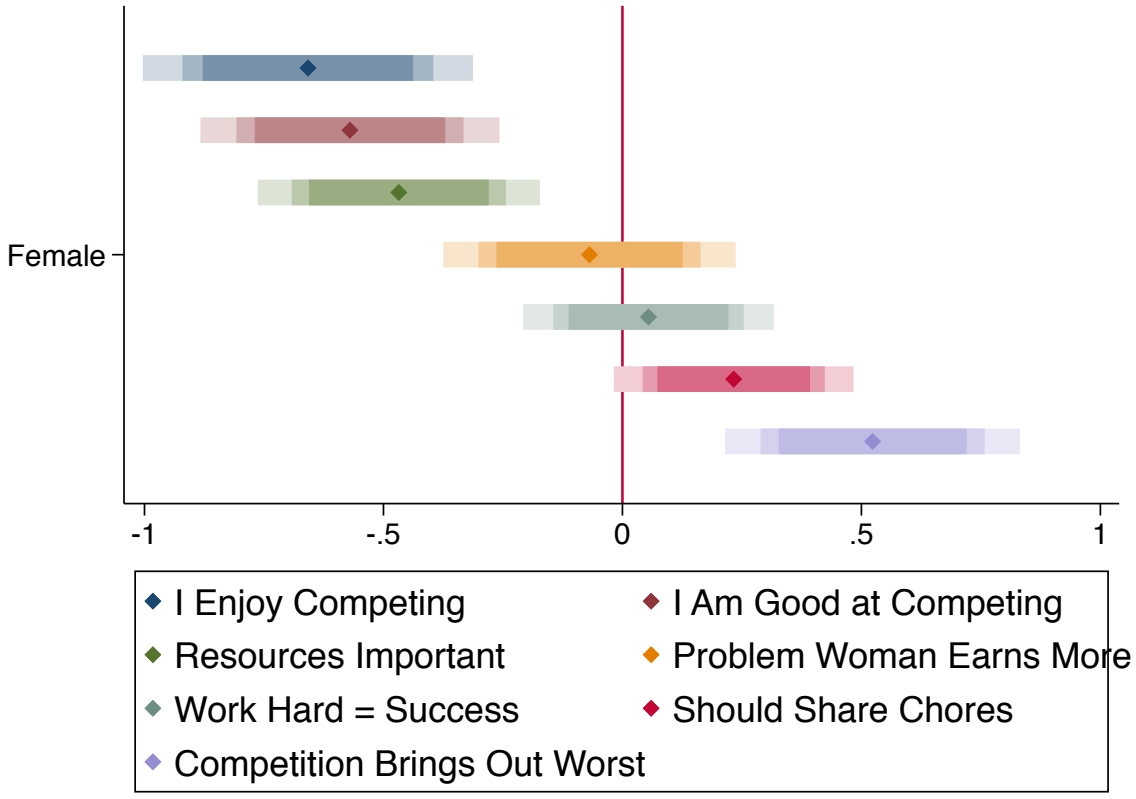

Figure 10: Coefficient Plots of Attitudes by Gender

B.7 Tables

Table 3: Summary Statistics of MTurk Sample by Treatment

	All	(1) Money	(2) Influence	t-test
	Mean	Mean	Mean	(1) vs. (2)
	(S.E.)	(S.E.)	(S.E.)	p-value
Female	0.40	0.36	0.45	0.076
	(0.023)	(0.032)	(0.034)	
Age	35.30	35.41	35.18	0.813
	(0.495)	(0.676)	(0.727)	
Secondary Ed.	0.27	0.25	0.30	0.192
	(0.021)	(0.029)	(0.031)	
Parent	0.37	0.38	0.37	0.767
	(0.023)	(0.033)	(0.033)	
White	0.76	0.77	0.74	0.440
	(0.021)	(0.028)	(0.030)	
Married	0.35	0.35	0.35	0.906
	(0.023)	(0.032)	(0.033)	
Fulltime	0.70	0.73	0.66	0.109
	(0.022)	(0.030)	(0.032)	
Income	2984.60	2988.53	2980.39	0.955
	(72.401)	(98.244)	(107.062)	
N	438	223	215	

Table 4: Effort by Treatment and Gender

	Women Mean Effort (Std. Dev) $N = 177$	Men Mean Effort (Std. Dev.) $N = 261$	Women=Men t-test p-value
Money	2.63 (1.74) $N = 81$	3.32 (2.22) $N = 142$	**0.017**
Influence	3.41 (1.90) $N = 96$	3.30 (2.04) $N = 119$	0.704
	Women	Men	
Money=Influence t-test p-value	**0.006**	**0.957**	

Table 5: Gender Composition of Winners in Money and Influence

	1st Rank		**2nd Rank**		**Total**	
	Money	**Influence**	**Money**	**Influence**	**Money**	**Influence**
Male						
N	38	31	41	28	79	59
%	**66.7**	**56.4**	**71.9**	**50.9**	**69.3**	**53.6**
Female						
N	19	24	16	27	35	51
%	**33.3**	**43.6**	**28.1**	**49.1**	**30.7**	**46.4**
Total						
N	57	55	57	55	114	110

Table 6: OLS Estimates Regressed on Score

	(1) All	(2) All	(3) All	(4) Money	(5) Money	(6) Influence	(7) Influence	(8) Men	(9) Men	(10) Women	(11) Women
Female	-0.69**	-0.61**	-0.62**	-0.69**	-0.77**	0.10	-0.02				
	(0.28)	(0.29)	(0.29)	(0.29)	(0.31)	(0.27)	(0.30)				
Influence	-0.01	-0.02	-0.03					-0.01	-0.12	0.78***	0.60*
	(0.25)	(0.25)	(0.26)					(0.27)	(0.28)	(0.28)	(0.28)
Female × Influence	0.79**	0.73*	0.69*								
	(0.40)	(0.40)	(0.41)								
Gamble		-0.03	-0.04		-0.03		-0.07		-0.05		-0.05
		(0.05)	(0.06)		(0.08)		(0.08)		(0.08)		(0.08)
Age		-0.01	-0.01		0.01		-0.03**		0.01		-0.03*
		(0.01)	(0.01)		(0.02)		(0.01)		(0.02)		(0.01)
White		0.65***	0.74***		0.56		0.91***		0.63***		0.80*
		(0.23)	(0.24)		(0.35)		(0.32)		(0.32)		(0.36)
Parent		-0.35	-0.36		-0.12		-0.72*		-0.40		-0.28
		(0.25)	(0.25)		(0.35)		(0.37)		(0.38)		(0.33)
Married		0.07	-0.02		-0.13		0.10		-0.11		0.19
		(0.24)	(0.25)		(0.34)		(0.37)		(0.37)		(0.34)
Secondary Ed.			-0.00		0.61*		-0.62*		0.04		-0.05
			(0.23)		(0.33)		(0.31)		(0.30)		(0.34)
Fulltime			-0.10		0.10		-0.36		-0.67**		0.47
			(0.23)		(0.33)		(0.31)		(0.34)		(0.30)
Income			0.00+		0.00+		0.00		0.00**		-0.00
			(0.00)		(0.00)		(0.00)		(0.00)		(0.00)
Constant	3.32***	3.37***	3.15***	3.32***	2.03***	3.30***	4.26***	3.32***	2.82***	2.63***	3.21***
	(0.17)	(0.43)	(0.51)	(0.17)	(0.73)	(0.18)	(0.68)	(0.18)	(0.69)	(0.21)	(0.72)
N	438	437	422	223	218	215	204	261	249	177	173

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$