Gender and competition at a young age

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Abstract

Gender gaps may be observed in a variety of economic and social environments. One of the possible determining factors is that men are more competitive than women and so, when the competitiveness of the environment increases, the performance of men increases relative to that of women. We test this hypothesis in a field study conducted with 9-year old children, running on a track. They first run alone and then in pairs over a short distance with different gender composition of the pairs. The results support the hypothesis that performance in competition varies according to gender. When children ran alone, there was no difference in performance. In competition boys, but not girls, improved their performance.

This finding relates to the discussion regarding single sex schools: the outcomes of examinations in a mixed sex school can show a gender gap in favor of boys, even when this gap does not reflect actual abilities. Girls who are as talented as boys will end up performing worse just because they are not as competitive, and will not achieve as high scores in examinations as boys.

Key words: Gender, Competition, Affirmative action, Single-sex schools
JEL Classification: D81

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1. Introduction

Gender gaps are observed in a variety of economic and social environments. For example, Bertrand and Hallock (2001) studied a data set with the top five highest paid executives of a large group of US firms over the period 1992-1997. Only 2.5 % of the executives in the sample were women. Such asymmetry has engendered heated controversy about the fairness of the selection process, and more generally on the fairness of allocation of opportunities. This controversy is passionate, extremely active, and not likely to disappear, regardless of any argument, however convincing, evinced on either side of the debate. A reason for such persistence, besides the real interests at stake, is that real life selection processes bring into play many different factors, and when all of them have been taken into account it is difficult to reach an agreement even on whether gender gaps exist, let alone on their causes.

The debate on the fairness of aptitude tests, such as SAT I, is exemplary. It is a fact that the performance of women is, on average, slightly worse than that of men (in the year 2000, it was 504 against 507 in the Verbal Test, and 498 against 533 in the Math test). Even more important, some statistical evidence indicates that the SAT I scores under-predict the performance of women in college,[1] which is taken by some as proof that the test is gender biased.

However, the difference in scores between genders is not large, particularly when compared to its standard deviation of 100. Further, other factors seem to be just as significant For instance, a difference in family income of ten thousand dollars raises, on

[1] This conclusion is extremely controversial too. For two different points of view, see Young, (2001), and Geiser and Studley, (2001). The first paper offers a comprehensive evaluation of the literature on the issue.

average, the score by approximately 25; so significant differences in income result in scoring differences that dwarf those due to gender.

Several explanations may be given for the difference in performance, besides a bias in the test. For instance, the percentage of women taking the test is higher for families of lower income (two thirds for the lowest income) and falls to a half for families with higher incomes.

Finally, the test may not be perfectly balanced: the SAT I has changed several times over the years, and the gender gaps have sometimes changed as a direct result of these changes.

In these examples, the unexplained gap could be due to discrimination, either explicit, or more subtle and latent: but direct evidence for such a claim is hard to find[2]. The gap could also be attributed to some difference between genders that is unobservable to the econometrician, such as a lack of long-term commitment for women (see the discussion in Bertrand and Hallock, 2001). In this paper, we study one of the possible unobserved differences between men and women; namely, the reaction to competition. A large body of literature in evolutionary biology and socio-biology documents differences in competitiveness between males and females, in many species[3]. It is argued that the differences in competitiveness arise because, due to differences in the cost of reproduction, competitive males will attempt to mate at every opportunity. Females, on the other hand, are inherently choosy, reserving their favors for the strongest suitor. In

[2] with some important exceptions: see, for instance, the study of Goldin and Rouse (2000), where they prove that blind auditions increase the proportion of women hired. A remedy that is typically associated with this analysis is affirmative action. The debate on this policy is even more heated than the one on the problems it is supposed to remedy. See e.g., Holzer and Neumark (2000) for an assessment of the policy.

[3] See Knight (2002) or Tregenza and Wedell, (2002) for recent overviews. The debate is a classic in the field: see Darwin, (1871), Bateman, (1948), and Trivers, (1972).

this paper, we wish to test whether similar differences are also prevalent between men and women, and if so, whether that could be a partial explanation of the gender gap. In view of the econometric difficulties associated with studying these unobserved differences using "real" empirical data, we use a field study to address two questions: Is there a gender gap, and if so, why is there one? We do so in a controlled environment in which most of the confounding factors are removed. The study we present here continues a line of investigation that began with Gneezy, Niederle and Rustichini (2001), in which we showed that men were more responsive to competition than women. The results of the present study confirm the initial conjecture. Competition enhances the performance of men, and is ineffective on women.

The Policy in Gender Issues

This study can offer more than a different view on the source of differential gender outcome. It might also suggest a more appropriate remedy to the real problem behind the asymmetry of the outcome: if the behavior of the subjects is affected by the competitive nature of the testing or selection procedure, then an optimal selection mechanism should take this into account. Of course, the precise nature of the optimal mechanism depends on the ultimate aims. If the ability to compete is a required skill or quality, a competitive setup may be appropriate. However, if it is not, a competitive environment in testing may produce a sub-optimal selection among candidates.

Consider, for example, the controversial issue of single sex schools. At present, Title IX forbids discrimination on the basis of gender; and its standard legal interpretation is that single-sex classrooms are against the law. Should they be? Our studies suggest a

clear shortcoming of the mixed-gender system. Since under that system, the performance of boys improves much more than of girls, the boys' ranking in the school will be higher than it should based on any real difference in quality. In mixed gender schools, an underlying difference in taste for competition manifests itself as a difference in talent, which penalizes girls. In the end, we might not be selecting the best students. Therefore, we seem to have the following choice. We could reduce competition in the educational environment, which is quite likely a bad idea, and impossible to implement in the final stage, when competition for college has to take place. Alternatively, we may want to consider the idea that a single-sex system gives a more balanced picture of the merit and talents of each individual, and does not discourage or penalize women unfairly.

2. Method of the Study

In Gneezy, Niederle and Rustichini (2001) we ran a laboratory experiment to study gender differences in performance in competitive and non-competitive environments. We compared performance in completing the same task, varying only the incentives the participants faced. In this way, we could study directly the effect of different levels of competitiveness on performance in an otherwise constant environment.[4] Subjects were asked to solve simple maze problems on a computer, and were paid according to different criteria. The results provide support for the idea that women and men behave differently in competitive environments. When subjects were paid for their individual performance, independently of that of other subjects, there was no significant gender difference in outcome. However, when subjects were paid on a

[4] This is related to the idea that there may be gender differences in altruism: see Andreoni and Vesterlund, (2001). See Heckel and Grossman for an assessment of gender differences detected in experimental economics studies.

competitive basis, with only the subject with the best outcome being paid, the performance of the male subjects increased significantly, while that of the female subjects remained constant. It was found additionally that the performance of women in a competitive environment was sensitive to the gender composition of the group. Women performed better when facing a homogeneous group of female competitors, rather than a mixed gender group. However, the improvement was small, and barely significant, so this specific finding required further scrutiny. We explained the results by appealing to the idea that there is a gender difference in reacting to competition.[5]

In this paper, we wish to extend the investigation in a number of directions. First, the age of the subjects is, on average, less than 10 years (as compared with 23 in the maze study). This difference can help in understanding whether the difference in competitiveness is due to socialization in the teenage years, or to something that begins at a much younger age. Second, the competition here is open, since children see the two competitors as they run, and the competitors receive feedback during the race (as opposed to getting feedback only at the end). Third, the competition relies on intrinsic motivation, since the children are not paid. This can help in learning whether males are more competitive only when an extrinsic reward is offered, or even when only intrinsic motivation is present. Finally, the current study is based on a field study in which the

[5] A possible difficulty with this explanation is that women in a competitive environment may anticipate that their effort is not going to be enough to compensate for, at the equilibrium provision of effort, the gender difference in ability. Rationally producing a higher effort than their female counterparts, men exhibit an increased performance in competitive environments. Of course, a first assumption necessary for this conclusion is that subjects had a rational and correct estimate of the difference in gender ability and its distribution for a task (the maze solving) that they had never seen before in their lives, but we can grant this for the sake of the argument. A second condition necessary to induce a difference in the performance, as an equilibrium behavior is that effort is made first and simultaneously, and outcome is revealed at a later stage. The study we present here addresses this difficulty directly, providing a more direct test of the hypothesis that genders differ in their view of competition. First, subjects know that the competitors (two) have been selected because they have approximately equal ability. Second, in this experiment the feedback on performance is immediate, simultaneous to the provision of effort.

participants did not know that they were being observed. If the results of the first study were due to the artificial environment of an experimental laboratory, this condition should eliminate this bias. Would we see the same pattern of males being more competitive than females in such a different environment?

3. Design of the field study

The study was conducted in an elementary school in the city of Ra'anana in Israel. The subjects were 140 children, 75 boys and 65 girls, all in the fourth grade, hence 9 to 10 years old. The variable studied was the speed of the children in a race over a short distance. It is important to bear in mind that at this age there is no significant gender difference in speed in a short distance race. (At an older age boys run faster than girls).

The study was conducted during a physical education class, and followed closely a standard practice in the class, which is that every child has to run twice over a track 40 meters long, with the teacher measuring the speed. The precise procedure was as follows. First, each child ran alone once. After that, the teacher matched the children in pairs, starting with the two fastest children, and then moved down the list, each time matching the next two fastest children, independently of their gender. When more than two children had the same time in the first round, the match was decided randomly. In this way, children matched into pairs had a speed as close as possible to each other. After this, each pair ran on the same track, with the two children side by side, and the time was taken for both. In our experiment, we added a control in which children ran alone the second time as well. This additional treatment was necessary to control for unobservable additional factors that may cause differences in the outcome. For instance, boys might get

tired faster than girls, or recover more slowly, and hence run at a lower speed in the second run. The rest of the design is identical to the procedure we have described earlier. The children were not aware that they were part of a study. They were not promised or offered any compensation of any kind.

The procedure was well known to the children from previous experiences, and their position in the ranking was clearly announced. Therefore, they would know their speed in the first round and their relative performance from the pairing and the rank of their pair. They would also know that the child in the same pair had a very similar speed in the first round.

4. The Results of the Study

Speed in the first round

Since all conditions were identical in stage one, we can pool the outcomes to test for gender differences. A summary plot of the distribution of time by gender is presented in Figure 1 below.

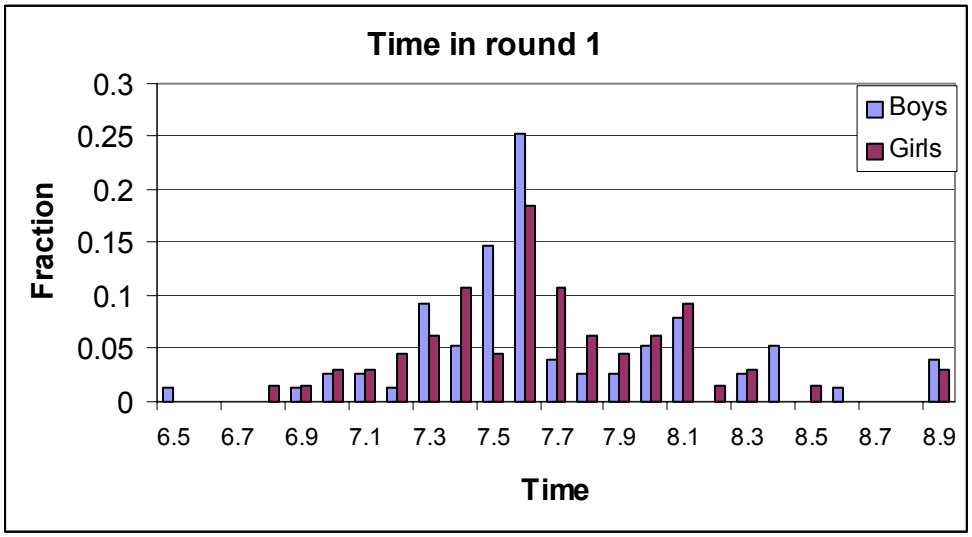

Figure 1: Results of the first round according to time.

In round 1, girls ran at the same speed as boys. The average time was 7.672 for girls and 7.693 for boys; the difference is not significant (p=.937).

Speed in the second round

We separate the discussion of the two groups: The no competition group, in which children ran alone in the second round, and the competition group, in which they ran in pairs in the second round.

No competition

In this sub-group there were 24 children: 12 boys and 12 girls. The distribution of changes in times (time of round 2 minus time of round 1) for the two genders is presented in Figure 2.

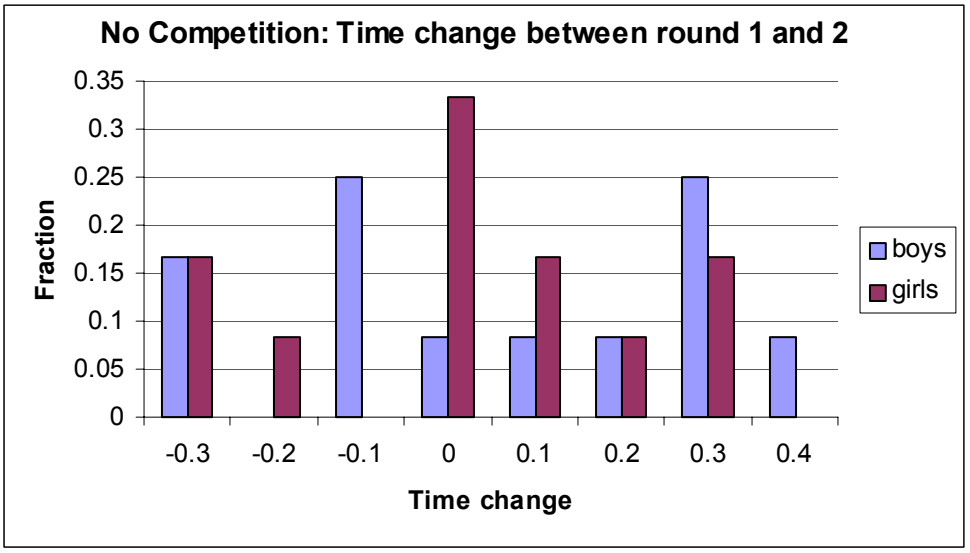

Figure 2: Distribution of changes in times (time of round 2 minus time of round 1) in the no competition treatment.

Note that we report the difference as the time of the race in the second round minus that in the first round. A negative number corresponds to a higher speed in the second round. Table 1 gives an overall summary of the time differences.

	N. of obs.	Round2-round1	Std.error
Total	24	-0.037	0.044
Total Boys	12	-0.058	0.070
Total Girls	12	-0.016	0.058

Table 1: Summary of the time changes in a non-competitive environment. Reported are times in Round 2 – times in Round 1, and the standard error.

Children running alone in the first and second rounds showed, on average, a slight improvement in the second round: the time fell from 7.79 to 7.75, a difference of -.037 seconds. Boys improved their time more than girls did (the difference was -.058 for boys and -.016 for girls). The difference in the improvement of performance between genders is, however, not significant (p=.839 for the null hypothesis that the performance in the second round is equal for the two genders; and p = .815 for the null hypothesis that the *difference* in time between the two rounds is the same for the two genders). The p-value for the percentage improvement (the ratio between the difference in time and the time in the first round) is .663.

Competition

There were 116 children in this sub-group, 63 boys and 53 girls. Figure 3 presents the time change according to gender, and Table 2 gives an overall summary.

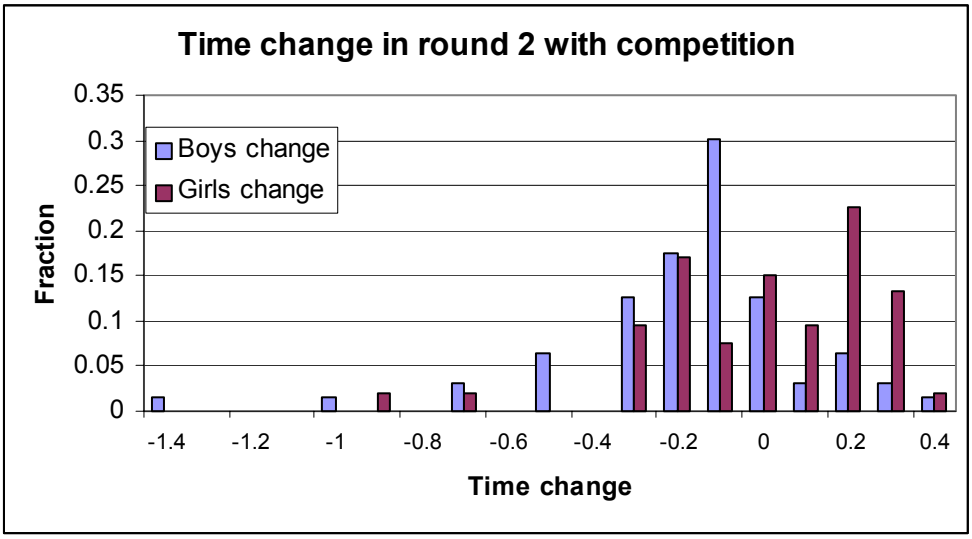

Figure 3: Distribution of changes in times (time of round 2 minus time of round 1) in the competition treatment.

	N. of obs.	Round2-round1	Std. Error
Total	116	-0.081	0.045
Total Boys	63	-0.163	0.036
Total Girls	53	0.015	0.035
Boys with Boys	34	-0.135	0.056
Girls with Girls	24	0.050	0.045
Boys in mixed pairs	29	-0.190	0.043
Girls in mixed pairs	29	-0.013	0.053

Table 2: Summary of the time changes in competitive environment.

The average change in time from the first to the second round was –.081. For boys, the average change was an improvement of -.163; for girls, the average time was *worse* in the second round, with a difference of .015. The difference is significant: the *p*-value for the Wilcoxon-Mann-Whitney test of the null hypothesis that the difference is the same across genders is .0005; on the percentage improvement the *p*-value of the same test is .0002. Next, we consider the change in performance in competitive environment according to the gender compositions of the pair.

Homogeneous pairs

In 10 out of the 17 (59%) homogeneous pairs of boys, the child that had a better time in the first round won in the second. In homogeneous groups of girls, 6 out of 12 (50%) girls who ran faster in round one also ran faster in round two. The time change between the two rounds, however, is noticeably different between boys and girls. When girls ran with girls, their performance was *worse*: the time increased by .066 seconds for the first runner (that is, the girl that had a better time in the first round) and .0333 for the second runner. The opposite happened with boys, who improved by a large margin when competing against boys. The first runner improved by -.182, and the second runner by -.088. We shall see that the boys also improved when running in mixed groups, but the improvement was smaller than in homogeneous groups of boys.

Mixed pairs

In mixed pair races, boys caught up with girls, but girls did not catch up with boys. In 8 out of 11 (73%) observations among the mixed pairs in which boys were slower than the girl in round 1, they won the second stage. In the remaining 18 mixed races where the girl had a worse time in the first round, a girl won in only 3 (17%) cases in the second round. The time improvement in the mixed group was far larger for boys than it was for girls. A boy first runner improved by -.183, and a boy second runner gained -.218. A girl as first runner showed the smallest average gain in this group. The largest gain occurred for a boy in the uneasy role of running against a girl as second runner, the gain being -.218. The gain for a girl running second against a boy was small, -.016, but was still larger than the *loss* for a girl running against a girl as second runner (which was .033).

The *p*-value on the null hypothesis that the difference in times in the rounds between two homogeneous groups is the same is .161. The *p*-value for the percentage improvement is .0084. When we make the same comparison between the homogeneous groups of boys and the mixed ones, the *p*-value for the difference is .6215, and .6988 for the percentage improvement. The similar comparison between homogeneous groups of girls and the mixed one has a *p*-value .094 for the difference and .0038 for the percentage.

5. Conclusions

Our evidence supports two main conclusions. First, competition improves performance for boys, but not for girls. Second, the gender composition of the competing

group affects the outcome. Boys improve in both mixed and homogeneous groups, but improve more in mixed gender competition. For girls the incentive is particularly weak in homogeneous groups, where their performance is even worse then in the single-child race.

In this field study, subjects were considerably younger than in the Gneezy, Niederle and Rustichini (2001) study. The socialization process however has had all the time to be effective, so the results cannot be interpreted as evidence of a natural inclination. The incentives are intrinsic, because no payment is offered. The outcome is public and is revealed progressively as the race develops, so the subjects know exactly how much effort, at any point in time, would be needed to try and win.

There are important similarities in the behavior of subjects in the two different environments. Competition has a positive effect on performance in both cases. However, this effect is stronger on boys than it is on girls, and the gender composition of the group of competing subjects is important.

There are also some important differences. In the current study, when two girls are matched, performance does not improve in the second round relative to the first. However, in the maze experiment the performance improved compared to the non-competitive environment. Yet, in the current study girls are strongly motivated when competing against boys (in particular, more than they are when competing with girls).

Overall, the experiment confirms the main results of the maze experiment. Competition increases the performance of males more than for females, hence creating a gender gap that does not exist in environments without competition. It is remarkable that this effect appears in two very different environments: different age, different task, and

different information available to subjects. This indicates that some strong, robust and general factors are active. The puzzle that remains concerns the more subtle effects of the effect of competition in homogeneous and heterogeneous groups.

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