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ABSTRACT

Gender, Willingness to Compete and Career Choices along the Whole Ability Distribution*

Men are generally found to be more willing to compete than women and there is growing evidence that willingness to compete is a predictor of individual and gender differences in career decisions and labor market outcomes. However, most existing evidence comes from the top of the education and talent distribution. In this study, we use incentivized choices from more than 1500 Swiss lower-secondary school students to ask how the gender gap in willingness to compete varies with ability and how willingness to compete predicts career choices along the whole ability distribution. Our main results are: 1. The gender gap in willingness to compete is essentially zero among the lowest-ability students, but increases steadily with ability and reaches 30–40 percentage points for the highest-ability students. 2. Willingness to compete predicts career choices along the whole ability distribution. At the top of the ability distribution, students who compete are more likely to choose a math or science-related academic specialization and girls who compete are more likely to choose academic over vocational education in general. At the middle, competitive boys are more likely to choose a business-oriented apprenticeship, while competitive girls are more likely to choose a math-intensive apprenticeship or an academic education. At the bottom, students who compete are more likely to succeed in securing an apprenticeship position. We also discuss how our findings relate to persistent gender differences in career outcomes.

JEL Classification: C91, D03, J01, J16
Keywords: willingness to compete, gender, career decisions, experiment

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1 Introduction

A large literature in experimental economics has documented a robust gender gap in willingness to compete. More recently, research has documented that preferences for competition are a predictor of individual differences in career decisions and labor market outcomes. So far, this literature has mostly focused on people at the top of the ability distribution, such as MBA graduates or (aspiring) university students. In this paper we elicit an incentivized measure of willingness to compete from more than 1500 Swiss students from all parts of the ability distribution while they are still in compulsory education.

This allows us to tackle two unanswered questions. First, our large sample and data on students' grades enable us to estimate how the gender gap in willingness to compete varies with ability. Second, linking our measure of willingness to compete to career choices that are made by the students one and a half years later, we can investigate how willingness to compete correlates with career choices at all skill levels, including choices between different types of vocational education and the choice between vocational and academic education. Knowing more about willingness to compete and how it affects choices below the top is important for several reasons. First, large differences in ambitiousness and expected salaries exist between various non-academic career options and these choices therefore determine the salaries and labour market success of a large part of the population. And second, as we will demonstrate, choices at the vocational level are extremely gendered, with male students choosing more ambitious and lucrative options on average. The Swiss setting is ideal for our purposes because at the end of nine years of compulsory schooling, a large part of students already make a clear choice of professional career within the Swiss vocational education system.

There is a large experimental economics literature on differences in willingness to compete using the design of Niederle and Vesterlund (2007), who show in a lab experiment that women on average shy away from competition while men tend to compete too often. Their design, where participants choose between individual and competitive incentives for their performance in an arithmetic task, has become the standard in the literature. The finding of a large gender gap in willingness to compete has been replicated many times and is especially robust when using stereotypically male numerical tasks (see Niederle and Vesterlund, 2011 and Croson and Gneezy, 2009 for surveys). This includes several studies which have measured willingness to compete in the same age group as our sample (Booth and Nolen, 2012; Dreber, von Essen, and Ranehill, 2014; Buser, Niederle, and Oosterbeek, 2014; Sutter and Glätzle-Rützler, 2014; Almås et al., 2015; Sutter et al., 2016).[1] This robust gender gap in willingness

[1] Of these studies, Booth and Nolen (2012) find that girls from single-sex schools are as competitive as boys and Dreber, von Essen, and Ranehill (2014) find a significant gender gap in a math but not a verbal task, indicating that environment matters. Other studies have explored at what age the gender gap emerges. Sutter

to compete in the lab attracted a lot of interest because of its potential for explaining gender differences in career choices and labor market outcomes (Bertrand, 2011).

More recently, a literature has emerged that directly tests the external relevance of these lab findings by testing whether experimental competition decisions correlate with choices made outside of the lab. Buser, Niederle, and Oosterbeek (2014) show that willingness to compete predicts specializing in math-related subjects for Dutch secondary-school students in the pre-university track and explains a meaningful part of gender differences in their course choices. Reuben, Sapienza, and Zingales (2015) show the same for the starting salaries and industry choices of MBA graduates. Reuben, Wiswall, and Zafar (2015) show that willingness to compete predicts future salary expectations of undergraduate students and Buser, Plug, and Geijtenbeek (2015) find that it correlates with earnings in a diverse sample of the Dutch population. Zhang (2012) finds that it correlates with participation in a competitive high school entrance exam and Berge et al. (2015) show that it predicts investment choices of entrepreneurs in Tanzania.

In a companion paper (Buser, Peter, and Wolter, 2017), we show that the Buser, Niederle, and Oosterbeek (2014) result replicates in our data for the subsample of 17 percent of students who choose to continue their education in academic high schools: competitive students in this group are more likely to specialize in math-related courses and willingness to compete can explain between 9 and 17 percent of gender differences in specialization choices.

In this paper, we aim to test whether willingness to compete influences career choices along the whole ability distribution. We find striking gender differences in educational choices, in particular in the choice of profession for individuals who opt for vocational education, where gender segregation into professions is even stronger than the well-documented gender differences in university major choice. Boys make up more than 90 percent of apprentices in the most math-heavy professions which lead to higher salaries. Also, boys are less likely than girls to choose the academic track but nevertheless make up nearly 70 percent of students who specialize in mathematics and physics within the academic track. Girls concentrate in language and social science-oriented specializations in the academic track and in low-math

and Glätzle-Rützler (2014) elicit willingness to compete in a sample of three to 18-year olds and find that the gender gap emerges as early as kindergarten (they use a running task and a picking-items-from-a-basket task for younger children and a math task for older children). Cardenas et al. (2012) find a significant gender gap in willingness to compete in both a math and a word-search task for Swedish children aged nine to 12 but no difference in either task for Colombian children. Bartling, Fehr, and Schunk (2012) and Samek (2013) find no gender difference for pre-schoolers using playful tasks. Looking at the interaction of age and culture, Andersen et al. (2013) find that girls in a patriarchal society become less competitive around puberty while there is no difference at any age in a matrilineal society. Running experiments with a hunter-gatherer tribe, Apicella and Dreber (2015) find the same gender gaps in willingness to compete for children and adults. A related literature looks at reaction to competitive incentives, finding that men's performance increases more (Gneezy, Niederle, and Rustichini, 2003). Gneezy and Rustichini (2004) show that this is the case already for children aged nine to ten.

apprenticeships.

Girls in our sample are significantly less likely to compete than boys. We find a striking and systematic relation between ability and this gender gap in willingness to compete. While the gender gap is basically zero for the lowest-ability students, it gradually becomes larger with grades and is highest for the highest-ability students. This is because boys with high grades are substantially more willing to compete than boys with low grades while the relationship between grades and willingness to compete is flat for girls. Conditional on performance in the task, girls with top grades are 30 to 40 percentage points less likely to compete than boys with comparable grades. We use both a numbers task and a letters task to check whether the domain in which willingness to compete is elicited (and the gender stereotypes attached to that domain) influences the results. Both the overall gender gap and its relationship with grades are very similar across the two tasks.[2]

We find that willingness to compete predicts career choices at all parts of the ability distribution. High-ability boys and girls who compete are more likely to specialize in math or science and high-ability girls who compete are more likely to follow academic education in general. At the middle of the ability distribution, boys who compete are more likely to choose a business-oriented apprenticeship, while competitive girls are more likely to choose a math-intensive apprenticeship or an academic education. At the bottom of the ability distribution, competitive students are more likely to succeed in entering an apprenticeship.

[2]Several studies have used both a numerical and another, more stereotypically female, task in the same lab experiment and compared the gender gap in willingness to compete across tasks. A number of studies use alternative tasks that are related to letters: Kamas and Preston (2009) have subjects make new words from letters in an eight-letter word; Große and Riener (2010) have subjects order five words into correct sentences; Shurchkov (2012) has subjects form sub-words from the letters in a larger word; in Dreber, von Essen, and Ranehill (2014), subjects had to find words in a grid of letters; and in Boschini et al. (2014) subjects had to form words from eight given letters. All of these studies find a significant gender gap in tournament entry in the numerical task but no significant gender difference in the letters task. However, Wozniak, Harbaugh, and Mayr (2014), who have subjects form words that begin with a certain letter, find the same significant gender gap as in an arithmetic task. Similarly, Cardenas et al. (2012) find the same gender gap in willingness to compete in both a math and a word-search task in a sample of school children. A couple of studies have used non-verbal stereotypically female tasks. Apicella and Dreber (2015), in a hunter-gatherer population, find gender gaps for a male task (strength) and a neutral task (skipping rope), but not a female task (collecting beads). Sutter and Glätzle-Rützler (2014) use a running task (stereotypically male) and a picking-items-from-a-basket task (stereotypically female) and find a gender gap in both tasks.

2 Background

2.1 The Swiss education system

Compulsory schooling in Switzerland is made up of six years of primary school and three years of lower-secondary school.[3] In the canton of Bern, where we collected our data, lower-secondary students are tracked into three levels which give differential access to educational programs in subsequent upper-secondary education. The "Real" (low) level of lower-secondary school gives access to the vocational track of upper-secondary education, while the "Sekundar" (medium) and "Spezielle Sekundar" (high) levels both give access to vocational education and to the academic track conditional on students receiving a recommendation from their school or passing an entry exam. Preparation for the academic track is part of the standard curriculum of the "Spezielle Sekundar" education, so students from this high level typically have a smooth transition to academic high schools.

Students can proceed to upper-secondary education after the 9th grade. There are many alternative forms of upper-secondary education. Most students choose the vocational track and do an apprenticeship. Students who wish to do this need to apply directly to companies which post a vacancy or to institutions specialized in vocational education and training. During their apprenticeship, students will typically spend part of their time learning on the job and part of their time in school. The second most popular option is to continue studying in a Baccalaureate school, which is an academic high school that prepares students for university. About 1 in 5 students follows this path. These academic-track students have to choose one of the following specializations: Physics & Math, Biology & Chemistry, Economics & Law, Ancient Languages, Modern Languages, Music & Arts, and Philosophy, Pedagogy & Psychology.[4] The third most popular choice is to take a so-called "tenth year", an additional year of school that is usually chosen by students who are either undecided or could not find an apprenticeship spot.

Finally, there are specialized schools which, in the canton of Bern, mainly fall into three categories: commerce schools leading to a diploma which is equivalent to finishing a commerce apprenticeship, applied computer science schools leading to a diploma which is equivalent to finishing a computer technician apprenticeship, and a school preparing students for professions in health and social work for which there are no apprenticeships.[5] Throughout, we will

[3] The exact division of years varies between cantons. In addition, two years of pre-school also recently became obligatory.

[4] There are actually two separate specializations for Music and Arts, but we grouped them together because of their similarities.

[5] This includes professions such as nurse and social worker for which students are deemed too young when finishing compulsory schooling at roughly the age of sixteen.

group these choices with the apprenticeships they most closely correspond with.

2.2 Grouping choices by math intensity

Apprenticeships cover the whole range of economic activity and vary considerably in required skills. There are more than 230 apprenticeships ranging from relatively low-skilled occupations such as hairdresser, painter, and domestic worker to highly skilled (and highly paid) occupations such as computer technician, lab technician, electronic technician, and polymechanic. A special case is the so-called commerce apprenticeship. This is by far the most popular apprenticeship (roughly one fifth of students in our sample who do an apprenticeship make this choice). While most apprenticeships train people for a clearly defined occupation, the commerce apprenticeship leads to a wide variety of careers, for example in administration, logistics, accounting, human resources, and communication, some of which are highly paid. Students can do this apprenticeship at two different levels, the higher of which is more prestigious and has considerably higher skill requirements.

Because of the large number of different apprenticeship choices, we need to group apprenticeships to make the choice tractable for quantitative analysis. To gauge how ambitious a given apprenticeship choice is, we group students who choose an apprenticeship into three roughly equally sized categories according to the math requirements of their chosen apprenticeship. As a measure of math-intensity we use the official measure of the Swiss Conference of Cantonal Ministers of Education (EDK) and the Schweizerischer Gewerbeverband (sgv) which measures the math requirements of a given apprenticeship on a scale from 1 to 100.[6] We treat the commerce apprenticeship as a fourth, separate category because it is so popular and because it leads to a large variety of careers, some of which are more math-intensive than others.

Apprenticeships were also ranked by requirements for language skills, foreign language skills and science skills. We choose math rather than other skills for three reasons: First, the math intensity of an apprenticeship is highly predictive of the salary graduates can expect later in life whereas the other measures are not. Second, math-intensity is also a main differentiator between specializations in the academic track so that we can more easily compare vocational and academic choices. Third, as we will show, gender differences in the math-intensity of the chosen career path are a main dimension of gender differences in career choices.

To establish the first point, we examined the relationship between the skill requirements of the apprenticeships and the average salary in the profession the apprenticeship officially

[6] A graphical representation of the measure can be accessed under http://www.anforderungsprofile.ch/.

prepares for.[7] For this purpose we obtained average salaries at a detailed occupational level from the Swiss Federal Statistical Office. The averages were calculated from the Swiss Labor Force Survey of 2014. We found that the math intensity of an apprenticeship strongly correlates with the average salary in the corresponding profession. Regressing the log of the income measure on math requirements at the apprenticeship level, we find that a one point higher math intensity corresponds to a 0.9 percent higher average salary with an R^2 of 0.36.[8] The requirements for language skills, foreign language skills, and science skills have an R^2 of 0.09, 0.02, 0.01 respectively. Among these, only language requirements are significantly correlated with expected salary and the correlation is negative.

We choose to group the apprenticeships by math intensity rather than expected salaries because we only have a rough measure of expected salaries and, more importantly, we lack expected salary information for the specialization choices at the academic level. We can, however, assess the math intensity of these specialization choices using the so-called "EVAMAR" math scores. EVAMAR was a research project initiated by the EDK and the Swiss Confederation to evaluate the Baccalaureate school reform of 1995 which among other things introduced the standardized specializations.[9] The EVAMAR math scores come from Phase II of this project, which tested students in several subjects at the end of Baccalaureate school. This phase of the research project was carried out by Eberle et al. (2008), who found the following average math scores by specialization: Physics & Math: 614, Ancient Languages: 512, Biology & Chemistry: 504, Economics & Law: 485, Modern Languages: 475, Philosophy, Pedagogy & Psychology: 462, Music & Arts: 460.[10] Specialization choices in high school have been found to strongly predict study majors at the university level and the choice of math and science classes in high school is a predictor of college attendance and completion (Goldin, Katz, and Kuziemko, 2006; Buser, Niederle, and Oosterbeek, 2014). In addition, math-intensive high school specializations have been found to have a positive causal effect on earnings (Joensen and Nielsen, 2009).[11]

[7] We base the correspondence between apprenticeships and occupational codes on the Occupational Database ("Berufsdatenbank") of the Swiss Federal Statistical Office.

[8] There is a sizable literature linking math skills to higher earnings. See for example Paglin and Rufolo (1990); Grogger and Eide (1995); Brown and Corcoran (1997); Altonji and Blank (1999); Weinberger (1999, 2001); Murnane et al. (2000); Bertrand, Goldin, and Katz (2010); Joensen and Nielsen (2009); Falch, Nyhus, and Strøm (2014).

[9] More on the EVAMAR project can be found here: www.sbfi.admin.ch/sbfi/de/home/themen/bildungsraum-schweiz/maturitaet/evamar.html.

[10] Students in the Physics & Math specialization take additional, more advanced math, while in some other specializations, students follow additional math-related courses such as chemistry or economics. The second place of Ancient Languages might seem odd but this is typically seen as a very demanding specialization (students have to study Latin or Ancient Greek) which few students choose - in our sample only five. In all our analyses, we group Ancient Languages with Modern Languages into a single Languages category.

[11] Also, specialization choices in high school predict major choices at the university level, where Kirkeboen, Leuven, and Mogstad (2016) establish positive causal effects of STEM-related majors on future income.

2.3 Grouping students by ability

One of the main aims of this paper is to investigate the correlation between willingness to compete and career choices at different ability levels. For these analyses, we split the students into four groups with different ability levels and, consequently, different choice sets.

1. Top (students from the high level of secondary school): These students can transition smoothly to academic high schools although a few of them still opt for vocational education.

2. Medium-high (students from the middle level of secondary school with a GPA higher than 4.75)[12]: These students can qualify for academic education via a recommendation from their secondary school teachers or through an entry exam. Most of them opt for vocational education where all choices are open to them.

3. Medium-low (students from the middle level of secondary school with a GPA of 4.75 or lower): These students overwhelmingly opt for vocational education although a few enter academic education via an entry exam.

4. Bottom (students from the low level of secondary school): These students cannot enter academic education and will find it hard to enter high-skilled apprenticeships where companies prefer students from the middle and high levels of secondary school.

The grade cutoff between the medium-low and medium-high groups has been chosen such that the groups are roughly of equal size.

3 Study design and sample

3.1 Data collection

The data for this study was collected within a larger project that gathered data from lower-secondary students in two waves. The first wave was conducted in the beginning of the 2013/2014 school year. This wave consisted of the incentivized willingness to compete experiment and a survey, both of which were computerized. We were interested in 8th grade students from all three regular educational levels (low, middle and high).[13] Accordingly, we contacted all lower-secondary schools from the German-speaking part of the canton of Bern that had such students. We asked schools to let us do the data collection during a regular

[12] In the Swiss system, the lowest grades is 1 and the highest grade is 6.

[13] This excludes students with special needs who are educated in dedicated classes or schools.

class hour. Twenty-eight schools (approximately 10 percent) were willing to participate.[14] Schools typically had several classes of 8th graders. The first-wave sample consist of 1514 students from 87 classes.[15]

We measured willingness to compete using a method based on Niederle and Vesterlund (2007). We conducted an incentivized experiment which consisted of three rounds. In each round, participants performed one of two simple tasks: Numbers or Letters. Students who got the Numbers task had to add up sets of four two-digit numbers in each round. Students who got the Letters task had to count how many times a certain letter appears in a random sequence of 50 letters. In every round, participants had 3 minutes to do as many of these problems as they could. The task type (Numbers or Letters) was randomized at the classroom level and stayed the same throughout the three rounds.

Students were informed that one randomly selected round would be paid out.[16] In the first round, students earned 25 cents for every correct answer (piece-rate scheme). In the second round, students had to compete against three randomly selected anonymous classmates (tournament scheme). If they won the tournament by outperforming their three competitors, they earned CHF 1 per correct answer, but if they lost, they did not earn anything. In the third round, students could choose between the two payment schemes.[17] This choice is our measure of willingness to compete.

After the competition task, the students proceeded to the survey, which included questions on students' grades, socio-economic background, and future plans.[18] The questionnaire also contained two incentivized risk preference tasks.[19] In the first, participants were asked to make a single incentivized choice between a sure payment of CHF 2 and four 50/50 lotteries of increasing variance and expected payoff: 3.50 or 1.50, 4 or 1, 5 or 0.50, 6 or 0 (Eckel and

[14]To incentivize schools to take part, they received money into the class funds of participating classes. In particular, on top of the individual payments to the students, the total earnings of the students from the class were paid into each class fund.

[15]In some cases, students from other classes could also join some lessons (e.g. students from lower grades could take lessons with 8th graders in case the class sizes were small). Such students were not eligible for our study. After the experiment, we discovered that four observations are not from regular students of the 8th grade classes that we surveyed. These observations were dropped and are not counted in the sample size of 1514.

[16]This was done to avoid that subjects use one round to hedge against outcomes in other rounds.

[17]The performance of those who chose to compete was compared to a random set of performances from the same round. These performances were selected amongst all other participants regardless of their choice. After every round, students got to know how many exercises they solved correctly, but they did not get to know the performance of other students.

[18]As the survey was part of a larger data collection project, it also contained unincentivized questions on variables such as time preferences, locus of control, and sunk cost aversion. The locus of control measure from this survey is used in Jaik and Wolter (2016).

[19]We also wanted to elicit participants' beliefs about their own relative performance in the experiment in an incentivized way. Unfortunately, due to a bug in the program the answers to that question were not recorded.

Grossman, 2002). The second measure of risk preferences was the "bomb risk elicitation task" (BRET), whereby participants decide how many of 100 boxes to collect, one of which contains a bomb. Earnings increase linearly with the number collected but drop to zero if the bomb is collected (see Crosetto and Filippin, 2013, for details). Finally, we also asked students about their confidence in their own math ability. In particular, we asked "How would you rate your own performance in math compared to the other students in your classroom".[20]

The second wave of data collection took place at the end of the 2014/2015 school year, when the students were about to finish the 9th grade. In this wave we surveyed the students about their educational and labor market choices and expectations. Participants knew from the start that there would be a second wave. We contacted students via their schools. In case the student had already left the old school, we asked the school for help with sending the survey to the student. Ultimately, we were able to follow up on almost 96 percent of the students: of the 1514 students from the first wave, 1450 responded in the second wave.

3.2 Descriptive statistics

Table 1 shows descriptive statistics on choices and performance in the incentivized competition task as well as on level of lower-secondary school and grades. Boys are approximately 14 percentage points more likely to choose competition and this difference is very similar in the numbers task and the letters task. Girls score better in both task, both under individual and under competitive incentives, and this difference is statistically significant in the letters task. Girls are significantly more risk-averse and rate themselves worse in math relative to their classmates. Girls are slightly more likely to be at the medium or high level of lower-secondary school but the differences are small. Within each level, girls have a higher GPA. Girls also have higher math grades at the medium level but lower math grades at the low and high levels.[21]

We will now describe the career choices of boys and girls in our sample. Of the 1450 students who responded to the follow-up survey, we have valid career choices for 1232 students. Of the remaining 218 students, 81 answered "other" or "not sure" concerning their future plans; 54 chose an apprenticeship for which information on math intensity is lacking; 40 stated they would spend a gap year abroad to learn a language; 21 chose an unspecified school-based option; 6 stated they would directly transition to work; 12 said they would do an apprenticeship or Baccalaureate school but did not provide (precise enough) informa-

[20]The students could choose between four answers: Top quarter, top half, bottom half, bottom quarter.

[21]It is a widely observed phenomenon in Western countries that girls do better at school than boys and that this difference is smallest for math and science (Voyer and Voyer, 2014). For an overview of the Swiss situation, see SCCRE (2014).

Table 1: Descriptive statistics

	(1)	(2)	(3)		(4)	(5)	(6)
	Experiment and questionnaire:					Ability:	
	Boys:	Girls:	Dif:		Boys:	Girls:	Dif:
	(N=760)	(N=754)			(N=760)	(N=754)	
Compete	0.554	0.419	0.135***	Level=low	0.351	0.296	0.056*
	(0.497)	(0.494)	(0.025)		(0.478)	(0.457)	(0.024)
Compete (numbers)	0.490	0.346	0.144***	Level=medium	0.571	0.603	-0.032
	(0.501)	(0.476)	(0.035)		(0.495)	(0.490)	(0.025)
Compete (letters)	0.623	0.496	0.127***	Level=high	0.078	0.101	-0.023
	(0.485)	(0.501)	(0.036)		(0.268)	(0.301)	(0.015)
Score 1 (numbers)	3.508	3.654	-0.146	Math grade (lev.=low)	4.616	4.487	0.130*
	(2.257)	(2.232)	(0.161)		(0.700)	(0.720)	(0.064)
Score 2 (numbers)	4.218	4.568	-0.350	Math grade (lev.=medium)	4.705	4.786	-0.081*
	(2.588)	(2.407)	(0.179)		(0.566)	(0.629)	(0.040)
Score 1 (letters)	7.593	8.207	-0.614**	Math grade (lev.=high)	4.805	4.704	0.101
	(2.677)	(2.738)	(0.200)		(0.572)	(0.612)	(0.103)
Score 2 (letters)	9.087	9.880	-0.793***	GPA (lev.=low)	4.515	4.629	-0.114**
	(2.811)	(2.942)	(0.213)		(0.481)	(0.476)	(0.043)
Lottery	3.186	2.731	0.455***	GPA (lev.=medium)	4.673	4.846	-0.173***
	(1.628)	(1.418)	(0.079)		(0.382)	(0.434)	(0.027)
BRET	40.272	35.515	4.758***	GPA (lev.=high)	4.780	4.890	-0.110
	(24.787)	(23.837)	(1.250)		(0.336)	(0.369)	(0.062)
Math confidence	1.999	2.276	-0.277***				
	(0.796)	(0.794)	(0.041)				

Note: Columns 1-2 and 4-5 contain variable means (standard deviations in parentheses). Columns 3 and 6 contain gender differences in means (standard error of the difference in parentheses; significance levels are from t-tests). Compete is binary indicator for choosing the competitive payment scheme over the individual payment scheme; Lottery is measured on a scale from 1 to 5 where 1 is the safe option and 5 is the riskiest lottery; BRET means number of boxes collected in the bomb risk elicitation task; Level means level of secondary school; in the Swiss system, grades are measured on a scale from 1 (low) to 6 (high). Math confidence means students' beliefs about their own math performance compared to their fellow students (from 1 "top quarter" to 4 "bottom quarter").

tion about their specialization; and 4 students did not finish lower-secondary education yet because of grade repetition.

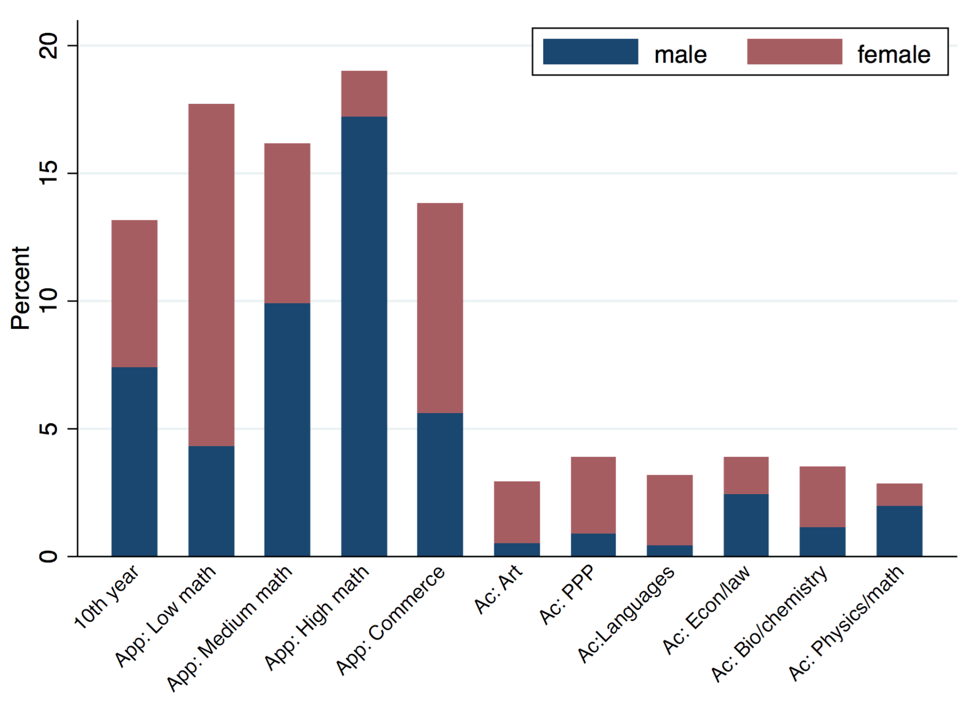
As described in Section 2, there are many different options within upper-secondary education. To be able to present the valid career choices in a structured way, we divide apprenticeships into the four categories that we describe in Section 2: low math (math-requirement score below 27.7), medium math (math-requirement score from 27.7 to 56.7), high math (math-requirement score of 56.8 or above), and commerce. The math-score cutoffs were chosen such that roughly a third of the students choosing an apprenticeship other than commerce ends up in each category. As described in Section 2, Baccalaureate-school students have to pick specializations, which we can put in decreasing order of math intensity: Physics & Math, Biology & Chemistry, Economics & Law, Languages, Philosophy, Pedagogy & Psychology, Music & Arts. The final career-choice category is the "10th school year" for students who could not make up their mind or who were unsuccessful in applying for apprenticeships.

Figure 1 shows the percentage of boys and girls in our sample who choose each of the career choice categories. Career choices are strikingly gendered in both the vocational and the academic track. In both tracks, low-math choices are dominated by girls and high-math choices are dominated by boys. Girls make up 76 percent of individuals in low math apprenticeships and between 77 and 87 percent of individuals in the three least math-intensive academic specializations (Languages, Philosophy, Pedagogy & Psychology, Music & Arts). On the other hand, they represent a mere 9 percent of individuals in high-math apprenticeships and 31 percent in the Physics & Math specialization. Girls are a majority in the academic track (64 percent of students) while boys are more likely to pick an apprenticeship (where they make up 56 percent of individuals) or take a 10th year of lower-secondary schooling (56 percent). Figure A1 in the Appendix shows choices by ability group.

3.3 Task stereotypes

As described in 3.1, we elicited willingness to compete in one of two tasks: Numbers (adding up sets of four two-digit numbers) and Letters (counting how many times a certain letter appears in a random sequence of 50 letters). The task was randomized at the classroom level. Past studies on the link between willingness to compete and career choices have typically used an arithmetic task equivalent to our numbers task. The reason to also include a letters-based task is to see whether the relationship between willingness to compete, gender and ability is the same in a stereotypically male numerical task and in a less stereotypically male letters-based task. Contrary to letters-based tasks used in past studies, our letters task is a

Figure 1: Career choices by gender



Note: “App” means apprenticeship, “Ac” means academic, and “PPP” means Philosophy, Pedagogy & Psychology. To save space, we will use the short label “Art” for Music & Arts in all graphs and tables.

counting task rather than a task measuring verbal skills. We will therefore now verify that the stereotypes attached to our tasks differ in the expected directions.

In the follow-up questionnaire, we asked the participants whether they thought boys or girls perform better in each of the tasks. Answer options were on a scale from 1 (girls are much better) to 5 (boys are much better) where 3 is neutral. To avoid participants being influenced by their own experience with the task and to avoid inducing an artificial difference by asking the two questions side-by-side, we asked participants who performed the Numbers task only about their beliefs concerning the Letters task and vice versa.

Overall, the students indeed think boys have an advantage in numbers (mean=3.16; p=0.000) and girls have an advantage in letters (2.95; p=0.095).[22] This assessment differs by gender, however. Girls think they have an advantage over boys in the letters task (mean=2.75; p=0.000) while they see no gender difference in the numbers task (3.04; p=0.209). Boys think there is a male advantage in both tasks (letters task: 3.16, p=0.000; numbers task: 3.29, p=0.000). Both genders agree that girls are relatively favored by the letters task and boys are relatively favored by the numbers task (p=0.032 and p=0.000 for boys and girls respectively).

4 Results

4.1 Gender difference in willingness to compete along the ability distribution

In this section we will use our large sample of over 1500 students and our data on GPA and math grades to investigate how the gender gap in willingness to compete varies along the ability distribution. To asses the potential labour-market consequences of the gender gap in willingness to compete, it is important to know whether it mainly stems from the bottom or the top of the ability distribution. That is, is it mainly the case that low-ability men are overly competitive or do high-ability women shy away from competition?

To start, in Table 2, we show the overall gender gap in willingness to compete and investigate whether the gap varies across tasks. We regress a competition choice dummy on a gender dummy, a task dummy and, in some specifications, the interaction of the two. In column 1, we show regressions with no additional controls. Women are around 14 percentage points less likely to compete. Adding controls for task performance and grades in columns 2 and 3 increases the gender gap to 16 percentage points. Controlling for risk preferences, confidence in math, age, and immigrant status in column 4, the gender gap is 12 percentage

[22] P-values are from t-tests of whether the mean is equal to 3.

Table 2: Gender gap in willingness to compete

	(1)	(2)	(3)	(4)	(5)	(6)
Female	-0.136***	-0.152***	-0.164***	-0.120***	-0.144***	-0.130***
	(0.028)	(0.028)	(0.029)	(0.027)	(0.037)	(0.036)
Task=letter	0.141***	0.127*	0.166**	0.129***	0.133***	0.119***
	(0.032)	(0.072)	(0.072)	(0.027)	(0.039)	(0.035)
Female*task					0.017	0.020
					(0.052)	(0.053)
N	1514	1514	1514	1514	1514	1514
R2	0.038	0.073	0.117	0.118	0.038	0.118
Performance		√	√	√		√
Grades, level, FE			√	√		√
Individual controls				√		√

Note: coefficients are from OLS regressions of a dummy for choosing the competitive payment over the individual payment on a female dummy, a task dummy and controls. Performance means scores in rounds 1 and 2 interacted with a task dummy; level means level of lower-secondary school (low, medium or high); grades means math grade and GPA interacted with level dummies; FE means school fixed effects; and individual controls include risk attitudes, confidence in math, age in months, dummies for number of siblings, and dummies indicating whether mother or father were born abroad. Standard errors in parentheses are clustered at the classroom level.

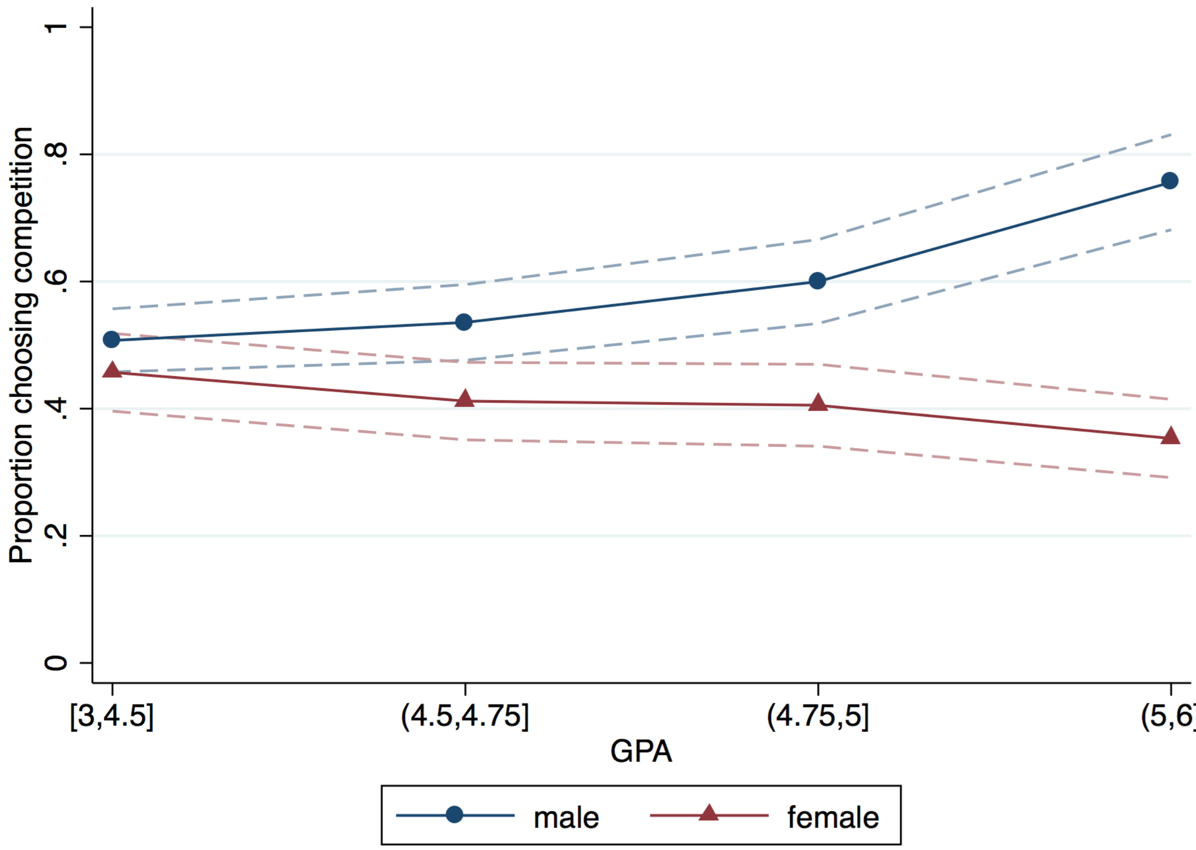
points.

In columns 5 and 6, we interact the gender dummy with a task dummy. The coefficient on the interaction term is very close to zero. This shows that the gender gap in willingness to compete is present not only in the standard Numbers task but also in the Letters task, which women actually find more stereotypically female.[23]

We will now ask how this gender gap varies with ability. Figure 2 shows the willingness to compete of male and female students at various points of the GPA distribution. The predicted values are obtained from regressions of the competition choice on a female dummy interacted with grade dummies, controlling for experimental task, performance in rounds 1 and 2 of the experiment (interacted with task), level of lower-secondary school, and school fixed effects. Grades in the Swiss system go from 1 (low) to 6 (high). While we observe no gender gap in willingness to compete for the lowest ability students, the gender gap increases monotonically with grades. The reason is that male willingness to compete increases steadily with grades while the relationship between grades and female willingness to compete is essentially flat. This results in a roughly 40 percentage points gender gap for students with a GPA above 5. In Figure A2 in the Appendix we show that the pattern is the same when we use math

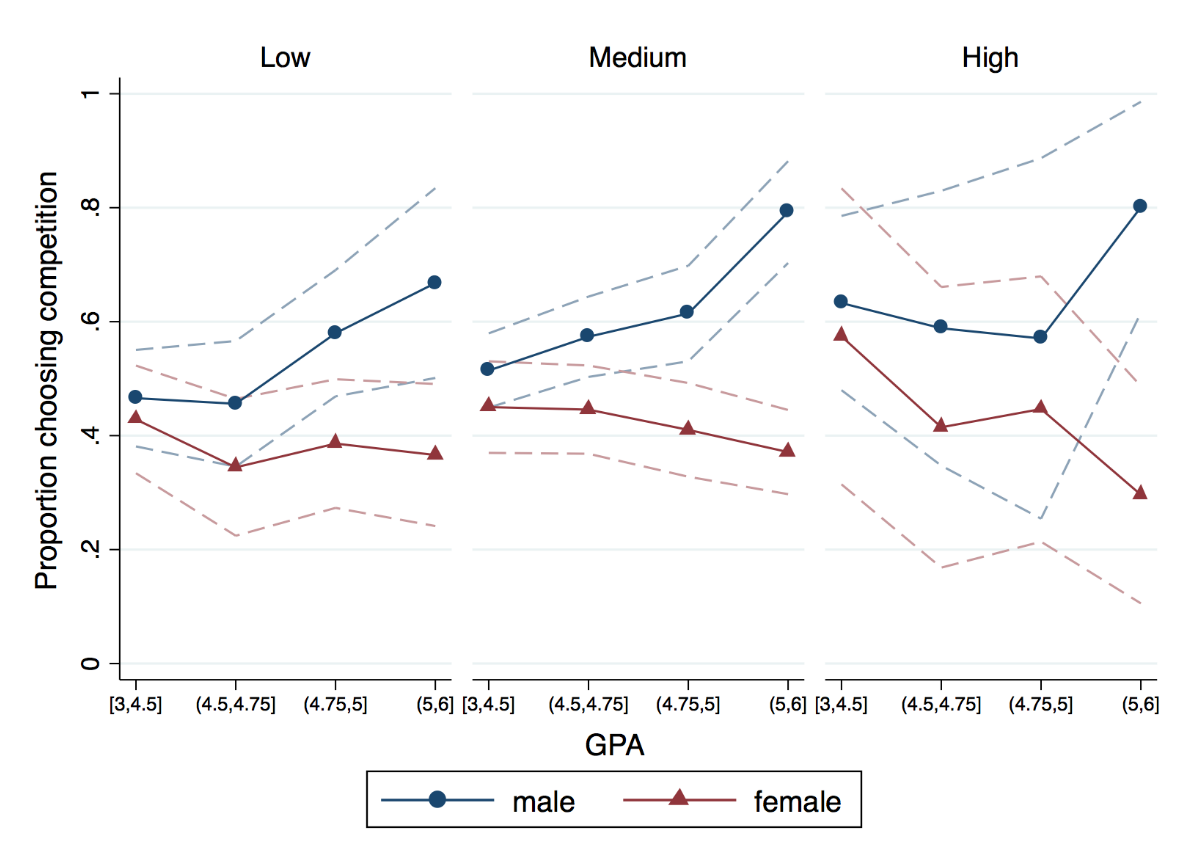
[23]The regressions also show that participants who received the Letters task are more willing to compete than those who received the Numbers task. One reason could be that the Letters task is perceived as easier, causing participants to overestimate their own rank (Dargnies, Hakimov, and Kübler, 2016).

Figure 2: Gender, willingness to compete and ability



Note: The graphs show willingness to compete for students with a specific GPA conditional on experimental task, performance in rounds 1 and 2 of the experiment (interacted with task), level of lower-secondary school (low, medium or high), and school fixed effects. Grades in the Swiss system go from 1 (low) to 6 (high). The estimators are obtained from OLS regressions of a tournament entry dummy on a female dummy, grade dummies and the interaction of the two plus the mentioned controls. Confidence bands represent 90-percent confidence intervals and standard errors are clustered at the classroom level.

Figure 3: Gender, willingness to compete and ability by lower-secondary school level



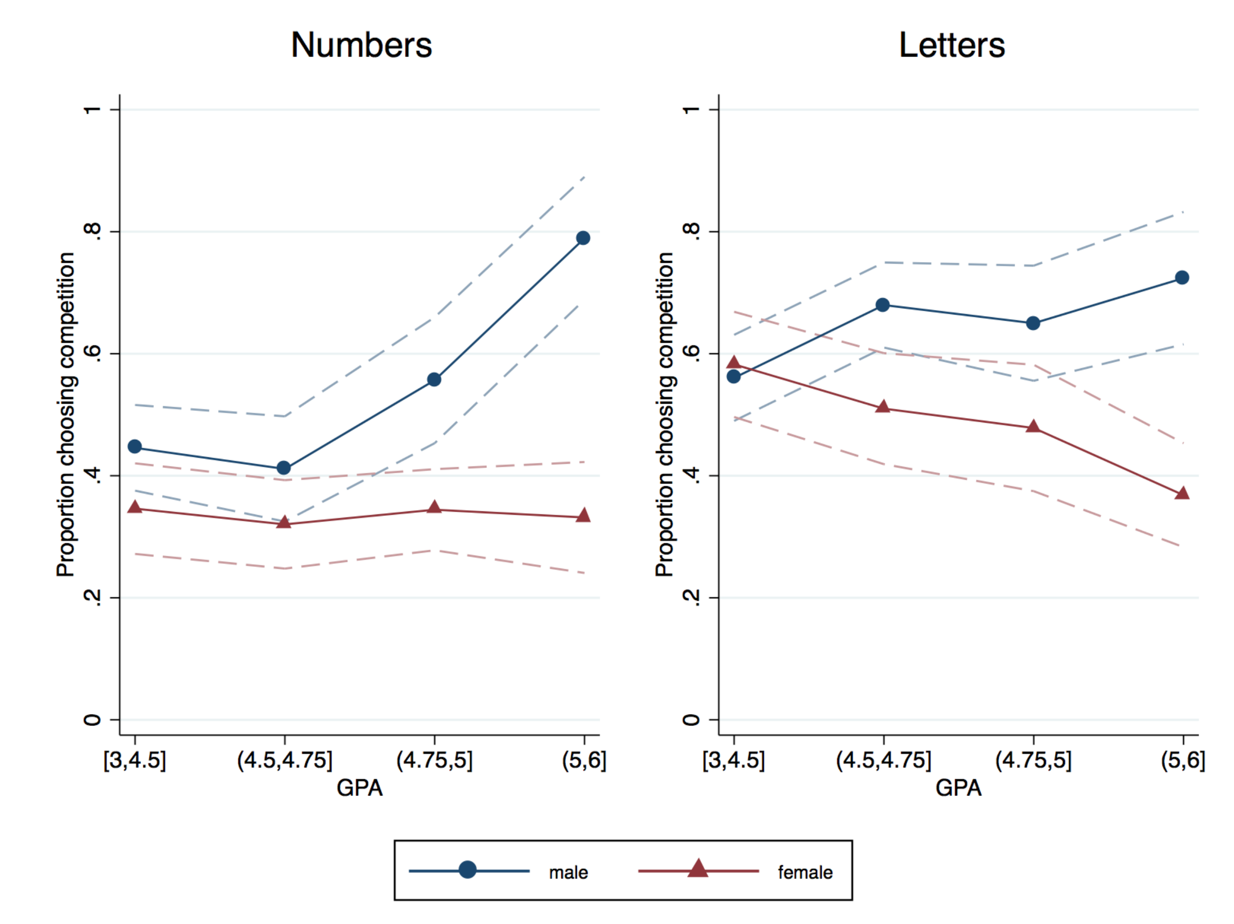
Note: The graphs show willingness to compete for students with a specific GPA conditional on experimental task, performance in rounds 1 and 2 of the experiment (interacted with task), level of lower-secondary school (low, medium or high), and school fixed effects. Grades in the Swiss system go from 1 (low) to 6 (high). The estimators are obtained from OLS regressions of a tournament entry dummy on a female dummy, grade dummies and the interaction of the two plus the mentioned controls. Confidence bands represent 90-percent confidence intervals and standard errors are clustered at the classroom level.

grades instead of GPA.

The experimental literature shows that risk preferences and confidence in one's own abilities significantly influence willingness to compete (Niederle and Vesterlund, 2011; van Veldhuizen, 2016). Moreover, Almås et al. (2015) consider how willingness to compete varies with socio-economic background and find that the gender gap in willingness to compete is zero for Norwegian high-school students with the lowest socioeconomic background (bottom 8 percent of families) whereas it is large and significant for the rest of students. In Figure A3 in the Appendix, we show that the observed relationship between grades and the gender gap in willingness to compete looks very similar when we additionally control for risk attitudes, self-rated confidence in math, and a range of socioeconomic controls.

Figure 3 shows the relationship between willingness to compete, gender and grades separately by level of lower-secondary school. The pattern is qualitatively the same at each level: the gender gap in willingness to compete increases with ability. It is worth noting that the highest gender gap is observed for students with the highest GPA at the high level of secondary school, who roughly represent the top 2 percent of students in our sample. The gap for this group is roughly 50 percentage points. In Figure A4 in the Appendix, we show that the same results are obtained when using math grades instead of GPA. Finally, in Figure 4, we demonstrate that the same pattern is observed when using the numbers task and the letters task (see Figure A5 in the Appendix for the same comparison using math grades instead of GPA).

Figure 4: Gender, willingness to compete and ability by task



Note: The graphs show willingness to compete for students with specific GPA conditional on experimental task, performance in rounds 1 and 2 of the experiment (interacted with task), level of lower-secondary school (low, medium or high), and school fixed effects. Grades in the Swiss system go from 1 (low) to 6 (high). The estimators are obtained from OLS regressions of a tournament entry dummy on a female dummy, grade dummies and the interaction of the two plus the mentioned controls. Confidence bands represent 90-percent confidence intervals and standard errors are clustered at the classroom level.

There are several possible explanations for the increasing pattern we find: positive signals about their ability may make boys more willing to compete (see Buser and Yuan, 2016), being competitive might drive boys to strive for higher grades, or willingness to compete and grades might be driven by the same personality factors. Either way, if willingness to compete translates to choosing more ambitious careers, the implications of these findings are clear. If top ability women shy away from competition while their male counterparts embrace it, the most prestigious careers will become dominated by males.

4.2 Does willingness to compete predict career choices?

In this section, we will analyze whether our experimental measure of willingness to compete predicts the career choices of the boys and girls in our sample. As discussed in Section 2, we can rank choices within both the vocational and academic realms by math-intensity. However, it is less obvious how to rank if we want to make comparisons between options in the vocational and academic tracks; that is, if we want to compare apprenticeships to academic specializations. While the Physics & Math specialization at the academic level is clearly the most demanding option of all, it is much less clear how to compare the most demanding apprenticeships such as computer technician, which lead to very high salaries, to less math-intensive academic specializations such as Languages. We will therefore use a non-parametric approach that does not impose a ranking on the categories.

The idea is to run a separate binary regression for each career alternative. In each column of Table 3 we regress a dummy indicating whether a student chose a specific alternative (vs all other alternatives) on a competition dummy interacted with gender. All regressions control for experimental task, performance in the first two rounds of the experiment, level of lower-secondary school, GPA, math grades, risk preferences, confidence in math, and school fixed effects.

We start by looking at the specializations in the academic track. We see that both boys and girls who choose to compete are more likely to choose Math & Physics. The coefficient is is equal to 3.1 percentage points for boys and 2.0 percentage points for girls, which is large considering that only 3.7 percent of boys and 1.8 percent of girls pick this challenging specialization. The effect of competition is jointly significant for boys and girls at $p<0.01$. Competitive girls (but not boys) are also 3.1 percentage points more likely to choose Biology & Chemistry. Competitive students of both genders are significantly less likely to choose Languages. In the penultimate column, we check how willingness to compete relates to choosing academic over vocational education by grouping all academic choices together. Girls, but not boys, who compete are more likely to choose academic education. At 5.1 percentage points, the effect size is meaningful considering 26.7 percent of girls pick the academic track overall.

Moving on to apprenticeship choices, we see that girls who choose to compete are significantly more likely to choose a high-math apprenticeship. The coefficient is 3.1 percentage points which is large given that only 3.7 percent of girls choose a high-math apprenticeship. Girls who compete are also 3.4 percentage points less likely to choose a medium-math apprenticeship. Although this second coefficient is not statistically significant, it is consistent with willingness to compete shifting girls from medium into high-math apprenticeships. Boys who compete, on the other hand, are less likely to pick a high-math apprenticeship and more likely

Table 3: Career choice regressions

		Vocational						Academic				Academic	Joint
	10th year	Low	Med	High	Com	Art	PPP	Lang	Econ	Bio/chem	Phys/math	Combined	p-val
Compete (m)	-0.042	0.051**	0.041	-0.065*	0.032	0.001	-0.011	-0.016**	-0.002	-0.020*	0.031**	-0.017	0.002
	(0.026)	(0.022)	(0.029)	(0.038)	(0.021)	(0.008)	(0.011)	(0.008)	(0.017)	(0.010)	(0.013)	(0.026)	
Compete (f)	-0.042	0.018	-0.034	0.031*	-0.024	0.023	0.012	-0.029*	-0.006	0.031*	0.020*	0.051*	0.053
	(0.026)	(0.041)	(0.030)	(0.017)	(0.025)	(0.016)	(0.019)	(0.016)	(0.012)	(0.016)	(0.012)	(0.030)	
Compete (all)	-0.042**	0.035	0.005	-0.019	0.005	0.011	0.000	-0.022**	-0.004	0.005	0.026***	0.016	0.001
	(0.019)	(0.023)	(0.020)	(0.021)	(0.017)	(0.009)	(0.012)	(0.009)	(0.011)	(0.009)	(0.007)	(0.017)	
N	1232	1232	1232	1232	1232	1232	1232	1232	1232	1232	1232	1232	

Note: Coefficients are from OLS regressions of a dummy for choosing a specific career category on a dummy for choosing the competitive payment option interacted with a gender dummy. Controls consist of experimental task dummies, performance in rounds 1 and 2 of the experiment, interactions of task and scores, GPA, math grades, lower-secondary school level dummies, interactions of grades and level dummies, school fixed effects, both incentivized measures of risk preferences and confidence in math. Standard errors in parentheses are clustered at the classroom level.

to choose the commerce apprenticeship.[24] At the bottom, both boys and girls who compete are less likely to take a 10th year of lower-secondary school, the result being significant when boys and girls are considered together. Boys are in turn significantly more likely to pursue a low-math apprenticeship, which is consistent with willingness to compete shifting people out of being stuck in lower-secondary school into actively pursuing an apprenticeship.

Finally, in the last column we show p-values from Wald tests where we test the hypothesis that the competition effects are jointly equal to zero. The tests show that willingness to compete is significantly related with career choices for boys and girls alike. In Table A1 we present two alternative specifications of the same regressions, first controlling only for performance in the experimental task and classroom fixed effects, and second additionally controlling for a range of socioeconomic background factors.[25] The coefficients are remarkably similar between these two specifications and Table 3.

We will now analyze how the relationship between willingness to compete and career choices varies along the ability distribution. For the following analysis, we split the sample into four ability groups as described in Section 2.3. Students with different abilities have different choice sets. For example, only students from the highest level of lower-secondary school get easy access to academic education while students at the lowest level are barred from academic education. Similarly, desirable apprenticeships which attract a lot of applications will be hard to obtain for students with below-average grades. See Figure A1 for choices by ability level.

Table 4 presents the career choice regressions separately for the four ability groups. For the top group (students who attend the high level of lower-secondary school), we only analyze academic choices and the choice between academic education and vocational education (plus 10th year), but not each vocational option separately. The reason is that few students in this group choose the medium and low levels of vocational education and sample sizes for some choices would therefore be very small.[26] For the same reason, we group all academic choices

[24] As mentioned in Section 2, the commerce apprenticeship can be completed at two levels, the higher of which is considerably more skill-intensive and prestigious and leads to higher-paid careers. We do not know for every student who chooses the commerce apprenticeship from which level they will graduate. However, for some students, we know for sure that they do the high level because they either mention it explicitly or because they pursue their diploma through a specialized school rather than an apprenticeship with a company. This group contains 21 boys and 16 girls (3.3 percent and 2.7 percent of boys and girls, respectively). If we regress an indicator of doing commerce at the high level on a competition dummy and the same controls used in Table 3, the competition coefficient is equal to 0.045 (0.014) for boys and -0.027 (0.014) for girls. This suggests that competitive boys, but not girls, are specifically attracted to the high level of the commerce apprenticeship.

[25] Mother living at home, father living at home, employment status mother, employment status father, immigration status mother, immigration status father, number of siblings, and language spoken at home.

[26] In particular, only 3 students in this group choose the 10th year and only 4 choose a medium-math apprenticeship. Furthermore, none of the boys choose a low-math apprenticeship and only one girl chooses a high-math apprenticeship.

together for the medium-low group where few students go for academic education.

We can see that the correlations between willingness to compete and choices at the academic level mostly stem from high-ability students. Students in the top group (high level of lower-secondary school) who compete in the experiment are 14 percentage points more likely to specialize in mathematics and physics. Girls who compete are also 17 percentage points more likely to specialize in biology and chemistry. Competitive students are also more likely to choose academic over vocational education, although this effect is marginally statistically significant only for girls.

The regressions also show that the correlations between willingness to compete and choice of apprenticeship mainly stem from the medium-high group (students from the middle level with above-median grades). Competitive girls in this group are 9.8 percentage points less likely to choose a low-math apprenticeship and 6.3 percentage points more likely to choose a high-math apprenticeship. Competitive boys, on the other hand, are less likely to choose a high-math apprenticeship and more likely to choose a commerce apprenticeship. The regressions also reveal that competitive students from the medium-high group are more likely to choose the Physics & Math and Music & Arts specializations in an academic high school.

Choices for the medium-low group (students from the middle level with below-median grades) are much less correlated with willingness to compete. The exception is that competitive girls in this group are less likely to choose a commerce apprenticeship and more likely to opt for academic education. The latter choice is very ambitious for students at this ability level and requires passing an entry exam. Finally, students in the bottom group (low level of lower-secondary school) who compete are 13 percentage points less likely to stay stuck in the additional, 10th grade of lower-secondary education (relative to a group average of 28 percent) and 11 percentage points more likely to choose a low-math apprenticeship.

Finally, we want to tackle the question of whether gender differences in willingness to compete can potentially account for gender differences in career choices. It is important to point out that we cannot answer this question in a causal way. We can merely demonstrate how the gender gap in our data varies with willingness to compete. Figure 5 contains the following thought experiment. How would gender differences in career choices look like in an extreme world where all boys and girls are willing to compete? And in a world where nobody is willing to compete? To answer these questions, we show the proportion of girls in each career option in four partially overlapping subsamples, corrected for grades and performance in the experimental tasks: 1. The subsample of all boys who chose competition and all girls who chose piece rate; 2. the subsample of all boys who chose competition and all girls who chose competition; 3. the subsample of all boys who chose piece rate and all girls who chose piece rate; and 4. the subsample of all boys who chose piece rate and all girls who chose

Table 4: Career choice regressions by ability level

Top (high level of secondary school):

	Academic						Academic	Joint
	Art	PPP	Lang	Econ	Bio/chem	Phys/math	Combined	p-val
Compete (m)	0.032	0.005	-0.069	0.038	-0.075	0.181*	0.116	0.061
	(0.067)	(0.081)	(0.071)	(0.123)	(0.126)	(0.097)	(0.209)	
Compete (f)	0.002	0.067	-0.132	0.047	0.174**	0.108	0.267*	0.000
	(0.133)	(0.042)	(0.097)	(0.072)	(0.073)	(0.071)	(0.126)	
Compete (all)	0.016	0.039	-0.103	0.043	0.061	0.141**	0.198	0.000
	(0.085)	(0.038)	(0.080)	(0.087)	(0.074)	(0.047)	(0.114)	
N	120	120	120	120	120	120	120	

Medium-high (medium level of secondary school with GPA higher than 4.75):

	Vocational					Academic						Ac.	Joint
	10th year	Low	Med	High	Com	Art	PPP	Lang	Econ	B/C	P/M	Comb.	p-val
Compete (m)	-0.021	0.078	0.021	-0.183**	0.138**	0.042	-0.001	0.005	-0.083	-0.043	0.048	-0.032	0.016
	(0.041)	(0.054)	(0.049)	(0.084)	(0.060)	(0.027)	(0.042)	(0.023)	(0.073)	(0.043)	(0.042)	(0.103)	
Compete (f)	0.042	-0.098*	-0.036	0.063**	0.029	0.075**	-0.036	-0.028	-0.043	0.000	0.032	-0.000	0.004
	(0.027)	(0.052)	(0.042)	(0.030)	(0.051)	(0.035)	(0.054)	(0.035)	(0.036)	(0.037)	(0.023)	(0.063)	
Compete (all)	0.018	-0.031	-0.014	-0.031	0.070*	0.062***	-0.023	-0.015	-0.058	-0.016	0.038*	-0.012	0.023
	(0.028)	(0.041)	(0.035)	(0.034)	(0.039)	(0.021)	(0.043)	(0.023)	(0.035)	(0.026)	(0.021)	(0.056)	
N	346	346	346	346	346	346	346	346	346	346	346	346	

Medium-low (medium level of secondary school with GPA of 4.75 or lower):

	Vocational					Academic	Joint
	10th year	Low	Med	High	Com	Combined	p-val
Compete (m)	0.021	-0.019	0.026	-0.060	0.061	-0.028	0.296
	(0.041)	(0.033)	(0.057)	(0.064)	(0.048)	(0.034)	
Compete (f)	-0.047	0.085	-0.058	0.010	-0.121*	0.131**	0.010
	(0.049)	(0.054)	(0.054)	(0.050)	(0.063)	(0.065)	
Compete (all)	-0.008	0.025	-0.010	-0.031	-0.016	0.039	0.253
	(0.032)	(0.028)	(0.036)	(0.042)	(0.040)	(0.033)	
N	396	396	396	396	396	396	

Bottom group (low level of secondary school):

	Vocational					Joint
	10th year	Low	Med	High	Com	p-val
Compete (m)	-0.165***	0.080	0.095	0.013	-0.023	0.001
	(0.046)	(0.052)	(0.066)	(0.053)	(0.018)	
Compete (f)	-0.079	0.150	-0.112	0.039	0.003	0.259
	(0.069)	(0.103)	(0.088)	(0.035)	(0.039)	
Compete (all)	-0.131***	0.107**	0.014	0.023	-0.013	0.000
	(0.036)	(0.045)	(0.052)	(0.038)	(0.019)	
Observations	370	370	370	370	370	

competition.

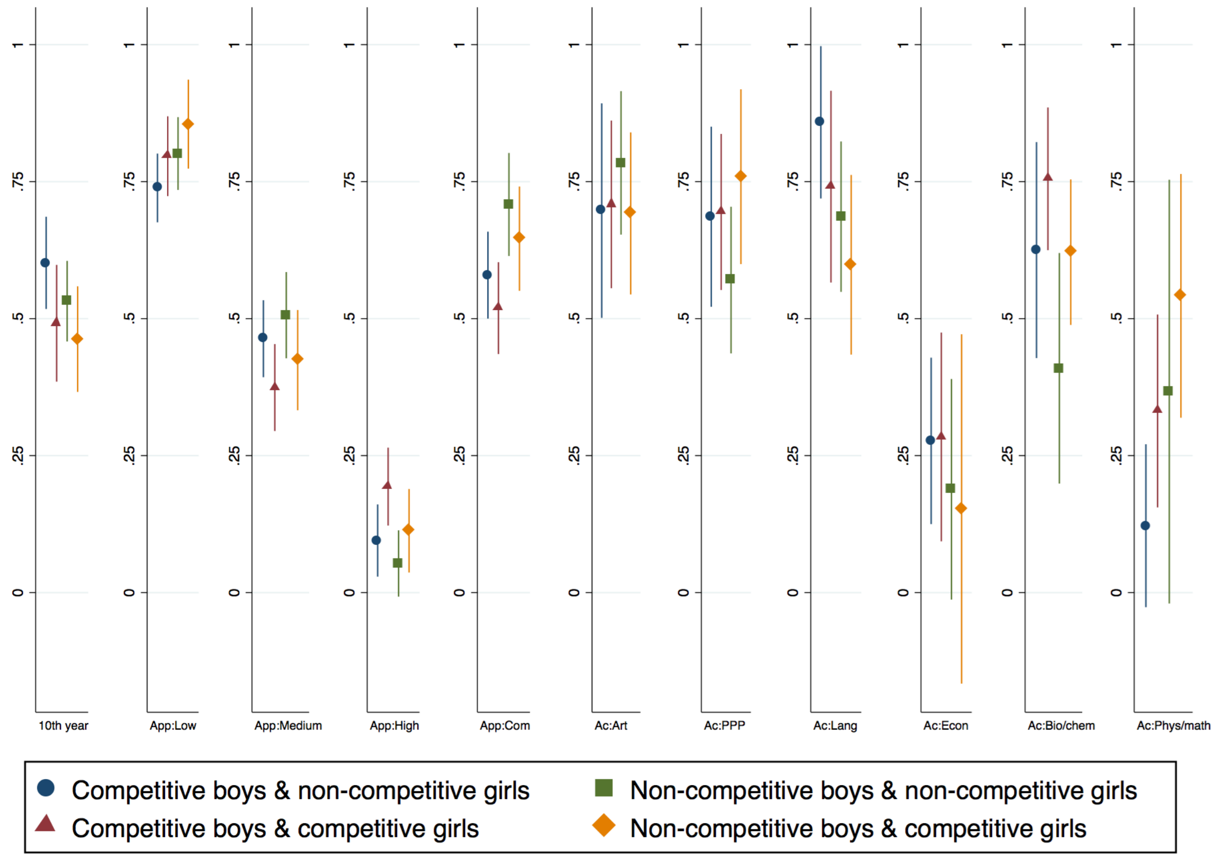
We observe the most extreme between-subsample differences in the Physics & Math specialization. In the subsample of girls who compete and boys who do not, 54 percent of the students who choose Physics & Math are female. In the subsample of boys who compete and girls who do not, the proportion of girls is a mere 12 percent. In the Language specialization, the corresponding proportions are 86 and 59 percent. Also, going from a world where girls do not compete to a world where all girls compete increases the proportion of girls in Biology & Chemistry by roughly 23 percentage points. In vocational education, going from a world where girls do not compete to a world where all girls compete increases the proportion of girls in high-math apprenticeships by roughly 10 percentage points and reduces the proportion of girls in medium-math apprenticeships by roughly 8 percentage points. Going from a world where boys do not compete to a world where all boys compete increases the proportion of boys in the commerce apprenticeship by roughly 12 percentage points.

It is again important to point out that this does not necessarily imply a causal effect of willingness to compete in the sense that this is how gender differences in career choices would change if we would somehow "train" boys or girls to be more or less competitive. Rather, it shows in which direction the gender differences in career choices (conditional on ability) change as all the unobserved personality factors that contribute to willingness to compete change in one direction or the other. Smaller changes in the proportion of competing boys and girls would fall in between the maximum and minimum gender imbalances we estimate. The observed differences are rather large at the academic level, especially concerning the most challenging and math-intense specializations. We also observe statistically significant differences at the vocational level. On the one hand, the difference in the proportion of girls in high-math apprenticeships between subsamples is large compared to the low proportion of girls in these apprenticeships. On the other hand, it is clear that willingness to compete can only bridge a small part of the huge gender gap in choosing such careers.

5 Conclusions

Our study is based on an incentivized measure of willingness to compete in a sample of over 1500 Swiss lower-secondary school students covering the whole ability distribution. Past research has shown that willingness to compete predicts career choices at the top of the talent distribution. For example, competitive individuals are more likely to specialize in STEM subjects in academic education or choose a career in finance. Moreover, a large experimental literature documents that men tend to be more willing to compete than women and there is evidence that this gender gap can partially account for gender differences in

Figure 5: Proportion of girls in each career option by willingness to compete



Note: The figure shows the predicted proportion of girls in each of the career options for different subsamples. The predictions are obtained from OLS regressions of career choice dummies on a gender dummy, a task dummy, performance in rounds 1 and 2 of the experiment, interactions between task and performance, GPA, math grades, lower-secondary school level dummies, interactions of grades and level dummies, and school fixed effects. "Competitive boys & non-competitive girls" is the subsample that contains all boys who choose competition and all girls who choose piece rate; "Competitive boys & competitive girls" is the subsample that contains all boys who choose competition and all girls who choose competition. "Non-competitive boys & non-competitive girls" is the subsample that contains all boys who choose piece rate and all girls who choose piece rate. "Non-competitive boys & competitive girls" is the subsample that contains all boys who choose piece rate and all girls who choose competition. Spikes represent 90-percent confidence intervals and standard errors are clustered at the classroom level.

career choices. Our sample allows us to answer two important questions that cannot be answered with selective samples of high-ability individuals: First, how does the gender gap in willingness to compete vary with ability? And, second, how does willingness to compete predict career choices along the whole ability distribution?

Our first main finding is that the gender gap in willingness to compete is highest for the highest-ability students and zero for the lowest-ability students. This is because high-ability boys are substantially more willing to compete than low-ability boys, while the relationship between ability and willingness to compete is flat for girls. Strikingly, we observe the largest gender gap for the best students at the highest level of secondary school. This indicates that the gender gap in willingness to compete is most pronounced for the individuals with the highest chances for academic and professional success, which may be informative for understanding why there are so few women in top positions in science and business.

Our second main finding is that willingness to compete predicts career choices at all levels of the ability distribution. For high-ability boys and girls, willingness to compete is positively associated with specializing in Math & Physics in the academic track, the most math-intensive and ambitious of career choices. Girls who are willing to compete in the experiment are also more likely to choose the academic specialization of Biology & Chemistry. For students just below the top of the ability distribution, willingness to compete predicts choosing a math-intensive apprenticeship for girls and a business-oriented apprenticeship for boys. At the bottom of the ability distribution, competitive students are more likely to enter an apprenticeship rather than staying stuck in a 10th grade of lower-secondary school. For girls, but not boys, willingness to compete also predicts choosing academic over vocational education in general. In summary, at each level of the ability distribution within the choice sets of the students, willingness to compete is associated with choosing options that are more challenging and lead to higher-paid careers.

Our findings are consistent with those of Buser, Niederle, and Oosterbeek (2014) in that we find that being willing to compete is associated with choosing more ambitious, math-intense, and highly-paid careers. An important feature that the Swiss and Dutch systems have in common is that (as in many other European countries) students are asked very early on to make a once-and-for-all choice committing them to a certain career and educational level. It seems plausible that competitive and confident people would be more willing to commit to a highly ambitious trajectory for the long term (Niederle, 2017). An important next step, and one that brings this research agenda closer to educational policy decisions, would therefore be to investigate how the institutional setting in which career choices are made moderates the link between willingness to compete and career choices (and the gender difference in career choices).

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Appendix: Tables

Table A1: Additional career choice regressions

Controlling only for performance in the task and classroom fixed effects:

	Vocational							Academic				Academic	Joint
	10th year	Low	Med	High	Com	Art	PPP	Lang	Econ	Bio/chem	Phys/math	Combined	p-val
Compete (m)	-0.041	0.048**	0.028	-0.064*	0.027	0.002	-0.015	-0.017**	0.008	-0.016	0.041**	0.003	0.006
	(0.028)	(0.022)	(0.029)	(0.037)	(0.025)	(0.007)	(0.014)	(0.008)	(0.019)	(0.012)	(0.015)	(0.031)	
Compete (f)	-0.025	0.005	-0.057*	0.030	-0.033	0.023	0.015	-0.012	0.002	0.029*	0.023*	0.080**	0.014
	(0.027)	(0.041)	(0.034)	(0.019)	(0.028)	(0.017)	(0.020)	(0.019)	(0.014)	(0.016)	(0.013)	(0.034)	
Compete (all)	-0.034*	0.027	-0.013	-0.019	-0.002	0.012	-0.001	-0.014	0.005	0.006	0.032***	0.040*	0.002
	(0.020)	(0.024)	(0.021)	(0.021)	(0.019)	(0.008)	(0.014)	(0.010)	(0.012)	(0.010)	(0.009)	(0.022)	
N	1232	1232	1232	1232	1232	1232	1232	1232	1232	1232	1232	1232	

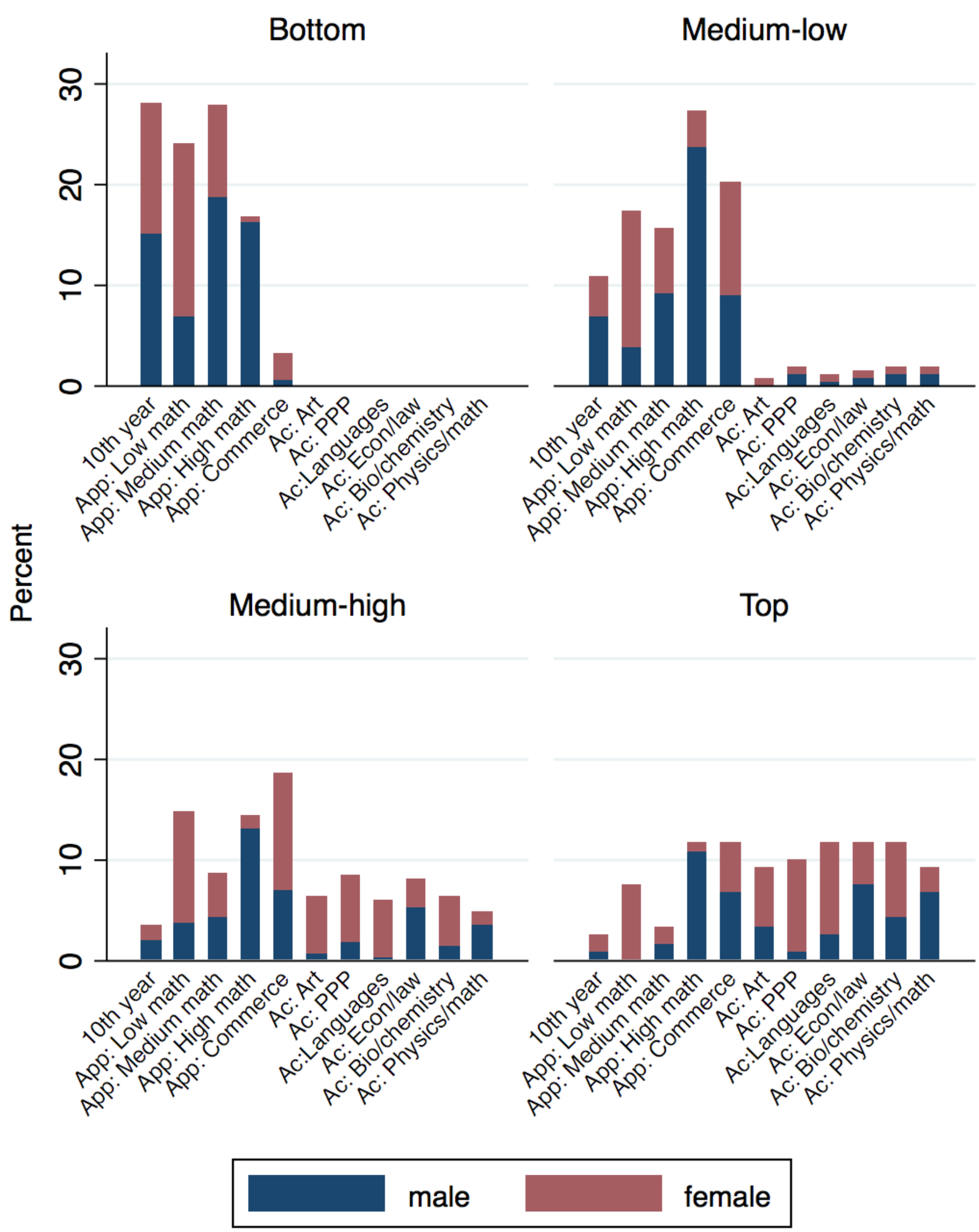
Additionally controlling only for socioeconomic background:

	Vocational							Academic				Academic	Joint
	10th year	Low	Med	High	Com	Art	PPP	Lang	Econ	Bio/chem	Phys/math	Combined	p-val
Compete (m)	-0.047*	0.053**	0.047	-0.063*	0.031	-0.001	-0.013	-0.016**	-0.002	-0.020*	0.032**	-0.021	0.001
	(0.026)	(0.022)	(0.029)	(0.037)	(0.021)	(0.007)	(0.011)	(0.008)	(0.017)	(0.011)	(0.014)	(0.026)	
Compete (f)	-0.043	0.015	-0.042	0.034*	-0.019	0.024	0.010	-0.028*	-0.006	0.031*	0.024*	0.055*	0.046
	(0.027)	(0.039)	(0.031)	(0.019)	(0.024)	(0.016)	(0.020)	(0.017)	(0.012)	(0.017)	(0.012)	(0.031)	
Compete (all)	-0.045**	0.035	0.004	-0.017	0.007	0.011	-0.001	-0.022**	-0.004	0.005	0.028***	0.016	0.000
	(0.019)	(0.023)	(0.020)	(0.021)	(0.017)	(0.008)	(0.012)	(0.009)	(0.011)	(0.009)	(0.008)	(0.017)	
N	1232	1232	1232	1232	1232	1232	1232	1232	1232	1232	1232	1232	

Note: Coefficients are from OLS regressions of a dummy for choosing a specific career category on a dummy for choosing the competitive payment option interacted with a gender dummy. Controls in the upper panel consist only of experimental task dummies, performance in rounds 1 and 2 of the experiment, interactions of task and scores and classroom fixed effects. Controls in the lower panel consist of experimental task dummies, performance in rounds 1 and 2 of the experiment, interactions of task and scores, GPA, math grades, lower-secondary school level dummies, interactions of grades and level dummies, school fixed effects, both incentivized measures of risk preferences and confidence in math plus the the following socioeconomic controls: mother living at home, father living at home, employment status mother, employment status father, immigration status mother, immigration status father, number of siblings, and language spoken at home. Standard errors in parentheses are clustered at the classroom level.

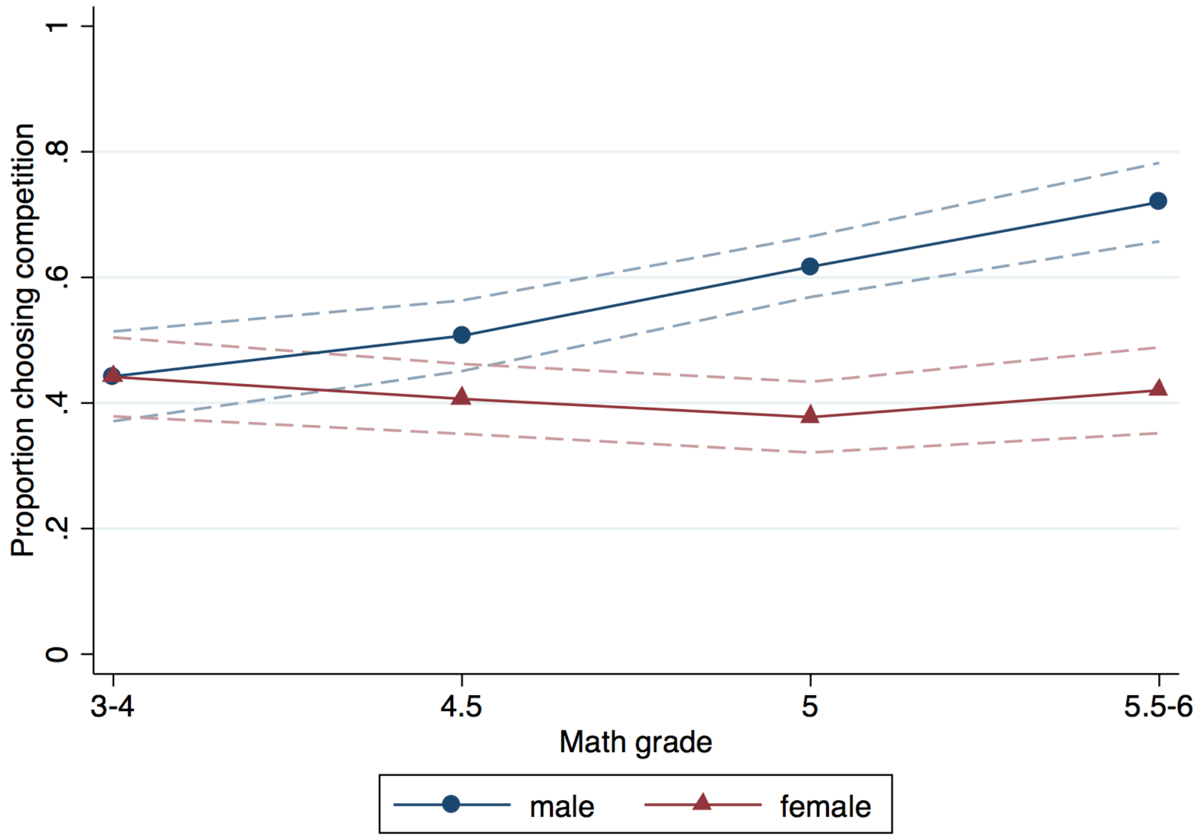
Appendix: Figures

Figure A1: Career choices of girls and boys by ability level



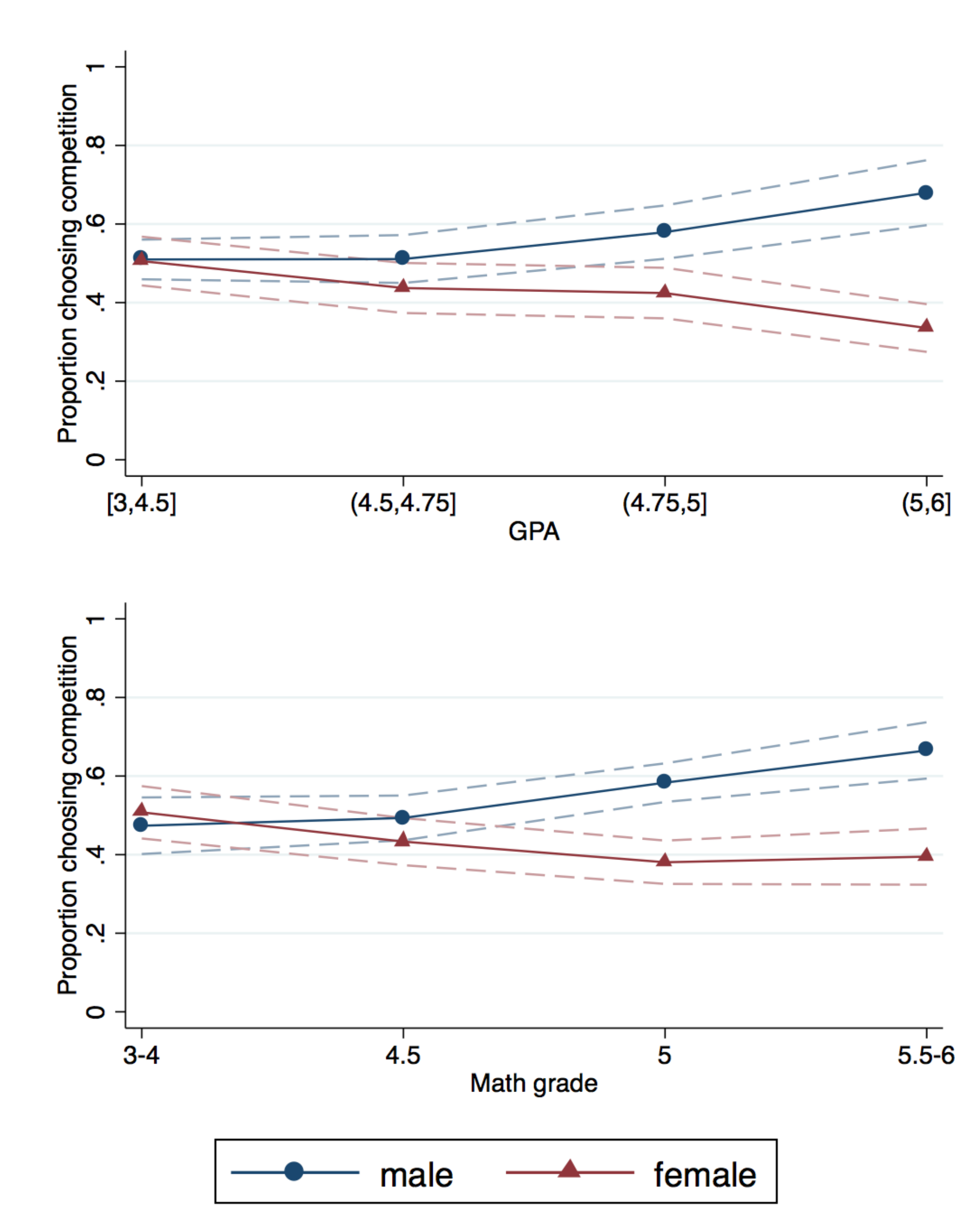
Note: “App” means apprenticeship, “Ac” means academic, and “PPP” means Philosophy, Pedagogy & Psychology.

Figure A2: Gender, willingness to compete and math grades



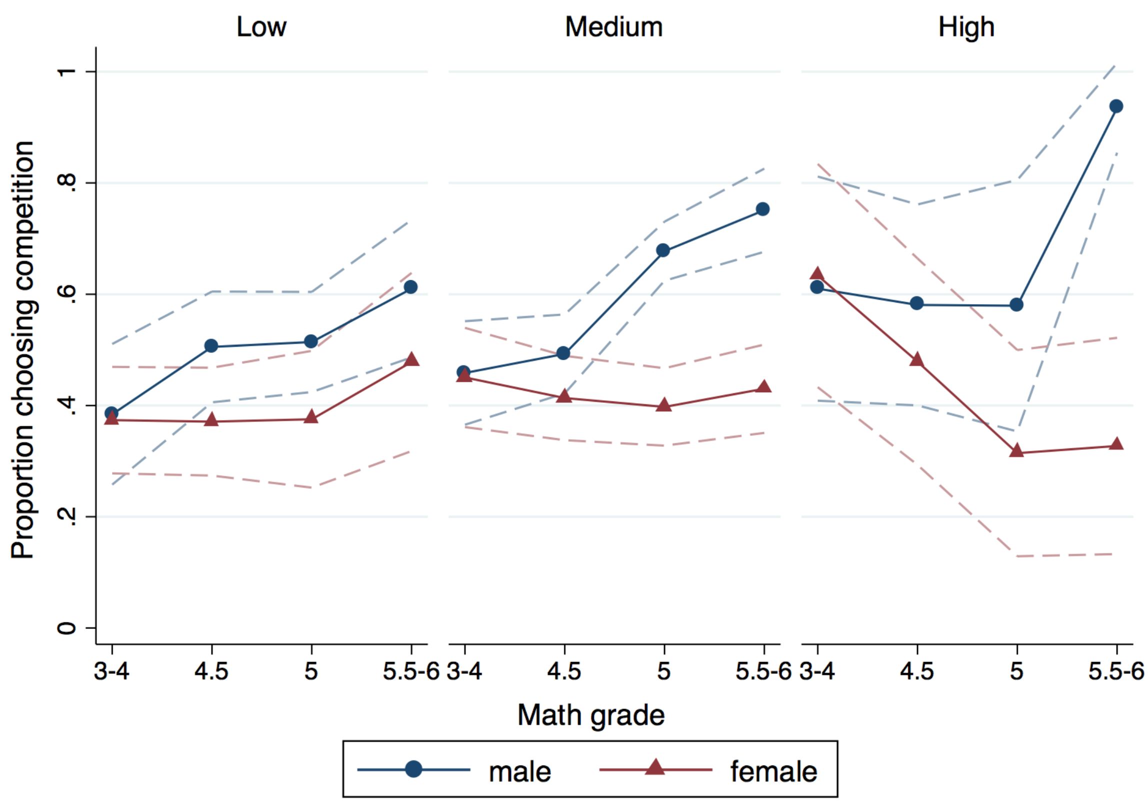
Note: The graphs show willingness to compete for students with a specific math grade conditional on experimental task, performance in rounds 1 and 2 of the experiment (interacted with task), level of lower-secondary school (low, medium or high), and school fixed effects. Grades in the Swiss system go from 1 (low) to 6 (high). The estimators are obtained from OLS regressions of a tournament entry dummy on a female dummy, grade dummies and the interaction of the two plus the mentioned controls. Confidence bands represent 90-percent confidence intervals and standard errors are clustered at the classroom level.

Figure A3: Gender, willingness to compete and ability controlling for risk attitudes, confidence in math, and socioeconomic controls



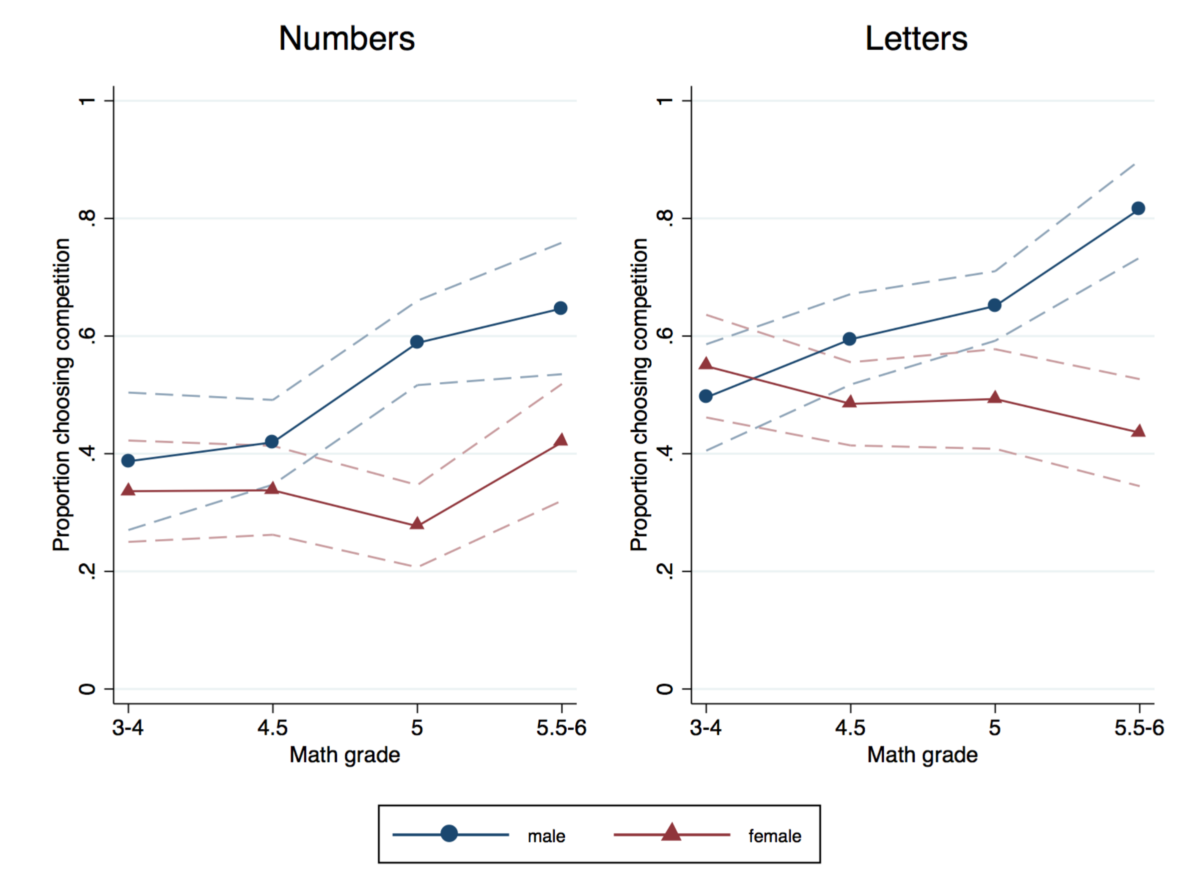
Note: The graphs show willingness to compete for students with a specific GPA or math grade conditional on experimental task, performance in rounds 1 and 2 of the experiment (interacted with task), level of lower-secondary school (low, medium or high), school fixed effects, two measures of risk attitudes (lottery choice and BRET) and self-reported confidence in math, plus the the following socioeconomic controls: mother living at home, father living at home, employment status mother, employment status father, immigration status mother, immigration status father, number of siblings, and language spoken at home. Grades in the Swiss system go from 1 (low) to 6 (high). The estimators are obtained from OLS regressions of a tournament entry dummy on a female dummy, grade dummies and the interaction of the two plus the mentioned controls. Confidence bands represent 90-percent confidence intervals and standard errors are clustered at the classroom level.

Figure A4: Gender, willingness to compete and math grades by lower-secondary school level



Note: The graphs show willingness to compete for students with a specific math grade conditional on experimental task, performance in rounds 1 and 2 of the experiment (interacted with task), level of lower-secondary school (low, medium or high), and school fixed effects. Grades in the Swiss system go from 1 (low) to 6 (high). The estimators are obtained from OLS regressions of a tournament entry dummy on a female dummy, grade dummies and the interaction of the two plus the mentioned controls. Confidence bands represent 90-percent confidence intervals and standard errors are clustered at the classroom level.

Figure A5: Gender, willingness to compete and math grades by task



Note: The graphs show willingness to compete for students with specific math grade conditional on experimental task, performance in rounds 1 and 2 of the experiment (interacted with task), level of lower-secondary school (low, medium or high), and school fixed effects. Grades in the Swiss system go from 1 (low) to 6 (high). The estimators are obtained from OLS regressions of a tournament entry dummy on a female dummy, grade dummies and the interaction of the two plus the mentioned controls. Confidence bands represent 90-percent confidence intervals and standard errors are clustered at the classroom level.