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Abstract

Women have historically been underrepresented in STEM jobs. This paper uses administrative data from China to examine the extent to which the presence of high-performing peers in mathematics affects the likelihood that women choose a science track during high school. Results indicate that having a higher proportion of high-performing females increases STEM major choices by girls, while more high-performing males may decrease this likelihood. There is little evidence of peer effects for boys. Our results suggest that girls doing well in quantitative fields may have a role model or affirmation effect that encourages their female classmates to pursue a science track.

JEL Classification: I21, I24, I26, J24

Keywords: STEM, Peer Quality, Gender Effects, China

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1 Introduction

The question of why there are fewer women in science, technology, engineering & math (STEM) has long been of interest to social scientists, educators and policy makers. Despite women holding 48 percent of all jobs and half of college-educated occupations, they make up only 24 percent of the STEM workforce in the U.S. This is of growing concern as STEM employment is a critical component of a country's competitiveness and the gender wage gap is relatively smaller in STEM jobs than that in non-STEM jobs (Beede et al., 2011). Importantly, differences in occupational choices are not easily explained by gender differences in math and science achievement.[1] Rather, much if not all of the gender gap can be traced back to non-performance based choices made in school. In a 2015 U.S. News report, it was estimated that only 3 and 2 percent of US high school girls reported an interest in engineering and technology fields respectively, compared to 31 and 15 percent for boys. Further, of all bachelor's degrees earned by women, only 13 percent of them were in a STEM field, compared to 28 percent for men. For graduate degrees, these numbers are 10 and 24 percent for women and men respectively (U.S. News, 2015). Given that the disparities in the human capital investment decisions of men and women likely have lasting consequences on both efficiency and gender equity, it is critical to understand the factors that affect these choices.

In this paper, we study the extent to which role model or affirmation effects matter in explaining the STEM gender gap. We do so in the context of the Chinese education system, a particularly relevant context, as negative gender stereotypes and the perception that men are better than women in science and engineering have led to a large STEM gender gap (Zhang and Zhen, 2011). Guo, Tsang and Ding (2010) estimate that 73.9% of college graduates in science and engineering are male compared to 26.1% female. This has also adversely affected overall college enrollment for girls as engineering majors are the largest group of students in terms of admission seats (Guo, Tsang and Ding, 2010). Additionally, unique features of the Chinese high school education system lend themselves favorably towards the estimation of our effects. One such feature is that students in China are subject to a common curriculum in their first year of high school and must choose between a science and arts track the following year. Importantly, this gives students one year of familiarity with a new set of formed peers before making track choices, allowing us to disentangle the effects of high school choice from track choice—which usually occur simultaneously in other educational settings.

[1]Recent U.S. evidence shows that there is at most a 0.65 percent of a standard deviation difference in average math test scores across genders in grades 2 through 11. The difference is also small at the top of the distribution (Hyde, Lindberg, Linn, Ellis & Williams 2008). At the college level, Turner and Bowen (1999) estimate that differences in SAT scores can explain at most half of the total gender gap in college major choices.

Utilizing student level administrative data from China, we look at how gender peer ability composition in high school affects females' decisions to choose a science or arts track. To account for observed and unobserved characteristics of schools and students that might be correlated with high performing peer composition, we rely on idiosyncratic variation in the proportion of high performing female and male students across cohorts within the same school. We demonstrate, using Monte Carlo simulations, that the observed within school variation in the proportion of high performing female peers is consistent with variation generated from a random process. Additionally, in our setting, transition from middle school to high school results in approximately 91 percent new peers being formed—allowing us to overcome concerns of reflection (Manski, 1993).[2]

Results indicate that a 1 standard deviation increase (0.108) in the proportion of high performing female peers significantly increases women's likelihood of choosing a science track by approximately 4 percentage points, relative to males. Conversely, our results indicate that being exposed to high performing male students has a negative effect on females, relative to males. In contrast, men are unaffected when exposed to high performing male or female peers, a result that is consistent with prior research documenting how men's choices may be less affected by their surroundings than women (See, for example, Bagès, Verniers and Martinot, 2016; Fischer, 2017; Ost, 2010). These results are robust to the inclusion of various cohort or time varying controls, district-by-cohort fixed effects and school specific linear time trends as well as to alternative definitions of high performing students.

The effects we document could be due to a change in beliefs, as Zafar (2013) shows that most of the gender gap can be attributed to differences in beliefs about enjoying coursework and differences in workplace preferences. Alternatively, it could also be due to a breakdown of socio-psychological factors; Blickenstaff (2005) has shown that gender stereotyping, lack of female role models in science and engineering as well as hostile environments for females in science majors are also considered potential barriers for women who would like to pursue a science path. Our results are most consistent with the socio-psychological interpretation of educational investments. Indeed, further analysis suggests that having more high achieving female peers in quantitative fields may provide a role model or affirmation effect for female students, mitigating the adverse effects of negative gender stereotypes.

Our paper is closest to an emerging body of literature that attempts to understand the persistent underrepresentation of women in STEM fields. Carrell, Page and West (2010) find that professor gender is a significant predictor of womens' likelihood of graduating with a STEM degree in college. Ost (2010) finds that female college students majoring in the

[2]Simply stated, peer effects may work in both directions, so that peer ability is endogenous to own ability if students have been together for a while.

physical sciences are more affected by grades than men. Zafar (2013) shows that the gender gap in science is mostly due to differences in beliefs about coursework as well as gender preferences. In recent work, Fischer (2017) and Hill (2017) highlight the importance of student peer composition on female STEM choices and persistence in college.

Our paper makes several contributions to the existing literature. First, to the best of our knowledge, this is the first paper to look at the determinants of female STEM choice in a high school setting.[3] This contrasts with the studies listed above which have focused on STEM enrollment or persistence at university. This is potentially important as dynamic complementarities in the formation of human capital dictates that early educational choices may matter more (Cunha and Heckman, 2007). Indeed, as noted earlier, there are already large gender differences in interest in STEM fields during high school. This lack of interest can cause women to under-invest in science during high school, which may forever lower their returns to later investments in STEM fields. Further, in many settings in the world, students are tracked into science versus non-science routes in high school, yet there is little evidence on how these choices are made and to what extent they perpetuate the gender gap in science.[4]

Second, our paper contributes to an active literature documenting the importance of gender peer effects in academic settings. A number of studies have shown that girls and boys benefit academically from an increase in the number of female peers in school (Hoxby, 2000; Lavy and Schlosser, 2011). More closely related to our study is a set of studies focusing on the effects of gender peer quantity on major choice. Anelli and Peri (2016) find that male students exposed to over 80 percent male peers are more likely to choose a male dominated college major in Italy. Schneeweis and Zweimüller (2012) show that girls with more female peers are less likely to choose female dominated school types in Austria. Conversely, Zölitz and Feld (2017) and Hill (2017) show that women exposed to a higher share of female college peers are more likely to choose female dominated majors. We contribute to this literature by showing that gender peer quality—not just quantity—is of considerable interest and may mask contextual heterogeneity, which may explain the seemingly contradictory findings in the aforementioned papers.[5] This is in line with recent work by Fischer (2017) who documents that being in a class with higher ability peers negatively affects women's likelihood of graduating with a STEM degree. We add to the understanding of how peer ability composition affects education choice by showing that, in our context, women benefit

[3]Eble and Hu (2017) exploit random assignment to estimate how having a female teacher affects girls beliefs and performance in mathematics in Chines middle schools.

[4]This form of tracking is common in many European and Asian countries.

[5]Put differently, two students in separate classrooms with the same number of female peers may have different outcomes depending on the ability composition of those females.

from high performing peers, conditional on them being female. This suggests that the direction and magnitude to which peer ability may affect female STEM choices is also highly dependent on the gender of those peers. Importantly, this also suggests that any potential gains from exposure to a higher number of female peers may be amplified by the quality of those peers.

Finally, our results are most consistent with a socio-psychological interpretation of educational investments and contribute to the understanding of the importance of positive role models in education (See, Carrell, Page and West, 2010; Paredes, 2014; Eble and Hu, 2017)—particularly for groups in a minority position. This is especially important in China where a 2011 survey revealed that 10 and 23.1 percent of female and male students respectively agreed with the statement that "men are born to be better than women" (Zhang and Zhen, 2011).

The rest of the paper is organized as follows. Section II presents information on the educational system in China. Section III describes the data used in this paper. Section IV reviews the identification strategy. Section V presents the main empirical results as well as robustness checks. We discuss our results in section VI and section VII concludes.

2 Institutional Background

Children in China generally start elementary school (1st grade) at around 6-7 years of age. After 6 years of elementary school, children then move on to the first part of middle school, a 3-year junior middle school (7th to 9th grade) to complete the 9-year national compulsory education. Graduates of 9th grade can then choose to continue education in the vocational or academic high school sector (10th to 12th grade). This is then followed by vocational (3-year or 4-year) or traditional college education (2-year or 4-year). Non-vocational high schools prepare students for four year colleges/universities and are rather competitive to get into as there are only enough seats for about 60% of the junior middle school graduates in our sample.[6] In order to gain entrance into high school, 9th graders must sit for a national high school entrance exam (HET). In this exam, students are tested on seven subjects including Chinese language, Mathematics, English language, Physics, Chemistry, Political Science and Physical Education.[7] The total score achieved on these seven subjects is the one and only

[6] Students attending vocational high schools are not prohibited from taking the college entrance exam. However, the curriculum in vocational high schools differs substantially from the material on the college entrance exam. Thus, if a student wants to increase their chances of gaining acceptance into a traditional college, he/she should attend a traditional high school.

[7] Chinese language, Mathematics and English language are worth 150 points each; Physics, Chemistry and Political Science are worth 100 points each; P.E. is worth 40 points but is not tested in all years in our sample.

criterion for high school admission for most students.[8] In this paper, we focus only on students in the traditional educational track and so we limit our discussion to traditional high schools and colleges/universities.

Unlike elementary and junior middle school, high school is neither compulsory nor free in China. However, the majority of high schools are public and they charge relatively low tuition. For example, in our province, public high school tuition is around $200/year, and is subsidized if family income is below a certain threshold.[9] Admission into high school is centrally operated by each district's education administrators. In early June, students fill out application forms indicating their ordered preference of high schools prior to taking the high school entrance exam, which is generally administered in the middle of June. High schools preselect the number of students they want to admit for that year and grant admission based on students' preferences and test scores using an admissions procedure similar to the Boston Mechanism.[10] Further, public high schools are allowed to designate around 10% of their seats as "high-priced". Students enrolled through the high-priced channel receive the same education as other regular students, but require a lower cutoff score to enter their desired high school. Students entering through this channel must pay an extra one-time fee to the school upon registration. This one-time fee is set by the schools and revealed to students before they apply. College bound students are incentivized to attend the best quality high school they can as this substantially increases the chance of going to a better college or any college (Hoekstra, Mouganie and Wang, forthcoming).

Students opting into the traditional high school sector spend the first year studying a common curriculum. At the end of the first year of high school, students decide whether to pursue a science or arts track. If a student chooses to concentrate in the sciences, then their college entrance exam (CET), administered at the end of high school, will consist of Chinese language, English language, Mathematics for science students, Physics, Chemistry and Biology. Arts students, on the other hand, take a CET exam that contains Chinese language, English language, Mathematics for arts students, Political science, History and Geography.[11] Similar to the HET, the total score of the CET exam is the sole determinant of college admission for most students. Students in the science track still take classes in

[8]The only exceptions are students with special talents; for example athletes. However, these students are a very small portion of the whole population.

[9]The $200 fee amounts to less than 1 percent of average GDP per capita in the city we study.

[10]For more details on the admissions procedure, refer to Hoekstra, Mouganie, and Wang (forthcoming).

[11]The Chinese language and English language tests are identical for both arts and science students .In the first three years of our sample, the CET takes the form of 3+X+S/A where a student will take the test on Chinese language, Mathematics (for science or arts), English language, one science or arts subject of her choice and a comprehensive science or arts test. A science student can choose any of the three science subjects (Physics, Chemistry or Biology) as her X subject and an arts student chooses her X subject from Political science, History and Geography.

History, Political science and Geography after making their track choice and vice versa. All students need to pass an assessment exam comprised of all subjects at the end of the second year in high school regardless of track choice. Passing this exam is necessary for eligibility to take the CET exam and to go to college. The assessment test is generally very basic and nearly all students pass. The high school graduation rate in our sample is 99.66% as of 2012. On the other hand, the national CET exams are meant to be more challenging so as to properly differentiate student ability. As a result, it is general practice that schools prepare students as much as possible on their chosen subjects, and just enough to pass the assessment exam on the subjects that are not going to be administered in the CET. This disparity in training makes it highly implausible that a student switch from science to arts or the other way around after some time.

During admissions, colleges get to decide whether they want to admit science or arts students or both for each of their majors. This information is given to students before taking the CET exam and is fairly consistent over time. Generally, 60 percent of college seats available for the sample province are for science students and around 40 percent are for arts students. As a result, a student may select into a science track for reasons besides interest in the subject itself; mainly due to the availability of more college seats for science students. Of course, students' mathematical ability or perception of their ability also plays a crucial role, seeing as it is common knowledge among students that the mathematics CET exam for arts is easier than the one administered to science students.

3 Data

3.1 Data Description

This paper uses student level administrative data for four separate high school cohorts in a large metropolitan area in southern China (students graduating high school from 2007 to 2010.). As a condition of using the data, we are prohibited from directly revealing the name of the province and city. The city has a population of more than 10 million individuals and a per capita GDP of more than $20,000, compared to a national average of $16,000. Each observation contains an individual and school identifier, students' HET and CET scores by subject, students' high school track choice (Science or arts), and some demographic information: gender, minority status, parental occupation. In our analysis, we drop all schools that do not have student records for all four cohorts, which occurs when a school is either new or an old one closes.[12] The final sample consists of 118 high schools and 176,896 student observations for the cohorts of 2007, 2008, 2009 and 2010. The average school size across all four cohorts is 375 students.

3.2 Summary Statistics

Summary statistics for the four cohorts of students used in our analysis are reported in Table 1. The percentage of females in our sample is 52%, whereas males constitute 48% of the sample. Strikingly, the percentage of women selecting a science track stands at 34%. This is in stark contrast to men who have a 70% likelihood of choosing a science track. Part of this disparity could be driven by differences in performance in quantitative versus non-quantitative subject material prior to selecting high school tracks. Table 1 provides some support for this hypothesis as males score higher in quantitative portions of the high school entrance exam (Math, Physics, Chemistry), while females tend to perform better in non-quantitative subjects (Chinese, English, Political Science). However, these differences are quite small and not meaningful enough to explain why men are twice as likely to choose a science track as compared to women. Total test scores on the HET exam are similar as males achieve an average total score of 594, while females score 599 out of a possible 790 points. Three years later, in the college entrance exam (CET), women perform significantly better than men overall, regardless of track chosen. Private school enrollment is quite low and averages around 1 to 2 percent for both genders. Further, there are more high price students who are male (12%) than female (8%) suggesting that parents are more likely to pay a premium for education if their child is male.

The treatment of interest in this paper is the proportion of high performing peers in a given cohort. We define a high performing student as one who scores within the top 20%, nationally, in the HET mathematics exam. We focus on math performance as women's underrepresentation in STEM is generally concentrated in math-intensive science fields.[13] Further, it is generally believed that math ability and skills are necessary for STEM careers (Kahn and Ginther, 2017). We then calculate the female (male) high performing ratio for student i by computing the percentage of high performing female (male) students in individual i's year-school cohort excluding individual i. Using this definition, we find that the proportion of high performing peers who are female is 8.6%, whereas that ratio is 11.8% for males.[14]

[12] 25 schools or roughly 6,330 observations were excluded from the sample, although including these observations does not change the main findings.

[13] In section 5.2, we show that the peer effects we document are robust to alternative definitions of high performing female and male peers.

[14] In total, 20.4% of students in our sample score in the top 20% of national test takers in the mathematics

4 Identification Strategy

The effect of ability composition within a classroom or school is usually confounded by the effects of unobserved factors that can themselves affect students' outcomes. Indeed, students sorting across schools based on ability and other school characteristics would lead to bias in the estimation of peer effects on individual choices. To overcome this issue, we rely on within school variation in peer composition across four adjacent cohorts of Chinese high school students. The basic premise behind our identification strategy is to compare the outcomes of students from adjacent cohorts who face the same school environment, except for the fact that certain cohorts had a higher proportion of high ability females or males in their first year of high school due to idiosyncratic variation.[15] Additionally, in our analysis, when looking at the effects of the proportion of high performing students on outcomes, we exclude high performing students from our sample. We do so for two reasons: First, good performance in quantitative coursework is correlated with track choice, therefore variation in the ratio of top performing students is mechanically linked to STEM choice for the sample of students who are top performers. Second, the marginal student induced into a science track due to exposure to better peers is most likely not a top performing student.[16]

Additionally, unique features of the Chinese educational system allow us to overcome other identification challenges. First, students select into a science or non-science track after being exposed to one year of common peers in their first year of high school. This allows us to disentangle the effects of track choice from school choice which are usually made simultaneously in other educational contexts. Second, in our setting, students form, on average, 91 percent new peers in high school. This contrasts with most settings in the U.S. where a student's peers are more or less constant throughout various stages of schooling. Importantly, the significant re-shuffling of students in high school alleviates concerns over whether our results are driven by common unobserved shocks faced by students in middle school. Further, this re-mixing allows us to exploit variation in peer composition that is immune to the reflection problem, a common issue in peer studies (See Manski, 1993). Indeed, if the peers a student was exposed to were constant over time, then it would be hard to identify the effect of peer ability composition on individual students from the effects of a student on his peers. Using four school cohorts, we estimate the following reduced-form

portion of the HET exam, suggesting that the city our sample is based on is reasonably representative of China.

[15] We do not possess classroom level data for our sample of students. Further, focusing on classroom level variation could lead to selection issues as classroom assignment within a school is not necessarily random (See for example, Lavy and Schlosser (2011)).

[16] We have run the analysis with the full sample and the estimates are slightly larger but statistically similar.

equation:

$$
\begin{aligned}
Y_{isc} &= \pi_1 TopF_{sc} + \pi_2 TopF_{sc} * Female_{isc} + \tau_1 TopM_{sc} + \tau_2 TopM_{sc} * Female_{isc} \\
&+ \quad \theta PropF_{sc} + \gamma PropF_{sc} * Female_{isc} + X'_{isc}\lambda_1 + S'_{sc}\lambda_2 + \alpha_s + \beta_c + \epsilon_{isc} \qquad (1),
\end{aligned}
$$

where i denotes individuals or students, s denotes high schools, and c denotes cohorts. Y_{isc} is the outcome of interest representing the likelihood of a student selecting a science track in the second year of high school. $Female_{isc}$ is a gender indicator variable which takes on values of 1 for females and 0 for males. $TopF_{sc}$ is the main treatment of interest and represents the proportion of high performing female students in high school s and cohort c excluding student i. Similarly, $TopM_{sc}$ represents the proportion of high performing males. Both of these variables are defined as the proportion of top female and male students who score in the top 20% of the national high school entrance math exam. In section 5.2, we also provide alternative definitions of treatment and show our results are robust to these specifications. $PropF_{sc}$ controls for the proportion of female peers in a cohort. α_s is a school fixed effect that controls for the most obvious potential confounding factor, the endogenous sorting of students across schools based on unobserved factors. β_c is a cohort fixed effect that controls for any unobserved cohort specific shocks common to all schools. X'_{isc} is a vector of student level covariates which includes gender, HET test scores, relative ranking of a student and high price student status. S'_{sc} is a vector of school characteristics of school s at time t, including average peer HET test scores. Finally, ϵ_{isc} represents the error term, composed of school, time and individual specific random elements. Standard errors are clustered at the school level throughout.

In our analysis, we report the results of our parameters of interest separately for males and females. This allows us to see how variation in the quality of peers differentially affects each gender. Accordingly, π_1 and τ_1 are parameters representing the respective effects of top performing female and male peers on male students, while π_2 and τ_2 summarize the additional effects for female students. Further, in some specifications, we add to equation (1) district-by-cohort fixed effects to account for any unobserved district specific time varying factors.[17] In other specifications, we also add to equation (1) school specific linear time trends. This allows us to control for any linear unobserved time varying factors that are also correlated with peer composition changes within a school. In these specifications, identification is achieved from the deviation in peer composition from its school long term trend.

[17] Students in our sample city attend 118 schools across 12 separate school districts.

5 Results

5.1 Main Results

Table 2 summarizes the main results of the paper. The first two rows present estimates outlining the effects of high performing female and male peers on male students. These correspond to π_1 and τ_1 in equation (1). The next two rows report estimates for female students, relative to males (π_2 and τ_2). Standard errors are clustered at the school level throughout and reported in parentheses. Column 1 presents results from our simplest specification which includes cohort and school fixed effects as well as a gender dummy. The main parameter of interest is the coefficient on the proportion of high performing females, as defined in the previous section. Results indicate that a 1 standard deviation increase (0.108) in the proportion of high performing female peers increases the likelihood of females enrolling in a science track by 3.6 percentage points, relative to males. It has no effect, however, on the likelihood that male students enroll in science tracks. Conversely, our results indicate that being exposed to high performing male students lowers the probability of science track choice for girls by 3.8 percentage points, relative to boys, but has no overall effect on boys.[18]

One might be concerned based on the results in column 1 that it is not high-performing women that matter, but women overall. Indeed, previous literature has shown that having more girls in a classroom can raise academic outcomes for both sexes through lower level of classroom disruption and violence (Lavy and Schlosser, 2011). As a result, in column 2, we add controls for the proportion of female students in a school cohort. After controlling for quantity of female peers, the coefficient on our treatment of interest is slightly reduced for males, but not in a significant way. Similarly, controlling for quantity of female peers does not meaningfully affect the coefficient for the proportion of high performing girls on females.[19] Similar to the results reported in column 1, the proportion of high performing males in school has no statistically significant effect on boys, but still has a negative effect on girls.

In columns 3 and 4, we control for cohort and individual level variables that could potentially affect the choice of high school track. Specifically, we control for overall peer mean HET exam scores and high school enrollment. We also control for students' high price status, relative ranking within a school and individual HET scores which could be a primary

[18]The overall effect of a 100 percentage point increase in the proportion of high performing female students for girls is $\pi_1 + \pi_2 = 0.52$ and is statistically different from zero. Similarly, the overall effect of a 100 percentage point increase in the proportion of high performing male students for girls is $\tau_1 + \tau_2 = -0.56$, which is also statistically significant.

[19]The effect of high performing females on females was 0.188+0.333 = 0.521 in column 1. This effect becomes -0.0230 + 0.453 = 0.43 after controlling for the proportion of female peers.

determinant of student ability. Finally, we control for district-by-cohort fixed effects to account for any unobserved time varying district-specific shocks. The results remain largely unchanged and in line with those found in column 2, lending support to our identifying assumption that cross cohort variation in gender peer composition is as good as random.

Finally, one may be concerned that there are time-varying unobserved factors that are also correlated with the proportion of top performing female students within a school. To account for this, we report results with the addition of school specific linear time trends in column 5.[20] Using this specification, the results are largely unchanged.[21] In conclusion, our results indicate that a 1 standard deviation increase in the proportion of high performing females in school increases the likelihood of women majoring in science by 3.6 to 4.9 percentage points relative to men. On the other hand, a 1 standard deviation increase in the proportion of high performing males decreases the likelihood of women majoring in science by 3.8 to 4.9 percentage points.

5.2 Robustness Checks

5.2.1 Validity of Identification Strategy

The key identifying assumption in this paper is that changes in the proportion of top performing female students within a school are uncorrelated with observed and unobserved factors that could themselves affect a student's likelihood of choosing a science track. To test for this, we check whether student gender, high price student status, and high school entrance exam test scores are related to the proportion of top performing female or male students in a cohort. Columns 1 through 3 of Table 3 report coefficients from separate regressions of the proportion of high performing female students in a cohort in a school on student characteristics using school fixed effects. Results indicate that student gender, high school entry test scores and high price student status are not statistically related to the proportion of high performing students within a school. Importantly, these effects are reasonably precise. For example, we can rule out effects as large as a 1 standard deviation increase in high school entrance exam test scores causing the proportion of top performing females to increase by 0.0018 percentage points, i.e. 1.4 percent of a standard deviation. In Columns 4 through 6, we repeat this same exercise for high performing males. We also find no statistically or economically significant effects of student characteristics on the proportion of high performing male students within a school.

[20] Although, one caveat with these results is the short time series trend we possess (4 cohorts).

[21] The coefficients documenting the effects of top performing female and male peers on male students increase, but remain statistically insignificant.

To further alleviate concerns over selection, we show that within school cohort-to-cohort deviations in the proportion of high performing female students are idiosyncratic. Specifically, we conduct Monte Carlo simulations for our high school sample to check whether the observed within school deviations in high ability female students is consistent with the variation stemming from a random process.[22] For each school, we randomly designate a female student as high ability in each cohort using a binomial distribution function with p equal to the average proportion of high ability females in the school across all four cohorts. We then proceed to calculate the within school standard deviation of high performing female students. We repeat this process 1,000 times to obtain a 95% empirical confidence interval of within school standard deviations. Based on these simulations, we find that the observed standard deviation in high performing female students for 93% of schools is within the 95% empirical confidence interval, consistent with a random process. These results are summarized in Figure 1, where we find that 8 out of 106 schools have a standard deviation outside the simulated confidence interval. As a further check, we also re-estimate all main regressions after dropping all schools that are not within the simulated confidence interval and obtain results virtually similar to those from the main sample. These results are summarized in Appendix Table A1.

Combined, these tests suggest that cohort-to-cohort variation in the proportion of high performing female peers is uncorrelated with observable and unobservable changes within schools. A final threat to our identification strategy would be if students strategically transferred to another high school after their first year. Specifically, we may worry that students interested in pursuing a science track transferred to schools with a larger proportion of high ability females. While we cannot directly test for this with the current data, we find this to be highly unlikely in our current context. Specifically, in the Chinese education system, students cannot generally transfer from one public high school to another unless they relocate to another city or province.

5.2.2 Alternative Definitions of Treatment

To alleviate any concerns attributed to the way we define high performing peers, we check the robustness of our results to alternative definitions of treatment. Particularly, we redefine high performing peers to include the top 15%, top 25%, top 30%, top 35% and top 40% national performers in the math high school entrance exam.[23] Table 4 presents the results for these alternative definitions of high performing peers. The main coefficients are

[22]This procedure is similar to the randomization test conducted in Lavy and Schlosser (2011)

[23]We do not use the proportion of top 5% and top 10% national scoring students when redefining treatment, as there are many schools that do not have such students resulting in a significantly reduced sample.

slightly reduced when we define the proportion of top performing students as a larger group, as would be expected. For example, in column 6 of Table 4, we find that a 10 percentage point increase in top performing female peers—defined as those scoring in the top 40% of the national mathematics HET exam—leads to a 1.74 percentage point increase in the likelihood of tracking into science for women. In contrast, when we define top performing peers as those scoring in the top 15%, as in column 1, that number rises to 4.96 percentage points. Importantly, the main findings of the paper remain the same; high performing female peers improve females' likelihood of pursing a science track, while high performing males decrease this likelihood. This holds true regardless of our definition of high performing female and male peers.

As a further check, we also redefine top performing students as those scoring in the top 20 percent in the math high school entrance exam within their respective high schools, as opposed to nationally. The results from regressions using this definition of high performing female peers are reported in Table A2 of the appendix.[24] Similar to our main results, we find that the proportion of top performing females in a school has no effect on men's decisions to pursue a science track. However, it has a positive impact on womens' likelihood of pursuing a science track. Specifically, a 10 percentage point increase in the proportion of high performing female peers increases the probability of women choosing a science track by 1.46 to 2.73 percentage points, depending on the specification used. These estimates are smaller than those from our main results, most likely because the marginal female student induced into a science track comes from a higher ranked high school that contains a lot of top performing students nationally. Indeed, when we condition our regressions on students attending only top tier high schools, as in Table A3, the magnitude of our estimates are significantly increased and are more in line with those from our main results. We find that a 10 percentage point increase in high performing females within each school increases the likelihood of females enrolling in a science track by 2.2 to 4.61 percentage points—consistent with our main results.

The focus in this paper is on how peers' math performance affects track choices for women. Our emphasis on mathematics is because women's underrepresentation in STEM is generally concentrated in math-intensive science fields and since it is also believed that math ability and skills are necessary for STEM careers (Kahn and Ginther, 2017). Further, there is a widespread stereotype that men are better able to learn mathematics than women, which inherently affects women's performance in that particular subject (Eccles and Wang, 2016; Eble and Hu, 2017). However, to the extent that women respond to positive peers

[24]Since we define top performing female students as the proportion of top 20% performing females within a school, the coefficients for top performing male students are just the opposite sign.

in quantitative subjects, then we should still observe some beneficial effects for women exposed to top performing females in slightly less quantitative subjects such as Physics and Chemistry. Results presented in columns 1 and 2 of Table 5 confirm that females exposed to high performing peers in Physics and Chemistry are more likely to choose a science track whereas increased exposure to high performing males decreases this likelihood. Similar to our main results, men remain largely unaffected. Conversely, when women are exposed to an increased proportion of high performing female peers in highly non-quantitative subjects such as Chinese, results indicate that they are less likely to enroll in a science track most likely because the stereotype of woman being worse in quantitative coursework and better in humanities is not overturned. Finally, column 4 shows that neither women nor men respond to the ability composition of peers in English. This could be because English is given at the same level in both the scientific and non-scientific tracks and because it may not be perceived to be an essential subject by Chinese students.

6 Discussion

We now turn to the question of why an increase in the proportion of top performing female peers in mathematics increases the likelihood that women choose a science track in high school. In particular, and consistent with the literature on the STEM gender gap, we focus on the impacts of stereotypes, ability beliefs and preferences.

The mechanism most consistent with our results is one in which high performing females in quantitative subjects provide a role model or affirmation effect to their fellow female classmates. This is particularly important in a context like China whereby negative gender stereotypes and the rampant perception that men are better than women in science and engineering has lead to a large STEM gender gap. A 2011 survey of Chinese college students majoring in science and engineering showed that 10% and 23.1% of female and male students respectively agreed with the notion that "men are born to be better than women" (Zhang and Zhen, 2011). These beliefs are particularly damaging to minority groups in the sciences such as women. Crocker and Major (1989) show that individuals in a minority position have a tendency to be influenced by stereotypes pertaining to their own social category.

Recent studies have shown the importance of role model effects in eliminating this stereotype bias. Eble and Hu (2017) study this in a context where there is initial widespread belief that men are better able to learn mathematics—the Chinese middle school system. They find that student-teacher gender match is able to reduce this belief and increase women's performance and investment in math-related human capital. They provide evidence that the main mechanism behind this change is positive role models. Experimental evidence has also shown that women respond to positive role models more than men, consistent with our main findings. Bagès, Verniers and Martinot (2016) find that 6th grade girls' math test scores dramatically improved when exposed to a role model explaining to them that "students' success is due to effort exerted", while no effect was found for boys.

In our context, exposure to high performing peers of the same gender may update females' beliefs about their mathematical ability, mitigating the effects of negative gender stereotypes, particularly in quantitative material. Results from Table 5 provide evidence that women update their beliefs based on the ability composition of their classmates and that these beliefs influence their STEM choices. Indeed, when women are exposed to a higher proportion of women excelling in quantitative subjects, this seems to provide them with an affirmation effect in quantitative ability, causing them to be more likely to choose a STEM track. Conversely, women are either negatively affected or unaffected by increased exposure to females excelling in non-quantitative subjects. This is consistent with Eccles and Wang (2016) who show that updating females' beliefs about their mathematical ability—controlling for actual math and writing ability—increases their likelihood of being in a STEM career.

To lend further support to the hypothesis that high performing female peers act as positive role models to other women, we check if treatment effect size differs with the size of the school. Interactions among peers should be more frequent at schools of smaller size and peer effects are expected to be larger at such schools. To test for this, we divide our sample into smaller and larger schools. Specifically, we define a school of smaller size to be one with less than the median number of students in our sample (481 students) and a large school to be one with more than 481 students. Columns 1 and 2 of Table 6 summarize these results. We find that the positive effect of having a larger portion of high performing female peers for females is greater in smaller schools (0.595) and statistically insignificant in larger ones (0.204), suggesting that interactions matter. We also check if the effects are more pronounced for female students residing in urban versus rural schools. Insofar as high performing female peers act as positive role models, this should matter more in rural areas where gender bias and stereotypes are stronger. In column 3 and 4 of Table 6, we report estimates for urban versus rural areas separately. Interestingly, while the coefficient on the effect of high performing female peers is statistically insignificant for women attending rural schools—most likely due to the significantly reduced sample size—it is larger in magnitude (0.484) than that for woman attending urban schools (0.342). This suggests that females residing in rural areas may be more positively influenced by an increase in the proportion of high performing females in school, though these results are not conclusive.

Teacher gender and student preferences have also been shown to affect females' decisions to enroll in STEM majors (See, for example, Carrell, Page and West, 2010; Zafar, 2013).

Absent data on teachers and student preferences, we cannot definitively rule out the possibility that school specific teacher hiring or preference changes over time may be correlated with the proportion of high performing female peers. For example, if certain schools wanting to close the gender gap in science decided to hire many female teachers during the four years for which we have data, then this could simultaneously explain variation in the proportion of high performing female students and science track enrollment for women. However, this would be inconsistent with our findings in section 5.2 that variation in female peer ability composition is as good as random. It would have also meant that adding school specific linear time trends should have affected the results in a meaningful way. Further, we are unaware of any policy that affected certain schools' hiring policies over the time period covered in our data nor are we aware of any school specific changes that could have affected female students' preferences over a span of four years. In summary, the interpretation most consistent with our main results is that high performing female students in mathematics are a positive reinforcement to females wanting to enroll in a science track.

7 Conclusion

In this paper, we estimate the effects of high performing female and male peers on female students' track choices in high school. Our unique data and Chinese setting allow us to track the choice of STEM fields as early as high school. The evidence provided in this paper suggests that the effects of high performing peers on boys are moderate to none. For girls however, having a larger portion of high performing female peers in quantitative subjects increases their likelihood of choosing a science track while having more high performing male peers could potentially harm their chances. One explanation for these results is that girls may perceive high performing female classmates as role models and an affirmation that they can do as well as them in quantitative subjects.

This affirmation effect may play a vital role in narrowing the STEM gender gap in college and the labor market. However, it is important to note that driving more women into science in high school is not a sufficient remedy on its own. In a recent survey, it was revealed that more than 44% of female STEM students in China reported "gender discrimination" in the job market. Further, with the benefit of hindsight, 53.8% of females surveyed stated that they would have rather chosen a major with less of a science component (Zhang and Zhen, 2011). Our results provide some suggestions on how to encourage girls into science in school, but without proper institutional support in college and the labor market, this investment may be suboptimal.

References

Anelli, M., and Peri, G., Forthcoming. The Effects of High School Peers' Gender on College Major, College Performance and Income. *The Economic Journal.*

Bagès, C., Verniers, C., and Martinot, D., 2016. Virtues of a Hardworking Role Model to Improve Girls' Mathematics Performance. *Psychology of Women Quarterly* 40 (1), 55-64.

Beede, D. N., Julian, T. A., Langdon, D., McKittrick, G., Khan, B., and Doms, M. E., 2011. Women in STEM: A gender gap to innovation. *Economics and Statistics Administration Issue Brief* (04-11).

Blickenstaff, Clark J., 2005. Women and science careers: leaky pipeline or gender filter? *Gender and education* 17 (4), 369-386.

Carrell, S.E., Page, M. E., West, J. E., 2010. Sex and Science: How Professor Gender Perpetuates the Gender Gap. *Quarterly Journal of Economics*, 125(3), 1101-1144.

Crocker, J., and Major. B., 1989. Social Stigma and Self-esteem: The Self Protective Properties of Stigma. *Psychological Review*, 96(4), 608-630.

Cunha, F. and Heckman, J., 2007. The Technology of Skill Formation. *American Economic Review*, 97(2), 31-47.

Paredes, V., 2014. A Teacher like Me or a Student Like Me? Role Model versus Teacher Bias Effect". *Economics of Education Review*, 39, 38-49.

Eble, A., and Hu, F., 2017. Role Models, the Formation of Beliefs, and Girls' Math Ability: Evidence from Random Assignment of Students in Chinese Middle Schools. *Working Paper.*

Eccles, J. S., and Wang M. 2016. What Motivates Females and Males to pursue Careers in Mathematics and Science. *International Journal of Behavioral Development*, 40 (2), 100-106.

Fischer, S., 2017. The Downside of Good Peers: How Classroom Composition Differently Affects Men's and Women's STEM persistence. *Labour Economics*, 44, 151-160.

Guo, C., Tsang, C. M., and Dink, X., 2010. Gender Disparities in Science and Engineering in Chinese Universities. *Economics of Education Review*, 29, 225-235.

Hoekstra, M., Mouganie, P., and Wang, Y., Forthcoming. Peer Quality and the Academic Benefits to Attending Better Schools. *Journal of Labor Economics.*

Hoxby, C., 2000. Peer Effects in the Classroom: Learning from Gender and Race Variation. *NBER Working Paper No. w7867.*

Hill, A. J., 2017. The Positive Influence of Female College Students on Their Male Peers. Labour Economics, 44, 151-160.

Hyde, J. S., Lindberg, S. M., Linn, M. C., Ellis, A. B., and Williams, C. C., 2008. Gender similarities characterize math performance. *Science*, 321(5888), 494-495.

Zhang L., and H.Zhen., 2011. A Study on the Dilemma The Female University Students in Science and Technology Encountered during Their Learning. *Tsinghua Journal of Education*, 32(5).

Lavy, V., and Schlosser, A., 2011. Mechanisms and impacts of gender peer effects at school. *American Economic Journal: Applied Economics.* 3, 1-33.

Manski, C., 1993. Identification of Endogenous Social Effects: The Reflection Problem. *The Review of Economic Studies*, 60 (3), 531-542.

Ost, B., 2010. The role of peers and grades in determining major persistence in the Sciences. Economics of Education Review, 29(6), 923-934.

Schneeweis, N. and Zweimüller, M., 2012. Girls, Girls, Girls: Gender Composition and Female School Choice. *Economics of Education Review*. 31(4): 482-500.

Turner, S. E., and Bowen, W. G., 1999. Choice of major: The changing (unchanging) gender gap. *Industrial & Labor Relations Review*, 52(2), 289-313.

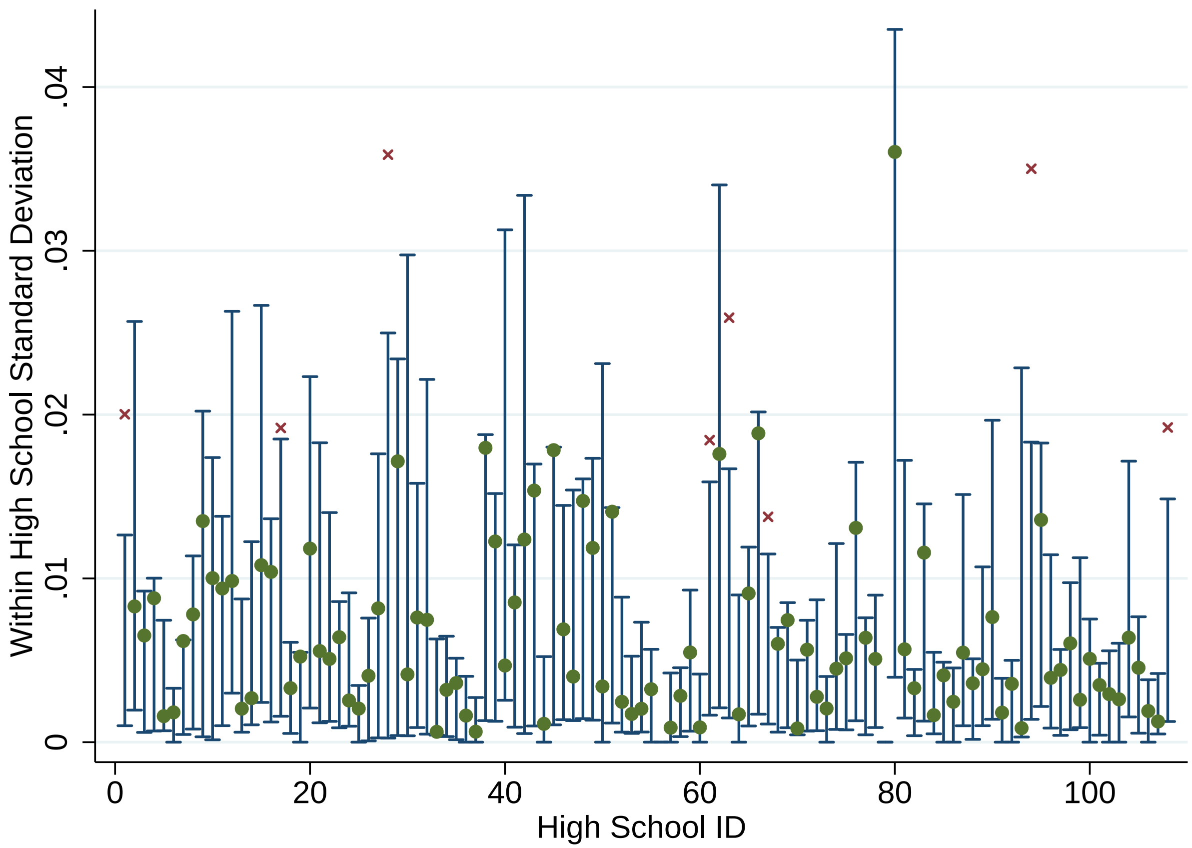
The U.S. News/Raytheon STEM Index Shows Gender and Racial Gaps Widening in STEM Fields. (2015). U.S. News.

Zafar, B., 2013. College major choice and the gender gap. *Journal of Human Resources*, 48(3), 545-595.

Zölitz, F., and Feld, J., 2017. The Effect of Peer Gender on Major Choice and Occupational Segregation. *Working Paper.*

A Figures

Figure 1: Monte Carlo simulations for the within high school standard deviation in the proportion of high performing female students



Notes: Vertical bars represent simulated 95% confidence intervals for within high school standard deviations in top performing female students. Scatter points represent actual within standard deviation for each school.
Filled circles indicate that the actual standard deviation is within the simulated 95% C.I., whereas X's indicate schools with standard deviations outside the simulated C.I.

B Tables

Table 1: Descriptive Statistics

	(1) Whole Sample	(2) Females	(3) Males
Proportion in cohort	1	0.52	0.48
Proportion selecting "Science" track	0.51	0.34	0.70
HET Chinese language exam score	109	111	106
HET English language exam score	110	115	105
HET Political Science exam score	75.5	77	74
HET Mathematics exam score	111	109	114
HET Physics exam score	77	75	79
HET Chemistry exam score	77	75	79
Total HET exam score	597	599	594
Total CET exam score (Science students)	488	504	480
Total CET exam score (Arts Students)	469	481	442
Proportion attending Private School	0.0017	0.0015	0.002
Proportion of high price students	0.010	0.086	0.121
Proportion of high performing peers	0.204	0.086	0.118
Number of schools	118	118	118
Number of Students	176,898	92,806	84,092

Note: The table reports the means of variables. High performing peers are defined as the proportion of students whose HET mathematics score are among the top 20% nationally.

Table 2: The effect of high performing peers on science high school track choices for non-top students

	(1)	(2)	(3)	(4)	(5)
Proportion High Performing Female	0.188	-0.0230	-0.0918	0.163	0.372
	(0.229)	(0.246)	(0.271)	(0.267)	(0.358)
Proportion High Performing Male	-0.207	-0.0431	-0.00729	0.0487	-0.0770
	(0.181)	(0.194)	(0.208)	(0.207)	(0.269)
Female × Proportion High Performing Female	0.333*	0.453**	0.447**	0.366*	0.368**
	(0.184)	(0.186)	(0.185)	(0.185)	(0.184)
Female × Proportion High Performing Male	-0.357**	-0.449***	-0.446***	-0.372**	-0.371**
	(0.157)	(0.151)	(0.150)	(0.151)	(0.151)
Gender Dummy	Yes	Yes	Yes	Yes	Yes
High School Fixed Effects	Yes	Yes	Yes	Yes	Yes
Cohort Fixed Effects	Yes	Yes	Yes	Yes	Yes
Proportion Female Peers		Yes	Yes	Yes	Yes
District-by-Cohort Fixed Effects			Yes	Yes	Yes
Overall Peer Mean HET Scores			Yes	Yes	Yes
Overall Individual HET Scores				Yes	Yes
School Enrollment				Yes	Yes
High Price Status				Yes	Yes
Relative Ranking Within School				Yes	Yes
School Specific Linear Time Trends					Yes
Observations	135547	135547	135547	135547	135547
R^2	0.172	0.172	0.173	0.201	0.204

Note: Each column represents estimates from separate regressions.
Standard errors clustered at the school level and reported in parentheses.
*** p <0.01 ** p <0.05 * p <0.1

Table 3: Tests for Random Assignment of Top performing Students

	High performing females	High performing females	High performing females	High performing males	High performing males	High performing males
	(1)	(2)	(3)	(4)	(5)	(6)
Female	0.0000896			-0.0000382		
	(0.0000973)			(0.0000953)		
High School entry test scores		-0.000446			-0.000497	
		(0.000926)			(0.00118)	
High price students			0.000354			0.000369
			(0.000244)			(0.000394)
Observations	135547	135547	135547	135547	135547	135547

Note: Coefficients represent estimates from separate regressions of proportion top performing peers on student level characteristics and high school fixed effects. Standard errors clustered at the school level and reported in parentheses

*** p <0.01 ** p <0.05 * p <0.1

Table 4: Robustness to alternative definitions of high-performing female and male students.

	(1) Top 15%	(2) Top 20%	(3) Top 25%	(4) Top 30%	(5) Top 35%	(6) Top 40%
Proportion High Performing Female	0.495	0.163	0.101	0.082	0.097	0.124
	(0.394)	(0.267)	(0.249)	(0.221)	(0.198)	(.183)
Proportion High Performing Male	-0.074	0.0487	-0.007	0.089	0.019	-0.058
	(0.294)	(0.207)	(0.198)	(0.165)	(0.155)	(0.153)
Female × Proportion High Performing Female	0.496**	0.366**	0.241*	0.248**	0.183*	0.174*
	(0.260)	(0.186)	(0.147)	(0.115)	(0.107)	(0.104)
Female × Proportion High Performing Male	-0.470**	-0.372**	-0.281**	-0.295***	-0.246**	-0.240**
	(0.194)	(0.152)	(0.132)	(0.108)	(0.104)	(0.106)
Gender Dummy	Yes	Yes	Yes	Yes	Yes	Yes
High School Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Cohort Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Proportion Female Peers	Yes	Yes	Yes	Yes	Yes	Yes
District-by-Cohort Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Overall Peer Mean HET Scores	Yes	Yes	Yes	Yes	Yes	Yes
Overall Individual HET Scores	Yes	Yes	Yes	Yes	Yes	Yes
School Enrollment	Yes	Yes	Yes	Yes	Yes	Yes
High Price Status	Yes	Yes	Yes	Yes	Yes	Yes
Relative Ranking Within School	Yes	Yes	Yes	Yes	Yes	Yes
Observations	135547	135547	135547	135547	135547	135547

Note: Each column represents estimates from separate regressions.
Standard errors clustered at the school level and reported in parentheses.
*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$

Table 5: Effects based on quantitative versus non-quantitative high performing peers

	(1) Physics	(2) Chemistry	(3) Chinese	(4) English
Proportion High Performing Female	-0.309	0.268	0.173	-0.0562
	(0.245)	(0.219)	(0.225)	(0.247)
Proportion High Performing Male	0.179	0.179	-0.352	0.00357
	(0.215)	(0.254)	(0.287)	(0.315)
Female × Proportion High Performing Female	0.395**	0.403**	-0.282**	-0.0493
	(0.184)	(0.192)	(0.130)	(0.160)
Female × Proportion High Performing Male	-0.430***	-0.436***	0.420*	0.0125
	(0.151)	(0.165)	(0.222)	(0.231)
Gender Dummy	Yes	Yes	Yes	Yes
High School Fixed Effects	Yes	Yes	Yes	Yes
Cohort Fixed Effects	Yes	Yes	Yes	Yes
Proportion Female Peers	Yes	Yes	Yes	Yes
District-by-Cohort Fixed Effects	Yes	Yes	Yes	Yes
Overall Peer Mean HET Scores	Yes	Yes	Yes	Yes
Overall Individual HET Scores	Yes	Yes	Yes	Yes
School Enrollment	Yes	Yes	Yes	Yes
High Price Status	Yes	Yes	Yes	Yes
Relative Ranking Within School	Yes	Yes	Yes	Yes
Observations	135547	135547	135547	135547

Note: Each column represents estimates from separate regressions.
Quantitative high performing peers are those excelling in Physics and Chemistry (Columns 1 and 2 above)
Non-quantitative high performing peers are those excelling in Chinese and English (Columns 3 and 4 above)
Standard errors clustered at the school level and reported in parentheses.
*** p <0.01 ** p <0.05 * p <0.1

Table 6: Heterogeneous effects of high performing peers

	(1) Smaller Schools	(2) Larger Schools	(3) Urban Schools	(4) Rural Schools
Proportion High Performing Female	-0.0571	0.242	0.211	-0.0295
	(0.381)	(0.409)	(0.302)	(0.437)
Proportion High Performing Male	0.0719	0.0187	0.0208	0.428
	(0.326)	(0.267)	(0.250)	(0.483)
Female × Proportion High Performing Female	0.595**	0.204	0.342*	0.484
	(0.248)	(0.283)	(0.190)	(0.470)
Female × Proportion High Performing Male	-0.549**	-0.217	-0.377**	-0.395
	(0.234)	(0.283)	(0.155)	(0.403)
Gender Dummy	Yes	Yes	Yes	Yes
High School Fixed Effects	Yes	Yes	Yes	Yes
Cohort Fixed Effects	Yes	Yes	Yes	Yes
Proportion Female Peers	Yes	Yes	Yes	Yes
District-by-Cohort Fixed Effects	Yes	Yes	Yes	Yes
Overall Peer Mean HET Scores	Yes	Yes	Yes	Yes
Overall Individual HET Scores	Yes	Yes	Yes	Yes
School Enrollment	Yes	Yes	Yes	Yes
High Price Status	Yes	Yes	Yes	Yes
Relative Ranking Within School	Yes	Yes	Yes	Yes
Observations	92341	43206	114875	20192

Note: Each column represents estimates from separate regressions.
Smaller schools defined as those with enrollment less than the media (481 students) and larger schools defined as those with more than 481 students.
Standard errors clustered at the school level and reported in parentheses.
*** p <0.01 ** p <0.05 * p <0.1

C Online Appendix

Table A1: The effect of high performing peers on science high school track choices for non-top students

	(1)	(2)	(3)	(4)	(5)
Proportion High Performing Female	0.105	-0.158	-0.164	0.104	0.403
	(0.233)	(0.247)	(0.280)	(0.271)	(0.365)
Proportion High Performing Male	-0.178	0.0228	0.0608	0.125	0.0230
	(0.188)	(0.200)	(0.211)	(0.208)	(0.280)
Female × Proportion High Performing Female	0.372*	0.500**	0.500**	0.411**	0.410**
	(0.191)	(0.193)	(0.192)	(0.193)	(0.193)
Female × Proportion High Performing Male	-0.391**	-0.490***	-0.491***	-0.408**	-0.407**
	(0.165)	(0.157)	(0.156)	(0.158)	(0.158)
Gender Dummy	Yes	Yes	Yes	Yes	Yes
High School Fixed Effects	Yes	Yes	Yes	Yes	Yes
Cohort Fixed Effects	Yes	Yes	Yes	Yes	Yes
Proportion Female Peers		Yes	Yes	Yes	Yes
District-by-Cohort Fixed Effects		Yes	Yes	Yes	Yes
Overall Peer Mean HET Scores			Yes	Yes	Yes
Overall Individual HET Scores				Yes	Yes
School Enrollment				Yes	Yes
High Price Status				Yes	Yes
Relative Ranking Within School				Yes	Yes
School Specific Linear Time Trends					Yes
Observations	126492	126492	126492	126492	126492
R^2	0.173	0.173	0.173	0.201	0.204

Note: Each column represents estimates from separate regressions.
Sample excludes students in schools where the within school standard deviation in top performing females is not within the 95% simulated confidence interval.
Standard errors clustered at the school level and reported in parentheses.
*** p <0.01 ** p <0.05 * p <0.1

Table A2: The effect of the proportion of top 20% female mathematics performers within each school on science high school track choices

	(1)	(2)	(3)	(4)	(5)
Proportion High Performing Female	0.0350	-0.0723	-0.0639	-0.0307	0.0123
	(0.0579)	(0.0767)	(0.0812)	(0.0820)	(0.0986)
Female × Proportion High Performing Female	0.146**	0.268***	0.273***	0.214***	0.215***
	(0.0579)	(0.0647)	(0.0650)	(0.0653)	(0.0649)
Gender Dummy	Yes	Yes	Yes	Yes	Yes
High School Fixed Effects	Yes	Yes	Yes	Yes	Yes
Cohort Fixed Effects	Yes	Yes	Yes	Yes	Yes
Proportion Female Peers		Yes	Yes	Yes	Yes
District-by-Cohort Fixed Effects		Yes	Yes	Yes	Yes
Overall Peer Mean HET Scores			Yes	Yes	Yes
Overall Individual HET Scores				Yes	Yes
School Enrollment				Yes	Yes
High Price Status				Yes	Yes
Relative Ranking Within School				Yes	Yes
School Specific Linear Time Trends					Yes
Observations	135547	135547	135547	135547	135547
R^2	0.184	0.184	0.184	0.217	0.219

Note: Each column represents estimates from separate regressions.
In the above regressions, treatment is now defined as the proportion of female students within the top 20% of mathematics performers within their respective high schools, as opposed to nationally.
Standard errors clustered at the school level and reported in parentheses.
*** p <0.01 ** p <0.05 * p <0.1

Table A3: The effect of the proportion of top 20% female mathematics performers within each school on science high school track choices—*for Top Tier schools*

	(1)	(2)	(3)	(4)	(5)
Proportion High Performing Female	0.134	-0.0536	0.0676	0.0918	-0.0208
	(0.142)	(0.159)	(0.162)	(0.155)	(0.164)
Female × Proportion High Performing Female	0.222**	0.461***	0.465***	0.423***	0.419***
	(0.0975)	(0.0974)	(0.0953)	(0.0908)	(0.0908)
Gender Dummy	Yes	Yes	Yes	Yes	Yes
High School Fixed Effects	Yes	Yes	Yes	Yes	Yes
Cohort Fixed Effects	Yes	Yes	Yes	Yes	Yes
Proportion Female Peers		Yes	Yes	Yes	Yes
District-by-Cohort Fixed Effects		Yes	Yes	Yes	Yes
Overall Peer Mean HET Scores			Yes	Yes	Yes
Overall Individual HET Scores				Yes	Yes
School Enrollment				Yes	Yes
High Price Status				Yes	Yes
Relative Ranking Within School				Yes	Yes
School Specific Linear Time Trends					Yes
Observations	67062	67062	67062	66699	66699
R^2	0.161	0.161	0.162	0.198	0.199

Note: Each column represents estimates from separate regressions.
In the above regressions, treatment is now defined as the proportion of female students within the top 20% of mathematics performers within their respective high schools, as opposed to nationally.
Standard errors clustered at the school level and reported in parentheses.
*** p <0.01 ** p <0.05 * p <0.1