Stockholm School of Economics
Department of Economics
Master's Thesis

Gender and Competitiveness

An experimental study

Abstract
Recent experimental economic research often shows that men are more eager than women to compete. In our study on Swedish secondary school students we find that this gender difference is task dependant. Moving from a task perceived by the subjects as male to a task perceived as female changes the patterns in competitive behaviour. We therefore conclude that it is hard to draw general conclusions on gender differences in competitiveness from experimental research on specific tasks. These findings also support the idea that competitive behaviour could be changed through changing people's perception of what is male and what is female.

Key words: Gender Differences, Competition, Behavioural economics

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1. Introduction

Gender issues in the labour market have been a widely debated topic and even after decades of progress several systematic gender differences remain in the Swedish labour market. The average Swedish woman earns 84 percent of the average man and women are heavily under-represented in leading position in public firms. In 2007, 98.3 percent of the CEOs and 82 percent of the board members in Swedish publicly listed companies were men. On lower levels men were over-represented in executive positions as well, holding 72 percent of *all* executive positions in the public and private sector (JÄMO 2007).

In neo-classical economic theory wages and other forms of perks and rewards, are set equal to the marginal productivity of labour, suggesting that the observed gender gap is due to differences in productivity. Historically, the nature of labour has been more physical and men might therefore have enjoyed advantages in the labour market. Due to culturally established differences in schooling and lower expectations of doing unpaid work at home men have also been able to invest more in education. It is therefore not too daring to say that men in the past may have been more productive in the labour market than women. However, this explanation is less likely to hold today when productivity is less connected to physical strength and there are no gender differences in education. Controlling for age, education, sector and participation in the labour market reduces the wage difference between men and women, but only to 92 percent (SCB 2009).

Rationale choice economists have explained the remaining difference with (1) discrimination, (2) gender differences in abilities not captured by level of education and job market participation and (3) gender differences in preferences (Niederle and Vesterlund 2005).

(1) Several economists have studied discrimination. In general the focus of economic discrimination research has been on what is known as statistical discrimination, presented simultaneously by Edmund Phelps (1972) and Kenneth Arrow. In an article on racial discrimination Kenneth Arrow (1998) defines statistical discrimination as:

> *"…the use of observable characteristics, race, as surrogates for unobservable characteristics which in fact cause the productivity differences".*

Assuming employers believe that men are more productive on average and that productivity is not an observable characteristic, it might be rationale for an employer to only hire men however small this difference in ability might be.[1] The theory of statistical discrimination increases the importance of studies on differences in abilities.

[1] Economists have received much criticism for legitimising discrimination through the theory of statistical discrimination e.g. SOU 2006:79. It is worth noting that economists only say that statistical discrimination is rational. According to rational choice theory an individual is rational if she, based on her beliefs, makes the decision that best suits her preferences. Whether these beliefs are true or false does not matter. Neither does the theory of statistical discrimination say anything about whether these preferences are just or fair.

(2) Studies on gender differences in abilities are not very conclusive, partly due to the complexity of defining ability. Often ability in the labour market is estimated with cognitive ability, measured in spatial or mathematical tests. In a meta-analysis of 100 studies, Hyde et al (1990) conclude that there is no average difference in mathematical ability. However, some studies suggest that there is a differences in the ability distribution between men and women with men having a higher variability, thus being more frequently represented both among the best and the worst performers. This could explain the male over-representation in executive positions (Benbow 1988).

(3) In recent years, several studies have been made to map and explain differences in preferences within the field of behavioural economics. The studies of preferences have generally focused on gender differences in three attributes namely *risk aversion*, *willingness to initiate negotiation* and *competitiveness*. If women are less prone to put themselves in competitive or risky positions than men this could have high explanatory value for the observed differences in positions on the job market.

In this thesis we try to estimate and explain gender differences in competitiveness in an experimental setting.

2. Previous research on competitiveness

In economic literature, competitiveness is usually measured in two ways: as the individual's change in performance in a competitive setting compared to a non-competitive setting and as an individual's willingness to self-select into competition. Both measures have been investigated in a small and relatively recent experimental literature.

2.1. Performance change

In a lab experiment on Israeli students, Gneezy et al. (2003) had their subjects solve mazes, some rewarded under a piece-rate payment scheme paying them after their absolute performance and some under a tournament payment scheme rewarding the highest performer. They found that men performed only slightly better than women under piece-rate payment. In the tournament setting however, men increased their performance significantly while the performance of women remained constant. In another experiment on French students, Datta Gupta et al. (2005) made similar findings.

Gneezy and Rustichini (2004) tested for this effect in a different environment. In a field study on 9-10 year old Israeli children, they measured the performance change between running 40 m individually and in pairs. They found that boys improved their performance in the competitive setting while girls did not. No monetary compensation was used to motivate the subjects; instead their behaviour was based on intrinsic motivation. Dreber et al. (2009) replicated this study on Swedish 8-10 year olds and found no gender differences in performance change.

2.2. Self-selection into competitive environments

In a very comprehensive experiment, Niederle and Vesterlund (2005) studied self-selection into competition in a population of American students. The participants solved simple math problems, first in a piece-rate payment scheme and then in a tournament where only the individual who solved the most problems in a group of four was compensated. In the third round the participants selected their preferred payment scheme, giving the authors two measures of competiveness. Both the subjects' performance change under competition but also the subjects' tendency to self-select into competition. Even after controlling for actual performance and the subjects estimation of their relative performance, a significant gender gap in the tendency to self-select into competition remained. Datta Gupta et al (2005) and Vandegrift and Brown (2005) carry out similar studies where the gender gap is significant as well.

Worth noticing is that some studies find men to select the competitive payment scheme more and women to select it less than what would be optimal for them, lowering both their personal expected pay-off as well as the total pay-off for the group as a whole (Niederle and Vesterlund 2005, Gneezy et al 2003). This suggests that more efficient outcomes can be reached not only by getting women to compete more but also by reducing the competitiveness of men.

2.3. Explanations

The decision to self-select into competition is not only an expression of your preference for competitive environments as such, but has several dimensions. It is often a decision whether to take risks or since you both have the chance of winning and the risk of losing. The decision builds on an assessment of your chance of winning which is an estimation of your relative performance and thus a sign of your (over)confidence. The decision is also influenced by your level of aversion against making someone else lose.

Gender differences in attitudes towards risk are well established from both field and experimental studies where women often are found to be more risk averse than men, see Jianakoplos and Bernasek (1998) Barsky et al (1997) and Levin et al (1988) among others. Similar gender differences in confidence have been established in several studies, e.g. Barber and Odean (2001) and Lundeberg et al. (1994). Results from studies on gender differences in other regarding behaviour, such as altruism and fairness, are less conclusive. All these factors have been proven to be important for explaining differences in men's and women's behaviour. Still they can't explain everything. In many studies a gender gap in the tendency to self-select into competition remains even after controlling for these factors.

But how could the above presented gender differences in behaviour be explained?

As always when explanations for gender differences are debated the explaining factors can be sorted into the categories of nature and nurture. Some research contributes the established behavioural differences to biology and human physiology

while others to social and cultural factors. Several studies suggest that hormone levels affect the subject's preferences for risk and competition. Apicella et al. (2008) found that financial risk-taking correlates positively with salivary testosterone and Mehta and Josephs (2006) found the same relationship between testosterone and the tendency to self-select into competition. However, a recent double-blind and randomized study by Zethraeus et al (2009) found no effect on economic behaviour of either testosterone or estrogen. Even though a hormonal explanation would support the importance of physiological factors it does not exclude social and cultural explanations. Hormonal levels are affected by the environment of the subject. Physiological factors such as hormonal levels can thus be an indicator of some cultural or social factor at play. Gray et al (2006) have studied how men's testosterone levels are affected by fatherhood, finding that paternal leave causes levels to drop.

Gneezy et al. (2009) conducted an experiment where they examined the competitive behaviour of men and women of the Maasai-people in Tanzania, a textbook example of a patriarchal society. In the experiment they found Maasai men to opt for competition to a higher degree than Maasai women. Later they conducted the same experiment on the Khasi-people in India, a matrilineal culture[2], finding the opposite results. Other studies have found differences in competitiveness between students from co-educational schools and students from single-sex school. In these studies single-sex education seem to have a positive effect on competitiveness making girls from single-sex schools just as likely to self-select into competition as co-educated boys (Booth and Nolen, 2009).

As mentioned above, the study by Gneezy and Rustichini (2004) was replicated on Swedish 8-10-year olds by Dreber et al (2009) finding no significant difference in competitiveness between boys and girls. Dreber et al suggests that this might be due to cultural differences between Sweden and Israel where Sweden in international comparisons is considered a significantly more gender equal country than Israel.[3]

2.4. Hypotheses

Previous experimental research has found that women tend to enjoy a lower performance increase than men under competition and are less prone than men to self-select into competition. The experiments vary in construction and control variables but the variety of the tasks the participants are evaluated on is relatively low. Most lab experiments use mazes or math problems and the field experiments conducted by Gneezly and Rustichini (2004) and Dreber et al (2009) uses running. Since previous research has shown that the environment as well as the society affects the gender gap in competitiveness, it seems reasonable to believe that the type of task performed affects

[2] In matrilineal societies lineage is traced through the mother and maternal ancestors. Even though it is different from a matriarchy it still places women in a systematic advantage. The simple reason to use a matrilineal society instead of a matriarchy is that there are no known matriarchal societies.
[3] Global gender gap report 2009 lists Sweden as the world's 4th and Israel 45th most gender equal country (UN 2009).

the behaviour. Math and running are often seen as activities where men perform better while maze-solving would possibly be considered to be more gender neutral.

Even though Hyde et al. (1990) showed that there is no gender difference in average math ability research suggest that there is a stereotype of men having higher math ability (Inzlicht and Ben Zeev, 2000; O'brien and Crandall, 2003).

In a study by Spencer, Steele & Quinn (1999) where subjects were asked to solve math problems, it was shown that the performance of women fell when the subjects were informed before taking the test that women normally underperform in this test. In fact, Schmader (2002) found that just asking the subjects to state their gender had a negative impact on the result of female subjects.

In order to estimate the effect of the gender classification of the task performed, Dreber et al (2009) also let the 8 to 10-year-olds compete in dancing and skipping rope, two tasks where there is a positive stereotype regarding female ability. But no difference in competitiveness of girls and boys on neither running nor skipping rope was found. Dreber et al however conclude that "*making inferences about adult behaviour from findings on children is not straight forward*" and that behavioural patterns can be established later on through socialization or the "*hormonal surge*" in the teenage years.

Based on this reasoning, we set out to investigate the gender differences in competitiveness through an experimental study on Swedish 16-18 year old secondary school students. We want to decompose any possible difference in behaviour between the sexes and see how behavioural differences could be understood in the light of economic theory. As we are interested in estimating how gender differences in competiveness are affected by the task at hand we design an experiment where competitiveness can be compared between the most common task in previous research, solving math problems, and a task we expect to be more gender neutral, solving word puzzles.

Since research underlines the importance of socialization on the gender gap in competitiveness, we expect the differences in competitiveness to vary depending of the gender classification of the task performed. We expect boys to compete more in tasks perceived by the subjects as being more "boyish" and girls to compete more in tasks perceived as being more "girlish". If this hypothesis holds it motivates criticism of the methodology used in previous studies in this field.

3. Experimental design

The design of our experiment follows Niederle and Vesterlund (2005) to a large extent with the main difference being that our subjects are given two different tasks to solve. In the first part of the experiment, the subjects are asked to solve math problems similar to those in Niederle and Vesterlund (2005) and in the second part they are asked to complete word puzzles. In the third part of the experiment, the participants answer a

number of questions designed to give us a measure of their risk aversion, altruism and other control variables. The subjects are informed that they will receive payment for one of the three parts, chosen at random.

Part one and two – solving math problems and word puzzles

In the math part of the experiment, the participants are asked to calculate the sum of three two-digit numbers. The participants are given two minutes to solve as many as possible of the 47 problems handed to them. They are not allowed to use calculators but have paper for making calculations at their disposal. The problems can be solved in any order.

Example of a problem from the math part

10 + 83 + 56 =_____

In the word puzzle part the participants are given two minutes to find as many words as possible in a 13x13 table of letters. Words can be formed in any direction and must consist of at least three letters. The participants are asked to mark the words they find by circling them.

Example of a word puzzle

L	**Ö**	**T**	**H**	**X**	**C**	**Y**	**H**	**R**	**H**	**T**	**T**	**P**
Ä	**O**	**E**	**U**	**R**	**O**	**P**	**A**	**V**	**K**	**S**	**O**	**M**
N	**P**	**H**	**B**	**R**	**M**	**K**	**P**	**K**	**E**	**Ö**	**S**	**C**
D	**E**	**U**	**Ö**	**E**	**Y**	**I**	**A**	**F**	**M**	**M**	**E**	**G**
E	**R**	**A**	**G**	**N**	**Å**	**S**	**K**	**U**	**G**	**Ö**	**N**	**T**
R	**A**	**Ä**	**M**	**O**	**X**	**L**	**S**	**R**	**S**	**Ä**	**M**	**Ä**
F	**F**	**X**	**U**	**T**	**O**	**I**	**N**	**L**	**O**	**Ö**	**E**	**V**
E	**I**	**D**	**V**	**F**	**K**	**M**	**E**	**P**	**A**	**F**	**L**	**L**
S	**N**	**Ä**	**M**	**A**	**R**	**E**	**M**	**A**	**K**	**N**	**O**	**I**
E	**A**	**L**	**L**	**Å**	**H**	**R**	**E**	**D**	**N**	**U**	**D**	**N**
F	**L**	**I**	**E**	**R**	**A**	**R**	**G**	**E**	**S**	**G**	**I**	**G**
J	**S**	**Ä**	**Q**	**H**	**S**	**C**	**H**	**L**	**A**	**G**	**E**	**R**
K	**Z**	**Ä**	**Ö**	**A**	**R**	**T**	**I**	**S**	**T**	**E**	**R**	**L**

Each task is performed three times under different compensation schemes. The subjects are informed that if the first or second part of the experiment is selected for payment, only one of the three rounds will be randomly selected for determining the level of compensation. This way, we hope to make the subjects consider each round independently.

In the first round of each part, the subjects are paid according to a set piece-rate compensation scheme. If any of these rounds are selected for payment, the subjects receive 3 SEK per math problem solved or word found.

In the second round, the subjects are paid according to a tournament compensation scheme. Each subject's result is matched with three randomly chosen results from the first round. This procedure is not visible to the subjects in any way. Thus they only have information on their absolute performance, and no information on their relative performance. If this round is selected for payment, subjects that have solved more problems or found more words than the results they are matched with get paid 12 SEK per math problem solved or word found.

Before the start of round three, the subjects get to choose if they in the coming round should be paid according to the set piece-rate payment scheme of the first round or the tournament payment scheme of the second round. If they select tournament payment, their results will be matched with three random results from round two. This way the choice of tournament in round three will have no impact on the other subjects' payoffs.

After the subjects have completed all three rounds they are asked to assess their performance relative to the other participants.

Part three – gender classification of tasks, risk attitudes and altruistic behaviour

The third and final part of the experiment is a survey, designed to provide us with complementing data.

The subjects are asked of how they would gender-classify each task in the previous parts. Each subject state how they perceive competing in math and word puzzles respectively on a scale 0-10, where 0 is "very boyish" and 10 "very girlish" (the words "pojkaktigt" and "flickaktigt" are used in the study).

We also try to estimate the subject's attitude towards risk both by asking them to assess their attitude towards risk on a scale from 0 to 10 but also by letting them make several choices between a fixed amount of money, from 20 SEK to 75 SEK, and a 50 percent chance of winning 100 SEK. We then used the lowest fixed amount chosen by the subject as a measure of the subject's attitude towards risk. The question can be found in Appendix A.

Some studies suggest that pro-social preferences, such as altruism and inequality aversion, to a higher degree are found among women (Eckeland Grossman, 1998; Dufwenberg and Muren, 2004) this could limit women's tendency to compete since winning often means making someone else lose. Therefore the experiment is designed so that the individual's performance will not affect the pay of any other participant. But to be able to control for any remaining effects established through the subjects previous experience of competition and competitive environments we want to estimate the participants' altruistic behaviour. This is done by letting the participants play a dictator game where they are asked to allocate 50 SEK between themselves and a Swedish charity organisation (Rädda barnen). Their distribution is anonymous so there should not be any personal gain in increased social esteem from giving money. This approach is based on previous research, both Hoffman et al (1996) and Eckel and Grossman (1996) use the dictator game to study "other regarding behaviour" (altruism or fairness), the

latter with charitable organisations as receivers. This question can be found in Appendix B.

In the end of part three we also ask several questions on social factors that could influence behaviour such as age, month of birth, number of siblings and upper primary school grades.

Through this experimental setting we can observe the subjects' performance increase in a competitive setting as well their tendency to opt for competition depending on gender and task while controlling for their risk attitude, altruism, actual performance, perceived performance and social factors.

4. Statistical model

We are interested in estimating the effect of several variables on a binary outcome variable, the decision to self-select into competition, that is equal to one if the participant chooses the tournament payment scheme and zero otherwise. In this setting a linear regression model has several disadvantages. The two most important are that the fitted values can exceed one or be less than zero and that the partial effect of each explanatory variable is constant (Wooldridge 2001).

To avoid these problems we decided to use a binary response model of the form:

$$P(y = 1 \mid \boldsymbol{x}) = G(\boldsymbol{x\beta}) = p(\boldsymbol{x})$$

Where y is a binary dependent variable, $\boldsymbol{x}$ is a vector of the explanatory variables and $0 < G(\boldsymbol{x\beta}) < 1$. The two most commonly used binary response models are the probit, where G is the standard normal cumulative density function (CDF) and logit where G is the standard logistic CDF. We decided to use the probit as this is the model favoured by most economists today (Wooldridge 2008). In practice the two models usually give very similar results. Thus, in the probit model:

$$g(z) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}z^2}$$

The model is then estimated using maximum likelihood estimation. As the model is non-linear, interpretation of the reported coefficients is less straightforward than for linear models. For a continuous variable x_j, its partial effect on $\boldsymbol{p(x)}$ is given by:

$$\frac{\partial p(\boldsymbol{x})}{\partial x_j} = g(\boldsymbol{x\beta})\beta_j$$

In other words, the partial effect depends on the values of $\boldsymbol{x}$. For this reason, we report the marginal effects evaluated at the average $\overline{\boldsymbol{x}}$ in the result section. That is, $g(\overline{\boldsymbol{x}}\boldsymbol{\beta})\beta_j$. For dummy variables we report $\partial p / \partial x_j$ for a change in the dummy variable from zero to one at otherwise average values of $\boldsymbol{x}$.

5. Results

The study was carried out on 210 students from six schools in Stockholm, Uppsala and Västerås.

5.1. Gender classification of the tasks

To see how the participants considered the gender classification of the two tasks, they answered a number of survey questions. The survey was taken at the end of the experiment to make sure that the subjects' performances not were influenced by the questions. They were asked to classify both tasks on a scale of 0-10, 0 being "very boyish" and 10 "very girlish". The mean classifications are reported below along with the two-tailed p-value from a t-test of equal means.

Table 1: **data from survey question of gender classification of tasks**

	Math	Word puzzles	p-value
Male participants	4.82 (.978)	5.16 (.968)	.0037
Female participants	4.79 (.689)	5.28 (.958)	.0003
All participants	4.80 (.842)	5.22 (.963)	.0000

The results indicate that both male and female participants consider math more boyish than word puzzles. The magnitude of the difference is relatively small but statistically significant and approximately equal for both genders.

5.2. Gender differences in performance

In the first part of the experiment, the participants are asked to perform the two tasks under a set piece-rate compensation scheme. This allows the participants to gain some understanding of the task and their absolute performance. It also allows for us to observe gender differences in a non-competitive setting.

The mean results are reported below along with the two-tailed p-value from a t-test of men and women's means being equal.

Table 2: **data on performance in round one for both tasks**

	All	Men	Women	p-value
Math problems solved	8.01 (3.81)	8.68 (4.02)	7.34 (3.48)	.0109
Words found	8.93 (3.44)	8.85 (3.23)	9.02 (3.66)	.7175

Figure 1: **Results from math round 1**

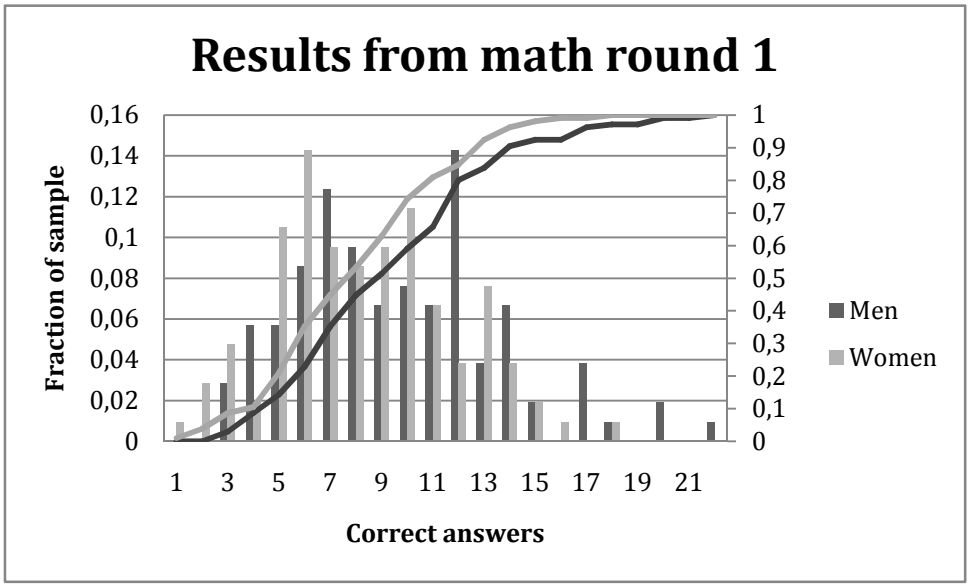
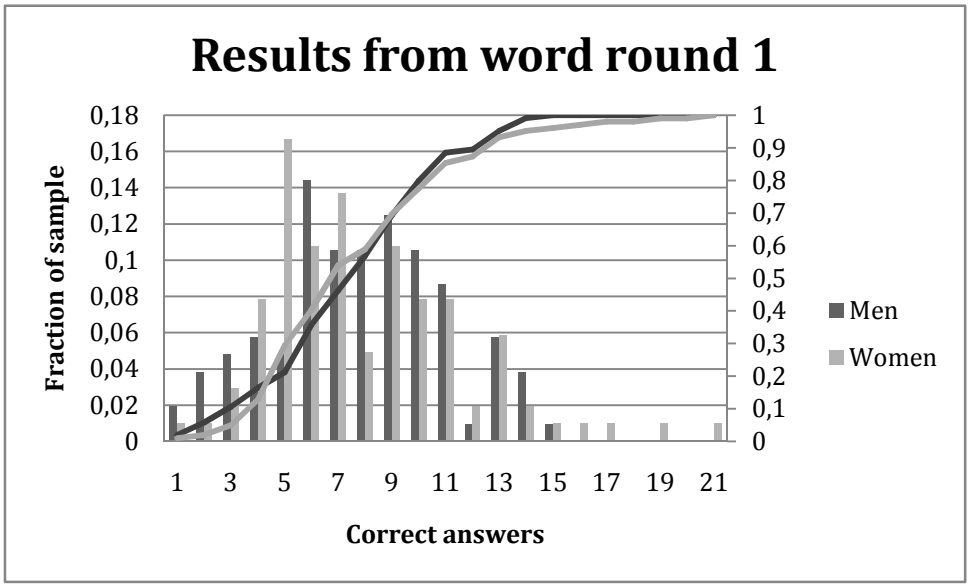


Figure 2: **Results from word puzzles round 1**



The results from the gender classification, as well as the performance in the first round show that the tasks we have chosen for our study are relatively well selected. The tasks are perceived as gendered with math having a positive male stereotype and word puzzles a positive female stereotype. However, while men on average outperform women in math there is no significant difference in performance solving word puzzles.

5.3. Performance change

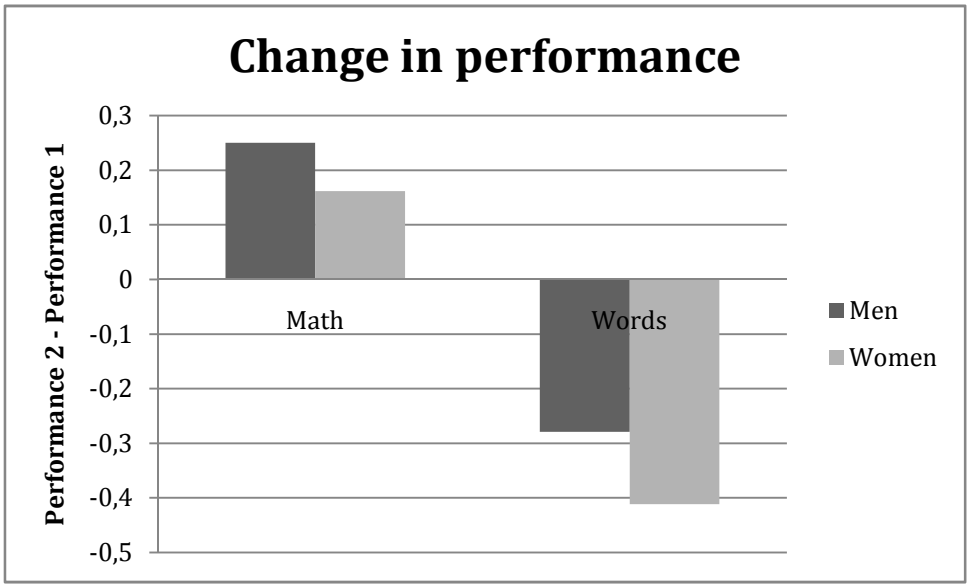
We want to examine the subjects' responsiveness to the competition stimuli observed as the change in performance when moving from a non-competitive to a competitive environment. Comparing the results from round one, where the participants are paid after the piece-rate scheme, and round two, where the participants are paid under the tournament compensation scheme, we get a combined measure including three effects:

i) The subject's reaction to the competition stimuli, in other words the performance change from being in a competitive environment. This is the effect we would optimally like to estimate.

ii) Learning and fatigue effects. Since the subject completes the task twice, she is likely to have a better understanding of the task the second time, increasing her performance. On the other hand, fatigue effects may work in the other direction.

iii) Differences in difficulty. Even though the tasks were chosen to be equally challenging, there may still be differences in difficulty affecting the observed performance change.

Figure 3: **Change in performance between round 1 and 2**



We observe a positive performance change in the math results and a negative performance change for the word puzzles. The latter result seems unintuitive and our best explanation is that our second word puzzle has a higher difficulty level than the first

one. The puzzles were taken from the site www.lektion.se and said to be of the same difficulty level although this is of course not scientifically established. However, the change in difficulty is the same for all participants and should thus not have any effect when comparing the performance change conditional on gender.

Table 3: **Change in performance between round 1 and 2**

	Men	Women	p-value
Change in math performance	.250 (2.80)	.162 (2.58)	.8131
Change in word performance	-.279 (3.72)	-.412 (3.30)	.7867

For both tasks, the magnitude of the effect is relatively low and we observe no significant gender difference in performance change.

5.4. Self-selection into competition

After performing the task under the two payment schemes, the participants are allowed to choose their preferred payment scheme for the last round. This gives us a measure of the participants' willingness to self-select into competition. As stated in the diagram below, we found that men to a higher degree than women chose the tournament payment scheme in round three of the math part. No significant gender difference was found in the tendency to self-select into competition in the word puzzle part.

Figure 4: **Proportion choosing competitive payment for round 3**

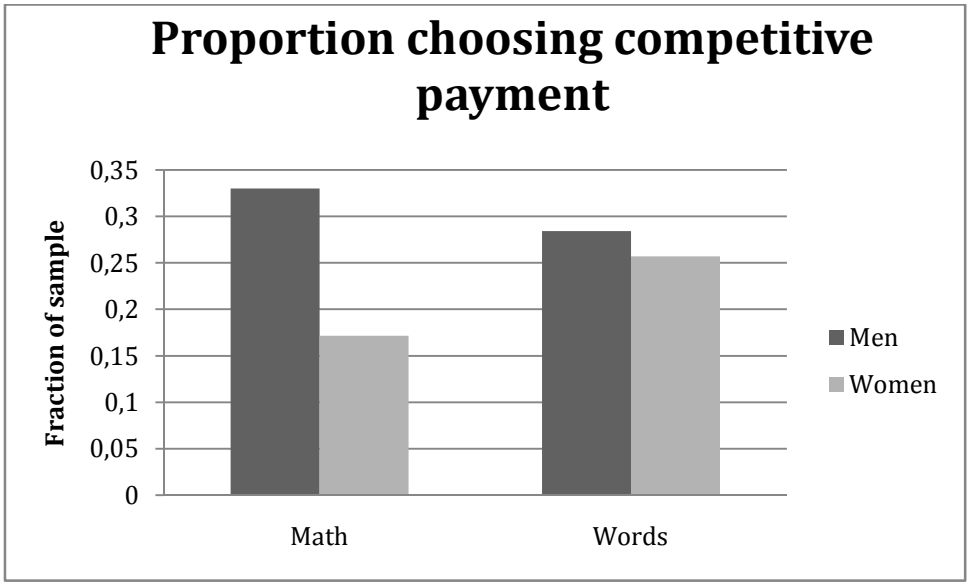
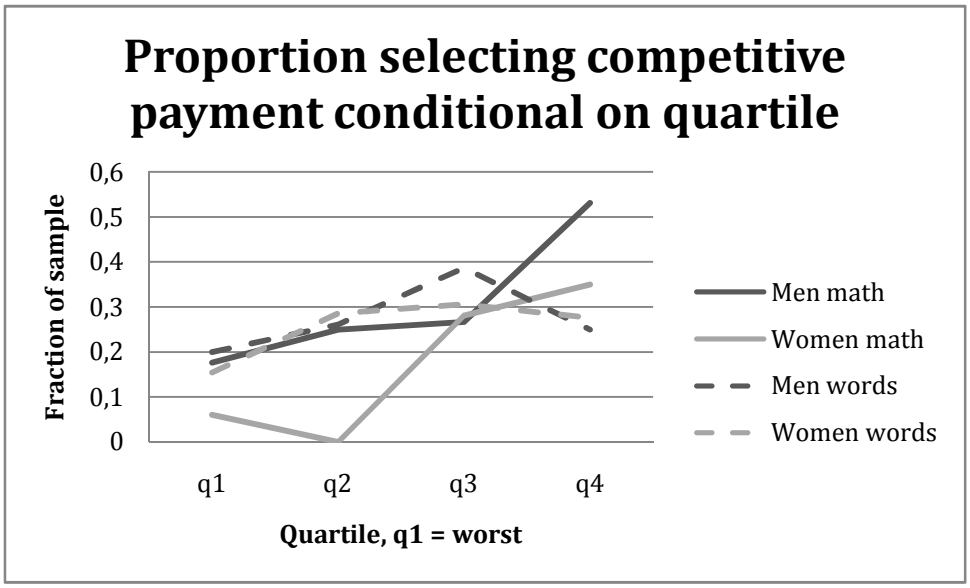


Table 4: **Proportion choosing competitive payment**

	Men	Women	p-value
Fraction of the sample choosing competitive payment -math	.330 (.473)	.171 (.379)	.0081
Fraction of the sample choosing competitive payment -word	.284 (.453)	.257 (.453)	.6618

Since men performed better on the math part, this is an expected result. In order to tell whether the observed gender difference can be fully explained by previous results, we look at competition choice conditional on round two results. A quick comparison between how men and women in the different quartiles of the sample acted is presented below.

Figure 5: **Proportion choosing competitive payment conditional on quartile**



The results from the word part show no indication of gender differences in competition choice. Conditional on their performance quartile in round two, fairly equal fractions of men and women self-select into competition. The results from the math part tell a different story. In three of the quartiles, men show a much higher tendency to self-select into competition. This can have several explanations such as gender differences in risk attitude (since the expected payoff from the piece rate scheme is less volatile than from the tournament scheme), believed relative performance or other factors. To be sure of anything we need to run some regressions.

5.5. Control Variables

We wanted to use a probit model to estimate the probability of an individual selecting into competition, and see if gender had any significant effect. To isolate the effect of

gender we control for several factors. Descriptive statistics of the control variables can be found in the appendix.

Performance in round two

A high performing individual should, if she is rational, select into competition to a higher degree than a low performing individual.

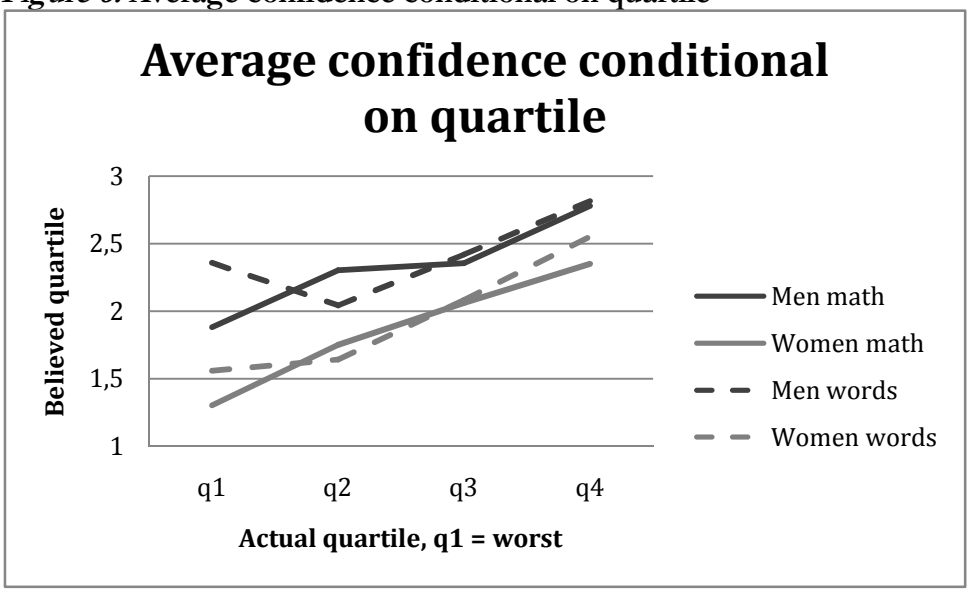
Performance change = (round two performance – round one performance)

Using data on the subjects' performance change from round one to round two allows us to control for learning effects. Subjects that increase their performance when repeating the task should be more likely to self-select into competition.

Self-reported relative performance in round two

A participant should be more likely to select the tournament payment scheme if she believes her relative performance to be high. We let the participants place their performance in round two in the quartile they believed to belong to and use this as a measure of believed relative performance. This measure might be noisy since people may be influenced by social conventions regarding modesty or bragging even though they remain anonymous throughout the study.

Figure 6: **Average confidence conditional on quartile**



As shown above men are far more confident than women assuming they state their actual beliefs. The graph should be interpreted with caution when trying to say something about the level of over- or under-confidence of men and women. For the lowest quartile there is an upward bias in confidence and a downward bias for the highest quartile since the respondents had to choose a quartile between one and four.

Altruism

As stated in the previous research section, pro-social behaviour and preferences for altruism or fairness could have a negative effect on competitiveness since winning often includes making someone else lose. When interviewing participants on their attitudes to competition we got responses like *"I like to compete. It's fun to win and depress someone else"*.

This supports the idea of a negative effect of pro-social behaviour on competitiveness. Although the design of the experiment is "altruism-proof", effects of altruism may still be present due to behaviour being based on bounded rationality such as rules of thumb or trial-and-error rather than an exact assessment of the current situation. As mentioned above, this value was taken from the dictator game in the survey. We transformed the amount given to charity to a 0-10 scale where an individual who did not give any money to charity is given the value 0. The mean value for women is significantly higher, 5.79, than for men, 4.58 (p=.0205 for a two-tailed t-test on equal means).

Preference for risk
Since the payoff from the piece rate scheme is less volatile than the payoff from the tournament scheme, attitudes towards risk might affect to what extent the participant self-selects into competition. This value is the average of the self-reported risk attitude and the turning point in the game of chance, when the participant decided to take the fixed amount rather than flip a coin. It is measured on a 0-10 scale where a lower value means more risk aversion. In our sample women are more risk averse than men with a mean of 4.35 and 5.01 respectively. The difference is highly significant, p=.0048 for a two-tailed t-test on equal means.

Year
What year of school the subjects attend might influence the result if gender differences are established over time.

Number of siblings
Behaviour can be related to the extent of social interaction the individual has been engaged in. The composition of the family might thus affect the participant's behaviour.

Programme
What programme the student attends might play an important role. Among else it can influence the expectation of the performance of other students. Students attending a natural science programme might have too high expectations of other students' math ability and students attending a physical education programme might be more competitive than others. Thus we have included dummies to control for fixed program effects, using social studies as base group.

5.6. Regression results

Running four regressions we get results as presented in the table below. The base case participant is a male enrolled in a social studies programme.

Starting by analysing the results from regression (1) we see that women compete less than men in math, even after controlling for performance. The gender difference is statistically significant (p=.064) and relatively large in magnitude. Comparing a woman with mean values on all control variables with a similarly average man, the woman is 11.3 percentage points less likely to self-select into competition.

The men in our sample have a higher preference for risk as well as a higher believed performance on average. Both these factors are believed to increase an individual's willingness to self-select into competition and should therefore explain part of the gender gap found in (1). In our second regression we include these variables as well as the other control variables previously mentioned.

Table 5: **Regression results**

	(1)	(2)	(3)	(4)
Dependent variable:	Math competition	Math competition	Word competition	Word competition
Independent variable:	choice	choice	choice	choice
Female (d)	**-.379***	**-.472***	-.0818	.166
Std error	(.205)	(.256)	(.188)	(.252)
dp/dx	-.113	-.124	-.0270	.0499
Performance round 2	**.125*****	**.101*****	.0279	.0132
Std error	(.0289)	(.0354)	(.0234)	(.0370)
dp/dx	.0374	.0266	.00920	.00396
Performance change		.000595		-.0225
Std error		(.0477)		(.0391)
dp/dx		.000156		-.00676
Confidence, round 2		**.416*****		**.690*****
Std error		(.138)		(.151)
dp/dx		.109		.207
Altruism		**.0938*****		.0558
Std error		(.0350)		(.0342)
dp/dx		.0246		.0168
Preference for risk		**.171****		**.169****
Std error		(.0781)		(.0699)
dp/dx		.0450		.0509
Year of study		-.204		**.365****
Std error		(.220)		(.183)
dp/dx		-.0536		.110
Number of siblings		-.0475		-.0180
Std error		(.102)		(.0808)
dp/dx		-.0125		-.00542
Up. primary school grades		.00007		-.00326
Std error		(.00314)		(.00278)
dp/dx		. 0000184		-.000981
Physical education (d)		**-1.08****		.532
Std error		(.426)		(.426)
dp/dx		-.174		.183
Hotel and restaurant (d)		.553		.431
Std error		(.399)		(.357)
dp/dx		.172		.144
Natural sciences (d)		-.553		**-.918****
Std error		(.411)		(.409)
dp/dx		-.117		-.200
Constant	**-1.60*****	**-2.73*****	**-.814*****	**-2.75*****
Std error	.311	.888	.244	.802
Pseudo R-squared	.119	.270	.0063	.196

**** p<.01, ** p<.05, * p<.10, Robust standard errors*

Adding the control variables increases the estimated gender gap to 12.4 percentage units and it is still significant on the ten percent level (p=.066).

As predicted several of the control variables are significant. But the control variables do not explain the whole difference in behaviour between women and men. Still we find a large gender effect, which is not explained by our other variables.

Continuing with regressions (3) and (4). We found no significant difference in competitiveness in word-puzzles between women and men when controlling for performance. Nor do we find any differences in competitiveness when using all our control variables.

The effect of the control variables

Overall, the effect of the control variables is as we expected. In both tasks, highly confident and risk-liking individuals are more likely to self-select into competition. Actual performance is however only significant for the math part of the experiment. This is perhaps suggesting that the participants find it more difficult to assess their relative performance based on their absolute performance in the word task.

The effect of our approximation of the participants' altruism demands some special attention. In the math regression, altruistic behaviour is positively correlated with the tendency to self-select into competition. Since previous research suggests that pro-social behaviour have a negative effect on competitiveness this is not what we expected. Our best explanation for this is that the altruism variable also captures some other variable correlated with the altruistic behaviour. One possibility is that altruism is correlated with the subject's family income, something we have not been able to control for. Possibly students from high income families can afford to give more money to charity. At the same time they might value small income streams lower than low-income students. Therefore they rather compete for higher pay than go for a lower, but certain payoff. Possibly this hypothesis is strengthened by the fact that altruism is correlated with high preference for risk (ϱ=0,23). Until we are able to control for income level, this is of course just speculation.

When estimating the model without the altruism variable, the gender dummy is no longer significant on the ten percent level for either task (p-value = .189 for the math task). The results are included in the appendix.

5.7. Comparison with Niederle and Vesterlund (2005)

As mentioned, our experimental design draws on Niederle and Vesterlund (2005). Comparing our results from the math part with their, we find both similarities and differences.

Looking at the performance change of the subjects when going from the piece-rate payment scheme to the tournament payment scheme, Niederle and Vesterlund, like us, find no difference in how men and women improve their results.

In our first attempt to look at the difference between men's and women's tendency to self-select into competition, regression (1), we only use the subject's gender and performance in round 2 to explain the choice of compensation scheme for round 3. Doing this we find both gender (p-value=0.064) and performance in round 2 (p-value=.000) to be significant explanatory variables. In Niederle's and Vesterlund's study a similar regression only found gender to be a significant explaining variable (p-value=.01).

Furthermore Niederle and Vesterlund find both women and men to be overly optimistic of relative performance but the over-confidence to be more persistent with men than women. In our study 20 % of the male participants were overly confident concerning their relative performance in the math part while only 12% of women were over-confident. At the same time many men and women were heavily under-confident (47 % and 48 % respectively), a result not picked up by Niederle and Vesterlund.

The differences in results between our study and the study conducted by Niederle and Vesterlund can either be based on differences in experimental design or differences in the population from which the sample is drawn.

Cultural factors may produce some differences. Possibly the well-known Swedish modesty could explain the difference in confidence (or stated confidence) between our sample and Niederle's and Vesterlund's sample of American university students.

5.8. What about the total gender gap?

So far our analysis has mainly focused on gender difference in competitiveness that we observe after controlling for a number of factors, that is the estimated coefficient on the female dummy. However, as we established earlier, a number of our explanatory variables varies with gender. Women are for instance more risk averse than men and enjoys a lower level of confidence on average, attributes that have a negative effect on competitiveness in our model. This implies that we need to discuss several different gender gaps, the gender gap captured in the dummy, as well as the gender gaps captured in the other explanatory variables.

To further investigate this, we use the third probit model from the math part of the experiment. In order to get a measure of each variable's influence on the estimated probability, we change the variable values from the female mean to the male mean one at the time and calculate the corresponding change in probability. This gives us a measure of how gender differences in the explanatory variables influence the estimated probability.

Table 6: **Composition of total gender gap**

	Effect	Female mean	Male mean	Effect on probability
Female (d)*	-	1.00	0.00	.110
Performance, task 2***	+	7.50	8.98	.0293
Performance change	+	.162	0.25	.000009
Confidence, task 2***	+	.819	1.40	.0498
Altruism***	+	5.79	4.58	-.0188
Preference for risk**	+	4.35	5.02	.0217
Year of study	-	1.87	2.00	-.00477
Number of siblings	-	1.90	1.63	.00228
Up. primary school grades	+	242	243	.000009
Physical education (d)**	-	.0667	.0762	-.00182
Hotel and restaurant (d)	+	.171	.0571	-.0108
Natural sciences (d)	-	.0571	0.162	-.00995
Total gender gap				**.167**

As seen in the table above, the unexplained gender gap is actually lower for the average woman in our sample (11.0 percentage points) than when estimated for the average subject (12.4 percentage points) as reported in *Table 5*. This is due to the non-linearity of the model where the partial effect of one variable depends on the value of the other variables. Some of the other variables tell a different story however. While the difference in average performance increases the total gender gap with 2.93 percentage points, the difference in average confidence adds another 4.98 percentage points. Lower preference for risk increases the total gap while higher altruism decreases it.

Apart from the unexplained gender effect, the difference in confidence is the biggest contributing factor to the gender gap in competitiveness, with differences in performance and preference for risk coming in as the third and fourth most important factor. These findings can be quite interesting from a policy maker's perspective.

6. Discussion

6.1. Analysis of the results

In our results we find that men are more prone to self-select into competition when competing in math but we find no significant gender difference when it comes to compete in solving word puzzles. Although these results should be taken lightly due to relatively low significance and limited understanding of the altruism variable, the results are in line with our original hypothesis. Gender classification of the task at hand seems to influence the level of competitiveness of men and women. Put more specifically, for

the task that is seen as more male, men compete more than women. For the task seen as more female, no gender difference in competitiveness can be identified.

From this, we can draw two major conclusions:

Firstly, our result raises questions about how useful results from experimental studies in this field are for drawing general conclusions about the world around us. If the level of competitiveness observed in experiments is task dependent, it would be risky to apply these results in different settings. In order to tell if gender differences in competitiveness create inequalities on the labour market, we need to use tasks of roughly the same gender classification in our experiments. Thus there is a need for further research where a lot of effort needs to be focused on creating tasks that would fill this requirement. The easiest way to solve this would probably be to use career-related tasks in the experiments, such as job interviews or salary negotiations. The drawback of this approach would of course be increased complexity and costs.

Secondly, if we believe that pursuing a career is seen as a male task, it would be reasonable to believe that men will compete more fiercely than women on the labour market. If this is the case, one way to decrease the inequalities observed on the labour market would be to change the gender classification of pursuing a career. This reasoning opens up for active policies to affect attitudes, such as affirmative action programmes. While it is not obvious how a policy maker would best go about this, the potential gains in both economic efficiency and gender equality could be substantial.

6.2. Internal validity of the study

Several measures were taken to ensure a high internal validity of the study and avoid systematic biases. To avoid influence from our hypothesis or line of reasoning, neither the participants nor their teachers were told about the hypothesis. As the survey questions on the gender classification of the task were rather revealing they were given at the end of the experiment.

Due to the logistical issues, the experiments were held by two pairs of experimental leaders. To minimize this problem, the behavior of the experimental leaders was standardized to a high extent. About half of the observations were collected by two female experimental leaders and the rest by two males. Regressions (2) and (4) was estimated again with a dummy variable for experimental leader gender. Including this dummy does not change the results above.

We also had some worries that the ordering of the tasks, i.e. whether the participants taking the math part or the word part first, could influence the results. We therefore randomized the ordering of the parts and included an order dummy as above. The results were stable in this case as well.

Anchoring problems may have affected our results, mainly because we did not anticipate them as the experiment was being designed. The subjects were given 47 math problems to solve. The average participant solved about eight problems, possibly giving

her the impression that she underperformed. Overall this may have reduced the fraction of participants selecting the tournament payment scheme in part three. This will however not lead to biased results if we believe that there is no gender difference in anchoring sensitivity. If we on the other hand believe that women are more sensitive to this than men, it will affect our results.

Another potential threat to the validity of the experiment is the construction of the tournament stage. The subjects were instructed that their results would be compared against three other subjects, chosen at random. During interviews with the participants, it turned out to be some confusion around how these groups were selected. Some subjects believed that their results would only be compared to other classmates while others thought their results were being compared to three random subjects from the whole study. Thus some subjects' choice of payment scheme was based on their believed performance relative to their class rather than the whole population. To minimize this effect, it would have been optimal to include dummy variables for each class. However, since we were using a probit-model this was not possible due to the dummy groups being too small. We have therefore used dummy variables based on attended program which should capture some of this effect even though it is less precise. In retrospect, the experimental design should have been more thoroughly explained to the participants.

Competition can take different forms, with the competitive dimension being more or less pronounced. After we started conducting our experiments we worried that the level of competition stimuli experienced by the subjects was too low. In Niederle and Vesterlund's study subjects were physically placed in groups of four, making the competition very visible. In our experiment the difference between the competitive and the non-competitive part was only a difference on paper. This could possibly have weakened the effects found in our study.

6.3. External validity of the study

All experimental studies need to question the possible selection problems in studies like these. We dare to say that our study stands strong on this issue compared to other experimental studies in this field. Since we have targeted whole classes instead of asking for subjects to volunteer, there is no self selection bias in our population. By targeting students at secondary schools our sample is also more representative for the whole population than is the case with university students, even though our study excludes the share of the population not attending secondary school. In this light much of our results could possibly be generalized for the whole Swedish population in this age group.

6.4. How big should the gender gap be?

In our study, the monetary payoff would be maximized if every subject with a higher expected return from competing chose the competitive payment scheme. This happens when the best performing 37 percent[4] of the subjects compete. As there was a difference in performance in math, more men than women should be found in this group and therefore a certain gender gap would maximize the monetary payoff.

However, microeconomic models assume that people maximize utility rather than monetary payoff. So what is the utility maximizing behaviour? How much should people compete and how much should this differ between men and women?

The answer differs between economists. Some economists solve the issue of the connection between preferences and choices by assuming that preferences are observed through choices. Under these assumptions we believe that people make rational and utility maximizing choices, given their preferences and the information they have. A decision can therefore only be suboptimal if people act on incorrect information. In our experimental setting the only relevant information is the subjects' assessment of their relative performance. Incorrect assessments regarding relative performance leads to inefficient outcomes. In our study this assessment varies systematically with gender. Thus the gender differences based on differences in confidence leads to inefficiencies. Under these assumptions all remaining gender differences, including the differences captured in our gender dummy, would be regarded as unproblematic since they only express gender differences in preferences.

This way of viewing the connection between preferences and choices has been criticized. Some would argue that our actions do not always reflect our true preferences and that rationality is bounded rather than perfect. People use rules of thumb and trial-and-error strategies rather than calculations of expected utility when making their decisions. If the way people make decisions differ systematically based on gender this difference would be captured in our dummy variable. Decision making strategies can vary in efficiency and we can therefore no longer assume that the gender differences caught in the gender dummy reflect the subjects' preferences. To put it in other words, a subject might not make a perfect rational decision. Instead she might base her decision on some kind of gendered stereotype or social norm. This would lead to inefficient outcomes. Analyzing the outcome in this way we do not only find gender differences in confidence problematic but also at least part of the differences captured in the gender dummy.

No matter whether we use a perfect rationality model or a bounded rationality model we note that at least part of the gender gap is explained by gender differences in preferences, such as risk attitudes. So far we have regarded these preference differences as static and exogenous, but what if we instead regard preferences as dynamic? We note that only 33 percent of men and 17 percent of women compete in the math part. For

[4] These subjects are expected to win more than one out of four times.

women this is far from the behaviour that maximizes monetary payoff. For an individual it might be optimal to choose a secure compensation scheme even if the expected monetary return from the competitive compensation scheme is higher. This is however not socially optimal as the size of the pie is reduced. From a societal perspective it might thus be efficiency increasing to reduce risk aversion and change other preferences. In our study this holds especially for women.

From this economic reasoning follows that all gender differences found in our study that makes women compete less than men and are not based on differences in performance leads to inefficiencies from a societal perspective.

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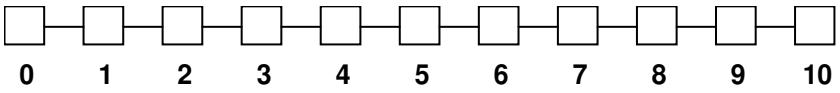
Appendix A. Instructions for questions on attitude towards risk

Question 1: How do you think of yourself: as a person who in general is prepared to take risks or as a person who tries to avoid taking risks?

Mark the scale below where 0 means "not at all prepared to take risks" and 10 means "very prepared to take risks".

Not at all prepared to take risks **very prepared to take risks**



Question 2:

In this part you are asked to consider six choices. In each choice you choose between getting a guaranteed sum of money or to toss a coin for 100 kronor. Mark your response for each choice.

If this question is randomly selected for payment one of the six choices will be seöected at random for payment. If you in the selected choice choose the guaranteed sum of money this is what you get. If you choose to toss a coin, we will toss a coin to see whether you win any money or not.

a) What alternative do you choose:

_____20 kronor

_____tossing a coin for 100 kronor (heads) or 0 kronor (tails)

b) What alternative do you choose:

_____30 kronor

_____tossing a coin for 100 kronor (heads) or 0 kronor (tails)

c) What alternative do you choose:

_____40 kronor

_____tossing a coin for 100 kronor (heads) or 0 kronor (tails)

d) What alternative do you choose:

_____50 kronor

_____tossing a coin for 100 kronor (heads) or 0 kronor (tails)

e) What alternative do you choose:

_____60 kronor

_____tossing a coin for 100 kronor (heads) or 0 kronor (tails)

f) What alternative do you choose:

_____75 kronor

_____tossing a coin for 100 kronor (heads) or 0 kronor (tails)

Appendix B. Instructions for the dictator game

You will now choose how to distribute 50 kronor between yourself and Save the Children. The decision is fully up to you. If this part is selected for payment, the money you keep out of the 50 kronor will be paid to you and the money you give to Save the Children will be sent to them.

Note the distribution of the 50 kronor below:

_____kronor to me

_____kronor to Save the Children

Appendix C. Summary statistics of control variables

				All		Men		Women	
Variable	Observations	Min	Max	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev.
Altruism	209	0	10	5.19	3.79	4.58	3.77	5.79	3.72
Risk	209	.625	10	4.68	1.71	5.01	1.63	4.35	1.71
Year	210	1	3	1.93	.736	2.00	.734	1.87	.735
Siblings	210	0	8	1.76	1.30	1.63	1.10	1.90	1.47
Grades	198	125	320	242	46.9	243	45.3	242	48.7
Hotrest	210	0	1	.114	.319	.0571	.233	.171	.379
Nv	210	0	1	.110	.313	.162	.370	.0571	.233

Appendix D. Descriptive statistics of confidence

Math		**Men**			**Women**		
Quartile	Under	Correct	Over	Under	Correct	Over	
1 (worst)		7	10		25	8	50
2	6	9	8	8	9	3	43
3	18	10	3	22	8	2	63
4 (best)	26	6		19	1		52
	50	32	21	49	43	13	208
	0,48543689	0,31068	0,203883	0,475728	0,417476	0,126214	

Words		**Men**			**Women**		
Quartile	Under	Correct	Over	Under	Correct	Over	
1 (worst)		5	15		13	12	45
2	4	15	5	7	5	2	38
3	20	4	7	27	9	0	67
4 (best)	22	5		27	2		56
	46	29	27	61	29	14	206
	0,45098039	0,284314	0,264706	0,598039	0,284314	0,137255	

Appendix E. The model without altruism

	(5)	(6)
Dependent var: Independent var	Math competition choice	Word competition choice
Female (d)	**-**.314	.250
Std error	(.239)	(.248)
dp/dx	-.0853	.0753
Performance task 2	**.108*** **	.0144
Std error	(.0347)	(.0375)
dp/dx	.0294	.00436
Performance change	-.0163	-.0132
Std error	(.0494)	(.0379)
dp/dx	-.00440	-.00399
Confidence, task 2	**.317** **	**.635*** **
Std error	(.134)	(.148)
dp/dx	.0858	.192
Preference for risk	**.230*** **	**.204*** **
Std error	(.0749)	(.0659)
dp/dx	.0624	.0617
Year of study	-.125	**.409** **
Std error	(.205)	(.178)
dp/dx	-.0338	.124
Number of siblings	-.0386	-.0199
Std error	(.0980)	(.0806)
dp/dx	-.0105	-.00601
Up. primary school grades Std error dp/dx	.00114 (.00295) . 000310	-.00270 (.00266) -.000816
Physical education (d)	**-.799** **	.614
Std error	(.436)	(.429)
dp/dx	-.154	.215
Hotel and restaurant (d)	.503	.370
Std error	(.387)	(.352)
dp/dx	.158	.122
Natural sciences (d)	-.458	**-.796** *
Std error	(.411)	(.408)
dp/dx	-.105	-.183
Constant	**-2.96*** **	**-2.83*** **
Std error	(.836)	(.791)
Pseudo R-squared	.240	.184