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Title: Gender and Competition in Adolescence: Task Matter

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Abstract:
We look at gender differences among adolescents in Sweden in preferences for competition, altruism and risk. For competitiveness, we explore two different tasks that differ in associated stereotypes. We find no gender difference in competitiveness when comparing performance under competition to that without competition. We further find that boys and girls are equally likely to self-select into competition in a verbal task, but that boys are significantly more likely to choose to compete in a mathematical task. This gender gap diminishes and becomes non-significant when we control for actual performance and beliefs about relative performance. These results show that among adolescents in our sample, the gender gap in competitiveness is not due to preferences for competition per se. Girls are also more altruistic and less risk taking than boys.

Keywords: competitiveness; risk preferences; altruism; adolescents; gender differences; experiment

JEL codes: C91; D03; J16
1. Introduction

Women’s economic and political opportunities have long been more restricted than those of men. This situation has gradually improved in the Western world: female participation in the labor market has increased substantially during the last decades and women today are in many countries at least as likely as men to complete higher education. Yet, both occupational segregation and gender wage gaps persist.

Gender differences in economic preferences provide one possible explanation for the observed gender gaps in the labor market (Croson and Gneezy 2009; Bertrand 2010). Gender differences in preferences are often studied through laboratory and field experiments, and according to this literature men are typically more competitive, more risk taking and less altruistic than men (see, e.g., Eckel and Grossman 2008a; 2008b; Croson and Gneezy 2009; Bertrand 2010; Engel 2011). Moreover, in addition to possible general gender differences in these economic preferences, females and males may also choose different areas for competition. Previous literature suggests that gender differences in competitiveness among adults, but not children, can depend on the nature of the competitive task. Most often, gender-neutral or female-oriented competitive tasks reveal no differences in preferences for competition, whereas men tend to compete more in male-oriented tasks (e.g. Günther et al. 2009; Grosse and Riener 2010; Schurchkov 2012).

However, an open question is at what age gender starts to matter for preferences for competition in different tasks. Identifying the age at which gender specific differences in the choice of competition across domains arise is important. For example, whether differences in competitiveness arise before or after adolescence can be of critical importance, as many decisions that potentially determine gender gaps in the labor market are taken during adolescence. More precisely, if girls and boys begin to choose certain competitive tasks and avoid others before or during adolescence, then corresponding real-world choices made during adolescence that have long-term labor market effects may be a critical source of gender gaps that prevail throughout the remaining lifecycle. A preference for competing in certain tasks among female adolescents may thus explain, for example, educational segregation and subsequent occupational segregation in the labor market and the gender wage gap. Therefore, we believe it is crucial to understand the extent to which preferences for competition are present among adolescents, a relatively under-explored area, in comparison to preferences among younger children and young adults.

\footnote{In particular, this might give rise to segregation in secondary education and consequently segregation in college or university education.}
In this paper we study gender differences in preferences for competition among Swedish adolescents aged 16-18 years. We measure competitiveness both by relative performance in competitive vs. non-competitive settings and by self-selection into a competitive payment scheme. Previous studies mainly focus on competitiveness among adults or younger children, thus we fill the gap between these two age groups.

Importantly, we study competitiveness in two tasks with varying gender associations; a “male” oriented task based on mathematical ability and a “female” oriented one based on verbal ability (e.g. Cvencek et al. 2011; Nosek and Smyth 2011). We also study gender differences in risk preferences and altruism, measured through incentivized behavioral tasks.

Previous literature typically shows that among adults (primarily, university students), men tend to self-select into competitive settings much more often than women in mathematical and spatial tasks (Gneezy et al. 2003; Niederle and Vesterlund 2007; Datta Gupta et al. 2011) but rarely in verbal tasks (Günther et al. 2009; Grosse and Rienner 2010, Schurchkov 2012; though see Wozniak et al. 2010 who find that men remain more competitive). This result is also confirmed in a large representative sample of the Swedish population aged 18-73 (Boschini et al. 2012), where men are more competitive than women in a math task but not in a verbal task. Much less research has been done among children when it comes to competitiveness in tasks that vary in gender stereotype. Two studies thus far show that tasks matter neither for Swedish children aged 9-10 (Dreber et al. 2011), nor for Colombian and Swedish children aged 9-12 (Cárdenas et al. 2012). This raises an important question: at what age do task related gender differences in competitiveness arise? Given these previous studies we expect adolescent boys to be more competitive in the mathematical task compared to adolescent girls, whereas we do not have a clear hypothesis for the verbal task in this age group.

Previous literature further shows that age, and adolescence in particular, as well as the cultural setting associated with different gender norms, influence gender differences in competitiveness. Sutter and Rützler (2010) find that gender differences in competitiveness among Austrian children are present already among three year olds in a running task. In India, using a task that involves throwing balls in a bucket, Anderson et al. (2012) find no gender difference in competitiveness at any age among children and adolescents in a matrilineal society, whereas girls become less competitive than boys during puberty in a patriarchal society. Almås et al. (2011) find that adolescent boys are more competitive than girls in Norway in a mathematical task, as do Booth and Nolen (2012a) in a maze task in mixed sex groups in the UK. Flory et al. (2012) use a task that implies arranging shapes in a specific
order when investigating gender differences in competitiveness in different age groups in matrilocality and patrilocality in Malawi.² Men are found to be more competitive only in patrilocality villages, where the gender gap is the largest among the youngest cohort in their sample (individuals aged 18-22). The gender gap further diminishes in each age group due to an increase in female competitiveness, and disappears somewhere between the age of 40 and 50. However, using both a verbal and a mathematical task, Boschini et al. 2012 find no correlation between competitiveness and age for either gender, or for either task, in Sweden, and Mayr et al. (2012) find that among adults aged 25-75 in the US, men are more competitive in a mathematical task in all age groups. More generally, these results suggest that, for the ages around adolescence, interaction with cultural gender stereotypes may be of significant importance when it comes to gender differences in competitiveness. Therefore, we include both “male” and “female” tasks in our study, to allow for the possibility that such cultural differences influence the extent to which we find differences in competitiveness among adolescents.

Many important decisions pertaining to education and labor market preparation are taken during the adolescent years. In general, competitiveness has been shown to predict educational as well as labor market choices, raising the possibility that gender differences in competition across domains among adolescents might have long-lasting effects. For example, students that self-select into laboratory competitions using mathematical tasks are more willing to take a high school entrance exam than students less inclined to compete (Zhang 2010) and are more likely to choose more math oriented and prestigious university majors (Buser et al. 2012). Similarly, Örs et al. (2008) find that women perform less well compared to men on the very competitive entry exam to one of France’s higher ranked schools, but first order stochastically outperform men in two less competitive settings. Flory et al. (2010) further find that women are less likely than men to choose to apply to jobs with highly competitive compensation regimes, but only if the domain of the job has a male stereotype. The importance of tasks for labor market decisions found in Flory et al. (2010) is of particular interest since Favara (2012) finds that, independent of ability, gender stereotypic educational choices are made as early as the age of 14 and stereotypically male choices lead to higher earnings. In a similar vein, mathematical test scores, as opposed to for example verbal test scores, have been found to be a good predictor of future income (Niederle and Vesterlund 2010). All of this implies that women shying away from competition in male-oriented tasks in adolescence may be a critical factor affecting subsequent long-term gender differences in

² Matrilocality often refers to a society in which a married couple lives with or close to the wife’s parents.
educational and labor market outcomes. Thus, in order to understand the gender segregation in educational outcomes and labor market outcomes it is important to understand gender differences in competitiveness among adolescents and how these differ by domain.

To our knowledge, this study is the first to look at gender differences in competitiveness in two tasks with differing gender associations among individuals at this age. We find that gender differences in competitiveness exist already among 16-18 year olds, but that it depends on the task. Whereas we find no gender difference in performance change under a competitive setting in comparison to a non-competitive setting, in either a mathematical or a verbal task, female participants are significantly less likely than male participants to self-select into a competitive setting in a mathematical task. The difference between the genders is large and economically relevant. More than twice as many boys as girls choose to enter the competition. This is not true for a verbal task, where adolescent boys and girls are equally competitive in terms of self-selection. However, in our study the gender gap in choosing to compete in the mathematical task diminishes and is no longer significant when we control for actual performance and relative performance beliefs. The gender difference in competitiveness between the two tasks is driven by a significantly lower number of girls choosing to compete in the math task than in the verbal task. Among boys the number of competitors is stable across the tasks.

We also study gender differences in risk preferences and altruism, since these preferences also exhibit gender differences and have been proposed to explain part of the gender gap in labor market outcomes (see, e.g., Bertrand 2010 for further discussion). Among adults, women are typically found to be less risk taking than men. Previous literature on children and adolescents finds either no gender gap (Harbaugh et al. 2002; Almás et al. 2011), or that boys are more risk taking than girls (Cárdenas et al. 2012, Borghans et al. forthcoming, Sutter et al. forthcoming). However, context or sample also seems to influence the gender gap in risk taking (see, e.g., Booth and Nolen 2012b; Cárdenas et al. 2012; Gong and Yang 2012). In a meta-analysis of adult behavior, Engel (2011) find that women are more altruistic than men. Previous literature on children and adolescents sometimes (Harbaugh et al. 2003; Gummerum et al. 2010) but not always (Benenson et al. 2007; Blake and Rand 2010; Almás et al. 2011) finds that females are more altruistic. We therefore hypothesize that if anything adolescent boys in our sample will be more risk taking and less altruistic compared to adolescent girls.

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3 Boys perform on average significantly better in the math task across all classes. From an optimality perspective though, the share of girls choosing to compete should not be smaller than that of boys. This is due to the fact that the gender composition of classes varies a lot and depends on academic specialization. Some classes therefore contain a large majority of girls or boys, and this is mirrored among the top performers in each class.
Our results confirm this: adolescent girls in our sample are indeed less risk taking and more altruistic than boys in a dictator game in which the recipient is a charity.

Our results emphasize the importance of studying adolescents when trying to understand the formation of preferences, and its effect on educational and labor market outcomes. Among adolescents, the gender gap in competitiveness is present only in the mathematical, but not the verbal domain, and its presence can be largely accounted for by other factors, such as performance and expectations, than a gender gap in preferences for competition per se. This result suggests that policies addressing gender gaps in the labor market should account for possible self-selection away from certain kinds of competition by females before labor market entry, and should target the underlying causes for why women shy away from competition in “male” tasks.

The outline of our paper is the following. We present the experimental setup in section 2, and move on to our results in section 3. We finish by a discussion in section 4.

2. Experimental setup

The study was conducted in nine school classes in five high schools in the Stockholm area during the fall of 2009. We contacted all schools in the cities of Stockholm, Uppsala and Västerås. Though we may have some selection regarding which schools that decided to participate, participation at the student level was compulsory. The school classes include a mix of different educational specializations. A total of 216 high school adolescents aged on average 17 years (min 15 and max 19 years old) participated in the study.4 Half of the participants were female.

The experiment consisted of three parts conducted in the classroom, measuring, in the following order, competitiveness, altruism and risk preferences. The experiment was conducted within a compulsory class and no show up fee was provided for participation. Participants were informed that each of the three parts consisted of a chance to earn money since one of the three parts would be randomly selected for payment, and the amount of money they could earn depended on the outcome of the choices they made in this part. After completing all parts the participants were given a survey with additional questions.

Competitiveness is typically measured as either the change in performance in a competitive setting compared to a non-competitive setting, or as a preference for competition, such as self-

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4 Among the participants, 56 attended the first year, 95 the second and 50 the third year in high school. 15 students attended a mixed class with students from years 1 and 2. For these students we have no information on which year they actually attended at the moment of the study. Participants earned on average about SEK 25 (USD 3.5).
selecting into a tournament instead of a piece-rate payment scheme. The competitive part consisted of three different stages. In the first stage, a piece-rate scheme, the participants were told that they had two minutes to solve as many exercises as possible of the task, for which they would be given SEK 3 each. In the second stage, a tournament, the participants were again told that they would get two minutes to solve exercises, but that they now would be randomly paired with three other individuals in the class who solved the same type of task, and that if they solved more or the same amount of exercises as these other individuals, they would get SEK 12 per exercise, whereas if they solved fewer exercises they would get SEK 0. In the third stage, the participants were told that they were to solve exercises for another two minutes, and that they now could choose whether they wanted to be given points according to the piece-rate scheme or the tournament (where they would again compete against three random other individuals in their class). The participants did not get any feedback about their performance in any stage. Our measure of reaction to competition is the absolute change in performance between the first and second stages. The choice in the third stage gives us a measure of competitiveness as a preference for competition. After the competitiveness task was over, we asked the participants to estimate where in the performance distribution of their class they believed themselves to be, for both the piece-rate scheme and the forced competition. This allows us to measure over-confidence as the discrepancy between performance beliefs and the actual performance of a participant. We focus on the relative performance beliefs from the forced competition since this is more competition specific.

To vary the gender stereotype of the competitive task, the participants competed in both a mathematical task and a verbal task; tasks that previously have been used as examples of tasks with opposing gender stereotypes. The implementation of the competitive tasks, as well as the math task which involved adding a series of three two digit numbers, was inspired by the seminal paper of Niederle and Vesterlund (2007) and similar to the setup used in Cárdenas et al. (2012). The verbal task was a word search task, where participants were asked to find words of at least three letters in a box with rows and columns of letters. Words could be formed in any direction; horizontally, vertically and diagonally. Examples of the tasks can be found in the appendix.

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5 In one of our previous studies in Sweden, the math task has been rated as more boyish and the word task as more girlish by both genders (Cárdenas et al. 2012). Moreover, vocabulary knowledge is positively correlated with reading comprehension (Yovanoff et al. 2005).
Next the participants took part in a dictator game, where they were asked to distribute SEK 50 between themselves and a well-known charity. They were informed that if this part was selected for payment the money they gave to the charity would be sent by us to the charity at the end of the study. Having a charity rather than another participant as recipient might increase overall giving, as suggested by Eckel and Grossman (1996). The amount that the participants give to the charity is our measure of altruistic behavior.

The last part measured risk preferences in two tasks. Our main measure of risk preferences consists of six choices where individuals choose between a lottery in the form of a coin flip that gives SEK 100 or 0 with equal probability and a safe option where the certain monetary amount increases successively over the six choices (from SEK 20 to 75). This measure is very easy to understand for the participants. The straight forward probability diminishes problems with gender differences in probability weighting (e.g. Fehr-Duda et al. 2006) and this measure has also been shown to be stable to changes in the list design (Bosch-Domènech and Silvestre 2012).

Our first measure of risk preferences relies on the unique switching point where the individual switches from preferring the lottery to preferring the safe option. This measure excludes inconsistent participants, i.e. participants with multiple switching points. 14 of our participants made inconsistent choices. Another advantage of the risk measure we use, however, is that it allows us to include subjects that make inconsistent choices, when we analyze risk taking as the number of times a person chooses the risky option compared to the safe. Using this measure of risk preferences in our analysis does not change the results. To further analyze risk preferences we included a survey question where the participants were asked to self-report their general risk taking propensity on a scale from 0 to 10, where 10 is “very risk taking” and 0 is “not risk taking at all”. This second measure of risk preferences was not incentivized, but has been shown to correlate with behavior in an incentivized experiment (Dohmen et al. 2011).

After the three parts of the study were conducted, a survey was included in order to measure performance beliefs, self-reported risk taking as well as other variables. In the end, one part

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6 The charity was the Swedish section of “Save the children”. We chose Save the Children since it is a large and well-established NGO in Sweden. Even if Save the Children does not explicitly focus or work on gender issues, there could be gender differences in perceptions of the charity.

7 When conducting the study SEK 7 corresponded to about USD 1.

8 We collected a variety of variables (the full survey is available from the authors on request). In this paper we use class (year), birth month, height, GPA, and life satisfaction (scale 0-10).
was randomly selected for payment and the money was handed out in private in cash to the participants. The participants earned on average SEK 25.

To summarize; we analyze competitiveness as the performance change in a mathematical task and a verbal task and as the choice to compete or not in the two tasks, altruistic behavior via a dictator game, and risk preferences through incentivized choices over lotteries and safe options as well as self-reported risk taking. We further look at additional measures such as relative performance beliefs.

3. Results

This section consists of three parts. To simplify, we start by studying gender differences in competitiveness in the two tasks using the two measures of competitiveness. We then explore altruism, followed by an analysis of risk preferences. When exploring competitive preferences we control for relative performance beliefs and risk preferences. All tests of the means throughout the paper are analyzed using the non-parametric Mann-Whitney test and a two-sided t-test. Only the p-values for the Mann-Whitney tests are displayed (since none of the variables are normally distributed according to a Kolmogorov-Smirnov test) unless the tests differ in statistical significance, in which case both results are reported. We have also compared whether the distributions for each reported variable differ between boys and girls using a Kolmogorov-Smirnov test. The results are similar to those reported for mean values. Results are reported to be significant if p<0.05, but we report the p-values throughout the results.

3.1 Competitiveness

In this section we explore competitiveness as measured by absolute performance change and as the choice whether to compete or not. Participants took part in both the mathematical task and the verbal task, with half of the classes randomly chosen to perform the math task first and the other half to perform the word task first. The order of the tasks does not influence our results. We also include an analysis where we control for relative performance beliefs and risk preferences.

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9 We also perform a regression analysis for each behavior using the control variables from the survey (class year, birth month, height, GPA, and life satisfaction). The female coefficient remains similar for all behaviors except altruism, where it is no longer significant. Most control variables are not significant. For those that are significant, we find the following correlations: altruism is negatively correlated with birth month (individuals born early are more altruistic) whereas it is positively correlated with class year and GPA. Risk taking is positively correlated with class year. Competitiveness as measured by the choice to compete in the verbal task is negatively correlated with GPA. For competitive performance change we also conduct a quantile regression on absolute performance change and find no gender gap in math or word search in any part of the performance distribution.
3.1.1 Performance and choice

Table 1 compares the performance between boys and girls in the first stage (a piece-rate scheme) and the second stage (a tournament). Studying performance in each stage separately, boys perform significantly better than girls in math in both stages, whereas there is no gender difference in performance in the verbal task.10

When it comes to absolute performance change, our first measure of competitiveness, we find no increase in performance under the competitive compensation scheme for either gender. Neither boys nor girls react to the competitive environment by increasing their performance comparing the second and the first stage. This stands in contrast to most previous studies measuring performance change conducted elsewhere than Sweden, but is in line with another study from Sweden (Cárdenas et al 2012). As a robustness check, we also analyze the relative performance change ((performance in stage 2 – performance in stage 1)/performance in stage 1). This does not alter our results. Thus, there is no significant gender gap in competitiveness with this measure in either task.

Table 1. Average performance, stage 1 and 2.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Math, stage 1</th>
<th>Math, stage 2</th>
<th>p-value</th>
<th>Word, stage 1</th>
<th>Word, stage 2</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>107</td>
<td>8.79</td>
<td>8.82</td>
<td>0.948</td>
<td>8.79</td>
<td>8.57</td>
<td>0.546</td>
</tr>
<tr>
<td>Girls</td>
<td>109*</td>
<td>7.31</td>
<td>7.44</td>
<td>0.510</td>
<td>8.74</td>
<td>8.61</td>
<td>0.542</td>
</tr>
<tr>
<td>p-value</td>
<td>0.010</td>
<td>0.020</td>
<td>-</td>
<td></td>
<td>0.524</td>
<td>0.952</td>
<td>-</td>
</tr>
</tbody>
</table>

*One girl had to leave the class room and did not participate in the first part of the word task.

Table 2 compares the proportion of boys with the proportion of girls choosing to compete in both the math task and the word task. We find a significant gender gap in math but not in word search, although the point estimate goes in the same direction for both tasks.11

In math, 36% of the boys choose to compete compared to 17% of the girls (p=0.001). The corresponding numbers in word search are 33% and 28% respectively (p=0.356).12 This difference in gender gaps between the tasks is mainly due to girls choosing differently across the two tasks. The share of girls choosing to compete in the verbal task is significantly larger...

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10 Given that the gender gap in math performance in Sweden is small compared to many other countries (Guiso et al. 2008) this is a somewhat puzzling result. However, it might have to do with the specific sample in our study.

11 One participant did not choose payment scheme for the third stage in math, and two did not perform in this stage. In the word task, two participants did not choose payment scheme. When possible, these individuals are included in the analysis. Including or excluding these participants has no effect on the results.

12 A sample size analysis indicates that 2037 observations would be needed to obtain a significant result for the gender gap in competition choice in word search. The basis for the power calculation is a significance level of 5% and a power of 80%.
than the share choosing to compete in the math task ($p=0.050$). Looking at boys, the share choosing to compete is stable across the two tasks ($p=0.701$).

Given girls’ lower average performance in the math task it may be optimal for girls to compete less than boys in our sample. We therefore calculated, based on performance in the stage two tournament, the winning probability of a specific participant if he or she chose to compete against three randomly chosen participants in his or her class. If this probability was 0.25 or more, the expected value of choosing to compete was larger than choosing piece rate. The result indicates that as many girls as boys should choose to compete (35% versus 36%).

This result is mainly due to the fact that the gender representation across classes with different specializations is very skewed in many classes, with large majorities of boys or girls depending on track. The proportion of boys choosing to compete in the math task is not significantly different from the optimal proportion ($p=0.959$) whereas girls compete less than optimally ($p=0.002$). In the verbal task, girls ought to compete at a slightly higher rate than boys, but the difference is not significant ($p=0.173$). As with the math task, the proportion of boys entering competition in the verbal task is not significantly different than the optimal level ($p=0.768$), but girls enter at significantly lower rates ($p=0.045$).

Table 2. Shares choosing to compete in stage 3.

<table>
<thead>
<tr>
<th>Task\Gender</th>
<th>N</th>
<th>% competing math</th>
<th>N</th>
<th>% competing word</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>106</td>
<td>0.358</td>
<td>105</td>
<td>0.333</td>
<td>0.701</td>
</tr>
<tr>
<td>Girls</td>
<td>109</td>
<td>0.165</td>
<td>109</td>
<td>0.275</td>
<td>0.050</td>
</tr>
<tr>
<td>p-value</td>
<td>-</td>
<td>0.001</td>
<td>-</td>
<td>0.356</td>
<td></td>
</tr>
</tbody>
</table>

3.1.2 Relative performance beliefs and risk preferences

We found a gender gap in performance in the math task in each of the two stages separately. All or part of the observed gender gap in choice may be due to participants incorrectly or correctly anticipating their probability of winning the tournament should they choose to compete.

We start by exploring confidence. Our measure of confidence is the difference between relative performance beliefs and actual relative performance, both in terms of quartile in the performance distribution. When assigning individuals to a quartile for actual relative performance, we divide each class into four equal groups (roughly equal groups when the class size cannot be divided by four) with 1 being the best quartile and 4 being the worst. In some cases several individuals performed equally across groups. Those individuals are given an expected quartile. For example, if four individuals perform similarly, and two needs to be
assigned to the worst quartile and two to the second to worst quartile, these individuals all received the expected quartile 3.5.

Table 3 reports the number of correct guesses regarding relative performance, divided by task and gender. Relative to their performance, we find that girls are under-confident in both the mathematical and the verbal task (Math: p<0.001; Word: p<0.001), whereas there is some evidence that boys are under-confident in the mathematical task but not in the verbal task (Math: p=0.065; Word: p=0.659). Comparing confidence in the two tasks, girls are as under-confident in the mathematical task as in the verbal task (p=0.851). Boys, on the other hand, are more confident in the verbal task (p=0.041). When we compare boys and girls, girls are significantly more under-confident in the verbal task (p<0.001), and there is some evidence that girls are more under-confident in math (p=0.097). This is interesting given that most studies on children and adults find that both genders are overconfident. However, in a study of confidence in math performance among 14-year old children in Sweden, Dahlbom et al. (2011) find that boys are overconfident and girls are under-confident.

Table 3. Distribution of guessed ranks.

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Guessed rank</td>
<td>Over-confident</td>
</tr>
<tr>
<td><strong>Math</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Best</td>
<td>9 (5)</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>23 (9)</td>
<td>8</td>
</tr>
<tr>
<td>3.</td>
<td>30 (10)</td>
<td>7</td>
</tr>
<tr>
<td>4. Worst</td>
<td>18 (6)</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>80</td>
<td>90</td>
</tr>
<tr>
<td><strong>Word</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Best</td>
<td>11 (3)</td>
<td>8</td>
</tr>
<tr>
<td>2.</td>
<td>25 (7)</td>
<td>11</td>
</tr>
<tr>
<td>3.</td>
<td>30 (13)</td>
<td>8</td>
</tr>
<tr>
<td>4. Worst</td>
<td>14 (6)</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>80</td>
<td>90</td>
</tr>
</tbody>
</table>

*Number of correct guessed in parenthesis.
* The sample size in this table is smaller compared to previous tables since 45 participants (two classes) were not asked to state their performance beliefs regarding stage 2 performance.

Individual risk preferences as well as relative performance beliefs have previously been found to influence competitive choices (e.g. Niederle and Vesterlund 2007; Niederle and Yestrumskas 2008). Looking at risk preferences in our incentivized risk task, girls in our sample who self-select into competition are significantly more risk taking than other girls in

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13 A t-test indicates that boys are significantly under-confident in math (p=0.041).
both the mathematical task (p=0.049) and the verbal task (p=0.004). For boys, there is a significant difference in risk taking between those who compete and those who do not only in math (p=0.009). However, exploring the self-reported risk measure, the only significant difference is when comparing boys choosing to compete or not in math (p=0.006).

3.1.3 Regression analysis: Gender gap in competitive choice

We also conducted a regression analysis analyzing the gender gap in competitive choices. We perform three regressions per task, with and without including control variables such as relative performance beliefs and risk preferences as can be seen in table 4 (math) and 5 (word) below. We analyze the full sample of individuals, however 45 participants (two classes) were not asked to state their performance beliefs regarding stage 2 performance. We thus also analyze a restricted sample excluding these individuals and those for whom we don’t have all control variables. We report bootstrapped standard errors, clustered by school class, due to a small number of clusters.

In math, we find that controlling for actual individual performance diminishes the size of the observed gender gap with 27% in the restricted sample and the coefficient on female is becomes only marginally significant (comparing the coefficients in regression 1 and regression 2 in Table 4). When comparing regression 1 with regression 3 in the restricted sample, i.e. also adding controls for relative performance beliefs and risk preferences, the effect of female diminishes with another 43% of the original difference, and is no longer significant. Beliefs about relative performance account for 30% points and risk preferences for the remaining 13% points. This can be compared to the results reported in Niederle and Vesterlund (2007), who find that 27% of the gender gap in tournament entry in their sample can be attributed to differences in relative performance beliefs. In our setting, the three control variables thus account for about 70% of the gender gap found in regression 1. Including only beliefs about relative performance in the restricted sample, in addition to the gender dummy, renders the dummy insignificant and diminishes the coefficient on the dummy with more than 50%.

The gender gap in tournament choice in the verbal task is not significant, independent of whether we control for performance or not. Performance beliefs and risk taking are, as in math, positively related to choosing to compete in the verbal task.

---

14 Actual performance and beliefs about performance in the regression analysis is based on performance and relative performance beliefs in the second stage (the tournament). Using performance in the third stage instead of performance in the second stage does not qualitatively change our gender results. Since 14 participants were inconsistent in their choices in the risk task, the risk measure included here is the number of risky choices the participants make.
### Table 4. OLS regression, dependent variable: choice to compete in math (=1) or not (0)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Math (restricted sample)</th>
<th>Math (full sample)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Female</td>
<td>-0.191***</td>
<td>-0.140*</td>
</tr>
<tr>
<td></td>
<td>(0.062)</td>
<td>(0.077)</td>
</tr>
<tr>
<td>Performance</td>
<td>0.035***</td>
<td>0.014*</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>Beliefs</td>
<td>0.158***</td>
<td></td>
</tr>
<tr>
<td>Risk</td>
<td>0.057***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.045)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.380***</td>
<td>0.063</td>
</tr>
<tr>
<td></td>
<td>(0.055)</td>
<td>(0.087)</td>
</tr>
<tr>
<td>Observations</td>
<td>169</td>
<td>169</td>
</tr>
<tr>
<td>R-Squared</td>
<td>0.045</td>
<td>0.134</td>
</tr>
</tbody>
</table>

*p<0.10, **p<0.05, ***p<0.01. Robust standard errors in parentheses; 999 bootstrap repetitions 45 (2 school classes) participants were not asked to state their beliefs about second stage performance, one participant did not answer the risk question and one did not choose payment scheme.

*Risk is measured as the number of risky choices.

### Table 5. OLS regression, dependent variable: choice to compete in word (=1) or not (0)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Word (restricted sample)</th>
<th>Word (full sample)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Female</td>
<td>-0.056</td>
<td>-0.053</td>
</tr>
<tr>
<td></td>
<td>(0.089)</td>
<td>(0.085)</td>
</tr>
<tr>
<td>Performance</td>
<td>0.016***</td>
<td>-0.004</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>Beliefs</td>
<td>0.218***</td>
<td></td>
</tr>
<tr>
<td>Risk</td>
<td>0.061***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.041)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.359***</td>
<td>0.222**</td>
</tr>
<tr>
<td></td>
<td>(0.079)</td>
<td>(0.091)</td>
</tr>
<tr>
<td>Observations</td>
<td>167</td>
<td>167</td>
</tr>
<tr>
<td>R-Squared</td>
<td>0.003</td>
<td>0.02</td>
</tr>
</tbody>
</table>

*p<0.10, **p<0.05, ***p<0.01. Robust standard errors in parentheses; 999 bootstrap repetitions 45 (2 school classes) participants were not asked to state their beliefs about second stage performance, one participant did not answer the risk question and two did not choose payment scheme.

*Risk is measured as the number of risky choices.

### 3.2 Altruism
Girls are significantly more altruistic than boys in our sample of adolescents \((p=0.014)\). Girls give on average SEK 29 and boys SEK 23 out of SEK 50 to the charity that is the recipient in our dictator game, see Table 6.\(^{15}\)

### Table 6. Altruism.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Average donation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>107</td>
<td>23.20</td>
</tr>
<tr>
<td>Girls</td>
<td>109</td>
<td>29.32</td>
</tr>
<tr>
<td>p-value</td>
<td>-</td>
<td>0.014</td>
</tr>
</tbody>
</table>

#### 3.3 Risk preferences

Analyzing the incentivized risk task we corroborate most previous findings that boys are more risk taking than girls. The average certainty equivalent to the lottery with equal probabilities of winning 100 and 0 is 45.2 for boys. For girls the certainty equivalent is significantly lower, 37.1 \((p=0.002)\).\(^{16}\) Our second measure of risk taking, self-reported risk propensity, supports this pattern. On a scale from 0 to 10 boys rated their average risk propensity to 6.15, whereas girls averaged on 5.59 \((p=0.026)\). Our two risk measures are significantly positively correlated (Spearman’s rho=0.219, \(p=0.002\)).

### Table 7. Risk preferences.

<table>
<thead>
<tr>
<th></th>
<th>N*</th>
<th>Average certainty equivalent</th>
<th>N</th>
<th>General risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>103</td>
<td>45.22</td>
<td>107</td>
<td>6.15</td>
</tr>
<tr>
<td>Girls</td>
<td>98</td>
<td>37.12</td>
<td>109</td>
<td>5.59</td>
</tr>
<tr>
<td>p-value</td>
<td>-</td>
<td>0.002</td>
<td>-</td>
<td>0.026</td>
</tr>
</tbody>
</table>

*One girl did not participate in this part and 14 participants (10 girls) made inconsistent choices (the gender difference is not significant: \(p=0.102\)).

#### 3.4 Summary of results

In sum, we find no gender gap in performance change when our participants are forced to compete. Boys and girls are equally likely to choose to compete in a verbal task, but boys are significantly more likely to choose to compete in a mathematical task. However, this gender difference diminishes and becomes insignificant when we control for relative performance.

---

\(^{15}\) A correlation analysis between all the behaviors we examine also shows that altruism is positively related to risk taking (as number of risky choices) in the incentivized risk task \((p<0.001)\), but not in the self-reported question. We also find no correlation between altruism and competitive choices \((p=0.255\) for math and \(p=0.479\) for word). A similar pattern is found among boys and girls separately. See appendix table A1. Our regression results do not change if we include altruism as a control variable.

\(^{16}\) The result is qualitatively similar when analyzing the number of risky choices instead of the switching point in order to include individuals that switch back and forth between the lottery and the safe points. Girls are still less risk taking compared to boys \((p=0.007)\). Moreover, there is no gender difference in the variance of incentivized risk taking \((p=0.210)\).
beliefs. We also find that among adolescents, girls give more in a dictator game where the recipient is a charity, and that boys are more risk taking than girls.

4. Discussion

In this study we look at how gender differences in competitive preferences among adolescents vary with the gender association of the competitive domain. In addition we explore altruism and risk preferences. Gender differences in preferences are one potential explanation to the often observed gender gap in labor market outcomes. We study adolescents since it is a period that has received little attention in previous literature at the same time as it is a period during which many important decisions are made that can have lifelong consequences. At the same time, adolescence is a period of important physical and social changes that are partly gender specific. If gender dissimilarity in competitive domains arises already during adolescence, it may have important effects on educational segregation and consequently labor market outcomes through occupational segregation and the gender wage gap.

Previous results indicate that adolescence is a critical period for the emergence of gender differences in competitiveness, and that changes that occur during this period are related to gender specific cultural aspects (e.g. Anderson et al. 2012). There are thus far only a handful of studies on gender differences in preferences among children, but the results suggest that at younger ages in contrast to older ages, the competitive task and its gender association does not matter for boys’ and girls’ competitive choices and performance. This raises the question: at what age does the task become important? Our results suggest that adolescence is that age period.

This study is the first to investigate the importance of the gender association of competitive tasks among teenagers aged 16-18 years old. Previous literature shows that gender differences in competitiveness exist among adults in areas such as spatial and mathematical tasks, whereas a gender gap is not often found in tasks that are more associated with females, such as verbal tasks. We find no gender difference in performance change in either a mathematical task or a verbal task, comparing performance in a forced tournament to performance in a piece-rate scheme. However, female participants in our sample are significantly less likely than male participants to self-select into a competitive setting in the mathematical task, whereas there is no gender difference in the verbal task. Our results are thus in line with what is typically found among adults. An optimality analysis suggests that boys and girls should enter the competition at comparable rates also in the math task.
The gender difference in the choice to compete in the mathematical task is economically relevant, with a proportion more than twice as large among boys as among girls. This gender difference arises due to girls competing significantly less in the mathematical task than in the verbal, whereas boys enter into competition at similar rates across tasks. However, the gender gap in self-selection into a competitive setting in the mathematical task diminishes and becomes insignificant when we control for actual performance and relative performance beliefs, or beliefs only, suggesting that other factors than preferences for competition per se drives this result. We further find that adolescent girls are more altruistic and less risk taking than adolescent boys, corroborating the general findings on adults as well as some studies on children and adolescents. Including risk preferences and altruism as control variables do not change our results on competitiveness.

To what extent our results are generalizable to adolescents in other countries and settings are not clear, in particular since Sweden typically scores very high on gender equality compared to many other countries (Hausmann et al. 2010). More research is needed in order to establish when and why gender differences in preferences arise. For example, biological variables may play a role. Adolescence is associated with hormonal changes in both boys and girls, and there is a burgeoning literature in economics suggesting that hormonal variables may affect economic decision making (e.g. Kosfeld et al. 2005, Apicella et al. 2008, Sapienza et al. 2009, Branas-Garza and Rustichini 2011, though see Zethraeus et al. 2009). How biological variables influence the gender gap in preferences among adolescents would thus be interesting to explore in future work.

In sum, our results underline the importance of studying adolescents when trying to understand gender differences in preferences, as well as the significance of using tasks with different gender stereotypes while including actual performance as well as performance beliefs when studying competitiveness.

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Tom Hedelius Foundation, the Swedish Council for Working Life and Social Research (FAS) and the Carl Silfvén Foundation is gratefully acknowledged.

References


Appendix

These are example exercises, of a similar type as the participants encountered during the study.

Example math exercise: \[10 + 83 + 56 = \_\_\_\_\_\_\_\_\_\]

Example word puzzle:

\[
\begin{array}{cccc}
H & U & N & D \\
E & T & A & T \\
U & \ddot{A} & T & S \\
M & V & T & O \\
S & O & I & A \\
\end{array}
\]

Table A1. Correlation matrix between altruism, risk preferences and competition

<table>
<thead>
<tr>
<th></th>
<th>Altruism</th>
<th>Math choice</th>
<th>Word choice</th>
<th>Number of risky choices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altruism</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math choice</td>
<td>0.153</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.118</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Word choice</td>
<td>0.008</td>
<td>0.113</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.935</td>
<td>0.252</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of risky choices</td>
<td>0.270</td>
<td>0.267</td>
<td>0.171</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>0.005</td>
<td>0.006</td>
<td>0.082</td>
<td></td>
</tr>
<tr>
<td>Self-reported risk</td>
<td>-0.018</td>
<td>0.249</td>
<td>0.093</td>
<td>0.214</td>
</tr>
<tr>
<td></td>
<td>0.796</td>
<td>0.000</td>
<td>0.177</td>
<td>0.002</td>
</tr>
</tbody>
</table>