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ABSTRACT

Girls Helping Girls: The Impact of Female Peers on Grades and Educational Choices*

We use idiosyncratic variation in gender composition across cohorts within Norwegian lower-secondary schools to analyze the impact of female peers on students' grades and choices of STEM subjects. We find that more female peers in lower secondary increases girls' probability of choosing STEM-courses in upper secondary, and the effect on choices is larger than the effect on grades. Survey evidence suggests that a potential mechanism is an improved classroom environment. Boys' performance is negatively affected by more female peers. They also start upper secondary later and more often choose vocational studies.

JEL Classification: I21, J16

Keywords: gender, education, peer effects

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1 Introduction

Girls outperform boys in most areas of education, including both attainment and performance (Goldin et al., 2006; OECD, 2015). However, girls and boys still make different educational choices. Boys to a larger degree choose STEM courses (science, technology, engineering, and mathematics) in upper secondary school, and while young women choose fields such as biology, medicine, agriculture, and the humanities, young men choose mathematics, physical sciences, and computing (Osborne et al., 2003; Charles and Grusky, 2004). In turn, the differences in educational choices lead to jobs that pay differently in the labor market (Kirkebøen et al., 2016). Over the last decades, women's increasing educational attainment has led to a convergence in their wages with men's, but since the late 1990s, convergence has slowed down. A large part of the persistent differences is associated with occupational segregation (Blau and Kahn, 2016; Olivetti and Petrongolo, 2016).

In this paper, we investigate the role of peers in explaining the choice of STEM subjects and male-dominated fields in upper secondary school, as well as performance in these subjects. More specifically, we investigate how the gender composition of students' peers influence these choices. In an international context, Norway has a high female labor force participation rate but also a highly gender-segregated labor market. Women are overrepresented in public-sector occupations, such as health care, nursing, and teaching, and men in private-sector, STEM-related occupations, such as engineering. In such an environment, there likely exist gender stereotypes and norms of appropriate educational choices for girls and boys. Combined with strong adherence to gender stereotypes at the beginning of puberty (Galambos et al., 1990; Galambos, 2004), the impact of the gender composition of students' peers on both performance and choices could be substantial.

To identify the effect of peer gender composition, we use the idiosyncratic variation in gender composition across cohorts within Norwegian lower secondary schools. In Norway, the peers at this level are given by institutional rules and regulations. Completing lower secondary school is compulsory, every student follows the same track, and school districts cover contiguous geographical areas. The gender composition of a grade, thus, is the product of random variations in how many boys and girls were born in a school district in a given year. As well, a large part of Norway is sparsely populated, and the number of students in a cohort is therefore small enough that we find quite substantial variation in the proportion of girls that we use for identification.

Several studies show that the gender of students' peers has an impact on school performance (e.g. Hoxby (2000); Whitmore (2005); Lavy and Schlosser (2011)). There are however few studies investigating the effect of peers' gender on choices, which may have much larger long-run consequences for the life-time earnings of men and women. There is some evidence from Austria that having a higher share of female peers makes girls more likely to choose a male-dominated school type, but only for students who in fourth grade chose a low-track school Schneeweis and Zweimüller (2012). There is also a recent working paper showing that more female peers affects men's choice of college major, their academic performance and their labor market income in Italy, but only for students who had already chosen a high school track (Anelli and Peri, 2016). Anil et al. (2016) finds more female peers lowers school dropout rates in Turkey.

Our research contributes to the literature by presenting a comprehensive study of all students who have completed compulsory school in Norway. We use rich, individual register data for the entire population of Norwegian youth, which enables analysis of their choice of academic or vocational track and type of subjects or fields within these tracks as well as their performance in these subjects. Our starting point is the last year of compulsory schooling, and we can thus observe all educational choices that a student has to take.

We also contribute new evidence on causal mechanisms, being the first paper to our knowledge that provides evidence on the causal mechanisms behind the effect on choices. We use survey data from the National Pupils' Study 'Elevundersøkelsen', which collects students' responses to questions about characteristics of the teaching environment, such as well-being, classroom disruption, bullying, discrimination, time spent on homework, and attitudes to competition. We test whether responses to these questions are affected by the proportion of female students in the class and whether they are correlated to educational choices and performance. This approach is similar to that of (Lavy and Schlosser, 2011) for grades.

We find that both performance and choices are affected by a higher proportion of female peers and that the effects are stronger for girls than boys. For girls, the main results are that math grades increase by 0.091 points (on a scale from 1-6), the likelihood to choose a male dominated field in vocational upper secondary school is 2.2% higher and the likelihood to choose STEM-courses in an academic upper secondary track is around 3% higher. For boys, there is a negative impact of 0.086 points on science grades, they less often make a direct transition into upper secondary and the likelihood of choosing a vocational track is 3.4% higher. The effects on grades are quite small relative to the much larger effects on choices. This indicates that girls do not primarily choose STEM subjects more often after being in a class with relatively more girls because they perform better in these subjects. Peers may therefore have a bigger effect on students long-run labor market outcomes through the impact they have on choices rather than performance.

Among evidence indicating causal mechanisms, a higher proportion of female students has positive effects on the classroom environment: students report higher levels of well-being and discipline and less bullying and discrimination. Higher levels of these measures are associated with better average performance among both boys and girls. This finding is in line with literature showing that disruptive students and bullying have a negative impact on school performance (see, for example, Figlio (2007); Eriksen et al. (2014)). The same mechanisms are associated with girls choosing more STEM subjects in upper secondary school. Improving the classroom environment therefore has a gender leveling effect on educational choices.

The paper is organized as follows. The next section discusses the relevant literature, and the Norwegian educational system is described in the third section. In the fourth section the identification strategy is explained, and aslo the data, variables, and the sample. Section 5 presents the main results. Possible mechanisms are presented in section 6, while analyses of robustness are presented in section 7, and then section 8 concludes the paper.

2 Literature

Hoxby (2000) is among the first to study how the gender of students' peers has an impact on school performance. Examining Texas public schools, she finds that, with a larger proportion of girls in school, both girls and boys perform better in reading and math. Whitmore (2005) and Lavy and Schlosser (2011) find similar results in kindergarten through third grade in Tennessee and in elementary, middle, and high schools in Israel, respectively. In Norway, positive impacts for girls have also been found on long-run outcomes, such as IQ scores, teenage childbearing, education length, and labor market position (Black et al., 2013). However, in contrast to earlier studies, boys seem to be negatively affected by the presence of many female peers. Related, there is also evidence that the placement of students within the classroom especially affects girls' performance. Being surrounded by girls in the classroom, instead of boys, improves girls' school results (Lu and Anderson, 2015).

There is, therefore, ample evidence that the presence of more girls in a classroom improves school results and other performance-related outcomes for girls, while the effects for boys are less clear-cut and vary among studies. However, evidence of how gender composition affects subject choices is scarcer, although there are some exceptions as mentioned in the introduction (Schneeweis and Zweimüller, 2012; Anelli and Peri, 2016).

Since Black et al. (2013) also use Norwegian register data on peer effects stemming from lower secondary school, it warrants an extra comment. We add to the literature compared with Black et al. (2013) by investigating the effect of female peers on short to medium run outcomes as opposed to long run outcomes; we analyse effects of female peers on grades and choices in lower and upper secondary school. We also add evidence on causal mechanisms behind these effects by merging the register data to survey data, measuring students' responses to questions about characteristics of the teaching environment.

Single-sex colleges provide some related evidence of the effect of having (all) female peers compared to peers with a mixed gender composition on educational choices. Women at single-sex colleges disproportionately enter prestigious, male-dominated fields (Tidball, 1985, 1986) and more often switch to male-dominated majors during their studies (Solnick, 1995). (Billger, 2002) show that women at formerly all-female colleges that open admission to men are less likely to choose male-dominated subjects and occupations.

The literature offers many reasons why the gender composition of students' peers affects performance and study choices. Some are related to the different characteristics of girls compared to boys. First, the mean ability of fellow students might exert a positive peer effect, and on average, girls perform better than boys in most subjects. Secondly, boys are often reported to be more disruptive in class. Having fewer boys in a class then lets the teacher devote more resources (e.g., time, energy) to the other students - confirmed in e.g. Betts and Shkolnik (1999). These explanations imply that both girls and boys benefit from having more girls in class. However, Hoxby (2000) finds that differences in peers' mean ability do not completely explain the effect of a higher proportion of female students and concludes that there must be additional causal channels. Lavy and Schlosser (2011) test indicators for classroom disruption and violence, inter-student and student-teacher relationships, and teacher fatigue and find results suggesting that improvements in these measures explain a large part of the improvement in average test scores and other measures of student performance.

More indirect explanations involve gender stereotypes and competitiveness. Gender stereotypes influence teenagers' self-concept and self-esteem, and peer pressure to follow gender stereotypes might be exerted depending on classroom composition. Developmental psychologists identify a period of strong adherence to gender stereotypes in early puberty (gender intensification) (Hill and Lynch, 1983; Galambos et al., 1990). The more girls there are in a classroom, the less important "femininity" might be in teens' interactions with fellow students and construction of a self-concept of their abilities and interests. The relative importance of being good at math might increase. Furthermore, when the female share increases, their beliefs about the gender-appropriateness of attitudes may weaken and they may tend to conform less strongly to gender appropriate roles, which in turn may lead them to choose subjects that historically have been branded as "male subjects", like different STEM-subjects.

A different explanation is related to competitiveness and groups of competitors. Gneezy et al. (2003) and Niederle and Vesterlund (2010) demonstrate that, in an experimental setting, women perform worse than men when competing against one another, even if they perform similarly in noncompetitive environments. When women compete against other women, however, their performance might improve. Niederle and Vesterlund (2007) find that boys have a higher preference for competition than girls and more frequently decide to compete when given the choice in an experimental setting. Preferences for entering competition also depend on group composition and social learning. Booth and Nolen (2012) e.g. report evidence that girls who attend single-sex schools make similar competitive choices as boys, even when randomly assigned to mixed-sex experimental groups. Competitiveness could influence which study tracks young people choose if some subjects are viewed as more competitive than others. Buser et al. (2014) test this hypothesis in real-life choices and show that differences in girls' and boys' competitiveness preferences can explain 20% of the gender differences in track selection in upper secondary school.

The references above are mainly studies that rely on natural variation. There is also a growing literature that exploits experimental induced variation to uncover peer effects in the educational sector (see e.g. Duflo et al. (2011); Carrell et al. (2013). In our context, Oosterbeek and van Ewijk (2014) is especially relevant, analyzing gender peer effect at the university level. The results show no substantial gender peer effects on achievement at this level.

3 Norwegian Educational System

Compulsory school in Norway consists of a seven-year-long primary and a three-year-long lower secondary education. In 1997, the school starting age was lowered from 7 to 6. Compulsory school then normally runs from age 6 to 16. In our analyses, the last two cohorts (2007 and 2008) are part of the new regime, while the rest is part of the old regime. Both groups typically end compulsory schooling at age 16. After graduating from compulsory lower secondary school, students can either choose to leave school or enroll into upper secondary school. More than 95% of youths in each cohort choose the latter alternative.

When entering upper secondary school, students must choose between an academic-oriented track, which leads to admission to a university or college, and a vocational track, which results in an occupational qualification. The academic program normally takes three years, while the vocational program usually consists of two years of classroom-based learning, followed by two years of on-the-job training (apprenticeship). All youth have a legal right to attend at least three years of upper secondary school after completing compulsory school.

Local municipalities govern and run compulsory schools, while the national government is responsible for upper secondary schools. Enrollment in compulsory school is based on place of residence (school district), and there is no ability tracking in compulsory school. In our analyses, the peer measure is from the last year of lower secondary school, which is also the last year of compulsory school. Data on students and grades are only available for the last year due to the registration of final exams. The peers we observe in this year are however by large the same peers they have in the three years of lower secondary school. After lower secondary, peers are no longer exogenous because students choose which type of upper secondary school to go to (or none at all).

Regarding school-starting age, parents can apply to municipalities to start school early or delay starting school by one year on pedagogical and psychological grounds. However, Norway enforces strict compulsory-school enrollment rules based on year of birth, so changes to school-start age are not common. Grade retention is even more rare in Norway (Strøm, 2004; Bedard and Dhuey, 2006), so almost all children start and finish compulsory school together at the same age.

4 Empirical strategy and data

4.1 Empirical model

The main estimated model is as follows:

$$\mathrm{Y}^{g}{}_{isc} = \alpha_1 + \alpha_2 \mathrm{Girls}^{-i}{}_{ics} + X_{ic}a_1 + S_{sc}a_2 + \gamma_s + \eta_c + \varepsilon_{isc} \quad (1)$$

where Y^{g}_{isc} is a measure of the choice or grade at level g (lower secondary or upper secondary) for student i from lower secondary school s in cohort c. Girls^{-i}_{ics} is the proportion of girls in student i's observed school cohort c, excluding student i. This variable takes a value between 0 and 1. γ_s is a vector of school dummies, η_c is a vector of cohort dummies, and X_{ic} is a vector of individual characteristics, including immigrant status, number of siblings, rank as oldest sibling, mother's age when giving birth, and mother's and father's education and average income while the student was 7-16 years old. S_{sc} is a vector of lower secondary school characteristics limited to the number of students in cohort c. The coefficient of main interest is α_2, which measures the impact of the proportion of girls in school s on cohort c.

To interpret the results as causal, the key identifying assumption is that the variation in the proportion of girls from year to year within school are uncorrelated to other observed or unobserved factors which might affect students' choices and outcomes. This assumption is for most students fulfilled. The sex of a child is by nature random, and Norwegian youth must attend the school where they live. There is however a potential problem related to endogenous school starting age. This arises if parents try to affect the school starting age by for example holding back their child one year, maybe if he or she is born late in the year or has friends that will start one year later. If postponing or moving forward a child's school starting age is in any way determined by the expected share of girls in the class, the actual female share may not be exogenous. To address this potential we employ an instrumental variable approach similar to Black et al. (2013), instrumenting the proportion of girls in student i's observed school cohort, Girls^{-i}_{ics}, with the proportion of girls in student i's birth year, Girls^{-i}_{ibs}, i.e., with the proportion of girls that would have occurred if every pupil started on time. All analyses in Table 3 and Table 7 are conducted using the intrumental variable approach. The first stage relationship between these measures is very strong and highly significant due to the high share of students that start school the year they are supposed to, and grade retention is very rare. [1].

The identifying assumption might also be violated if people move during the course of lower secondary and sort themselves across schools and/or municipalities based on gender

[1]The first stage coefficient is 0.944 (0.939) and the standard error 0.0029 (0.0032) for girls and boys respectively.

composition. In that case, the female share measured at school s, Girls_{ibs}^{-i}, might still not be exogenous. We argue that such selective moving is not a cause of concern in the studied context. The data include information on whether students' parents moved between municipalities when the children were age 14 to 16. Of the 675,000 students in the sample, only 4.2% moved to another municipality during lower secondary school. There are no indications that boys move more frequently than girls: 50.5% of movers are boys, and 49.5% are girls. Those who move exhibit no gender differences in socioeconomic background. Therefore, there does not seem to be selective moving of students between municipalities related to children's sex.

We do not have panel information for schools, so we cannot directly analyze whether students change schools within municipalities. However, for the last year of lower secondary school, we have detailed information about students' residential addresses ("grunnkrets")[2] and unique school identifiers. Based on this information, we calculate the share of students who attend a lower secondary school other than the school in which the largest share of students in the "grunnkrets" is enrolled. This calculation can serve as an indicator of the proportion of students who opt out and choose another school. The proportion of girls in these two types of schools is almost identical, as are the socioeconomic background variables. There is no evidence, therefore, of selective moving of schools within municipality either.

School-fixed effects are included in all regressions to control for time-invariant, unobserved school characteristics. In Section 7 we show that our estimates are not sensitive to time-trends in unobservables.

4.2 Data, variables, and sample

The estimations of variants of equation 1 are based on a comprehensive set of individual register data collected and maintained by Statistics Norway. The starting point is individual register information from the Norwegian National Education Database (NUDB), which has detailed longitudinal information on all students in compulsory school, upper secondary school, and

[2]Grunnkrets are the lowest-level regional unit in Norway. There are approximately 12,000 local units in Norway.

Table 1: Descriptive Statistics

	Girls		Boys		T-test
	Mean	Sd	Mean	Sd	
Individual characteristics					
First born	0.42	(0.49)	0.42	(0.49)	0.02
Number of siblings	2.02	(1.27)	2.03	(1.26)	0.13
Age mother when ind. born	27.3	(4.99)	27.3	(5.00)	0.26
Mother lower secondary school	0.29	(0.45)	0.29	(0.45)	0.78
Mother upper secondary school	0.43	(0.49)	0.43	(0.49)	0.71
Mother higher education	0.28	(0.45)	0.28	(0.45)	0.81
Mother missing education	0.0081	(0.090)	0.0086	(0.093)	0.03
Father lower secondary school	0.23	(0.42)	0.23	(0.42)	0.74
Father upper secondary school	0.50	(0.50)	0.51	(0.50)	0.08
Father higher education	0.26	(0.44)	0.26	(0.44)	0.06
Father missing education	0.0069	(0.083)	0.0071	(0.084)	0.33
Mothers income, ind. 7-16 yrs	190154.1	(135977.3)	189226.2	(133708.5)	0.00
Fathers income, ind. 7-16 yrs	352000.1	(273082.0)	349872.7	(270256.7)	0.00
Non western immigrant	0.026	(0.16)	0.027	(0.16)	0.06
Western immigrant	0.0028	(0.053)	0.0029	(0.053)	0.71
Normal school start	0.976	(0.15)	0.977	(0.15)	0.00
Results					
Math grade, lower secondary school	3.55	(1.13)	3.41	(1.15)	0.00
Science grade, lower secondary school	4.13	(1.09)	3.76	(1.14)	0.00
GPA, lower secondary school	4.19	(0.78)	3.78	(0.82)	0.00
Math grade, 1st year	3.25	(1.31)	3.16	(1.31)	0.00
STEM grade, 1st yr up. sec.	3.48	(1.36)	3.33	(1.33)	0.00
STEM grade, 2nd yr up. sec.	3.66	(1.42)	3.52	(1.38)	0.00
STEM grade, 3rd yr up. sec.	3.76	(1.39)	3.53	(1.40)	0.00
Choices					
Vocational studies	0.44	(0.50)	0.54	(0.50)	0.00
Male dominated vocational studies	0.052	(0.22)	0.77	(0.42)	0.00
STEM, 1st yr	0.28	(0.45)	0.33	(0.47)	0.00
STEM, 2nd yr	0.15	(0.36)	0.22	(0.41)	0.00
STEM, 3rd yr	0.10	(0.31)	0.19	(0.39)	0.00
School characteristics					
Number of students	77.4	(38.8)	77.2	(38.9)	0.01
N	333984		352087		

Notes: The means, standard deviations and number of observations of the control variables (”individual characteristics”) and outcome variables (”results” and ”choices”). Choices are observed for the full sample 1995-2008 cohorts, results are only observed for the 2003-2008 cohorts. STEM includes courses in mathematics, physics and IT. Results from a t-test of whether the differences are significantly different from 0 are presented in the last column.

higher education. NUDB data are linked via unique personal identifiers to other registers containing demographic information. The data includes both public and private lower secondary schools, but private secondary schools are rare in Norway, and contains only approximately 5 percent of the total number of lower secondary schools.

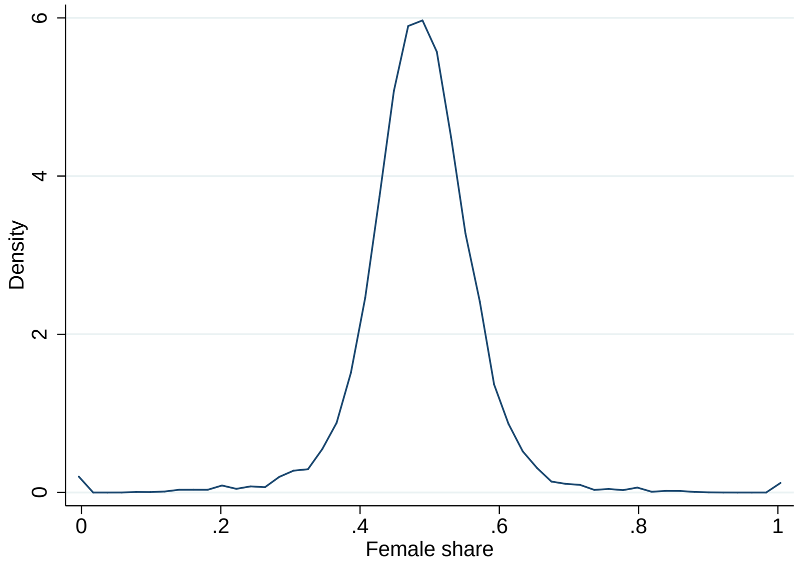
From this database, we use data on all youth who completed lower secondary school from 1995 to 2008. For determination of grades (performance), the period of analysis is limited to 2003-2008 because data on grades are not available before 2003. For all cohorts of students, we link data on individual characteristics (fixed and time-varying), family and school-related characteristics, and information on their peers (proportion of girls in lower-secondary school).

The dependent variables are measures of students' grades (given by the teacher) and choices. For grades, we include three measures from lower secondary school: math grades and science grades as well as GPA. In upper secondary school, we include grades from the academic track and first-year math, which is an obligatory course. An effect on upper secondary school grades will capture a persistent effect of the peers in lower secondary school, even though the peer group has changed. Grades range on a scale from 1 to 6, with 6 being the best score.

Regarding variables for choices, we first include a variable measuring direct transition to upper secondary (defined as ending lower secondary and starting upper secondary in the same year). After having estimated the effect of female share on direct transition, we condition all the next choices on direct transition. This is to compare the choices of students of equal distance to lower secondary schooling, and the same age, because we do not want to mix the effect of female share on choices with the effect of starting later on choices. The next choice, is the choice of vocational versus academic track. Conditional on choosing a vocational track (and direct transition), we include a dummy variable measuring whether the course is male dominated (70% or more male students). For the academic track, we include three binary-choice variables for each of the three years: choice of mathematics, science, or IT. As for the grade measure mentioned, we pool the three courses.

Control variables include the individual student's number of siblings, rank as the oldest child, immigrant status (non-western or western immigrant), and parents' education and annual

Figure 1: Share of girls in a school-cohort



Notes: Kernel density estimate of the distribution of the key explanatory variable (the share of girls (Figure 1) and number of students (Figure 2)) estimated at the individual level.

income. Parents' education is measured using five dummy variables: 1) compulsory school; 2) upper secondary school; 3) undergraduate college or university; 4) graduate-level college or university (master's degree or higher); and 5) unknown education level. Parents' annual income is measured as the average annual total income from the period when the child was 7-16 years old. Control variables at the school level include the number of students in each cohort, in addition to the fixed-school effects.

Table 1 shows the mean values of the background characteristics and dependent variables of the sample. Girls and boys have, on average, almost identical individual characteristics and family backgrounds. This finding reflects the randomness in whether families have a boy or girl and supports an underlying assumption of the model: the share of girls in a grade at any given school is random.

Girls score significantly better than boys in all measured subjects. Regarding choices of field of study, boys more often choose vocational studies over an academic track. Those who do choose an academic track more often than girls enroll in math and physics despite poorer results.

Figure 1 shows variations in the main variable of interest, which is the proportion of girls

Table 2: Balance Test

	Girls	Boys
Dependent variables		
First born	-0.012	-0.0053
	(0.011)	(0.011)
Number of siblings	-0.042	0.0033
	(0.030)	(0.028)
Mother's age at birth	0.12	0.098
	(0.12)	(0.12)
Mother's years of education	-0.0039	-0.018
	(0.018)	(0.017)
Father's years of education	-0.012	0.017
	(0.016)	(0.015)
Mother's income when ind. 7-16 yrs	-33.6	987.2
	(3130.7)	(2698.4)
Father's income when ind. 7-16 yrs	10017.2	3480.0
	(6245.2)	(5721.6)
Non-western immigrant	-0.0011	-0.0026
	(0.0034)	(0.0033)
Western immigrant	-0.0012	-0.0015
	(0.0012)	(0.0012)
Number of students	-0.79	-0.26
	(1.34)	(1.36)
N	333727	351784

Notes: Each cell is a point estimate of the effect of the proportion of female students on the background variable indicated in the left column. Standard errors are reported in parenthesis. The included covariates are school- and cohort-fixed effects. Level of significance: *** 1%, ** 5%, * 10%.

at the student's school and level. The main bulk of the variation ranges between 40% and 60% of girls, which means that the results are less representative of extreme cases of proportion of girls.

To investigate potential channels through which the proportion of female students has an impact on performance and choices, we use the National Pupils' Survey (”Elevundersøkelsen”). This annual, Internet-based survey of students from fifth grade through the last year of upper secondary school covers various topics, including the teaching environment, well-being, classroom disruption, bullying, discrimination, time spent on homework, and attitudes toward competition. The survey is obligatory for all seventh- and 10th-grade students (last year of lower secondary school) and is considered an important tool for maintaining and developing the pedagogical environment.[3] The Norwegian Directorate for Education and Training administers the survey. We use the 10th-grade surveys from 2007 and 2008 (earlier surveys are unfortunately not available). The survey data on the individual level cannot be linked, so for each question,

[3]This approach is reflected in the high response rates of 81%-84% for 2007-2010.

we calculate mean values for each school and cohort. These are merged with the register data set by a unique school identifier. School-specific mean values are calculated separately for girls and boys.

Table 2 shows the results from a balance test of the instrumental variable. We regress the students' family background variables on the instrument, Girls_{ibs}^{-i}, including school- and cohort-fixed effect. This balance test shows that the proportion of girls is not significantly correlated to any of the students' predetermined characteristics. Nevertheless, when we estimate the model, we include these characteristics, which are barely associated with the key variable, to increase the efficiency of our model by comparing more similar individuals[4].

5 Results

The results are shown in Table 3. The model is estimated separately for boys and girls. All models are estimated using the IV-strategy preseneted earlier. The effects of a higher proportion of girls on grades in STEM courses are in line with the findings of previous literature: girls benefit from a higher proportion of girls. The effect on GPA is however not as clear: the coefficient is negative, but not significant. It is however clear that performance in math and science is improved relative to other subjects. The effect is immediate; these girls have significantly higher grades in lower secondary school math and even continue to have higher math grades during the first year in upper secondary school, when their peer group has changed (and most probably the gender composition of the peer group). The persistent effect into upper secondary school indicates that the effects in lower secondary are not only due to the teacher grading the students relative performance in the class. After the first year of upper secondary school, we cannot measure the effect on later grades, because choices of subjects are affected after the first year in upper secondary school.

The size of the effects is also small. The coefficient for math grades in lower secondary school is 0.091, which means that a 10-percentage point increase in the proportion of female

[4]We also estimate the main model without the individual controls, and the results are almost identical.

students results in a 0.0091 unit increase in math grades (on a scale of 1-6). The average math grade in the girls' sample is 3.55 (see Table 1 for mean values). The percent increase evaluated at the mean is therefore also very small; a 10-percentage point increase in female share increases math grades by 0.26%. Going from a class with 40% girls to 60% girls (a 20-percentage point increase in the proportion of female students), which is where the main variation lies, thus increases math grades by 0.52%.

The proportion of girls also has a positive effect on math grades in the first year of upper secondary school. The coefficient suggests that a 10-percentage point rise in the proportion of girls increases math grades by approximately 0.014 units, or, in relative terms, by 0.43%.

A higher proportion of female peers negatively influences boys' grades, both generally (GPA) and specifically in lower secondary science. This finding can explain why previous research on Norwegian data in Black et al. (2013) finds that a higher proportion of female peers negatively affects boys' long-term outcomes. It conflicts however with the findings in most previous literature in other countries.

Panel B shows the results for choices: whether students from lower-secondary-school cohorts with a larger proportion of girls more frequently choose a vocational track in upper secondary school, whether they choose a male-dominated track in vocational studies, and whether students who choose an academic track more frequently choose STEM courses.

For girls, having more female peers in lower secondary school has a clear effect on study choices: as expected, they make less typically female choices when they have had more female peers. The effects on some choices are also considerably larger than the effects on grades. The coefficients for direct transition into upper secondary school and the choice of academic versus vocational track are small and insignificant. Insignificant does not necessarily mean no effect, however together with small coefficients, this enables us to interpret the effects on choice of STEM subjects and male dominated vocational track in upper secondary school in causal terms. A 10-percentage point proportion of girls results in a 0.22-percentage point increase in the probability of choosing a male-dominated track in vocational studies, or a 4.2% change evaluated at the mean. Girls choosing an academic track in upper secondary school have a

Table 3: Results. IV-estimates

	Girls	Boys
Panel A: Grades (Cohorts 2003-2008)		
Lower secondary school - final year (N=173786, N=181947)		
Math grade	0.091**	-0.023
	(0.044)	(0.046)
Science grade	0.0071	-0.086*
	(0.048)	(0.047)
GPA	-0.041	-0.098***
	(0.028)	(0.030)
Academic track in upper secondary school (N=80954, N=66640)		
Math grade, 1st year obligatory	0.14*	-0.032
	(0.081)	(0.091)
Panel B: Choices (Cohorts 1995-2008)		
Transition to upper secondary school (N=333727, N=351784)		
Direct transition	0.0042	-0.0088*
	(0.0042)	(0.0049)
Choice of track in upper secondary school (N=326518, N=343351)		
Vocational studies	0.012	0.034***
	(0.013)	(0.012)
Vocational track in upper secondary school (N=141905, N=186382)		
Male dominated field	0.022**	0.022
	(0.0092)	(0.014)
Academic track in upper secondary school (N=184613, N=156969)		
Math physics it, 1st yr	0.033**	0.027
	(0.016)	(0.017)
Math physics it, 2nd yr	0.028**	0.037**
	(0.013)	(0.016)
Math physics it, 3rd yr	0.012	0.0085
	(0.011)	(0.015)

Notes: Each cell is a point estimate of the effect of the proportion of female students on the outcome variable indicated in the left column. Standard errors are reported in parenthesis. Number of observations for each outcome is given in parentheses. Each choice is conditional on the choices above (e.g. choice of vocational track is conditional on direct transition). The included covariates are the individual characteristics in Table 1, in addition to school- and cohort-fixed effects. Level of significance: *** 1%, ** 5%, * 10%.

higher probability of choosing STEM courses in both the first and the second year. A 10-percentage-point higher proportion of girls in lower secondary school leads to a 1.2% and 1.9% higher probability of choosing math, physics, or IT courses in the first and second years of upper secondary, respectively. There is no significant effect of proportion of girls on choosing STEM courses in the third year, indicating that some of those who chose STEM courses because of more female peers drop out of these courses at higher levels. The coefficient is however still positive, which means we cannot interpret this too far. In summary, having more female peers in lower secondary school has clear effects on girls choices, but they persist for only a couple of years after the peer group changes.

For boys, the effect on choices in upper secondary of having more female peers is harder to interpret as their choices are affected immediately after lower secondary. Already transition into upper secondary school is delayed due to having more female peers - and is consistent with the negative effect of female peers on boys' grades in lower secondary school. Their choice of vocational track is also significantly affected (we also tried including those who do not have a direct transition into upper secondary, and the effect on the choice of vocational track is almost identical to the estimate reported in the table). Calculating the impact in percentages, a 10-percentage-point higher proportion of girls leads to an approximately 0.6% higher probability of boys choosing a vocational track in upper secondary school. Effects after that should be interpreted with caution however, as the composition of boys within the academic/vocational track is affected by the proportion of girls.

Overall, the effects are the largest for choices - for both girls and boys. Considering that girls, on average, perform better in the STEM courses we measure (see descriptive statistics, Table 1), why they do not choose these courses as frequently as boys requires explanations other than performance in these subjects. The results also indicate that, when girls more frequently choose differently after being in classes with relatively more girls, they are not primarily motivated by their better performance in these courses. The effects on grades are quite small compared to the larger effects on choices.

6 Possible Mechanisms of Gender Peer Effects

In this section, we investigate the potential mechanisms by which the proportion of girls in a class might affect students' educational performance and choices. To do so, we use data from the National Pupils' Survey, a survey administered to students in the Norwegian education, as described in section 4.2. This Internet-based survey of all Norwegians students from fifth grade up contains questions about the classroom environment. The analysis is similar to that of Lavy and Schlosser (2011) and partly confirms some of their findings based on Norwegian data, instead of Israeli. We also extend their analysis by including other types of questions as well as investigating the effect on choices.

We focus on five characteristics of classroom environments: well-being and safety, structure and discipline, discrimination, classroom disruptions, and competitive behavior. These are all mechanisms discussed directly or indirectly in the research literature. Questions concerning the first four characteristics are obligatory for schools, while the last is voluntary. This reduces the share of schools by approximately 20%.

Each question is answered on a scale from 1 to 5 (1 = totally disagree; 5 = totally agree). For some questions, the scale is reversed (1 = totally agree; 5 = totally disagree). These questions are indicated by a minus sign in front of the mean values in the descriptive statistics in Table A.1. A less negative value indicates agreement with the statement.

All estimations control for school-fixed effects and students' background characteristics, as in previous models. However, the National Pupils' Survey covers only the last two cohorts in the sample (2007 and 2008), which implies that identification through within-school variations is relatively less powerful in these samples[5].

Table 4 shows the effect of the proportion of female students on different indicators of classroom environments separately for girls and boys. We estimate them in the same way as the effects of female peers on grades and choices, and they are as such valid estimates of the effect of proportion of girls on the average responses of boys and girls to the survey. The

[5]We have estimated the baseline model on grades and choices in this subsample, and the results are similar as in the full sample.

estimates reported for well-being and safe environment suggest that a higher proportion of girls increases the level of well-being (”Do you feel well at school?”) for both girls and boys. The proportion of girls is also negatively related to bullying for girls (”Are you bullied by your schoolmates?”) but has no significant relationship for boys. The proportion of girls also has a positive impact on student discipline: girls do more homework (”Do you do your homework?”), and both boys and girls are tardy to school less frequently (”Are your classmates often late for class?”). These questions are related to those about disruptions that Lavy and Schlosser (2011) find important. We do not, however, obtain clear significant results for questions which directly measure disruption: (”Do the teachers use much time to restore order in class?”) and (”Do other students disturb you during class?”), but boys report that they more often disturb other students when surrounded by more girls (”Do you disturb the other students when they work”). Taken together, the results suggests that, at least in the Norwegian context, the most important effect of the proportion of female students is to create a more sociable, disciplined environment rather than directly reducing noise in the classroom.

The survey also includes questions that more directly address gender. Regarding discrimination, we find significant relationships but only for girls. The presence of more girls in the classroom is associated with less gender discrimination (”Have you been discriminated because of your gender?”) and less unjust treatment by students (”Have you been treated unjustly by your classmates?”). Earlier, we discussed literature reporting that girls's willingness to compete increases when they compete with other girls. One then might expect that, when the proportion of girls increases, they are more willing to compete. However, the two available indicators (”I try to do better than the others students”, ”I want to be best in something”) suggest no such relationship for girls, the coefficients even go in opposite directions. Boys however become more competitive when surrounded by more girls - consistent with the theories that boys (and girls) take on more ”masculine” (”feminine”) traits when they are fewer.

The next step is to explore how these indicators of classroom environments are related to outcomes where we find significant gender peer effects (see Table 3). We regress answers to the survey on grades and choices, controlling for the same characteristics as in the previous 2sls

Table 4: Effect of the Proportion of Female Students on the Classroom Environment

	Girls	Boys
Well-being and safe environment		
Do you feel well at school?	0.22*	0.49***
	(0.13)	(0.15)
Are you bullied by your classmates?	-0.24*	0.0022
	(0.13)	(0.15)
Structure and discipline		
Do you do your homework?	0.36*	0.033
	(0.22)	(0.22)
Are your classmates often late for class?	-0.39**	-0.34**
	(0.17)	(0.17)
Discrimination		
Have you been discriminated against because of your gender?	-0.26**	0.12
	(0.12)	(0.18)
Have you been unjustly treated by your classmates?	-0.21*	0.22
	(0.11)	(0.13)
Classroom disruption		
Do the teachers use much time to restore order in class?	-0.19	0.0053
	(0.21)	(0.19)
Do other students disturb you during class?	-0.16	0.019
	(0.17)	(0.18)
Do you disturb the other students when they work?	-0.077	0.29**
	(0.12)	(0.15)
Competitive behaviour		
I try to be better than the other students	0.024	0.41*
	(0.29)	(0.24)
I want to be best in something	-0.17	0.31
	(0.22)	(0.19)

Notes: Each cell is a point estimate of the effect of the proportion of female students on the outcome variable indicated in the left column. Standard errors are reported in parenthesis. The included covariates are the individual characteristics in Table 1, in addition to school- and cohort-fixed effects. Level of significance: *** 1%, ** 5%, * 10%.

regressions. The results can only be interpreted as correlations, but will indicate whether classroom environment indicators are correlated to grades and choices - and thus be candidates for causal mechanisms. We limit the presentation to classroom environments that were significant in Table 4.

Tables 5 and 6 presents the results for performance separately for girls and boys. For girls, we find positive relationships of well-being at school and homework discipline with performance in math in lower secondary school and obligatory math courses in upper secondary school. Table 4 reveals positive relationships of the proportion of girls with both homework and well-being. These findings suggest that these classroom environments are mediating mechanisms for the positive gender peer effect reported in Table 3. Tardiness is negatively related to math grades in the first year of upper secondary school for girls. Along with the negative results for tardiness and the proportion of girls reported in Table 4, this is a potential mediating mechanism for the gender peer effect.

The last column presents results for boys. For boys, well-being and competitiveness is positively related to science grades in lower secondary school and to the proportion of girls in Table 4, while their reporting of disturbing other students is negatively related to science grades and increases with the proportion of girls. Table 3 shows a negative effect from the proportion of girls on boys' science grades in lower secondary school. Together, these findings indicate that the presence of more female peers has a positive effect on boys' grades through a positive effect on well-being and competitiveness and a negative effect on boys' science grades through an increased propensity of disturbing others. The presence of more female peers seems therefore to have a negative effect on boys' disturbing others (and other factors that are not measured in the survey) that outweighs the positive effect on well-being.

The relationship between classroom environment indicators and school results is more significant than the relationship to choices. It suggests that the proportion of female students influences performance in relation to measurable characteristics of girls and boys, such as bullying behavior and discipline. The mechanisms behind the effect of female share on choices is perhaps not as directly linked to observable characteristics. As well, other mechanisms might

Table 5: Regressing Classroom Environment Indicators on Results and Choices, Girls

	Results		Choices
	Math, low. sec.	Math, up. sec.	STEM, 1st yr
Well-being and safe environment			
Do you feel well at school?	0.19***	0.16**	0.048*
	(0.049)	(0.080)	(0.027)
Are you bullied by your classmates?	-0.071	-0.080	-0.018
	(0.056)	(0.082)	(0.031)
Structure and discipline			
Do you do your homework?	0.078**	0.15***	0.0030
	(0.032)	(0.041)	(0.017)
Are your classmates often late for class?	-0.061	-0.14***	-0.016
	(0.039)	(0.054)	(0.023)
Discrimination			
Have you been discriminated because of your gender?	-0.036	-0.20***	-0.0075
	(0.058)	(0.075)	(0.029)
Have you been unjustly treated by your classmates?	-0.067	-0.11	-0.032
	(0.059)	(0.082)	(0.030)

Notes: Each cell is the result from regressing a classroom environment indicator (given in the left column) on the results and choice outcomes indicated in the head of each column. Standard errors are reported in parenthesis. The included covariates are the individual characteristics in Table 1, in addition to school- and cohort-fixed effects. Level of significance: *** 1%, ** 5%, * 10%.

Table 6: Regressing Classroom Environment Indicators on Results and Choices, Boys

	Results	Choices
	Science, low sec.	Vocational track
Well-being and safe environment		
Do you feel well at school?	0.27***	-0.042***
	(0.050)	(0.015)
Structure and discipline		
Are your classmates often late for class?	-0.021	0.0071
	(0.044)	(0.014)
Classroom disruption		
Do you disturb the other students when they work?	-0.012	0.0099
	(0.042)	(0.012)
Competitive behaviour		
I try to be better than the other students	0.23***	-0.050***
	(0.055)	(0.016)

Notes: Each cell is the result from regressing a classroom environment indicator (given in the left column) on the results and choice outcomes indicated in the head of each column. Standard errors are reported in parenthesis. The included covariates are the individual characteristics in Table 1, in addition to school- and cohort-fixed effects. Level of significance: *** 1%, ** 5%, * 10%.

be at work. It would have been beneficial to ask questions that capture self-concept, self-image, gender stereotypes, and gendered norms, which are all mechanisms that can affect educational choices and might be influenced by the proportion of female peers. Unfortunately, the National Pupils' Survey does not include questions covering these topics in a satisfactory manner. In addition, having survey information for only two cohorts of pupils results in less powerful estimations, potentially affecting the precision of some mechanisms. Some of the same mechanisms that explain school results are however also significant in explaining choices. Improving the classroom environment will, according to our results, both have a positive impact on school results and also on the choice of an academic track (boys) and choosing STEM courses within the academic track (girls).

7 Robustness

In this section, we do several robustness checks to test whether our main results for grades and choices are sensitive to time-trends in unobservables and to cohort size.

There is a potential concern that trends in the proportion of girls within a school might be related to unobservable characteristics which might influence school results and choices. One such trend might be a trend in preferences for having boys rather than girls. Preferences for boys over girls have been shown to influence the stopping rules of families (Dahl and Moretti, 2008) and rates of elective abortion, especially in some Asian countries (Sen, 1992), and therefore could affect the gender balance at the aggregate level. In Norway, Lillehagen and Lyngstad (2014) find differences in sex preferences in the immigrant and native populations which result in different fertility behaviors. If the composition of families in a school district changes over time, preferences for girls or boys might also change, leading some schools to have a higher proportion of girls compared to others. The differences in fertility behavior across immigration and native groups are however so small, that we believe this to be a minor problem.

We do three robustness checks to test this concern. First, we estimate the model, including a moving average of the background characteristics of the student's peers. We also estimate a

Table 7: Robustness. IV-estimates

	Girls			Boys		
	Mov.av.	School tt	Ex. trend sc.	Mov.av.	School tt	Ex. trend sc.
Panel A: Grades (Cohorts 2003-2008)						
Lower secondary school - final year						
Math grade, middle school	0.078	0.082*	0.077*	-0.0082	-0.019	-0.0094
	(0.049)	(0.045)	(0.046)	(0.049)	(0.046)	(0.047)
Science grade	0.0049	0.0016	0.0076	-0.090	-0.084*	-0.077
	(0.053)	(0.048)	(0.049)	(0.055)	(0.048)	(0.051)
GPA	-0.046	-0.050*	-0.032	-0.088**	-0.099***	-0.075**
	(0.033)	(0.028)	(0.032)	(0.037)	(0.030)	(0.035)
Academic track in upper secondary school						
Math grade, 1st year obligatory	0.18**	0.13	0.18**	-0.025	-0.048	0.024
	(0.086)	(0.081)	(0.080)	(0.094)	(0.091)	(0.085)
Panel B: Choices (Cohorts 1995-2008)						
Transition to upper secondary school						
Direct transition	0.0048	0.0037	0.0059	-0.00034	-0.0077	-0.00036
	(0.0044)	(0.0043)	(0.0043)	(0.0057)	(0.0053)	(0.0053)
Choice of track in upper secondary school						
Vocational studies	0.0024	0.0083	-0.0098	0.017	0.025*	0.020
	(0.015)	(0.013)	(0.014)	(0.015)	(0.013)	(0.015)
Vocational track in upper secondary school						
Male dominated field	0.015	0.021**	0.011	0.020	0.023	0.029*
	(0.0097)	(0.0093)	(0.0094)	(0.016)	(0.015)	(0.016)
Academic track in upper secondary school						
Math physics it, 1st yr	0.015	0.036**	0.0085	0.018	0.026*	0.020
	(0.017)	(0.015)	(0.016)	(0.018)	(0.016)	(0.017)
Math physics it, 2nd yr	0.022	0.030**	0.0086	0.035**	0.035**	0.033**
	(0.014)	(0.012)	(0.013)	(0.017)	(0.015)	(0.016)
Math physics it, 3rd yr	0.014	0.010	-0.0023	0.012	0.0053	0.014
	(0.012)	(0.010)	(0.011)	(0.016)	(0.014)	(0.015)

Notes: Each cell is a point estimate of the effect of the proportion of female students on the outcome variable indicated in the left column. Standard errors are reported in parenthesis. The included covariates are the individual characteristics presented in Table 1, in addition to the moving average of background characteristics of the student's peers in columns 1 and 4, linear time trends in columns 2 and 5, and the baseline model with time dummies excluding schools with a significant time trend from the sample in columns 3 and 6. The sample size is 84% of the baseline sample size given in Table 1 when we include the moving average (because we cannot use the first and last year), the sample size is 95% of the baseline sample size when we exclude schools with a significant timetrend. Level of significance: *** 1%, ** 5%, * 10%.

model controlling for school-specific, linear time trends. Finally, we follow Schneeweis and Zweimüller (2012) and estimate the model excluding schools with a significant time trend in the proportion of girls[6]. The results are reported in Table 7.

The results are quite similar in all specifications of the baseline model in Table 3. Some coefficients, however, are no longer significant. Controlling for a linear time trend in columns 2 and 5, we keep all the original observations, and our results are robust to the inclusion of time-trends. When we introduce moving averages, we lose observations from the first and last cohorts (because averages are not known the prior and subsequent years), and when excluding trending schools, we also lose a part of the sample. Overall, the results from moving averages and excluding time trends are similar in the direction of the effects, indicating that trends in the proportion of girls in schools over time are not important for the effects identified in the baseline model in Table 3.

We also test the sensitivity of the results to the inclusion of small schools in our sample. There is to some degree grade mixing in small schools in Norway (Leuven and Rønning, 2014) which might induce measurement error in the measure of female share. We estimate the model with different restrictions on grade size, excluding grades with less than 10, 15, and 24 students. We see in Table A.2 in Section 7 that the results are highly similar across these restrictions, but also here we have a problem with less significant results as the sample size decreases. We conclude that the effects estimated in the baseline model are not strongly driven by small classes, and the external validity of the results is not limited to small schools.

8 Conclusion

Women outperform men in investing in education, but a considerable wage gap persists. This wage gap is, in part, closely connected to occupational gender segregation in the labor market, which is strongly linked to earlier educational choices. In this paper, we use the idiosyncratic variation in gender composition across cohorts in Norwegian lower secondary schools to ana-

[6]The regression is: $\text{Girls}_{sc} = \beta_1 + \beta_2 \text{Time}_s + \gamma_s + u_{sc}$, where Time_s is a linear, school-specific time trend. Approximately 5% of the schools in our sample have a significant β_2.

lyze the impact of the proportion of female students on performance in and choice of typically masculine subjects. We use gender composition in lower secondary schools because peers are governed by institutional rules and regulations at this level. Completing lower secondary schools is mandatory, all students follow the same track, and school districts adhere to geographical areas, producing random variations in the proportion of girls in each school cohort.

The evidence presented in this paper suggests that a higher proportion of female students has positive effects on grades in STEM courses. Girls benefit from a higher proportion of girls in the classroom, or in other words, girls help girls. The size of the effects is however small. For boys, we find negative impacts on science grades from higher proportions of female students, in contrast with many results reported in the literature.

The results for choices reveal larger effects. For girls, the results show that having more female peers increases the likelihood of choosing male dominated tracks and STEM subjects in upper secondary school. For boys, we find that a higher proportion of girls in the classroom increases the likelihood of delayed start in upper secondary and also the choice of vocational track. The results are generally robust across different specifications controlling for time-varying school-quality indicators. The greater effects on choices than grades, especially for girls, suggest that the positive gender-peer effect on girls' choices is not fully explained by positive peers effects on grades; in other words, girls' choice of STEM courses is not fully explained by their improved performance in these courses relative to boys.

We find that causal mechanisms are related to an improved classroom environment. More students report that they feel well at school, do their homework and show up on time. All these classroom environment indicators correlate positively with school results for both girls and boys - and with the probability of choosing STEM courses in upper secondary. For boys, there are however some negative effects of an increased female share on performance that outweighs the positive impacts of a positive classroom environment. These effects are related to a higher probability of boys reporting that they disturb others.

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A Appendix

Table A.1: Descriptive statistics, Pupils' Survey

	Girls		Boys	
	mean	sd	mean	sd
Well-being and safe environment				
Do you feel well at school?	4.14	(0.22)	3.97	(0.28)
Are you bullied by your classmates?	-4.72	(0.17)	-4.59	(0.23)
Structure and discipline				
Do you do your homework?	4.03	(0.34)	3.66	(0.38)
Are your classmates often late for class?	-2.61	(0.30)	-2.59	(0.29)
Discrimination				
Have you been discriminated because of your gender?	-4.68	(0.18)	-4.51	(0.28)
Have you been unjustly treated by your classmates?	-4.64	(0.17)	-4.58	(0.22)
Classroom disruption				
Do the teachers use much time to restore order in class?	-2.51	(0.34)	-2.59	(0.31)
Do other students disturb you during class?	-2.83	(0.28)	-2.96	(0.27)
Competitive behaviour				
I try to be better than the other students	3.14	(0.30)	3.34	(0.31)
I want to be best in something	4.18	(0.24)	4.16	(0.25)

Notes: Each question is answered on a scale from 1 to 5 (1 = totally disagree; 5 = totally agree). For some questions, the scale is reversed (1 = totally agree; 5 = totally disagree). These questions are indicated by a minus sign in front of the mean values, and a less negative value indicates agreement with the statement.

Table A.2: School size

	Girls			Boys		
	> 10	> 15	> 24	> 10	> 15	> 24
Panel A: Grades (Cohorts 2003-2008)						
Lower secondary school - final year						
Math grade, middle school	0.084	0.081	0.11*	-0.022	-0.016	-0.026
	(0.053)	(0.057)	(0.062)	(0.055)	(0.058)	(0.064)
Science grade	0.018	0.018	0.0076	-0.12**	-0.12*	-0.15**
	(0.058)	(0.062)	(0.068)	(0.060)	(0.064)	(0.071)
GPA	-0.056	-0.059	-0.044	-0.12***	-0.12***	-0.13***
	(0.037)	(0.038)	(0.042)	(0.042)	(0.044)	(0.049)
Academic track in upper secondary school						
Math grade, 1st year obligatory	0.11	0.12*	0.12	0.036	0.053	0.050
	(0.069)	(0.072)	(0.078)	(0.065)	(0.069)	(0.074)
Panel B: Choices (Cohorts 1995-2008)						
Transition to upper secondary school						
Direct transition	0.0036	0.0046	0.0049	-0.0035	-0.0055	-0.0085
	(0.0045)	(0.0047)	(0.0051)	(0.0052)	(0.0052)	(0.0056)
Choice of track in upper secondary school						
Vocational studies	-0.0081	-0.00070	-0.0026	0.028	0.034*	0.042*
	(0.017)	(0.018)	(0.019)	(0.019)	(0.020)	(0.022)
Vocational track in upper secondary school						
Male dominated field	0.013	0.012	0.0051	0.029	0.036*	0.044*
	(0.011)	(0.012)	(0.013)	(0.019)	(0.020)	(0.023)
Academic track in upper secondary school						
Math physics it, 1st yr	0.015	0.017	0.029	0.018	0.017	0.016
	(0.018)	(0.020)	(0.022)	(0.020)	(0.021)	(0.023)
Math physics it, 2nd yr	0.012	0.0076	0.014	0.036**	0.030	0.033
	(0.015)	(0.016)	(0.018)	(0.018)	(0.019)	(0.021)
Math physics it, 3rd yr	-0.0080	-0.0076	-0.0059	0.020	0.016	0.013
	(0.013)	(0.014)	(0.015)	(0.017)	(0.018)	(0.020)
Start higher educ, at 21	-0.013	-0.025	-0.024	-0.0024	-0.016	-0.029
	(0.020)	(0.021)	(0.024)	(0.024)	(0.025)	(0.026)
Started higher education						
Male dom. higher educ	0.022	0.029*	0.035**	0.048*	0.054*	0.037
	(0.015)	(0.016)	(0.017)	(0.027)	(0.029)	(0.031)
Female dom. higher educ	-0.013	-0.025	-0.036	-0.0069	-0.0088	0.00049
	(0.021)	(0.022)	(0.024)	(0.028)	(0.030)	(0.032)

Notes: Each cell is a point estimate of the effect of the proportion of female students on the outcome variable indicated in the left column. Standard errors are reported in parenthesis. The included covariates are the individual characteristics in Table 1, in addition to school- and cohort-fixed effects. The sample size is 97% of the baseline sample size given in Table 1 when we exclude schools with cohorts< 10 students, 95% of the baseline sample excluding schools with cohorts< 15 students and 90% excluding schools with cohorts< 24 students. Level of significance: *** 1%, ** 5%, * 10%.