Sex, Competitiveness, and Investment in Offspring: On the Origin of Preferences

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Abstract: Gender differences in competitive behavior has received much recent attention from economists, demonstrating a systematic gap between males' and females' tendencies to compete. While culture and variation in experimental conditions attenuate this gap, theories predict a strong biological factor, which is linked to an evolutionary response to the different paths to reproductive success for men and women. One key theoretical prediction is that the strategies for reproductive success should change over the female life-cycle. In particular, the gender gap is predicted to be largest for young adults; but after menopause women are expected to be as competitive as men. Using data drawn from two very different societies, we find strong support for this theoretical prediction: competitiveness in women is tightly linked to their biological roles in childrearing.

Evidence regarding gender differences in the willingness to compete has received much recent attention in the economics literature. This literature focuses on documenting the gap in competitiveness, its policy implications, and its role in differential success between men and women in labor markets. Avoiding competition is often costly: whether for a well-paying job, a position of authority, or rights to scarce resources, to opt out of the competition is to forego potential gains. A consistent finding in the experimental literature is that women are less willing than men to compete, even when it is in their material interest to do so. [1] Although there is evidence that the pattern can be affected by culture (Gneezy, Leonard and List, 2009) and changes in the experimental conditions (see Balafoutas and Sutter, 2012 and Niederle, Segal and Vesterlund, 2012 for example), the persistence of the gap presents a puzzle.

One possible explanation for this gap is that evolutionary processes have favored women who avoid competition and have favored men who seek competitive environments. The discussion of the origins of gender differences in behavior from the evolutionary literature is classic, going back to Darwin (1871), Bateman (1948) and Trivers (1972). A large body of literature in evolutionary biology and socio-biology documents differences in competitiveness between males and females in many different species (see Knight, 2002). The general economic argument is that differences in competitiveness across gender derive from natural selection and the benefits and costs of competition for reproductive success. For males, winning competitions against other males in order to mate with many partners increases the number of children they produce. On the other hand, for females--whose higher inherent investment in the reproductive process makes them the scarce parental resource in most species--there is no reproductive benefit to competing for mates. However, there is a potential reproductive *cost* of competition for

[1] See for example Gneezy, Niederle and Rustichini (2003); Gneezy and Rustichini (2004); Niederle and Vesterlund (2007); Flory, Leibbrandt, and List (2010); Booth and Nolen (2012); Sutter and Rützler (2010). For a survey see Croson and Gneezy (2009).

females with young offspring: in humans, since the mother delivers the majority of direct care for young, even a short-term loss of resources resulting from failure in competition can reduce the chance of offspring survival (Campbell, 2004). Thus, competition-aversion may improve fitness among human females). Selection thus favors females who are competition-averse when they are likely to be primary care-givers for young offspring, and favors males who are competition-loving during the period they can mate.[2]

The key feature of the evolutionary explanation has not been examined: women's strategies for reproductive success should change over the life-cycle. Since women in the post-menopausal stage do not have young offspring, competitiveness among this group no longer has a fitness cost to offset its benefits. Men, on the other hand, can produce offspring at all ages after puberty. Under this interpretation, men's competitiveness should not be affected by age, while women should avoid competition only before menopause. No study we are aware of has tested these predictions directly.[3] The findings on gender and competition in the existing literature come from younger populations, mostly university or grammar school students, leaving open the question of what happens to competitiveness in the later years of the life cycle.

To test the evolutionary predictions, we run laboratory experiments with men and women of all adult ages in two different societies with different histories. One sample draws from an urban US population. The other draws from villages in remote rural communities of Malawi, a low-income country in sub-Saharan Africa. We use two different societies to help control for cohort effects (where older individuals face different environmental conditions), which should be

[2] For evolutionary models that discuss these questions more formally, see Dekel and Scotchmer (1999), Robson (1996), and Robson and Samuelson (2009).
[3] Other studies examine the effect of accounting for age, e.g., in the study of social preferences (List, 2004; Charness and Villeval, 2009).

uncorrelated across our quite distinct societies. Changes in the role of women in US society over the last several decades, for example, may have led to differences between age-cohorts that influence attitudes towards competition. There may also be other unobserved social or economic factors that drive women to compete more as they get older; for example, age may proxy for years of experience in the US economy. Thus, age effects in the US alone would make it difficult to confidently attribute the cause to age itself.

The data strongly support the evolutionary prediction in both societies. In particular, the gender gap in competitiveness disappears entirely around the time of women's menopause. While men's competitiveness does not change with age, younger women are less competitive than men, and women after menopause are just as competitive as men. Beyond their implications for explaining the gender gap, these results should have practical significance for empirical researchers, policymakers, and the rapidly growing body of research that uses experimental methods. Gender differences in behavior have deservedly drawn a great deal of attention from the research community. When considering the effects on behavior of individual attributes such as sex, it is important that we not lose sight of other fundamental characteristics that are as likely to play important roles. Age is one of these, and it is a factor that is easily overlooked in many experimental studies, owing to the ease of using student-participants. From a policy perspective, understanding the limits of gender-dependent behavior are important.

I. Experimental Design

To test the hypothesis that the gender gap in willingness to compete is a function of age, we rely heavily on the experimental protocol of Niederle and Vesterlund (2007) with participants

from a broad age distribution.[4] The task that we used in our experiment involved a simple cognitive exercise – arranging shapes in a row from smallest to largest. Each participant has a set of six blocks. Each side of a given block has one of six shapes. The relative location of the shapes on each of the six blocks is different. The task is to arrange all six blocks such that a given shape (e.g., star) appears facing up, and to align the six versions of that shape (e.g., all 6 stars) in order from smallest to largest. Upon completing one shape, the participant moves to the next shape. The blocks are designed so that the order of the blocks for one shape does not confer any advantage to arranging the blocks for the next shape. All participants work with identical blocks and face the same order of shapes to complete.

Participants were paid based on the number of shapes completed in a 3-minute interval. There are four different rounds. Participants are informed they will be paid for one of the four, selected at random.

- In round 1 (piece-rate), participants are paid *X* for each set of shapes successfully completed.
- In round 2 (tournament), they receive *4X* per success if they complete the most successes in their group of four, but receive nothing otherwise. The group is randomly determined, and participants never know who is in their group.
- In round 3, they first choose which of the two payment schemes they want to work under, and then perform the task.

[4] As a check on the validity of our experimental protocol, we restrict our sample to adults between the ages of 18 and 25 and compare our results (in Malawi and the US) to those found by Neiderle and Vesterlund (2007), who used a similar protocol with university students. The results are strikingly similar and are available in Appendix A.

- In round 4, they do not actually perform the task. Rather, they simply choose to submit their past performance in round 1 either to the non-competitive piece-rate scheme or the competition-based pay scheme.

Before making the choice for round 3, participants are informed that if they choose competition, their group is the same group they were placed in for round 2, and the performances they compete against are the round two performances. That is, they would compete with individuals who had been forced to compete, rather than individuals who had self-selected into competition. Before making the choice for round 4, participants are again informed that their group is the same group they were randomly placed in for round 2, and this time the performances they compete against are the round 1 (piece-rate) performances of the group. Thus, if they submit their piece-rate performance to competition, they compete with the performance of all individuals in their group, not just those who chose to compete. At the end, participants are asked how they believe their performance compares to the others in their group for rounds 1 and 2, and earn an additional amount Y if their assessment is correct.

The focus of the exercise is the choice of compensation scheme for round 3 – whether participants want to perform the task under competition. Rounds 1 and 2 serve to familiarize participants with each pay scheme. In addition, the number of successes in each of the first two rounds allows us to control for the influence of ability in the task (and any potential boost in ability under competition) on the decision to compete. This allows us to ensure, for example, that it is not simply a difference in ability that drives the lower willingness to compete among young women. The choice made in round 4 helps isolate the effects of sex and age for women on the willingness to perform in competition against others, independent from any effects they might

have on willingness to be rewarded based on relative evaluation of a performance. That is, the round 4 choice captures the influence of other factors which may affect willingness to compete besides a preference for performing under competition per se, such as risk-aversion, feedback-aversion or self-confidence.

The same instructions were used both in the Malawi villages and in the US. (In Malawi, they were translated into Chichewa). Since many adults are illiterate in rural Malawi, the instructions were read aloud. For comparability across the two environments, the script was also read aloud in the US.

Facilitators demonstrated how to perform the task, kept track of participants' number of successes in each round, and recorded participants' choices. The only speaker during the session was the script-reader, who read the instructions for the experiment. Amounts for the US: X = \$1, Y = \$0.50. Amounts for Malawi: X = 50 kwacha (approx \$.33), Y = 20 kwacha (approx \$.13). Each session lasted about an hour, and included on average 16 participants, equally balanced between men and women.

The first subject pool comes from an urban area in the US, and includes three sets of sessions. One set draws from staff and students at a large university; a second set draws participants from a flea market and swimming pool near the campus; and a third set of sessions draws from a farmer's market and its surrounding community. In total, we had 84 participants, with a mean age of 36. The split was 33% of participants below the age of 26, 42% between the ages of 26 and 49, and 25% are 50 or older. The gender split is nearly even, with 56% females.

The second subject pool includes over 700 participants in 12 villages of rural Malawi. As in the US, the Malawi participants represent a broad age distribution and an even split by sex:

39% below the age of 26, 40% between the ages of 26 and 49, and 21% age 50 or above (mean age of 36); 50% male, 50% female.

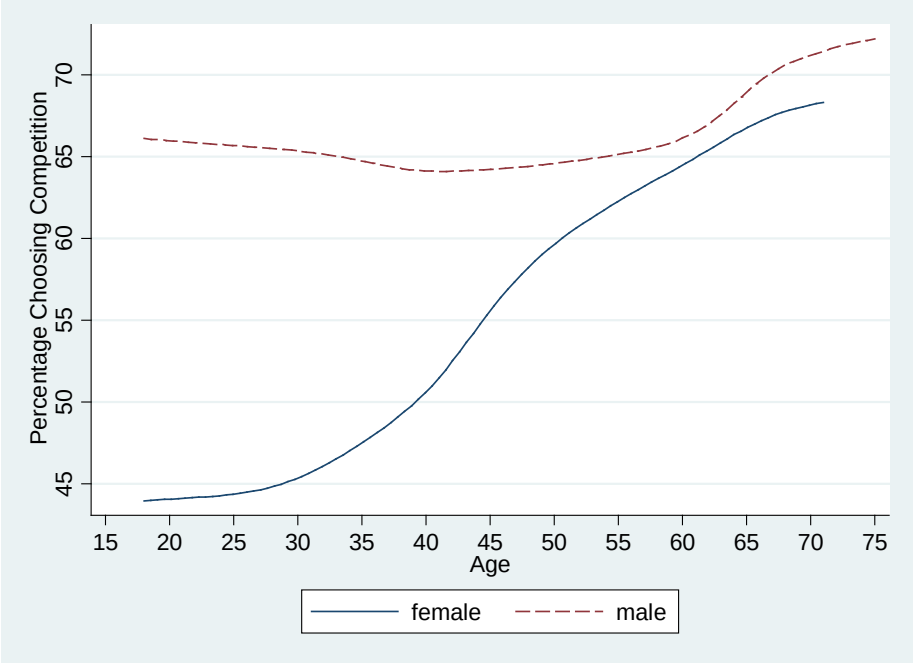
II. Experimental Results

Our first step in testing our hypothesis is to focus on the data from the US. For this group, the average success rate was 11.6 (11.5 for men; 11.7 for women) in round 1 and 13.2 in round 2 (13.1 for men; 13.3 for women). The gender difference in performance of the task in either round was not statistically significant (Mann-Whitney U-tests).

More importantly, with these data, we can test our hypothesis on the willingness to compete by examining the choices that individuals make in round 3, where they must choose piece rate or competition before they perform the task. In the full US sample, 51.1 percent of women and 66.7 percent of men choose the tournament (the Fisher's exact test shows no significant difference in these proportions). To examine formally these data, we run three different Probit specifications that test for the presence of a gender gap in willingness to compete using the full sample of US adults.

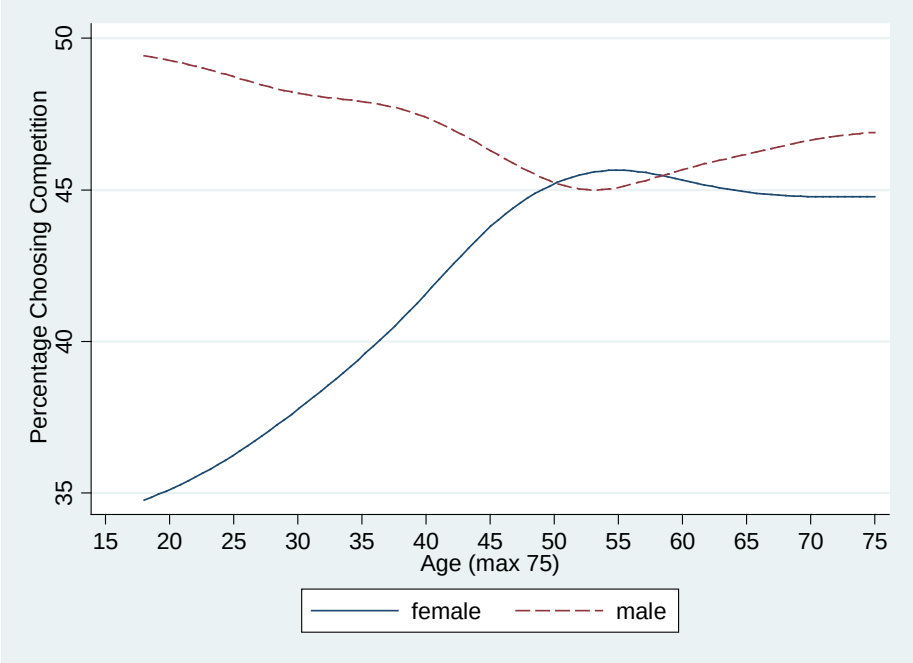
Columns 1-3 of Table 1 report the empirical findings. As column 1 shows, when looking across all ages, there is no significant difference in competitiveness between men and women. The effect of gender remains insignificant when controlling for performance (column 2), and when including the full set of controls available through the experiment (column 3). This result suggests gender alone does not have a general effect on competitiveness when looking across adults of a broad age range.

A



Urban US

B



Malawi Villages

Fig. 1. Age, gender, and competitiveness. Each figure plots predicted values from a locally weighted regression of whether the participant chose to compete in round 3 against the age of the participant, using a bandwidth of 0.8 and smoothed with a kernel regression using Gaussian kernel and bin width of 5 years. Graphs shown separately for urban US (**A**) and Rural Malawi (**B**) samples.

At first glance, this appears inconsistent with the robust findings in the literature on gender differences in competition. Accounting for age reveals a striking pattern, however. Figure 1A illustrates the relationship between the choice to compete and age, for each sex. As the figure shows, the gap between men and women is large among younger individuals, but disappears among more mature individuals. Indeed, for participants aged 25 or younger, only 35.7 percent of women choose to compete, while 64.3 percent of men choose to compete. This gender gap among the student-age participants of the sample is consonant with the empirical findings in experiments that use university students as subjects.

To more closely examine the pattern among the younger portion of the sample, we run the same three empirical specifications as discussed above, but restricting the sample to adults below the age of 50. Columns 4-6 of Table 1 report the results. As column 4 shows, among adults below the age of 50, being female reduces the probability of choosing to compete by an estimated 24 percentage points (significant at $p < .05$).[5] This effect persists when controlling for performance (column 2) and increases to 27 percentage points when using the full set of controls (column 3). This 24 to 27 point drop in likelihood of choosing to compete is consistent with estimates of the gender effect reported in other studies, which sample students on university campuses, clearly a younger sample.[6] (For the quarter of the sample age 50 or above, the coefficient estimate for being female is marginally *positive* for each of the three analogous regressions, though not significant at conventional levels).

[5] A Fisher's exact test among participants under 50 also shows a marginally significant difference (p=.077).

[6] For example, among studies using student-participants, Gupta et. al. (2005) find a marginal effect of -.36 without controlling for performance, Niederle and Vesterlund (2007) find a marginal effect of -.38 when controlling for performance, Niederle, Segal, and Vesterlund (2012) find a marginal effect of -.36. Flory, Leibbrandt, and List (2010) find a smaller marginal effect, -.15, among participants a little older than the typical student age (mean age 28) in a field experiment.

Figure 1A suggests that older women are substantially more competitive than younger women. Regression results reported in Table 2 confirm that age has a significant positive impact on the probability of choosing to compete when restricting the sample to women (p=0.054). Importantly, in line with the evolution-based hypothesis, the effect of age on women's willingness to compete is limited to the discrete effect of being over the age of 49; estimates of the effect of continuous age on women's willingness to compete are positive but not significant. However, age has no effect when the sample is restricted to men.

Table 3 reports results from regressions which allow the age of women to have an independent effect on the probability to select competition, in addition to gender. Column 1 shows results for the simple Probit regression of tournament-entry on being female, where the estimated effect of gender is insignificant. The model reported in column 2 includes female age as a continuous variable, while column 3 includes the discrete indicator for being female and over the age of 49. As the coefficient estimates for gender in columns 2 and 3 show, as soon as we control for age in either manner, being female has a large and significant negative effect on the willingness to compete (marginal effects of -.268 and -.237 in columns 2 and 3). In column 2, the coefficient on the continuous age variable is not significantly different from zero. In column 3, however, we see that the estimated effect of being 50 or older on women's probability to select competition is significant and large (0.293) – enough to erase the gender gap.

Column 4 of Table 3 reports results from a regression that includes the full set of variables available through the experimental protocol, in order to capture the impact of competitiveness independent of ability, beliefs of ability, risk aversion, and feedback aversion (Niederle and Vesterlund, 2007). As such we include the number of successes in round 1 and the change in number of successes between rounds 1 and 2, which control for the influence of ability

and any potential boost in ability under competition. Including participant guesses about how their performance ranked in comparison to the rest of their group (1=best, 4=worst) controls for confidence in one's own relative ability.

The final variable is the choice made in round 4 – whether to submit the round 1 piece-rate performance to a tournament pay regime. The difference between the decision in round 4 and that in round 3 is that only in the round 3 decision does the participant choosing the tournament actually perform against others. Since risk-aversion, feedback-aversion, and confidence should affect both choices, including this decision helps control for the influence of these factors on the decision to enter and perform in competition against others.[7]

Any effects of sex or the sex-age interaction on the round 3 choice, after conditioning on performance, guessed rank, and the decision for round 4, represent effects on the preference for performing in active competition against others. As column 4 shows, after controlling for these additional factors, the estimated marginal effects of *female* and the *female-age* interaction are both higher than without the controls. While being female reduces the probability of competing by about 25 percentage points, being 50 or older raises women's probability of competing by an estimated 34 percentage points, closing the gender gap (women 50 and older actually select into competition slightly more often than men of all ages, though the difference is not significant at conventional levels). These patterns in the US sample show that age plays a key role in the gender gap in competitiveness, causing the gap to disappear among older individuals.

One might question whether these results represent a cohort effect, rather than our preferred interpretation. Experimental results from Malawi help to shed light on this potential

[7] For further discussion on how these variables help isolate the effect of gender on willingness to perform under competition see Niederle and Vesterlund (2007).

confounder. In the Malawi experiment, task performance and overall preferences for competing differ from that of the US. The average success rate was 6.1 in round 1 (6.5 for men, 5.7 for women, Mann-Whitney U-test $p<.01$) and 7.4 in round 2 (7.8 for men; 7.1 for women, $p<.01$). Overall willingness to compete is also lower: in round three, 47% of males and 39% of females chose the tournament (compared to 67% and 51% in the US).

Nevertheless, we find the same patterns in willingness to compete by sex and age in Malawi as in the US. Figure 1B illustrates the relationship between the choice to compete and age for men and women separately. In rural Malawi, just as in the US sample, we find a sharp gender difference in competitiveness at young ages, which then closes as age increases and women compete more, until the gap vanishes among older individuals.

Regression results confirm that the pattern in villages of Malawi is similar to that in the US. Column 5 of Table 3 reports results from the same Probit model as that reported in column 4, but using the sample of adults from Malawi instead of the US. Identical to the US, while being female has a strong negative effect on the propensity to compete (marginal effect of -.105, $p=.012$), the positive effect of age for women more than compensates for this overall tendency (marginal effect of .14, $p=.047$), causing the gender difference to vanish among older individuals (just as in the US, women 50 and older actually select into competition marginally more often than men of all ages, though the difference is not significant.) In both populations, being *young* and female reduces willingness to compete. However, as older women are just as willing to compete as men, the gender difference disappears amongst older cohorts.

III. Conclusion

According to the evolutionary model, behavior over the lifecycle of women comes from pre-historical fitness costs to competitiveness for younger women; even though these costs are not relevant to survival in today's world. The biological mechanism behind the change over the life cycle may be hormonal. Wozniak, Harbaugh, and Mayr (2010) show, for example, that competitiveness in younger women is linked to changes in hormonal levels; these hormonal changes may also explain the difference between younger and older women.

As predicted by the evolutionary mechanism, we find a strong link between age and competitive choice by women, but not amongst men. In Malawian villages, just as in the US, age has no effect on men, whereas the likelihood that women choose to compete is higher among older participants, causing the gender gap observed among younger individuals to vanish for older cohorts. Beyond its practical import, methodologically, our paper reinforces the complementarities that economic experiments with non-convenience samples can have with more traditional laboratory studies.

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Tables

Table 1. Effect of Gender on Tournament Entry

	Adults of a Broad Age Range			Adults Under 50		
	(1)	(2)	(3)	(4)	(5)	(6)
Female	-0.156	-0.154	-0.140	-0.242**	-0.244**	-0.265**
	(0.106)	(0.107)	(0.114)	(0.122)	(0.122)	(0.134)
Piece Rate		-0.00803	-0.0204		-0.0114	-0.0288
		(0.0220)	(0.0241)		(0.0296)	(0.0348)
Improvement		-0.0403	-0.0191		-0.0366	0.00261
		(0.0366)	(0.0399)		(0.0440)	(0.0511)
Guessed Rank			-0.0972			-0.236**
			(0.0850)			(0.119)
Submit Piece-Rate to Tournament			0.365***			0.346**
			(0.111)			(0.142)
Observations	84	84	84	63	63	63

Estimated marginal effects from a Probit regression of the choice to select tournament for round 3. Columns 1-3 include the full sample of participants. Columns 4-6 restrict the sample to participants between the ages of 18-50. The variable *Female* is an indicator for whether the participant is a woman. *Piece Rate* measures the number of successes in the first round, under the piece-rate regime. *Improvement* measures the increase in number of successes between the first and second round. *Guessed Rank* indicates the participant's stated belief about how well she performed, relative to the three other individuals in her group. *Submit Piece-Rate to Tournament* is an indicator for whether the participant chose to submit her past performance in round 1 (piece-rate) to a tournament against the past piece-rate performance of the other members in her randomly assigned group. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 2. Effect of age on choosing to enter the tournament, within each sex

	(1) Women	(2) Men	(3) Women	(4) Men
Age 50 or Older	0.326**	0	0.365**	-0.0230
	(0.152)	(0.179)	(0.166)	(0.211)
Piece Rate			0.0108	-0.0111
			(0.0345)	(0.0352)
Improvement			-0.119*	0.0139
			(0.0673)	(0.0467)
Observations	45	39	45	39

Estimated marginal effects from a Probit regression of the decision to select tournament in round 3 on an indicator for whether the participant is at least 50 years old. Columns 1 and 3 restrict the sample to women, columns 2 and 4 restrict the sample to men. The first two columns have no controls, while the second two columns control for performance. Standard errors are in parentheses.*** p<0.01, ** p<0.05, * p<0.1.

Table 3. Probit Regression of Tournament Entry Choice (Marginal Effects)

	US				Malawi
	(1)	(2)	(3)	(4)	(5)
Female	-0.156	-0.268**	-0.237**	-0.246**	-0.105**
	(0.106)	(0.132)	(0.111)	(0.120)	(0.0417)
Female x Age		0.00641			
		(0.00490)			
Female x Over 49			0.293**	0.339***	0.141**
			(0.123)	(0.114)	(0.0709)
Piece Rate				-0.00494	0.00686
				(0.0258)	(0.00829)
Improvement				-0.00957	0.0132
				(0.0409)	(0.0146)
Guessed Rank				-0.121	-0.00469
				(0.0897)	(0.0200)
Submit Piece-Rate to Tournament				0.373***	0.391***
				(0.114)	(0.0350)
Observations	84	84	84	84	728

Columns 1-4 report estimated marginal effects from Probit regressions with the 84 US participants (39 men and 45 women). Column 5 reports results from a regression identical to that of column 4, but which uses the sample from communities in rural Malawi (365 men, 363 women). The variable *Age* measures increases in age above 18. *Over 49* is an indicator for whether the participant is at least 50 years old. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Appendix A:

Comparison of results with similar studies on competitiveness

Since the experimental protocol we implement similar to that of Niederle and Vesterlund (2007) [henceforth, NV], who use university students, it is worth a closer look at how the results of our study compare when restricting to participants of similar ages. When we restrict our US sample to adults between the ages of 18-25, the sample shrinks to just 28 observations, limiting statistical precision. However, the patterns are very similar. Table A shows the findings reported in the study of university students along with our results. After conditioning on performance in the task, NV find that being female reduces the probability of competing by an estimated 38 percentage points in their sample of 80 students (significant at the .01-level), while we find an estimated 41 percentage point reduction in our sample of 28 similarly aged adults (significant at the .10-level). When adding the additional variables to control for other factors which may also affect willingness to compete, the magnitude of the estimated effect in NV drops by over 50% and the significance reduces substantially. Similarly, when conditioning on the full set of controls in our sample of 18-25 year-olds from the US, the estimated magnitude drops by nearly a half and the significance drops considerably. While the sample size limitations make the estimate in column 4 imprecise, the basic pattern is similar to that of the students in the earlier study. The Malawi sample has many more individuals in the 18-25 age range, enabling a more precise estimate. As can be seen in column 6, in the specification which best isolates the effect of gender on a preference for performing against others, we see a precisely estimated effect of gender very close to that found in NV. Thus, our methods replicate the findings of previous studies when using populations of similar ages.

Table A. Comparing Results Across Different Experimental Settings

	University of Pittsburgh Students		US Adults 18-25		MW Adults 18-25	
	(1)	(2)	(3)	(4)	(5)	(6)
Female	-0.38	-0.162	-0.410	-0.242	-0.180	-0.144
	(0.00)	(0.05)	(0.07)	(0.43)	(0.00)	(0.03)
Tournament Performance	-0.015	-0.009	-0.0615	0.0313	-0.0204	-0.0134
	(0.41)	(0.42)	(0.31)	(0.75)	(0.13)	(0.35)
Improvement	-0.015	0.011	-0.198	-0.170	0.0446	0.0402
	(0.50)	(0.44)	(0.06)	(0.24)	(0.07)	(0.12)
Guessed Rank		-0.120		-0.809		-0.0485
		(0.01)		(0.047)		(0.14)
Submit Piece-Rate to Tournament		0.258		0.829		0.389
		(0.012)		(0.037)		(0.00)
Observations	80	77	28	28	291	291

Estimated marginal effects from Probit regressions in 3 different samples of participants which experienced the same basic experimental protocol. Columns 1 and 2 contain results reported in NV, for which they use students from the University of Pittsburg. Columns 3 and 4 show the results from the 28 individuals (14 men and 14 women) between the ages of 18 and 25 from our sample in the urban US. Columns 5 and 6 show results from the 291 individuals (140 men and 151 women) between the ages of 18 and 25 from our rural Malawi sample. Parentheses contain p-values, to facilitate comparison with the results reported in NV.

Appendix B

Experiment Details and Instructions

3.1. Sampling

In the US, we recruited participants in three waves. The first set of sessions was conducted at a major university campus near the end of the work-day. We recruited participants from staff, graduate students, and undergraduates. The second set of sessions was on a Saturday afternoon on campus, with participants recruited from a farmer's market, a flea market, and a local swimming pool. The third set of sessions was conducted at a farmer's market, with participants recruited from the market, the nearby commuter rail station, and the surrounding community.

In Malawi, we drew from twelve different villages, recruiting from the entire village population. Each village was visited a few days prior to the experiment, to notify residents and advertize the significant show up payment. We then randomly selected participants from the large pool that arrived.

3.2. Instructions

Welcome

In the study today, we will ask you to complete a simple task in four different rounds. None of these rounds will take more than 5 minutes. Because we are not simply asking you questions, but asking you to perform a task, we will pay your for your work. You will receive {*amount*} at the beginning and at the end you will receive {*amount*} for having completed the four rounds. In addition, you can earn more money based on your performance in one of the four rounds.

In order to participate in this study you must be at least 18 years old and you must agree to participate in the study or you must have the permission of your parent or guardian.

We will now give you some information about the study today. In each round, we will ask you to do something that can earn you money. When you are done here, you go to the cashier, he will put four cards into a bag, and you will pick one of these cards from the bag without seeing the cards. These are the four cards, this one is for the first round, this one is for the second round, this one is for the third round and this one is for the fourth round [*speaker places cards in bag*]. You will be allowed to pick one just as this man is going to show you right now. He cannot see which card he will pick, but we are not choosing the card. You will receive money according to how well you have done for the round that you pick from the bag without seeing. We will explain to you exactly how you can earn money in each round. Some people will only earn the show up fee today. Others will earn more. But everyone who begins will earn {*amount*}and everyone who finishes will earn {*amount*} again.

This is the payment desk [*speaker points*]. When you are finished with the tasks, please go here to answer some questions that we will ask and after that please come here to receive your payment.

Explanation and practice round

Welcome to this study. Now your helper will give you the {*amount*} that we promised to give to you at the beginning of the study. Today we will ask you to perform tasks and make decisions. If you listen carefully, you can earn a large amount of money. So pay close attention to the instructions, and ask questions if you do not understand, because it may affect how much money you earn.

Please do not talk with one another at any time during this study. I am happy to answer any questions you have at any time. But please direct your questions only to me. The person

sitting in front of you is here to help show you the task, and to record the decisions that you make. They are not allowed to help you make decisions; please do not ask them for help with the decisions we ask you to make.

You see the blocks that are in front of you. Please look at them and see the shapes and colors on each of the blocks. Take one of the blocks and show your helper each of the shapes on the block as he points to it on the paper in front of you. Every shape shown on the paper is shown on each of the blocks. The task we will ask you to perform today is to arrange the shapes in order from smallest to largest. The person helping you will now demonstrate for you how to complete the task. First, your helper will show you how to find all of the circles. When all of the circles are facing up, he or she will put them in order from the smallest circle to the largest circle. The circles are now finished and they are finished correctly. The task is complete.

We will now ask *you* to practice doing the task one time. Your helper will now turn your card to the next shape, which is a square. We want you to perform the task for the squares. When you think you are finished, look at your helper for confirmation. If you have completed the task correctly, your helper will nod his head. If you are incorrect, he will shake his head, and you must continue until the squares are arranged from smallest to largest.

The way you are paid for this task will change each round. So pay close attention to these rules each round and be sure you understand them, because they will affect how much money you can earn in that round. For each round, we will explain the rules, before we ask you to begin. Please do not begin until we tell you to.

We will ask you to perform this task as many times as you can within 3 minutes. As soon as you finish arranging the blocks for one shape, look to your helper and he or she will indicate

to you whether you may move to the next shape. If he nods his head, then turn the paper in front of you to show the next shape and then begin the next shape. If your facilitator shakes his head this means you have not correctly completed the task and you need to keep trying. You have 3 minutes to complete as many shapes as possible. The number of tasks that you complete is recorded on the paper but we will never tell anyone else how you have done.

Does anyone have any questions about how to perform the task?

Round One: Individual Performance.

We will now begin round one. Before we begin, we will explain how you will be paid for the tasks this round: If Round 1 is the task that you draw from the bag at the end, then you get $\{X\}$ for each shape you successfully complete. For example, if you complete one set of shapes you receive $\{X\}$, if you complete two sets of shapes you receive $\{2X\}$, if you complete three sets of shapes you receive $\{3X\}$, if you complete four sets of shapes you receive $\{4X\}$, and so on for as many shapes as you complete. We call this **individual performance**. This is represented by the single person standing alone in the picture in front of you.

Please do not talk during the task or after you have finished. This is very important. If you have any questions, please raise your hand and ask me now. Once we begin, you cannot ask any questions. Do you have any questions before we begin?

Are the facilitators ready? *[When ready:]* Okay, go. *[When time is up:]* Okay, everyone please stop now.

Round Two: Compared Performance.

Now we will move to the second round. For this round, the task is exactly the same. However, the way you are paid is now different. In this round, your payment depends on your performance

compared to a group of other participants. Each group consists of four people. The three other members of your group come from other participants. Your group members may be in this room right now, but they may not be. You will never know the names of the other people in your group and they will never know your name. The person sitting next to you is not in your group. Do you have any questions about who is in your group? If you have a question, please raise your hand and ask me now.

We will now explain how your payment is determined in this round. If round 2 is the task that you draw from the bag at the end, then your earnings depend on your number of successes compared to the three other people in your group. If you complete the most shapes in 3 minutes out of anyone in your group, you receive {*4X*} for each set you complete. But if someone else in your group completes the most shapes, you receive nothing.

One times {*4X*} is {*4X*}. Two times {*4X*} is {*8X*}. Three times {*4X*} is {*12X*}. Four times {*4X*} is {*16X*}. And so on. We call this **compared performance.** This is represented by the group of 4 people standing together in the picture in front of you. You will not know how you did in the compared performance until the end of today's activity, when you receive your earnings.

Please do not talk during the task or after you have finished. This is very important. If you have any questions, please raise your hand, and ask me now. Once we begin, you cannot ask any questions. Do you have any questions before we begin?

Are the facilitators ready? *[When ready:]* Okay, go. *[When time is up:]* Okay, everyone please stop now.

Round Three: Choice of Payment Scheme, Before Doing Task.

Now we will move to the third round. The task in this round is exactly the same, but now you can choose which way you want to be paid. If round 3 is the one that you draw from the bag, then your earnings for this task are determined as follows. If you choose **individual performance**, you receive {X} per success and you will not be compared to anyone else.

If you choose **compared performance** your payment for this round is similar to the payment in round two. The only difference is that your performance in this round is compared to the performance of the other three members of your group for round 2, the one we just finished, instead of being compared to their performance this round. If you complete the task more times than the other people in your group did for round 2 then you will receive four times the payment from the individual performance, which is {$4X$} per success. You will receive no earnings for this round if you choose compared performance and you do not complete more sets of shapes than the other people in your group did for round 2.

Notice that this round is a little different than last round because nothing you do in this round can affect the earnings of other people in your group, and nothing that other people in your group do this round can affect your earnings from this round.

You will not know how you did in the compared performance until the end of today's activity, when you receive your earnings. Do you have any questions? If you have any questions, please ask me now.

Please do not talk as you are making your decision. If you would like to choose individual performance, please point to the picture of one person. If you would like to choose compared performance please point to the picture of the group.

Please do not talk during the task or after you have finished. Are the facilitators ready? *[When ready:]* Okay, go. *[When time is up:]* Okay, everyone please stop now.

Round Four: Choose Scheme for Past Performance

For this new round, you do not have to do any tasks. Instead, you may be paid one more time for how you did in the first round of the experiment. Now we are going to ask you how you would like to be paid for the tasks that you completed in the first round. You can choose to be paid for your individual performance or compared performance.

If the fourth round is the one selected for payment, then your earnings for this round are determined like this. If you choose *individual performance*, you receive {X} per success you had in round 1. If you choose *compared performance*, your performance will be compared to the performance of the other three members of your group in the first round. If you completed the task more times in round 1 than they did in round 1, then you receive four times the earnings of the individual performance choice, which is {$4X$} per success. If you choose compared performance and you did not complete the task more times than others did in round 1 you will receive no earnings for this round. Do you have any questions? If you have any questions, please ask me now.

Please do not talk as you are making your decision. Now your helper will show you how many times you successfully completed the sets of shapes in the first round. Now your helper will show you a picture. If you would like to choose individual performance, please point to the picture of the one person. If you would like to choose compared performance please point to the picture of the group.

Belief-Assessment Questions:

We will now ask you how you think you performed in the tasks, compared to the 3 other people in the group we assigned you to, for the first two rounds. You will earn *{Y}* for each correct guess. Please look at the picture of the four people. The highest person completed the most sets of shapes in your group; he is first in the group. The next person completed the second-most sets of shapes in your group; he is second. The next person completed the third-most sets of shapes; he is third. The final person completed the least sets of shapes in your group; he is fourth.

We will first ask you how you think you performed in Round 1, the ***individual performance***. If you are correct, you will be paid an additional *{Y}* when we pay you your earnings. Before we ask you, do you have any questions? If you have any questions, please ask me now.

Please do not talk as you are making your decision. Now please silently show your helper how you think you performed in Round 1, the ***individual performance,*** compared to the other people in your group, by pointing to the position in the picture. Do you think you were the best? Do you think you were the second-best? Do you think you were third-best? Or, do you think you were last?

We will now ask you how you think you performed in Round 2, the ***compared performance***. If you are correct, you will be paid an additional *{Y}* when we pay you your earnings.

Please do not talk as you are making your decision. Now please silently show your helper how you think you performed in Round 2, the ***compared performance,*** compared to the other people in your group, by pointing to the position in the picture. Do you think you were the best? Do you think you were the second-best? Do you think you were third-best? Or, do you think you were last?

Thank you very much for your participation today. You can go now. Please go to there to answer some questions for our study.