Experimental Economics (2022) 25:1299–1326
https://doi.org/10.1007/s10683-022-09765-8

ORIGINAL PAPER

Willingness to compete, gender and career choices along the whole ability distribution

Thomas Buser[1] · Noemi Peter[2] · Stefan C. Wolter[3]

Received: 19 February 2021 / Revised: 22 June 2022 / Accepted: 23 June 2022 /
Published online: 8 August 2022
© The Author(s) 2022

Abstract

We expand the scope of the literature on willingness to compete by asking how it varies with academic ability and whether and how it predicts career choices at different ability levels. The literature so far has mainly focused on career choices made by students at the top of the ability distribution, particularly in academic institutions. We experimentally elicit the willingness to compete of 1500 Swiss lower-secondary school students at all ability levels and link it to the study choice that students make upon finishing compulsory school. Our analysis of the relationship between willingness to compete and the study choice considers the full set of study options, including the options in vocational education. We find that willingness to compete predicts which study option high-ability students choose, not only among academic specializations but also among vocational careers, and, importantly, it also predicts whether low-ability boys pursue upper-secondary education upon finishing compulsory schooling. Our second main contribution is to systematically explore how willingness to compete varies with academic ability. We find that high-ability boys, but not girls, are substantially more willing to compete compared to all other children. As a consequence, the gender gap in willingness to compete is significantly lower among low-ability students than among high-ability students. Overall, our study highlights that insights from the literature on willingness to compete are relevant for a broader set of policy questions, populations and choices.

Keywords Willingness to compete · Gender · Career decisions · Ability

We gratefully acknowledge funding from the Swiss State Secretariat for Education, Research and Innovation (SERI) through its Leading House on the Economics of Education, Firm Behaviour and Training Policies. We also thank Mr. Walter Goetze (bfb Büro für Bildungsfragen AG) for providing us the exact values of the apprenticeship requirement ratings. The authors thank Rahel Braun, Katharina Jaik and Michael Raaflaub for their help in collecting and preparing the data. We thank Muriel Niederle, Alvin Roth, Lise Vesterlund, and Laura K. Gee for their insightful comments. The replication material for the study is available at https://doi.org/10.3886/E170641V1.

✉ Noemi Peter
a.n.peter@rug.nl

Extended author information available on the last page of the article

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

JEL classification D91 · J16 · J24

1 Introduction

Individual differences in willingness to compete have attracted a lot of attention in economics as a potential determinant of labor market outcomes. Starting with Gneezy et al. (2003) and Niederle and Vesterlund (2007), many studies have used incentivized experiments to measure willingness to compete, focusing in particular on documenting gender differences. A growing number of studies link experimental measures of willingness to compete to career choices (e.g. Buser et al., 2014; Reuben et al., 2015). This literature, including a companion paper of ours (Buser et al., 2017), tends to focus on selective samples of students from the top of the ability distribution, such as (aspiring) university students.

In this paper we expand the scope of investigation by asking how willingness to compete varies across different levels of academic ability and whether and how it predicts career choices at different ability levels. Our comprehensive analysis includes the full range of options available at the end of compulsory schooling. Many of the most pressing issues in educational policy relate to choices made by students at lower levels of academic ability which are plausibly linked to willingness to compete. For instance, in many OECD countries, policymakers are concerned about students at the low end of the ability distribution who are at risk of not obtaining an upper-secondary education (OECD, 2012). For effective policies it is important to understand which factors motivate struggling students (Heckman et al., 2012).[1] This issue is not specifically about girls, which may explain why it received little attention so far in the traditionally gender-focused competitiveness literature. There is also renewed international interest in vocational education including apprenticeship programs (Bertrand et al., 2021; OECD, 2015; Symonds et al., 2011). Notably, large differences in ambitiousness and expected salaries exist between career options in the vocational sector. We examine whether the link between experimental competition choices and choosing more ambitious careers holds when vocational options are included.

Our study is based on two data collection waves. In the first wave, we experimentally elicited the willingness to compete of more than 1500 Swiss students from all parts of the ability distribution while they were still in compulsory education. More than one and a half years later, we conducted a second data collection wave so that we can relate the experimental measure of willingness to compete to the choice of post-compulsory education. We use our rich data and diverse sample to examine several new questions.

[1] Policy reforms can easily backfire if policymakers do not understand students' motivations. An illustrative example is the introduction of the GED program in the US. The GED test was supposed to give people a second chance to get a qualification, but had the unintended consequence of increasing dropout rates. Apparently, many students preferred this easier but lower-return option over high school graduation. See Heckman et al. (2012) for details.

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

The first data collection wave enables us to examine how the gender gap in willingness to compete varies with academic ability. One reason to expect ability to matter is that in the field, competitions are often organized for those who are at the top of the ability distribution, meaning that high-ability students are likely more exposed to, and therefore more comfortable with, competition.[2] While this may make high-ability boys more inclined to compete than low-ability boys, the situation is more complex for girls. According to psychologists, gender norms prescribe that women should be modest (Smith & Huntoon, 2014; Budworth & Mann, 2010).[3] If the modesty norm makes high-ability girls behave as if they were of lower ability, the correlation between ability and willingness to compete will be weaker among girls. We further contribute by measuring students' willingness to compete in either a Numbers task or a Letters task, which differ from each other in associated gender stereotypes.[4] Our design therefore enables us to examine the variation of the gender gap along the ability distribution not only in a standard, stereotypically male numerical task, but also in a more stereotypically female task.

Our second data collection wave allows us to link the experimental measure of willingness to compete to the study choice that students make upon finishing compulsory school. Our analysis looks at the relationship between willingness to compete and this study choice at all ability levels, and it considers the full set of study options, including the options within vocational education. Previous studies linking willingness to compete to study choices tend to use selected samples or consider a limited set of study choices. Many studies focus on selective samples from the top of the ability distribution, such as students in the academic track of high school (Buser et al., 2014), college students (Reuben et al., 2017), or MBA graduates (Reuben et al., 2015), and analyze a restricted set of choices that are specific to these groups. Others examine more diverse samples but link willingness to compete to a binary educational choice such as taking an academic exam (Zhang, 2012) or choosing the academic track of upper-secondary education (Almås et al., 2016).[5]

[2] In the educational context, many student competitions are targeted towards high-ability students. The Swiss Coordination Centre for Research in Education lists competitions as one of the measures used in gifted and talented education (see SCCRE, 2007).

[3] In line with this, Mancuso et al. (2020) find a gender gap in self-promotion and Exley and Kessler (2020) find that women describe their own performance at a test more modestly than equally performing men, even after receiving full information about their absolute and relative performance.

[4] There is a debate in the literature on the dependence of the gender gap in competitiveness on task stereotypes. A number of studies found that the gender gap is present only in a numbers-based task but not in a letters-based task, suggesting that the gap is driven by task stereotypes (Kamas & Preston, 2009; Große & Gerhard, 2010; Shurchkov, 2012; Dreber et al., 2014; Boschini et al., 2014). However, others found that the gap is similar across such tasks (Cardenas et al., 2012; Wozniak et al., 2014). The evidence is mixed for non-cognitive tasks as well. Apicella and Dreber (2015) find gender gaps for a male task (strength) and a neutral task (skipping rope), but not a female task (collecting beads). However, Sutter and Glätzle-Rützler (2014) find a gender gap in both a stereotypically male task (running) and a stereotypically female task (picking items from a basket).

[5] Furthermore, Flory et al. (2015) and Samek (2019) run field experiments recruiting people for real jobs and find that compensation schemes which depend on relative performance deter women from applying relative to men.

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

In a companion paper (Buser et al., 2017), we show that the finding of a significant relationship between willingness to compete and the specialization choices of academic-track high school students in the Netherlands by Buser et al. (2014), hereafter BNO, replicates in Switzerland. Since the sample of BNO consisted exclusively of students from the academic track of secondary education, the companion paper looks at a subsample of our dataset: those students who chose to continue their education in academic high schools. That selective subsample is only about 17 percent of the whole sample. In the current paper, we use the whole sample which enables us to look at the whole ability distribution and address our new research questions.

We build on a large literature which uses incentivized experiments to measure willingness to compete. In pioneering studies, Gneezy et al. (2003) find that men react more strongly than women to competitive incentives and Niederle and Vesterlund (2007) find that men are more likely to enter a competition than women. This second result has been replicated many times (see Niederle, 2016; Niederle & Vesterlund, 2011; Croson & Gneezy, 2009 for surveys). Several studies have investigated willingness to compete in the same age group as our sample or in younger children.[6] While some of these studies have diverse samples that cover children from different ability levels (e.g. Sutter & Glätzle-Rützler, 2014; Almås et al., 2015), none of them have systematically related the gender gap in willingness to compete to field data on academic ability. A crucial insight from a policy perspective is provided by Alan and Ertac (2019), who conduct a randomized educational intervention in compulsory schools and show that children's competitiveness is malleable.

Our analysis yields two major findings which enhance our understanding of individual and gender differences in willingness to compete and their relevance for explaining career paths.

First, we find a strong relationship between academic ability and willingness to compete in our incentivized choice experiment. Remarkably, the gender gap in willingness to compete increases with ability 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. Conditional on performance in the task, girls at the highest ability level are 27 percentage points less likely to compete than boys with comparable academic ability. This gap is only about 10 percentage points

[6] Booth and Nolen (2012) find that girls from single-sex schools are as competitive as boys but Lee et al. (2014) find no effect of random assignment to single-sex schools on the gender gap in willingness to compete. Dreber et al. (2014) find a significant gender gap in a math but not a verbal task while Cardenas et al. (2012) finds a significant gap in both tasks in Sweden but no gap in any of the tasks in Colombia. Almås et al. (2015) find that the gender gap is not present any more when one looks at children with a low socioeconomic background and Bartling et al. (2012) find that young children with health problems are less willing to compete. Other studies have explored at what age the gender gap emerges. Sutter 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. In contrast, Samek (2013) finds no gender difference for pre-schoolers. 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.

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

for low-ability students. We find that the gender gap increases with ability both in a male-stereotyped numbers-based task and in a less stereotyped letters-based task.

Second, we find that willingness to compete predicts choices not only of academic specializations but also of vocational careers, as well as the choice between academic and vocational education, and, crucially, whether low-ability (male) students enter upper-secondary education upon finishing compulsory schooling.

2 Background

2.1 The education system

Our data comes from Switzerland, from the German-speaking part of the second-largest canton, Bern. Compulsory school is made up of six years of primary school and three years of lower-secondary school. Upon finishing the 9th grade, students can proceed to upper-secondary education, which has both an academic and a vocational track.

We collected data in lower-secondary schools in two waves: at the beginning of the 8th grade (experiment and background variables) and at the end of the 9th grade (study choices). In lower-secondary school, students are tracked into different levels based on their ability. To determine the appropriate level, students are observed and assessed at the end of primary school (in grades 5-6). Low-ability students are then assigned to the so-called “Real” level, whereas medium-ability and high-ability students are assigned to the “Sekundar” level. In some schools there is also a special track within the Sekundar level for high-ability students, called “Spezielle Sekundar”, which incorporates preparation for the academic track of upper-secondary education in the core curriculum.[7]

For our analysis, we want to use an ability classification that has high validity in the field. Therefore, we follow the official ability categorization and consider all “Real” students as low-ability and all “Spezielle Sekundar” students as high-ability. Since the regular “Sekundar” level has both medium- and high-ability students, within this level we use grades to assign students to the high-ability versus the medium-ability group. Our ability classification is therefore based entirely on field data and consist of the following three groups: low (Real students), medium (Sekundar students whose GPA is at or below the median), and high (Sekundar students with above-median GPA and Spezielle Sekundar students).

When it comes to the transition to upper-secondary education, students from the low (Real) level can get into the vocational track, but not into the academic track. To get into vocational education, students have to apply for an apprenticeship position with companies which post a vacancy or with institutions specialized in vocational education and training. For students from the standard (Sekundar) and the pre-academic (Spezielle Sekundar) levels, both vocational education and the academic track

7 In contrast, at the Sekundar level the preparation for the academic track is an elective part of the curriculum.

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

are possible paths. To get into the academic track, students have to either acquire a recommendation from their school or pass an entry exam.

The vocational track is the most popular form of upper-secondary education in Switzerland. It covers a wide range of economic activity with a large number of specific apprenticeships. To make the analysis tractable, we group apprenticeships based on their math intensity. Our grouping makes use of the fact that the apprenticeships were officially assessed in an evaluation project of the EDK (Swiss Conference of Cantonal Ministers of Education) and the Swiss Trade Association (sgv). Building on that evaluation, we use the following apprenticeship categories in our analysis: low math, medium math, high math and commerce. We treat the commerce apprenticeship as a separate category because, unlike the other apprenticeships, it is chosen by a large fraction of people (roughly one fifth of students in our sample who do an apprenticeship make this choice), and because it leads to a large variety of careers, some of which are more math-intensive than others. For further details on the categorization, see "Online Supplementary Material Appendix C.1".

During an apprenticeship, most students spend part of their time learning on the job and part of their time in school. About 5 percent of students choose to study at a specialized school. Specialized schools mainly fall into three categories: commerce schools where students can do the school-based equivalent of the commerce apprenticeship, applied computer science schools where students can do the school-based equivalent of the computer technician apprenticeship, and schools specialized in the domain of health and social work. Throughout, we will group these choices with the apprenticeships they most closely correspond with.

The academic track is the second-most popular option and is chosen by about 1 in 5 students. It consists of studying at a Baccalaureate school, which is an academic high school that prepares students for university. Baccalaureate-school students have to select one of the following specializations: Physics & Math, Biology & Chemistry, Economics & Law, Languages (Ancient or Modern), Music & Arts, and Philosophy, Pedagogy & Psychology.[8]

About a fifth of the students do not transition to upper-secondary education right after the 9th grade. There can be various reasons behind this. Some are not able to make up their mind on what to study or lack motivation, and hence do not apply anywhere. Others may apply for apprenticeships but give up after a few rejections. In any case, students who do not transition often choose some kind of institutionally organized interim option. Most commonly they enter the "10th grade", which is a non-certifying additional year of lower-secondary school. Other organized options are pre-apprenticeships and practice-oriented courses. There are also various informal alternatives, such as language stays abroad. For simplicity, in the analysis we

[8] In practice, Ancient Languages and Modern Languages are two separate specializations, and Music and Arts are also two separate specializations. We made two merged categories from these four specializations because of their similarities and to avoid a low number of observations for each choice separately.

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

will use the umbrella term “outside options” to cover all alternatives that are outside upper-secondary education.[9]

From a policy perspective, it is worrisome that many young people fail to enter upper-secondary education upon finishing compulsory schooling. Upper-secondary educational attainment is considered to be a key determinant of success in the Swiss job market and the Swiss Conference of Cantonal Ministers of Education (EDK) has repeatedly articulated that nearly all young people should acquire an upper-secondary qualification (EDK, 2006; EDK, EVD, & EDI, 2011; EDK, 2015). Timing is also important: postponing the entry into upper-secondary education to a later year means forgone earnings for the individual and forgone financial contributions to society.[10]

2.2 Data collection

The data for this study was collected within a larger project that gathered data in two waves. The first wave consisted of the incentivized willingness to compete experiment and a survey, both of which were computerized. It was conducted in the beginning of the 2013/2014 school year among 8th graders. We were interested in students in regular education, irrespective of whether they were attending the low (Real), standard (Sekundar) or pre-academic (Spezielle Sekundar) level.[11] Accordingly, we contacted all regular lower-secondary schools in the German-speaking part of the canton of Bern. We mentioned only the broad topic of our research (study choices), without going into specifics such as our interest in gender and competition. We asked schools to let us collect data during a class hour. Twenty-eight schools were willing to participate, and most of them had several classes of 8th graders.[12] As a result, our first-wave sample consists of 1514 students from 87 classes.[13] This is about 17 percent of the students from the target population. The gender ratio is balanced and the participating schools are geographically dispersed, from rural as well as urban areas of the canton. The average class size is close to the cantonal and

[9] Choosing an outside option at the end of the 9th grade means that the students spends the next academic year, and possibly more years, outside upper-secondary education. We could not re-survey students in later years, but longitudinal data on earlier cohorts shows that around a third of those who did not make a direct transition do not make a transition to upper-secondary education in the year after that either (TREE data, reported in Egger, Dreher & Partner AG, 2007).

[10] Some students may postpone the entry in the hope of getting a better apprenticeship next year, but research shows that they typically end up with an apprenticeship that is similar to what they could have gotten had they transitioned immediately (Sacchi & Meyer, 2016).

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

[12] To incentivize schools to take part, they received money for 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 also paid into each class fund.

[13] 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.

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

national average. At the time of the first wave, students were on average 14 years old.

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 (adding up sets of four two-digit numbers) or Letters (counting 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. 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.[14] 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 and socio-economic background.[15] The questionnaire also contained two incentivized risk preference tasks. In the first, participants had 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 & Grossman, 2002). The second task 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 & 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".[16] We will use the answers to this question as our confidence measure in the analysis. This is admittedly a less precise measure of beliefs than the incentivized measure used by Niederle and Vesterlund (2007).[17] When discussing competition choices, we will stick to the term willingness to compete and not claim that we can isolate preferences for competition.

[14] The performance of those who chose to compete was compared to a random set of performances from the same round (similarly to Dreber et al., 2014). 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.

[15] As the survey was part of a larger data collection project, it also contained opinion questions related to education, questions on students' aspirations, and unincentivized questions on variables such as time preferences, locus of control, and sunk-cost aversion. The locus of control measure and the aspirations from this survey are used in Jaik and Wolter (2016) and Jaik and Wolter (2019), respectively.

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

[17] We actually wanted to elicit participants' beliefs about their own relative performance in the experiment in an incentivized way, and empirically compare the predictive power of the two confidence measures for study choices. Unfortunately, due to a bug in the program the answers to the Niederle-Vesterlund question were not recorded.

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

The second wave of data collection took place at the end of the 2014/2015 school year, when the students were around 16 years old. In this wave we surveyed the students about their educational and labor market choices and expectations. The survey took place when the students were about to finish the 9th grade. By this time, the recommendation process and entrance exams for Baccalaureate school were over and the overwhelming majority of apprenticeship contracts was also signed already. Thus, the choices we analyze are final. We contacted students via their schools. In case the student had already left their 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.

2.3 Task stereotypes

We elicited willingness to compete in either a Numbers or a Letters task. The Numbers task is a standard math task which is often used in the literature: participants need to add up sets of four two-digit numbers. In the Letters task, participants need to count how many times a certain letter appears in a random sequence of 50 letters. The Numbers task has previously been found to be stereotypically male (Cardenas et al., 2012). With the Letters task, we aimed to find a task that differs in associated stereotype but is still in the math domain.[18] Previous studies used letters-based tasks that were verbal tasks, and hence they cannot separate the change in task stereotypes from the change in the cognitive domain.[19]

To check whether our intuition was correct, we included questions about the tasks in our survey. In particular, in the second-wave 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 had performed the Numbers task in the first wave only about their beliefs concerning the Letters task and vice versa.

Overall, the students think boys have an advantage in Numbers (mean=3.16; $p = 0.000$) and girls have an advantage in Letters (2.95; $p = 0.095$).[20] When splitting the

[18] Consider the options of a policymaker who wants to attract more women to a mathematical field by changing some features of the study program. Clearly, if the aim is to attract women to a mathematical field, the solution cannot be to make the study program non-mathematical. Instead, the policymaker can try to change perceptions.

[19] Kamas and Preston (2009) have subjects make new words from letters in an eight-letter word; Große and Gerhard (2010) have subjects order five words into correct sentences; Shurchkov (2012) has subjects form sub-words from the letters in a larger word; Cardenas et al. (2012) and Dreber et al. (2014) have subjects do a word search task; Boschini et al. (2014) have subjects form words from eight given letters; Wozniak et al. (2014) have subjects form words that begin with a certain letter.

[20] The above-mentioned p-values are from t-tests of whether the mean is equal to 3. If we conduct the distribution-based Kolmogorov-Smirnov test, it also confirms that the two distributions are not equal ($p = 0.000$). Thus, irrespective of which test is used, we find that the Letters task is perceived to be more female-friendly.

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

sample by students' gender, we see differences in their assessments. Girls think they have an advantage over boys in the Letters task (mean = 2.75; p = 0.000) while they see no significant gender difference in the Numbers task (3.04; p = 0.209). Boys think there is a male advantage in both tasks, with the difference being less pronounced in the Letters task (Letters task: 3.16, p = 0.000; Numbers task: 3.29, p = 0.000). All in all, both genders agree that girls have a comparative advantage in the Letters task (p = 0.032 in the subsample of boys, p = 0.000 in the subsample of girls, and p = 0.000 in the overall sample).

2.4 Descriptive statistics

Table 1 shows descriptive statistics on choices and performance in the incentivized competition task as well as on the level of lower-secondary school and grades. Boys are approximately 14 percentage points more likely to choose competition. Despite the fact that the two tasks have different gender stereotypes, the gender difference in willingness to compete is very similar in the Numbers task and the Letters task. When we look at the scores, we see that they cannot explain the difference in willingness to compete. In the Numbers task, there is no significant gender difference, while in the Letters task girls actually perform significantly better than the boys. This is true both under individual and under competitive incentives. (Figure A1 in the Online Supplementary Material shows the performance distribution in round 1 in each of the two tasks by gender). Girls are significantly more risk-averse and have lower confidence in their math ability. Girls on average have a higher GPA and similar math grades compared to boys.[21] Girls are also slightly less likely to be at the low level of lower-secondary school but the differences are small.

With respect to career options, recall from Sect. 2.1 that to make the study choice empirically tractable, we group the many apprenticeship options into four categories: low math, medium math, high math, and commerce (see "Online Supplementary Material C.1" for background and details on the categorization). The specializations in the academic track are: Physics & Math, Biology & Chemistry, Economics & Law, Languages, Philosophy, Pedagogy & Psychology, Music & Arts. The final career-choice category is the "Outside" category which consists of young people who fail to transition to upper-secondary education directly after the 9th grade.

[21] We asked the students about their grades in Math, German, French and English. GPA is the average of these four grades. The reason for asking specifically about these four grades is that access to Baccalaureate schools is commonly based on grades in Math, German and French, and companies usually select applicants based on their grades in Math, German, French and English. 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 & Voyer, 2014). For an overview of the Swiss situation, see SCCRE (2018).

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

Table 1 Descriptive statistics

	(1)	(2)	(3)		(4)	(5)	(6)
	Experiment and questionnaire				School levels and grades		
	Boys	Girls	Dif		Boys	Girls	Dif
	(N = 760)	(N = 754)			(N = 760)	(N = 754)	
Compete	0.554	0.419	0.135***	School 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***	School level = standard	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***	School level = pre-academic	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	4.682	4.689	− 0.007
	(2.257)	(2.232)	(0.161)		(0.619)	(0.668)	(0.033)
Score 2 (numbers)	4.218	4.568	− 0.350	GPA	4.626	4.786	− 0.160***
	(2.588)	(2.407)	(0.179)		(0.425)	(0.452)	(0.023)
Score 1 (letters)	7.593	8.207	− 0.614**				
	(2.677)	(2.738)	(0.200)				
Score 2 (letters)	9.087	9.880	− 0.793***				
	(2.811)	(2.942)	(0.213)				
Lottery	3.186	2.731	0.455***				
	(1.628)	(1.418)	(0.079)				
BRET	40.272	35.515	4.758***				
	(24.787)	(23.837)	(1.250)				
Confidence	3.001	2.724	0.277***				
	(0.796)	(0.794)	(0.041)				

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 a 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). Confidence means students' beliefs about their own math performance compared to their fellow students (from 4 "top quarter" to 1 "bottom quarter")

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

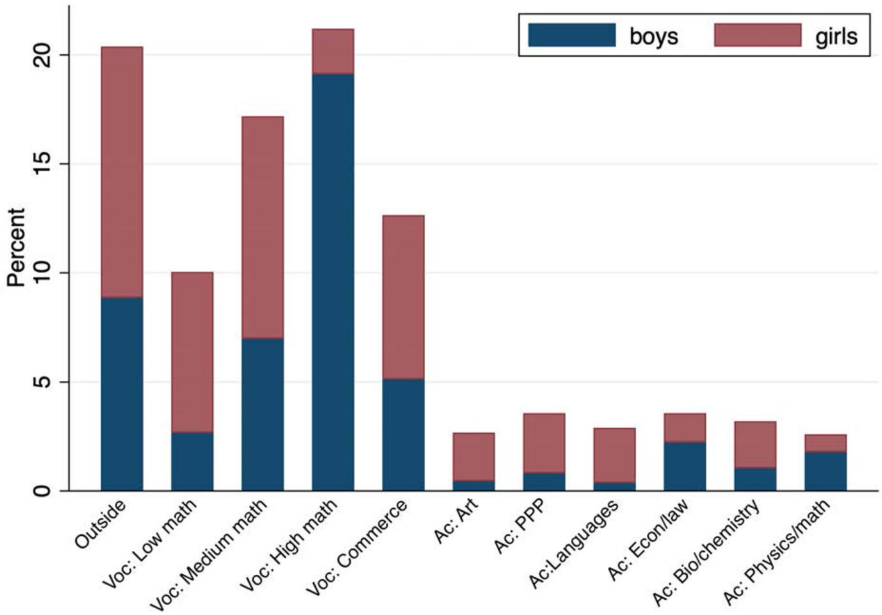

Fig. 1 Career choices by gender. *Note:* "Voc" means vocational, "Ac" means academic, and "PPP" means Philosophy, Pedagogy & Psychology. To save space, we use the short label "Art" for Music & Arts in all graphs and tables

Of the 1450 students who responded to the follow-up survey, we have clear information on career choices for 1344 students.[22] Figure 1 shows the percentage of boys and girls in our sample who chose each of the career choice categories. Career choices are strikingly gendered in both the vocational and the academic track, which is in line with international findings (Bertrand et al., 2021; OECD, 2011). In both tracks, low-math choices are dominated by girls and high-math choices are dominated by boys. In particular, girls make up 73 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 10 percent

[22] Specifically, in 1070 cases we could clearly identify one of the above-mentioned upper-secondary education categories as the student's choice and in 274 cases the choice was described clearly enough to be identified as an outside option (of those, 162 chose the "10th grade"). This means that we have clear information on career choices for 1344 of the 1514 students in the first data collection wave. The missing students do not differ significantly from the non-missing students in terms of gender and tournament choice. 13 percent of boys and 10 percent of girls are missing ($p = 0.116$, chi-squared test). 12 percent of competers and 11 percent of non-competers are missing ($p = 0.541$, chi-squared test). Neither is there differential attrition by tournament entry within gender. 13 percent of boys who do not compete and 12 percent of boys who compete are missing ($p = 0.890$, chi-squared test). 11 percent of girls who do not compete and 9 percent of girls who compete are missing ($p = 0.274$, chi-squared test).

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

of individuals in high-math apprenticeships and 31 percent in the Physics & Math specialization.

In Fig. A2 in the Online Supplementary Material, we show career choice graphs separately for each of the ability groups described in Sect. 2.1. The appendix figure shows that career choices vary substantially by ability level, which is in line with patterns in countries with a large vocational sector (Bertrand et al., 2021; OECD, 2015). Students in the high-ability group pick from all available options, including those in the academic track. Students in the medium-ability group tend to pick an apprenticeship, although some enter the academic track. Finally, students in the low-ability group have access only to apprenticeships and more than a third of them go for an option that is outside upper-secondary education. The finding that outside options are particularly popular among low-ability students has been noted with concern in the Swiss literature (SCCRE, 2018). A lack of cognitive skills alone cannot explain why students in this group opt more frequently for outside options. The Swiss education system offers apprenticeships along the whole skill range and research shows that even the lowest performing students are capable of successful direct entry into some apprenticeships (Bayard, 2011; Sacchi & Meyer, 2016). The literature therefore suggests that non-cognitive factors could play an important role in the decision to pick an outside option instead.

3 Results

3.1 Willingness to compete along the ability distribution

In this section we will analyze data from the first data collection wave to address the question whether willingness to compete, and the gender difference therein, varies with academic ability. To start, in Table 2 we replicate the overall gender gap in willingness to compete found in previous studies 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. Girls are around 14 percentage points less likely to compete than boys. Adding controls for task performance, academic ability and school in columns 2 and 3 increases the gender gap to more than 16 percentage points. In column 4 we add our confidence measure as a control. The results show that our measure is a significant predictor of willingness to compete and that the addition of this control reduces the gender gap such that it is now below 15 percentage points. In column 5, we add controls for risk preferences and the gender composition of the class. The gender gap is reduced to 13 percentage points.

In columns 5 and 6, we interact the gender dummy with a task dummy. The coefficient on the interaction term is insignificant and close to zero. This shows that the

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

Table 2 Gender gap in willingness to compete

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Girl	− 0.136***	− 0.152***	− 0.164***	− 0.147***	− 0.132***	− 0.144***	− 0.142***
	(0.028)	(0.028)	(0.029)	(0.029)	(0.029)	(0.037)	(0.038)
Task = letters	0.141***	0.127*	0.166**	0.157**	0.157**	0.133***	0.151**
	(0.032)	(0.072)	(0.072)	(0.072)	(0.071)	(0.039)	(0.069)
Confidence				0.058***	0.051**		0.051**
				(0.020)	(0.021)		(0.021)
Girl * task						0.017	0.019
						(0.052)	(0.054)
N	1514	1514	1514	1514	1514	1514	1514
R2	0.038	0.073	0.117	0.122	0.136	0.038	0.136
Performance		x	x	x	x		x
Level, grades, FE			x	x	x		x
Confidence				x	x		x
Risk, class gender comp.					x		x

Coefficients are from OLS regressions of a dummy for choosing the competitive payment over the individual payment on a gender 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, standard or pre-academic); grades means math grade and GPA interacted with level dummies; FE means school fixed effects; confidence means students' beliefs about their own math performance compared to their fellow students; risk means the lottery and the BRET risk preference measures; class gender comp is the gender composition of the class. Standard errors in parentheses are clustered at the classroom level

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

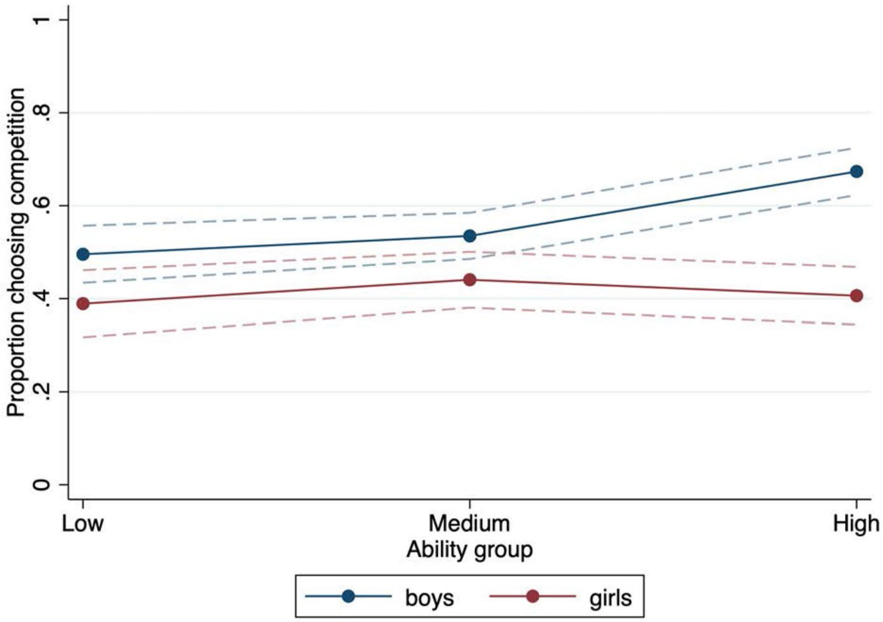

Fig. 2 Gender, willingness to compete and ability. Note: The graph shows willingness to compete for students in a specific ability group conditional on experimental task and performance in rounds 1 and 2 of the experiment (interacted with task). The estimators are obtained from an OLS regression of a tournament entry dummy on a gender dummy, ability group 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

gender gap in willingness to compete is present not only in the standard Numbers task but also in the Letters task, which girls believe favors women.[23]

We will now document how willingness to compete varies with academic ability. To do so, we split the sample into the three ability groups described in Sect. 2.1 : low ("Real" students), medium ("Sekundar" students whose GPA is at or below the median), and high ("Sekundar" students with above-median GPA and "Spezielle Sekundar" students). Approximately one-third of the students fall in each ability group.[24]

Figure 2 shows the willingness to compete of the boys and girls in each of the three ability groups. The predicted values are obtained from a regression of the competition

[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 et al., 2019).

[24] Specifically, 32% are categorized as low-ability, 33% are categorized as medium-ability, and 35% are categorized as high-ability. As explained in Sect. 2.1, the ability classification relies on field data. Our data on performance in the experiment also supports this three-way split. In particular, "Spezielle Sekundar" students and "Sekundar" students with above-median GPA perform similarly to each other, and both perform significantly better than "Sekundar" students whose GPA is at or below the median, who in turn perform significantly better than the "Real" students. Specifically, for the Letters task average scores in the first round are: 8.6 (Spezielle Sekundar), 8.5 (Sekundar with above-median GPA), 7.9 (Sekundar with at or below median GPA), and 7.2 (Real). For the Numbers task, average scores in the first round are: 4.6 (Spezielle Sekundar), 4.4 (Sekundar with above-median GPA), 3.7 (Sekundar with at or below median GPA), and 2.6 (Real).

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

choice on a gender dummy interacted with ability group dummies, controlling for experimental task and performance in rounds 1 and 2 of the experiment (interacted with task). We find that the willingness to compete of boys, and therefore the gender gap, varies strongly with ability. While the gap is only around 10 percentage points for the low-ability and medium-ability groups, it is nearly three times as large at 27 percentage points for the high group. This difference in the gender gap across groups is statistically significant at the 5-percent level. The widening of the gender gap at the top occurs because high-ability boys are significantly more likely to compete compared to low-ability boys while the relationship between ability and willingness to compete is flat for girls.

To investigate the robustness of this result, we present several additional graphs in the Online Supplementary Material. First, in Fig. A3 we show results when separating high-ability students from the standard (Sekundar) level and students from the pre-academic (Spezielle Sekundar) level into two separate groups. We find that in both high-ability groups, boys are highly likely to compete, which suggests that the high willingness to compete among these boys is related to their ability level and not to an early specialization towards the academic track. Again, for girls there is no difference in willingness to compete between any of the groups. Second, we investigate how the graph looks like when we split

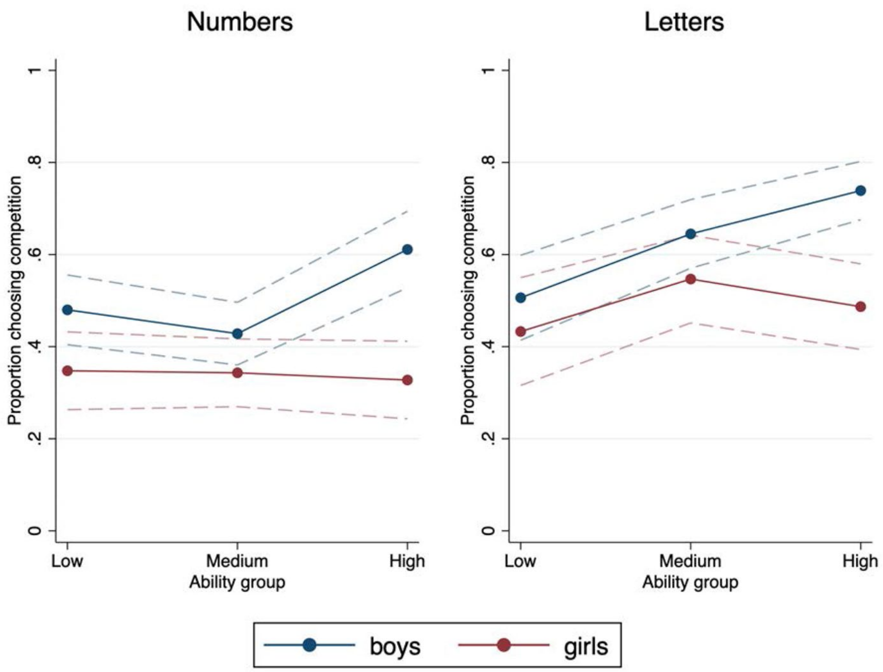

Fig. 3 Gender, willingness to compete and ability by task. Note: The graphs show willingness to compete in the specific task (left panel: Numbers, right panel: Letters) for students in a specific ability group conditional on performance in rounds 1 and 2 of the experiment. The estimators are obtained from OLS regressions of a tournament entry dummy on a gender dummy, ability group 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

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

students from the standard (Sekundar) level by math grade instead of GPA. Figure A4 shows that the results are very similar. Finally, in Fig. A5 in the Online Supplementary Material we additionally control for risk attitudes, self-rated confidence in math, and a range of socioeconomic controls, all interacted with gender, as well as school fixed effects. The experimental literature shows that risk preferences and confidence in one's own abilities significantly influence willingness to compete (Niederle & Vesterlund, 2011; van Veldhuizen, 2017). Moreover, Almås et al. (2015) and Boneva et al. (2021) show that willingness to compete can vary with socio-economic background. We find that the variation in willingness to compete across ability levels is similar to what we observed without these controls.

As previously described, there are a number of studies that investigate whether the gender difference in willingness to compete depends on the task, some (but not all) of which find that the gender difference disappears in tasks for which there is no stereotype of a male advantage. Our experimental data allow us to investigate whether the relationship between ability and the willingness to compete of boys and girls is the same for two tasks which differ in associated gender stereotypes. In Fig. 3, we demonstrate that the same pattern of an increasing gender difference is observed when using the stereotypically male Numbers task and the stereotypically more female Letters task. Despite the fact that girls believe that there is a female advantage in the Letters task, their willingness to compete does not increase significantly along the ability distribution in this task either. High-ability boys' willingness to compete is extraordinarily high in both tasks.

The findings in this section contribute to the literature in several ways. First, they give an indication for where along the ability distribution we can expect gender differences in willingness to compete to have the highest explanatory power for gender differences in career choices and labor market outcomes. Second, the increase in the gender gap along the ability distribution suggests that ability composition needs to be taken into account in the design of research studies. For example, when investigating how the gender gap varies across countries, it is advisable to look at samples that are comparable in terms of ability.[25] Third, our results reveal how much room there is for a change in willingness to compete in a particular group. In the next section we make further contributions by linking the data collected in the first and second waves, giving an indication of how changes in willingness to compete in different ability groups could translate into differences in labor market outcomes.

[25] This is particularly important when the education system of the countries differs. For example, suppose that a researcher collects data from public schools both in country A and country B, but in country A public schooling is universal, whereas in country B there is an extensive private school sector which siphons off high-ability students. Differences between the gender gaps then may reflect differences in ability composition rather than differences in culture.

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

3.2 Willingness to compete and career choices

We will now analyze whether and how our experimental measure of willingness to compete predicts the career choice for students in the different ability groups. We will do the analysis without imposing a ranking on the career options because there is no clear way to compare academic and vocational options to each other for a full ordering. While the Physics & Math academic specialization is plausibly more demanding than any other option, it is less obvious how to compare demanding apprenticeships such as computer technician, to less math-intensive academic specializations.

We use two methods to answer our research questions. First, we run a separate binary OLS regression for each career alternative. Second, we complement this analysis with results from unordered multinomial logistic regressions. We use two methods because each has advantages that compensate for the shortcomings of the other method. Binary OLS regressions allow us to give an easily interpretable picture of how willingness to compete correlates with the likelihood of choosing each option, but this approach does not provide a joint statistic to judge the overall significance of the relationship between willingness to compete and the study choice. Multinomial logit, by modeling all choice options at the same time, allows for testing the overall significance. However, multinomial logit coefficients are more difficult to interpret and it takes more space to report the full results of these regressions. Therefore, in the main text (Table 3) we focus on the results of easily interpretable ordinary regressions, and also report the joint p-values that we obtained from the multinomial logit regressions. The full multinomial logit results are reported in Online Supplementary Material Tables A1, A2, A3, A4, A5, A6, A7, A8, A9.[26]

Panels A, B and C of Table 3 report the results for high-, medium-, and low-ability students, respectively. The last column of each panel shows the logit p-values, which test overall significance across all options and hence show *whether* willingness to compete matters at different ability levels. The preceding columns display the results of the OLS regressions, showing *how* willingness to compete correlates with the career choice of students in the different groups. In each of those columns, we regress a dummy indicating whether a student chose a specific alternative (vs all other alternatives that are available given the ability level) on a competition choice dummy. The first/second/third row of each panel shows the coefficient of the competition dummy for boys/girls/all students. All regressions control for gender, experimental task, performance in the first two rounds of the experiment, risk preferences, confidence in math, and school variables (see notes to tables for full list). The number of columns differs between the panels because career options differ by ability level (recall Online Supplementary Material Fig.

[26] These tables show all pairwise comparisons. That is, they the report the relative log-odds associated with the compete variable for each pair of options. Because each coefficient has to be estimated separately for each choice option, multinomial logit regressions require the estimation of many coefficients. Multinomial logit regressions therefore do not include school fixed effects (including them would preclude convergence). The different Online Supplementary Material tables report results for different samples, see notes to the tables for details and interpretation of the estimated coefficients.

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

Table 3 Career choices and willingness to compete

Panel A: High-ability students

		Vocational				Academic						Logit
	Outs.	Low	Med	High	Com	Art	PPP	Lang	E &L	B &Ch	P &Math	p-val
Comp (b)	− 0.002	0.028	0.041	− 0.175**	0.099**	0.047**	0.006	− 0.022	− 0.053	− 0.045	0.078**	0.088
	(0.035)	(0.031)	(0.042)	(0.075)	(0.049)	(0.023)	(0.031)	(0.023)	(0.059)	(0.044)	(0.036)	
Comp (g)	− 0.028	− 0.034	− 0.097**	0.047*	0.042	0.049	0.011	− 0.044	− 0.021	0.041	0.033*	0.026
	(0.034)	(0.023)	(0.046)	(0.024)	(0.041)	(0.032)	(0.037)	(0.032)	(0.027)	(0.028)	(0.019)	
Comp	− 0.018	− 0.010	− 0.045	− 0.037	0.063*	0.048**	0.009	− 0.036	− 0.033	0.009	0.050***	0.007
(all)	(0.026)	(0.020)	(0.037)	(0.029)	(0.034)	(0.021)	(0.030)	(0.023)	(0.028)	(0.022)	(0.018)	
N	490	490	490	490	490	490	490	490	490	490	490	

Panel B: Medium-ability students

		Vocational				Academic	Logit
	Outs.	Low	Med	High	Com	Combined	p-val
Compete (b)	0.061	− 0.032	− 0.010	− 0.036	0.047	− 0.030	0.199
	(0.045)	(0.029)	(0.037)	(0.060)	(0.045)	(0.031)	
Compete (g)	0.001	0.021	− 0.049	0.033	− 0.119**	0.113**	0.037
	(0.058)	(0.035)	(0.062)	(0.048)	(0.049)	(0.056)	
Compete (all)	0.034	− 0.008	− 0.027	− 0.005	− 0.028	0.034	0.486
	(0.033)	(0.025)	(0.032)	(0.037)	(0.034)	(0.031)	
N	441	441	441	441	441	441	

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

Table 3 (continued)

Panel C: Low-ability students

		Vocational			Logit
	Outside	Low	Med	High/Com	p-val
Compete (b)	− 0.202***	0.080	0.101*	0.022	0.000
	(0.056)	(0.050)	(0.052)	(0.067)	
Compete (g)	− 0.039	0.112	− 0.103	0.029	0.646
	(0.066)	(0.077)	(0.077)	(0.054)	
Compete (all)	− 0.131***	0.094**	0.013	0.025	0.014
	(0.040)	(0.040)	(0.050)	(0.046)	
N	413	413	413	413	

Coefficients are from OLS regressions where the dependent variable is a dummy for choosing a specific career category instead of something else that is available to the student. In Panel A, B and C we examine the choices of high-ability, medium-ability and low-ability students, respectively. In all panels, the first two rows are based on a regression where competition choice is interacted with gender such that the first/second row shows the coefficient of the competition choice dummy for boys/girls. In the third row of each panel we run a separate regression where the competition dummy is not interacted with gender. Controls consist of a gender dummy, an experimental task dummy, performance in rounds 1 and 2 of the experiment interacted with the task dummy, the risk preference measures, confidence in math, the gender composition of the class, lower-secondary school level dummies, school fixed effects, and GPA and math grade interacted with the level dummies. Standard errors in parentheses are clustered at the class level. Logit p-values are from tests of the overall significance of the competition coefficient from a single unordered logit regression (see Online Supplementary Material Tables A1, A2, A3, A4, A5, A6, A7, A8, and A9 for the full logit results)

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

A2). High-ability students pick from all options, including the academic specializations, and hence Panel A of Table 3 displays all 11 options. Students in the medium-ability group can in principle also enter the academic track, but in practice few of them do so, and hence in Panel B the academic options are combined into a single "Academic Combined" category to ensure a sufficient number of observations in each category. Finally, students in the low-ability group do not have access to the academic track so there is no academic option in Panel C. Furthermore, the commerce apprenticeship is so rare among low-ability students that we merge this category with high math apprenticeships in Panel C (see again Online Supplementary Material Fig. A2 to review choices by ability and gender).

As we can see from the p-values, willingness to compete is a significant predictor of study choices both in the high-ability ($p = 0.007$) and in the low-ability ($p = 0.014$) group. In the low-ability group this is driven by boys, while in the high-ability group the association between willingness to compete and the career choice is stronger among girls ($p = 0.026$) than among boys ($p = 0.088$). In the medium-ability group the association is significant for girls only ($p = 0.037$).

With respect to specific career options, Panel A shows that at the highest ability level the most significant relationship is with the Physics & Math specialization. The coefficient is positive for both genders, which is consistent with the notion that willingness to compete can increase boys' and girls' willingness to choose Physics & Math. It is noteworthy that this specialization stands out also in the multinomial table, in that Physics & Math has a sizable positive coefficient in all pairwise comparisons (see bottom row of Online Supplementary Material Table A1). This means that our compete variable is associated with a higher log-odd of choosing Physics & Math relative to each specific alternative option. Panel A of Table 3 also shows that willingness to compete predicts specializing in Arts, which may happen because this specialization allows gifted students to take part in special talent-development programs.[27]

Furthermore, the panel reveals interesting gender-specific patterns with respect to the vocational options. Girls who are willing to compete are less likely to do a medium math apprenticeship and in turn more likely to do a high math apprenticeship (multinomial logit estimations confirm that the pairwise coefficient medium math-vs-high math is significant, see Online Supplementary Material Table A2). Boys who are willing to compete are less likely to pick a high math apprenticeship and in turn more likely to choose the commerce apprenticeship (multinomial logit

[27] For example, some secondary schools collaborate with specialized coaches or with higher institutions, such the Bern University of the Arts (HKB). The HKB is Switzerland's first transdisciplinary university of the arts which provides world-class education with an outstanding infrastructure and an orientation to the latest artistic and scientific developments. It is plausible that the presence of such a top institution attracts competitive students to Arts. We would be cautious about extrapolating the Arts result, though. In areas without such renowned artistic institutions ambitious students may strive to the top in more standard ways, such as by choosing the Physics & Math specialization.

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

estimations confirm that the pairwise coefficient high math-vs-commerce is significant, see Online Supplementary Material Table A3).[28]

Panel B shows results for medium-ability students, where willingness to compete is a significant factor only for girls, not for boys. Girls who are willing to compete are less likely to choose a commerce apprenticeship and in turn more likely to choose academic education, which is a very ambitious choice for students from this part of the ability distribution (multinomial logit estimations confirm that the pairwise coefficient commerce-vs-academic is significant, see Online Supplementary Material Table A5).

In Panel C we concentrate on students at the low (Real) level of lower-secondary school, who can proceed to upper-secondary education only via the vocational sector. Our results reveal that willingness to compete predicts whether low-ability students, particularly boys, transition to upper-secondary education after the 9th grade. Specifically, those who compete are significantly less likely to go for an outside option, and in turn significantly more likely to pursue low-math vocational education, which is consistent with willingness to compete shifting people away from outside options and into actively pursuing an apprenticeship (multinomial logit estimations confirm that the pairwise coefficient is significant, see Online Supplementary Material Tables A7 and A9).

Earlier we highlighted two policy concerns: 1) that the number of students, and in particular women, in math-intensive fields is too low and 2) that upon finishing compulsory education, many students fail to transition to upper-secondary education. By looking at study choices along the whole ability distribution, we show that willingness to compete may matter for both issues.

With respect to the first policy issue, we found that those high-ability girls who are willing to compete are more likely to choose a math-intensive study. These results suggest that interventions that increase high-ability girls' willingness to compete have the potential to increase the share of women in math-intensive fields. Willingness to compete also predicts the study choices of boys and in some cases differently from the choices of girls. Building on these correlations, in Online Supplementary Material Figure A6 we give a visual indication of how the proportion of girls in each career option could change if girls or boys were more or less willing to compete (see Online Supplementary Material C.2 for a more detailed description of this exercise). We find that the Physics & Math specialization is where the share of girls varies most strongly with willingness to compete.

[28] As explained in Online Supplementary Material C.1, 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 indicate it or because they pursue their diploma through a specialized school rather than an apprenticeship with a company. This group contains 14 high-ability boys and 8 high-ability girls (6.8 percent and 2.8 percent of high-ability boys and girls, respectively). If we regress an indicator of doing commerce at the high level on the same variables as used in Table 3, the competition coefficient is equal to 0.071 (0.028) for high-ability boys and -0.011 (0.026) for high-ability girls. This suggests that competitive boys, but not girls, are specifically attracted to the high level of the commerce apprenticeship.

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

With respect to the second policy issue, we found that low-ability students who are willing to compete are less likely to choose an outside option and more likely to enter at least a low math apprenticeship. Here, willingness to compete seems to matter especially for boys. Recall from section 3.1 that low-ability boys are less willing to compete than high-ability boys, so also for low-ability boys there would be room to increase willingness to compete. While we can only measure a correlation, it is plausible that willingness to compete can affect this study choice by inducing students to aim higher or to submit more apprenticeship applications.[29]

In Online Supplementary Material A, we present several robustness checks. Table A10 and Table A11 show results from two alternative specifications of the career choice regressions. In the first table we control only for gender, performance in the task, grades, school fixed effects and school levels (and appropriate interactions). The second table shows results where in addition to the original controls used in Table 3, we also control for a range of socioeconomic background factors. The coefficients are remarkably similar between these two specifications and Table 3, although some have varying significance, such as the results on Commerce and Arts in the high-ability (male) sample. Importantly, whichever specification we examine, the key results hold. The correlation between willingness to compete and the study choice is statistically significant for both high-ability boys and high-ability girls, as well as for low-ability boys. Looking at the binary OLS regressions, willingness to compete strongly predicts whether high-ability students specialize in Physics & Math, and whether low-ability boys transition to upper-secondary education after the 9th grade or choose an outside option instead.

In Online Supplementary Material Tables A12, A13, A14, we additionally analyze whether choices are predicted by risk preferences and confidence in math. In these regressions, we interact the controls for risk preferences (as measured by the lottery choice measure) and confidence in math with gender and report the coefficients in the same way as the competition coefficients in Table 3. The first insight is that the results on the competition variable are largely in line with the previous findings. The second insight is that risk preferences and confidence have much less predictive power than willingness to compete. Confidence is generally not significant, except in the medium-ability sample where it predicts choosing an academic education. The risk measure is more often significant but not necessarily in the same way as the competition variable, which is interesting in light of recent studies questioning how distinct willingness to compete is from risk preferences (Gillen et al., 2019; van Veldhuizen, 2017). Most notably, in our low-ability sample risk-seeking students are less likely to transition to upper-secondary education, whereas those who are willing to compete are more likely to transition. This is in accordance with Buser et al. (2020) who show that risk seeking and willingness to compete are distinct characteristics that predict distinct life choices.

[29] Our study focuses on study choices and hence our results refer to entry into apprenticeships. For stability in apprenticeship relations see recent work in progress by Lüthi and Wolter (2021).

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

4 Conclusions

We experimentally elicited the willingness to compete of more than 1500 Swiss lower-secondary school students and also collected field data on their ability. In a second data collection wave, we collected follow-up data that allows us to link students' choices in the experiment to study choices made more than one and a half years later. While previous studies tended to focus on specific, mostly high-ability groups, our sample includes students from the whole ability distribution. Our rich data and large and diverse sample allow us to make several contributions. In particular, we expand the scope of the literature on willingness to compete, gender and career choices by documenting whether previous findings generalize to career choices and populations that have so far been neglected.

First, we show how boys' and girls' willingness to compete varies along the ability distribution. We find that the gender gap in willingness to compete is much lower at low ability levels than at the highest ability level. The gap increases with ability because high-ability boys are substantially more willing to compete than low-ability boys while there is no significant increase in girls' willingness to compete along the ability distribution. The fact that low-ability boys' willingness to compete is significantly lower than high-ability boys' indicates that one should not make overly general assumptions about boys' average behavior and gender differences based on selective samples from the top of the ability distribution. We also examine generalizability in relation to the task used in the experiment, and find that both the overall gender gap as well as the variation along the ability distribution is present irrespective of whether willingness to compete is elicited using a stereotypically male numbers task or a stereotypically more female letters task.

We then provide a comprehensive picture of how willingness to compete correlates with the choice of post-compulsory education. Our analysis shows that the external validity of willingness to compete experiments generalizes to career options that have not previously been studied but that represent a large part of the choice set for a large proportion of students. The competitiveness literature has so far mainly focused on the top of the ability distribution, and particularly on students in academic institutions. Our study includes vocational options in the analysis and provides further evidence that willingness to compete is significantly related to the study choice made by high-ability students. But importantly, it reveals that willingness to compete predicts students' decision at the bottom of the ability distribution too.

With respect to policy, we highlighted two issues. The first one is the underrepresentation of women in math-intensive fields, which has traditionally been the focus of the competitiveness literature. The second is that upper-secondary education has become crucial for labor market success in most OECD countries, and therefore there is an urgent need to understand factors that influence the decision-making of students who are at risk of not pursuing upper-secondary education (OECD, 2012). By looking at study choices along the whole ability distribution, we find evidence that willingness to compete matters for both of these issues. Regarding the first

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

issue, we find that high-ability girls who are willing to compete are more likely to choose a math-intensive study. These results suggest that interventions that increase high-ability girls' willingness to compete have the potential to increase the share of women in math-intensive fields. As for the second issue, we find that low-ability boys who are *not* willing to compete are more likely to choose an option outside upper-secondary education. We showed that low-ability boys are less willing to compete than high-ability boys, so also for low-ability boys there would be room to increase willingness to compete.

It should be noted that there are caveats to using interventions to increase the willingness to compete of students as a means of tackling education policy issues. First of all, it should be kept in mind that our estimates capture correlations, not causation. That is, our study gives guidance for the design of future interventions, but does not substitute for a careful evaluation of the eventual causal effects of those interventions. Second, policies that encourage individuals to "lean in" and be more ambitious can backfire. See for example Exley et al. (2020), who show that pushing women who are reluctant to negotiate into negotiation is not helpful. Thus, it is important to carefully consider which type of willingness to compete interventions may be suitable in which context.

The literature on gender and willingness to compete shows that willingness to compete is driven to an important extent by beliefs about the likelihood of success and that high-performing women in particular are underconfident. This suggests that in some settings informational treatments may work well; for example, Kessel et al. (2021) find that telling experimental participants about the gender gap in willingness to compete and advising them about potential earnings implications decreases the gap by increasing women's willingness to compete. One possibility to apply this insight would be to include a similar informational intervention about math-intensive study programs into the career counseling of high-ability girls.

If a setting calls for more substantial treatments, it is also possible to target preferences: there is recent evidence that competitiveness is malleable and can be changed by interventions (Alan & Ertac, 2019; Boneva et al., 2021). Including such interventions in the mix of policy measures that are applied to foster educational progression could help in situations where a lack of willingness to compete precludes individuals from realizing their full potential.

In summary, our paper highlights that the policy relevance of the literature on willingness to compete may be broader than previously established.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10683-022-09765-8.

Declarations

Conflict of interest The authors have no conflict of interest to declare.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit http://creativecommons.org/licenses/by/4.0/.

References

Alan, S., & Ertac, S. (2019). Mitigating the gender gap in the willingness to compete: Evidence from a randomized field experiment. *Journal of the European Economic Association, 17*(4), 1147–1185.

Almås, I., Cappelen, A. W., Salvanes, K. G., Sørensen, E. Ø., & Tungodden, B. (2015). Willingness to compete: Family matters. *Management Science, 62*(8), 2149–2162.

Almås, I., Cappelen, A. W., Salvanes, K. G., Sørensen, E. Ø., & Tungodden, B. (2016). What explains the gender gap in college track dropout? Experimental and administrative evidence. *American Economic Review, 106*(5), 296–302.

Andersen, S., Ertac, S., Gneezy, U., List, J. A., & Maximiano, S. (2013). Gender, competitiveness, and socialization at a young age: Evidence from a matrilineal and a patriarchal society. *Review of Economics and Statistics, 95*(4), 1438–1443.

Apicella, C. L., & Dreber, A. (2015). Sex differences in competitiveness: Hunter-gatherer women and girls compete less in gender-neutral and male-centric tasks. *Adaptive Human Behavior and Physiology, 1*(3), 247–269.

Atkinson, R. D., & Merrilea, M. (2010). *Refueling the U.S. innovation economy: Fresh approaches to science, technology, engineering and mathematics (STEM) education*. Washington, DC: Information Technology and Innovation Foundation.

Bartling, B., Fehr, E., & Schunk, D. (2012). Health effects on children's willingness to compete. *Experimental Economics, 15*(1), 58–70.

Bayard, S. (2011). *Berufslehre, schulische Ausbildung oder Zwischenlösung? Die Bedeutung sozialer Faktoren und nichtkognitiver Kompetenzen beim Übertritt an der ersten Schwelle*. Dissertation, Universität Zürich.

Bertrand, M., Mogstad, M., & Mountjoy, J. (2021). Improving Educational Pathways to Social Mobility: Evidence from Norway's "Reform 94''. *Journal of Labor Economics, 39*(4), 965–1010.

Boneva, T., Buser, T., Falk, A., & Fabian, K. (2021). The Origins of Gender Differences in Competitiveness and Earnings Expectations: Causal Evidence from a Mentoring Intervention. Working paper.

Booth, A., & Nolen, P. (2012). Choosing to compete: How different are girls and boys? *Journal of Economic Behavior & Organization, 81*(2), 542–555.

Boschini, A., Dreber, A., von Essen, E., Muren, A., Ranehill, E. et al. (2014). Gender and economic preferences in a large random sample. Working paper.

Budworth, M.-H., & Mann, S. L. (2010). Becoming a leader: The challenge of modesty for women. *Journal of Management Development, 29*(2), 177–186.

Buser, T., Niederle, M., & Oosterbeek, H. (2014). Gender, competitiveness and career choices. *Quarterly Journal of Economics, 129*(3), 1409–1447.

Buser, T., Niederle, M., &Oosterbeek, H. (2020). Can competitiveness predict education and labor market outcomes? Evidence from incentivized choice and survey measures. Working paper.

Buser, T., Peter, N., & Wolter, S. C. (2017). Gender, competitiveness, and study choices in high school: Evidence from Switzerland. *American Economic Review, 107*(5), 125–130.

Cardenas, J. C., Dreber, A., von Essen, E., & Ranehill, E. (2012). Gender differences in competitiveness and risk taking: Comparing children in Colombia and Sweden. *Journal of Economic Behavior & Organization, 83*(1), 11–23.

Crosetto, P., & Filippin, A. (2013). The "bomb" risk elicitation task. *Journal of Risk and Uncertainty, 47*(1), 31–65.

Croson, R., & Gneezy, U. (2009). Gender differences in preferences. *Journal of Economic Literature, 47*(2), 448–474.

Dargnies, M.-P., Hakimov, R., & Kübler, D. (2019). Self-confidence and unraveling in matching markets. *Management Science, 65*(12), 5603–5618.

Dreber, A., von Essen, E., & Ranehill, E. (2014). Gender and competition in adolescence: Task matters. *Experimental Economics, 17*(1), 154–172.

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

Eckel, C. C., & Grossman, P. J. (2002). Sex differences and statistical stereotyping in attitudes toward financial risk. *Evolution and Human Behavior, 23*(4), 281–95.
EDK. (2006). Leitlinien zur Optimierung der Nahtstelle obligatorische Schule - Sekundarstufe II.
EDK. (2015). Chancen optimal nutzen. Erklärung 2015 zu den gemeinsamen bildungspolitischen Zielen für den Bildungsraum Schweiz.
EDK, EVD, & EDI. (2011). Chancen optimal nutzen. Erklärung 2011 zu den gemeinsamen bildungspolitischen Zielen für den Bildungsraum Schweiz.
Egger, D., & Partner A. G. (2007). Vertiefungsstudie Bildungsangebote im Übergang von der obligatorischen Schule in die Berufsbildung. Report prepared on behalf of the Swiss Federal Office for Professional Education and Technology.
Exley, C. L., & Kessler, J. B. (2020). The gender gap in self-promotion. Working paper.
Exley, C. L., Niederle, M., & Vesterlund, L. (2020). Knowing when to ask: The cost of leaning in. *Journal of Political Economy, 128*(3), 816–854.
Flory, J. A., Leibbrandt, A., & List, J. A. (2015). Do competitive workplaces deter female workers? A large-scale natural field experiment on job-entry decisions. *Review of Economic Studies, 82*(1), 122–155.
Gillen, B., Snowberg, E., & Yariv, L. (2019). Experimenting with measurement error: Techniques with applications to the caltech cohort study. *Journal of Political Economy, 127*(4), 1826–1863.
Gneezy, U., Niederle, M., & Rustichini, A. (2003). Performance In competitive environments: Gender differences. *The Quarterly Journal of Economics, 118*(3), 1049–1074.
Goldin, C., Katz, L. F., & Kuziemko, I. (2006). The homecoming of American college women: The reversal of the college gender gap. *The Journal of Economic Perspectives, 20*(4), 133–156.
Große, N. D., & Gerhard, R. (2010). Explaining gender differences in competitiveness: gender-task stereotypes. Working paper.
Heckman, J. J., Humphries, J. E., LaFontaine, P. A., & Rodríguez, P. L. (2012). Taking the easy way out: How the GED testing program induces students to drop out. *Journal of Labor Economics, 30*(3), 495–520.
Jaik, K., & Wolter, S. C. (2016). Lost in transition: The influence of locus of control on delaying educational decisions. Working paper.
Jaik, K., & Wolter, S. C. (2019). From dreams to reality: Market forces and changes from occupational intention to occupational choice. *Journal of Education and Work, 32*(4), 320–334.
Joensen, J. S., & Nielsen, H. S. (2009). Is there a causal effect of high school math on labor market outcomes? *Journal of Human Resources, 44*(1), 171–198.
Kamas, L., & Preston, A. (2009). Social preferences, competitiveness and compensation: Are there gender differences? Working paper.
Kessel, D., Mollerstrom, J., & van Veldhuizen, R. (2021). Can simple advice eliminate the gender gap in willingness to compete? *European Economic Review* :103777.
Kirkeboen, L. J., Leuven, E., & Mogstad, M. (2016). Field of study, earnings, and self-selection. *The Quarterly Journal of Economics, 131*(3), 1057–1111.
Lee, S., Niederle, M., & Kang, N. (2014). Do single-sex schools make girls more competitive? *Economics Letters, 124*(3), 474–477.
Lüthi, S., & Wolter, S.C. (2021). Is being competitive always an advantage? Degrees of competitiveness, gender, and premature work contract termination. *IZA Discussion Paper No 14675* .
Mancuso, J., Neelim, A., & Vecci,J. (2020). Gender differences in self-promotion: Understanding the female modesty constraint. Working paper.
Niederle, M. (2016). Gender. In J. Kagel, A. E. Roth (Eds.), *Handbook of Experimental Economics* (pp. 353–375). Princeton University Press.
Niederle, M., & Vesterlund, L. (2007). Do women shy away from competition? Do men compete too much? *The Quarterly Journal of Economics, 122*(3), 1067–1101.
Niederle, M., & Vesterlund, L. (2011). Gender and competition. *Annual Review of Economics, 3*(1), 601–630.
OECD. (2011). *Education at a Glance 2011: OECD Indicators*. OECD Publishing.
OECD. (2012). *How well are countries educating young people to the level needed for a job and a living wage? Education Indicators in Focus 7*. OECD Publishing.
OECD. (2015). *OECD Reviews of Vocational Education and Training—Key Messages and Country Summaries*. OECD Publishing.
Peri, G., Shih, K., & Sparber, C. (2015). STEM workers, H-1B visas, and productivity in US cities. *Journal of Labor Economics, 33*(3), S225–S255.

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.

Reuben, E., Sapienza, P., & Zingales, L. (2015). Taste for competition and the gender gap among young business professionals. Working paper.
Reuben, E., Wiswall, M., & Zafar, B. (2017). Preferences and biases in educational choices and labor market expectations: Shrinking the black box of gender. *Economic Journal, 127*(604), 2153–2186.
Sacchi, S., & Meyer, T. (2016). Übergangslösungen beim Eintritt in die Schweizer Berufsbildung: Brückenschlag oder Sackgasse? *Swiss Journal of Sociology, 42*(1), 9–39.
Samek, A. (2019). Gender differences in job entry decisions: A university-wide field experiment. *Management Science, 65*(7), 3272–3281.
Samek, A. C. (2013). Is there a gender gap in preschoolers' competitiveness? An experiment in the US. *Journal of Economic Behavior & Organization, 92,* 22–31.
SCCRE. (2007). *Begabungsförderung - kein Tabu mehr*. Aarau: Swiss Coordination Centre for Research in Education.
SCCRE. (2018). *Swiss education report 2018*. Aarau: Swiss Coordination Centre for Research in Education.
Shurchkov, O. (2012). Under pressure: Gender differences in output quality and quantity under competition and time constraints. *Journal of the European Economic Association, 10*(5), 1189–1213.
Smith, J. L., & Huntoon, M. (2014). Women's bragging rights: Overcoming modesty norms to facilitate women's self-promotion. *Psychology of Women Quarterly, 38*(4), 447–459.
Sutter, M., & Glätzle-Rützler, D. (2014). Gender differences in the willingness to compete emerge early in life and persist. *Management Science, 61*(10), 2339–23354.
Symonds, W. C., Schwartz, R., & Ferguson, R. F. (2011). *Pathways to prosperity: Meeting the challenge of preparing young Americans for the 21st century*. Cambridge, MA: Pathways to Prosperity Project, Harvard University Graduate School of Education.
UNESCO. (2017). *Cracking the code: Girls' and women's education in science, technology, engineering and mathematics (STEM)*. Scientifc and Cultural Organization: United Nations Educational.
van Veldhuizen, R. (2017). Gender Differences in Tournament Choices: Risk Preferences, Overconfidence or Competitiveness? Working paper.
Voyer, D., & Voyer, S. D. (2014). Gender differences in scholastic achievement: A meta-analysis. *Psychological Bulletin, 140*(4), 1174.
Wozniak, D., Harbaugh, W. T., & Mayr, U. (2014). The menstrual cycle and performance feedback alter gender differences in competitive choices. *Journal of Labor Economics, 32*(1), 161–198.
Zhang, Y., Jane. (2012). Can experimental economics explain competitive behavior outside the lab? Working paper.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Authors and Affiliations

Thomas Buser[1] · Noemi Peter[2] · Stefan C. Wolter[3]

Thomas Buser
t.buser@uva.nl

Stefan C. Wolter
stefan.wolter@vwi.unibe.ch

[1] University of Amsterdam and Tinbergen Institute, Amsterdam, The Netherlands

[2] University of Groningen, Groningen, The Netherlands

[3] University of Bern, Bern, Switzerland

Downloaded from https://www.cambridge.org/core. 16 Mar 2025 at 18:36:24, subject to the Cambridge Core terms of use.