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Understanding the Gender Gap in Postsecondary Education Participation: The Importance of High School Choices and Outcomes

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Executive Summary

We use data for a large sample of Ontario students who are observed over the five years from their initial entry to high school to study the impact of course selections and outcomes in high school on the gender gap in postsecondary enrolment. Among students who start high school "solidly" in terms of taking the standard set of grade 9 courses (e.g., math, language, science, etc.) and performing well in these courses, we find a 10 percentage point gap in the fraction of females versus males who register for university or college (69% versus 59%). This gap is seen with respect to university registration (43% for females versus 32% for males) but not in college registration. We then show how the gender gap in university registration is related to the gender gaps at two earlier stages: (1) the first year of high school, where students can select either academic or applied track classes in core subjects including math and languages; (2) the final year(s) of high school, where students who intend to enter university must complete a minimum number of university-level classes.

We find that individual students' progress through high school and on to university exhibits strong serial persistence. Simply knowing whether a student had "good grades" (a score of 70 or higher) in academic-track math and language courses in their first year of high school is highly predictive of course selection and grades at the end of high school and of university entry. In this setting, the large differences between females and males in early high school course choices and outcomes translate directly to large differences in entry to university.

Overall, we find that gender differences in track selection and grades in grade 9 math and language courses explain 70% of the gender gap in university registration. Another 20-25% is explained by differences in end-of-high-school course choices and grades among females and males with similar track choices and grades in grade 9. Females who start off with high achievement in grade 9 are more likely to stay "on track" than males and perform well enough in university-level classes in the last year of high school to ensure a high probability of entry to university. Conversely, females who start off with lower achievement are better able to get "back on track" than males and complete high school with enough university-level courses to enter university. Thus, nearly all of the gender gap in entry to university is explained by choices and outcomes in high school, with the majority traceable to decisions and performance in the first year of high school.

We also investigate the impact of pre-high school differences between females and males on course selection and grades in the first year of high school. We find that differences in student characteristics – specifically, the fraction of males versus females who are classified as "special needs" students – together with the gender gap in average grade 6 reading scores can explain up to one-third of the key differences in grade 9 track choices and outcomes between females and males.

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I. Introduction

Over the past three decades young women in most developed countries have made remarkable gains in education relative to men.[1] In the 1970s, only one-third of recent university graduates in Canada were female. By 2006 women accounted for 60% of recent graduates.[2] Similar trends have occurred in the US, the UK and most other OECD countries (Vincent-Lancrin, 2008). A number of studies have argued that the emerging gender gap in postsecondary education (PSE) attainment can be traced to widening differences between the academic performance of males and females in high school. Machin and McNally (2006) and Goldin et al. (2006) show that in both the UK and the US there is now a sizeable gap between females and males in their average course grades in the final year of secondary school. Since these grades play such a large role in determining entry to college and university, even a modest gender gap can lead to wide differences in the number and quality of postsecondary opportunities available to female versus male students.

In this report we analyze the role of choices and outcomes during high school on the gender gap in entry to PSE using a rich administrative data set of students who attended publicly funded high schools in Ontario in the mid to late 2000s. Specifically, we follow about 130,000 students who entered grade 9 in the 2005/2006 calendar year, looking at course selections and outcomes during high school and initial entry to university and college.[3] We focus on the gender gaps at two key stages: (1) initial course selections and grade outcomes in the first year of high school (grade 9); (2) course selections and grades in the last year of high school (grade 12). We then use simple decomposition techniques to show how the gaps at these two stages contribute to the gender gap in PSE participation.

As in many other secondary school systems, high school courses in Ontario are "tracked" or "streamed." In the first two years of high school students can take either "academic" or "applied" courses in most subjects, including mathematics and languages (either English or French, depending on the school). The academic track leads to upper-level courses that prepare students for entry to university – in the upper years of high school the academic track is termed university or mixed. Admission to the province's university system is based on grades in the university or mixed level courses that are normally taken in the last year of high school. The applied track is designed for students who plan to attend a two- or three-year college program or work immediately after high school – in the upper years of high school the applied track is termed "college."[4] Most college programs are open to all students who have obtained a high school diploma

[1] See Vincent-Lancrin (2008) for an overview of OECD countries, Goldin et al. (2006) for a discussion of trends in the US, and Frenette and Zeman (2007) for a discussion of trends in Canada.
[2] Card, Payne and Sechel (2011) present data on a recent cohort of students in Ontario. Other recent studies of the gender gap in Canada include Christofides, Hoy and Yang (2010), Buchmann, DiPrete and McDaniel (2008), Fortin, Oreopoulos and Phipps (2013), and Austen and MacPhail (2011).
[3] We use the standard convention in Ontario of referring to institutions that offer bachelor's degrees as "universities" and those that offer alternative programs – typically of two or three years in duration – as "colleges."
[4] There are other course tracks in the Ontario high school curriculum. For instance a "workplace" track exists with courses designed more for students seeking a job immediately after high school.

regardless of their taking courses in the academic or applied streams, though a number of highly competitive college programs impose higher requirements.

Our empirical analysis suggests that students' course selections and grades early in high school explain a surprisingly large share of the gender gap in entry to university among recent cohorts of Ontario youth. Among students observed in grade 9 in 2005 who remain in high school for at least four years there is an 11 percentage point gap between the fractions of females and males who have registered to enter university by 2010 (43% versus 32%). About 70% of this gap can be explained by gender differences in track selection and grades in *grade 9* math and English/French. Another 20% is explained by gender differences in grade 12 math and English/French course choices and grades among students with similar track choices and grades in grade 9. Thus, 90% or more of the overall gender gap in entry to university is explained by choices and outcomes in high school, with the majority traceable to decisions and performance in the first year of high school.

These findings raise the question of whether the gender differences in course selection and grades at the beginning of high school can be explained by differences in underlying characteristics of males and females, or in how much they have learned prior to entering high school.[5] Males are twice as likely as females to be classified as special needs students by the time they enter high school, suggesting that there are important gender differences in the incidence of learning disabilities and behavioural and communicative disorders. Unfortunately, we lack information on grades in earlier years and on individual-level performance on the standardized tests administered by the provincial testing authority (known as the Education Quality and Accountability Office, or EQAO). As an alternative, we use gender-specific average levels of performance on grade 6 EQAO tests in reading and math for the males and females who enter each high school in our sample. We find that differences in the fraction of special needs students, together with differences in average gender-specific grade 6 scores, explain a significant share (up to one-third) of overall gender differences in grade 9 track choices and outcomes.

The report proceeds as follows. The next section presents a brief overview of the Ontario school system, followed by a discussion of our data set. We then turn to a descriptive analysis of the evolution of gender gaps in choices and outcomes over the course of high school. Section III presents our main decomposition results. The final section presents a brief summary of our main conclusions.

II. Institutional Setting: Secondary Education in Ontario

Ontario students usually enter grade 9 at age 14 or 15 and are expected to graduate in four years, though as we discuss below many students spend five years in high school.[6] Two types of high school graduation certifications are offered: the Ontario Secondary School Diploma (OSSD) and the Ontario Secondary School Certificate. The "diploma" has more rigorous requirements and is typically obtained by students who intend

[5] We find that males and females attend very similar schools so we rule out a direct effect of schools.
[6] Historically Ontario had a five-year high school system. The fifth grade, known as "grade 13," was eliminated in 2003 but students are allowed to remain enrolled in high school beyond the four years that are nominally required to graduate.

to pursue PSE. To obtain an OSSD, a student is required to complete a total of 30 credits, where a typical full-year course counts as one credit.[7] Most students take a course load of seven or eight credits per year. Of the 30 required credits, 18 represent compulsory courses, including four credits in English or French (typically satisfied by taking one language course per year) and three in mathematics, at least one of which is at the grade 11 or 12 level. There are also various requirements for courses in science, history, geography and languages.

Most high school courses, including the core courses in math and English (or French), are offered in two versions: academic and applied.[8] Courses are designated by "levels," with level 1 referring to courses usually taken in the first year of high school (i.e., grade 9) and level 4 referring to classes usually taken in the last year (i.e., grade 12). Students who choose the applied track for level 1 math or English/French typically take the same track in level 2, though this is not a formal requirement. Beyond level 2 most courses have prerequisites that are tied to either the academic or applied streams, and level 4 courses are classified as "university level" or "college level." There are also some so-called "mixed" courses in level 3 that fulfill the requirements of both tracks and give students the flexibility to enter either university or college courses in level 4.

In the final year of high school, students who intend to apply to one of the 20 universities in the province submit an application though the Ontario University Application Centre (OUAC). Students complete a common application form (typically in January) and the OUAC collects transcript information directly from high schools and forwards the information to the admissions offices at each university. A similar centralized application system (the Ontario College Application Service, OCAS) handles applications to the approximately 28 colleges in the province.[9] Some fraction of Ontario students attends college or university outside the province. Since we only have information on provincial institutions, however, we define PSE participation as application or entry to an Ontario college or university. We have not seen evidence to suggest that there are significant differences between males and females who choose to attend PSE institutions outside of Ontario.

III. Data Overview

Data Sources

We obtained a longitudinal data set comprised of 172,000 students who were enrolled in grade 9 in the 2005-2006 academic year at a publicly funded Ontario high school.[10] The data set includes information on courses, grades and, if applicable, university and college applications and matriculation over the next five

[7] Students are also required to pass a literacy test and complete 40 hours of community service.
[8] There are also "locally developed" courses at most levels that count for full credit. Our data set excludes information on these courses.
[9] In addition to the 20 universities and 28 colleges accessed via OUAC and OCAS (all publicly funded), there are a number of private religious universities in the province and a large number of private career colleges. We ignore these institutions in this paper.
[10] This includes so-called "public" high schools, which are non-religious and open to all students, and Catholic high schools, which are fully government-funded and open to Catholics and non-Catholics. Within each of these two categories the majority of high schools are English-languages schools, but there are also some French-language schools.

years (i.e., up to and including the 2009-2010 school year). Students are included in the data set if they move between high schools but disappear if they leave the publicly funded high school system for any reason (e.g., move out of province, switch to a private school, or drop out of school). Standardized courses in the academic and applied tracks that conform to the province-wide high school curriculum are coded using a system that allows us to identify the subject, grade level and track of each course.[11] Unfortunately, we lack any information on enrolment or grades in non-standardized courses, including "locally developed" courses and co-op courses that are designed by individual school boards.

In addition to enrolment and grades in all standard courses, we have information on each student's gender, birth year, home postal code (first three digits only) and special education status (i.e., indicators for gifted students, special needs students and second language learners). We also have test scores on the province-wide math test that is administered near the end of grade 9, and an indicator for whether the student wrote the academic or applied version of the test.

Finally, we have information from OUAC and OCAS on whether a given student has applied to a university or college in the province and whether they were observed "registering" at either a college or university (i.e., formally enrolling). We use registration as our primary measure of PSE participation.

We use the available information on each student's residential location to merge in various neighbourhood characteristics from the 2006 Census, including median family income and the local fraction of single-parent families.[12] We also use the student record data to construct a variety of school-level statistics for the cohorts of interest, including the share of students identified as second language learners and the share of students enrolled in academic track courses.

In the absence of student-level information on grades or test scores before entering high school, we obtained information on average achievement levels in province-wide grade 6 standardized tests for the cohort of Ontario students who were in grade 6 in 2004-2005 and grade 9 in 2007-2008, the first year in which grade 6 and grade 9 test scores can be linked. This data set includes grade 6 reading and math scores, grade 9 math scores, the track of the math test taken in grade 9, the student's gender and the location of their grade 6 school. We use these data to calculate the mean grade 6 test outcomes by gender and location. We then assign these mean scores to students in our grade 9 sample based on these two characteristics. Given that we cannot match to specific students and we are using data from a different cohort of students, we interpret the grade 6 test scores as measures of the average pre-high-school scores of the students who attend each school in our sample.

Derivation of Analysis Sample

Since our primary focus is on the evolution of the gender gap in student achievement over the course of high school, we limit our attention to the subset of students who enter high school between the ages of 13

[11] The province has a standardized curriculum for all high schools and the course numbering system refers to specific courses in this curriculum.
[12] The Census data are tabulated at the level of the "forward sortation area" (FSA), which corresponds to the first three digits of the postal code.

and 15, take both a language course and a math course in grade 9, and take a full or nearly full course load in each of the next four years (as measured by being enrolled in at least three academic or applied track courses per year). Table 1 describes our sample restrictions and the fractions of males and females eliminated by each requirement. Approximately 3% of males and females are excluded for being "too young" or “too old,” with a slightly larger effect on males, who are more likely to be held back in earlier grades than females. A larger group of students – 12% of males and 8% of females – is excluded for not having taken a level 1 (grade 9) math class. Nearly 4% of males and 3% of females are excluded for not having taken a level 1 language (English or French) class. Another 2% of males and 1% of females are excluded if we fail to observe at least three courses in 2005-2006 (grade 9).[13] A small proportion of students (less than 1%) are excluded because they are enrolled in rural or low-enrolment high school, while 2% of each group is excluded because they appear to leave the publicly funded school system or are observed taking fewer than three courses per year in any of the next three years.

Table 1: Derivation of Analysis Sample: Cohort Entering Grade 9 in September 2005

	Males (1)	Females (2)
Sample size: all available students in cohort	88,746	83,067
Percent excluded for being too old/too young in grade 9	3.3%	2.7%
Percent excluded with no level 1 math	12.1%	8.2%
Percent excluded with no level 1 English/French	4.5%	3.4%
Percent excluded for having too few courses (<3) in grade 9	1.8%	1.3%
Percent excluded from special and small rural schools	0.3%	0.3%
Percent excluded if no school data for students who should still be in school, or less than 3 courses per year [a/]	2.1%	2.1%
Final sample size	67,391	68,107
Percent of original group retained in analysis sample	75.9%	82.0%

Notes: Sample consists of students observed in grade 9 in a publicly supported Ontario high school in 2005-2006. Records are available for up to four additional years (to 2009/10 academic year). Students are considered "too old" or "too young" if their birth year is <1990 or >1992.

[a/] It is assumed that students entering grade 9 should be in school for at least four years if they have not completed a high school diploma. Students who do not have an average of at least three courses per year during the first four years of high school could have dropped out or switched to a private school, could have left the province, or be taking only locally developed courses that we do not observe. Students in this category are dropped if the student has either less than nine attempted credits and/or is missing data for one or more years (and we do not observe receiving a high school diploma)

[13] This does not necessarily mean that the student is only taking one or two courses, as we cannot measure participation in courses outside of the standard applied or academic tracks such as the locally developed courses.

As shown in the bottom row of Table 1, these various exclusions eliminate 24% of males and 18% of females from our final analysis sample. We estimate that only about 33% of the excluded males and 36% of the excluded females obtained a high school graduation diploma within five years of entering grade 9. The majority of the excluded students appear to have reached the minimum school-leaving age without a certificate.[14]

Importantly, our focus on students with at least a "minimal" course load in grade 9 and the next three years means that we almost certainly *understate* the overall gender gap in PSE-related educational outcomes for students as a whole. For example, if none of the excluded students enter university, the gender gap in university entrance in our analysis sample understates the overall gap in university enrolment by 6 percentage points (the gender gap in exclusion rates). On the other hand, if one-third of the excluded males and females enter university, our analysis sample understates the gender gap in the overall student population by 4 percentage points.

Descriptive Analysis

Table 2 provides a descriptive overview of the characteristics of males and females in our main analysis sample. Looking first at the individual student characteristics, males are substantially more likely to be classified as special needs students than females (11% versus 5%) and a little more likely to be classified as gifted (2.8% versus 1.7%). By comparison, the fractions of males and females not born in Canada (and therefore classified as immigrants) are about equal, as are the fractions of students who are classified as second language learners.

Table 2: Characteristics of Male and Female Students under Study

	Males (1)	Females (2)
Student Characteristics:		
Special need student (%)	10.6%	5.3%
Gifted (%)	2.8%	1.7%
Immigrant (%)	11.3%	11.1%
Second language learner (%)	0.6%	0.5%
School and Neighbourhood Characteristics:		
Catholic school (%)	33.6%	34.6%
ESL student share in school (%)	2.7%	2.6%
Share of students excluded from analysis	16.4%	16.0%
Average neighbourhood household income	$72,477	$72,002
Visible minority share in neighbourhood (%)	22.3%	22.1%

[14] At present students in Ontario are required to attend school until they reach the age of 18 or have attained a high school graduation certificate, which suggests that early school-leaving rates should be relatively low. We are unaware of direct information on how strictly these rules are enforced. We assume that many of these students are enrolled in low numbers of courses and/or take non-standard courses until they reach the age of 18. Parent (2004) shows that among young adults in the late 1990s, males in Canada are 5-10 percentage points less likely to hold a high school diploma than females.

	Males (1)	Females (2)
Single parent family share in neighbourhood (%)	15.4%	15.5%
Average distance to closest university (kms)	32.7	32.9
Average distance to closest college (kms)	22.3	22.5
Imputed Grade 6 Standardized Test Scores		
Average math score (4-point scale)	2.75	2.74
Share with level 4 math score	10.9%	10.2%
Share with level 3 or 4 math score	56.0%	56.6%
Average reading score (4-point scale)	2.64	2.83
Share with level 4 reading score	4.8%	9.4%
Share with level 3 or 4 reading score	54.5%	64.7%
Observed in school post 2005		
Percent observed in 2006 (Grade 10)	99.3%	99.4%
Percent observed in 2007 (Grade 11)	98.6%	98.7%
Percent observed in 2008 (Grade 12)	96.1%	96.9%
Percent observed in 2009 (extra year)	34.8%	23.6%

Notes: See notes to Table 1 for sample description. Sample contains 67,391 males and 68,107 females.

Looking next at school- and neighbourhood-level characteristics, about one-third of the high school students in Ontario are enrolled in Catholic schools, with nearly equal rates for males and females. Neighbourhood characteristics such as the fraction of “visible minority” residents, average household income, and the distance to the nearest universities and colleges are also balanced across genders, as would be expected if parents choose similar neighbourhoods and schools regardless of the gender of their children.

The third panel of Table 2 presents results on average grade 6 test scores. Overall, the math scores for females and males are quite similar, while females have higher reading scores. Nearly 10% of females have the highest score (level 4) in reading, versus only 5% of males; 66% of females score in the top 2 categories (level 3 or 4) versus 56% of males.[15]

Finally, the last panel of the table shows the fractions of females and males who are observed in each of the next four years. Recall that to be included in our analysis sample a student has to either stay in high school for at least three years after grade 9 (with a "reasonable" course load) or obtain a secondary graduation certificate. Three years after entering high school (i.e., in what would be considered grade 12), only 3-4% of students have graduated early, with a slight advantage for males. Interestingly, over one-third of males and nearly one-quarter of females stay in high school for an extra year.

[15] As noted in Machin and Pekkarinen (2008), the tendency for females to perform better in reading than males is true across most OECD countries.

Table 3: High School Choices and Outcomes for Male and Female Students

	Males (1)	Females (2)
Track, Grades and EQAO Math Scores in Grade 9		
Academic track in grade 9 math (%)	70.4%	75.0%
Mean grade in math	68.2	70.1
Academic track in grade 9 English/French (%)	70.6%	82.8%
Mean grade in English/French	68.5	73.7
Academic track in EQAO grade 9 math test (%)	69.7%	74.3%
Mean score on EQAO grade 9 math test (4-point scale)	2.59	2.55
Track Choices and Grades in Level 4 Classes		
Percent observed taking English/French (any level)	86.7%	90.6%
Percent observed taking math (any level)	63.1%	56.7%
If Observe any Level 4 University-Level Courses		
Number university/mixed level 4 completed	6.2	6.3
Mean grade in university/mixed level 4 courses (if 4+ courses)	76.2	78.7
Percent observed taking level 4 calculus	20.5%	16.8%
Percent observed taking level 4 functions	30.1%	28.1%
Percent observed taking level 4 university level English/French	51.2%	66.0%
Received HS diploma after 4 years of HS (%)	54.6%	67.9%
Received HS diploma after 5 years of HS (%)	80.6%	85.7%
Register for university after 4 years of HS (%)	24.6%	37.8%
Register for university after 5 years of HS (%)	32.1%	43.4%
Register for college after 4 years of HS (%)	14.2%	16.0%
Register for college after 5 years of HS (%)	26.9%	26.0%

Notes: See notes to Table 1 for sample description. Sample contains 67,319 males and 68,107 females.

Table 3 presents some basic information on the course selections made by females and males, their course grades and their likelihood of transitioning to university or college. The first panel focuses on track choices and outcomes in grade 9. Females are 5 percentage points more likely to take academic track math (75% versus 70%) and 12 percentage points more likely to take academic track English or French (83% versus 71%). Despite their higher participation in academic track courses – which are presumably harder – they also have higher grades than males, particularly in English or French. The gender gap in track choice for the grade 9 EQAO test is a little smaller than the gender gap in course choice. Interestingly, males also score slightly higher on this test than females.

In the last year(s) of high school the gender gap in math participation is reversed: 63% of males take at least one level 4 math course, while only 57% of females do so. Among students who take at least one level 4 university-level class, the differences between males and females in the number of university-level courses taken and the average grades in these classes are relatively small. There is some evidence of gender specialization, however, with slightly higher participation by males in calculus and functions (the two "highest-level" math classes available at most schools) and substantially lower participation by males in university-level English or French classes (51% versus 66% by females).

The final panel of Table 3 shows the fraction of students receiving a high school diploma and the fraction registering for university or college within four or five years of entering grade 9. Notice first that only 55% of males and 68% of females receive a high school diploma within four years. An additional 26% of males and 18% of females receive a diploma after their fifth year of high school. Even allowing this extra time, however, males still have a 5 percentage point shortfall in diploma receipt. Since our analysis sample excludes students at high risk of dropping out without finishing a degree, the gender gap in diploma receipt for the overall grade 9 student population is even wider – around 7 percentage points.[16]

The pattern of registration at university is broadly similar. After four years of high school the fraction of males entering university is 25%, versus 38% for females. Another 8% of males and 6% of females register after five years, leading to an 11 percentage point gender gap in entry to university. Entry rates to college are more similar for males and females, with 27% of males and 26% of females registering within five years of grade 9.

IV. Explaining Gender Differences in Postsecondary Registration Rates

The comparisons in Table 3 show that even as early as the beginning of grade 9, when high school students choose either academic or applied tracks for math and English/French, males appear to be "aiming lower" than females. How much of the gender gap in university registration, or in any form of postsecondary registration, can be explained by choices and outcomes early in high school? How much more is explained by choices and outcomes between the first and last years of high school? To answer these questions we use a standard "decomposition" technique (see Fortin, Lemieux & Firpo, 2011). We ask: how much would the observed gender gap change if females had the same pre-high school characteristics, made the same high school course choices and earned the same grades as males, but continued to make their own PSE enrolment decisions, conditional on these factors? We examine sequentially the impacts of different sets of variables, starting with a very simple set of indicators of grade 9 course selection and grades, then adding indicators for course selection and grades in level 4 and finally adding information on student backgrounds

[16] As noted in the discussion of Table 1, we estimate that about one-third of students excluded from our analysis sample eventually receive a diploma. This implies that the overall diploma rates are 69% for males and 76% for females.

prior to high school.

We begin in Table 4 with a very simple three-way classification of grade 9 course selection and grade outcomes. We distinguish: (1) students who take academic track languages (English or French) and math, and score 70 or higher in both courses; (2) students who take academic track languages (English or French) and/or math, and score 70 in one of these courses; (3) students who either do not take academic track language and math classes, or score less than 70 in both. We use a cutoff based on a score of 70 or higher since informal discussion with teachers suggested that this is a traditional benchmark in making recommendations to students about track choice for the next year of school.

Table 4: Postsecondary Outcomes of Males and Females by Grade 9 (Level 1) Course Selection

			Level 1 Language/Math Track Choice and Grade Outcomes					
	Overall Cohort		Level 1 Academic Track Language AND Math with Grades >70		Level 1 Academic Track Language OR Math with Grades >70		No Level 1 Academic Track Language OR Math; or both Grades <70	
	Males	Females	Males	Females	Males	Females	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of students	67,391	68,017	19,606	27,508	13,344	16,088	34,441	24,511
Percent of Cohort	100.0%	100.0%	29.1%	40.4%	19.8%	23.7%	51.1%	36.0%
Postsecondary registration (percent registered within 5 years)								
Register in university	32.1%	43.4%	69.1%	72.1%	37.5%	43.0%	8.9%	11.5%
Register in college	26.9%	26.0%	14.1%	12.3%	31.7%	30.7%	32.4%	38.2%
Register in university or college	59.0%	69.4%	83.2%	84.4%	69.2%	73.7%	41.3%	49.6%

Notes: See notes to Table 1 for sample description. Subgroup in columns 3-4 completed Level 1 "Academic" track courses in math and English/French and received grade of 70 or higher in both. Subgroup in columns 5-6 completed one Level 1 "Academic" track course in math or English/French with a

grade of 70 or higher. Subgroup in columns 7-8 did not enroll in Level 1 "Academic" track math or English/French, or did not receive at least one grade of 70 or higher.

Columns 1 and 2 present overall data for females and males, highlighting the 11-point gender gap in university enrolment and the 10-point gap in any PSE participation. Columns 3 and 4 show data for our first ("high achievement") group, which includes 40% of females but only 29% of males. Within this group, 69% of males and 72% of females eventually register for university, while 83% of males and 84% of females enter some form of PSE within five years. Columns 5 and 6 show data for our second ("middle achievement") group, which includes 20% of males and 24% of females. Within this group the gender differences in university registration and PSE entry are a little bigger – 4 or 5 percentage points – but still much smaller than the overall gender gaps. Finally, columns 7 and 8 show data for our third ("low achievement") group, which includes 51% of males but only 36% of females. Students in this group are relatively unlikely to enter university (9% of males and 12% of females) but have college entry rates that are not too different from those of the middle achievement group.[17]

A key conclusion that emerges from Table 4 is that much of the overall gender gap in university entry can be predicted from the relative fraction of males and females in the three broad achievement groups based on grade 9 course selection and grades. To quantify the impact of grade 9 outcomes, note that the university registration rate for either gender can be decomposed as:

Overall rate =	Fraction in group 1 × Registration rate for group 1
+	Fraction in group 2 × Registration rate for group 2
+	Fraction in group 3 × Registration rate for group 3

To calculate what would happen to the gender gap in university registration rates if females had the same grade 9 course selections and grades as males, we can use the *males'* fractions in each of the three achievement groups, times the *females'* registration rates in each group. This counterfactual assumes that females continue to make the same PSE enrolment choices conditional on their grade 9 achievement group, but the fraction of females in each group is equal to the fraction of males. Performing this calculation, we see that the predicted registration rate for females would be 35.4%.[18]

[17] In Appendix Table 1 we report the basic characteristics of the students as reported in Tables 2 and 3, grouped into the three achievement groups. There are some striking differences across the groups, particularly in the first pane ("student characteristics"). Higher proportions of students with special needs are observed in the low achievement group. A strikingly high proportion of the males who are gifted, however, are observed in the highest achievement group. From Table 2 we observed that the immigrant rate was the same for males and females. The distribution of immigrant students across the three achievement groups, however, varies across genders. A higher proportion of immigrant males are observed in the higher achievement groups.

[18] The shares of males in the three groups are 0.291, 0.198 and 0.510. The registration rates of females in these three groups are 72.1%, 43.0% and 11.5%. Thus the predicted overall registration rate is 0.291 × 72.1 + 0.198 × 43.0 + 0.510 × 11.5 = 35.4%.

Under this "counterfactual scenario," the gender gap in university registration would fall to 3.2 percentage points, a little less than one-third of its actual 11-point magnitude. Thus, just over 70% of the gender gap can be attributed to the fact that males are underrepresented in the two higher achievement groups and overrepresented in the third low achievement group, where both females and males have very low chances of entering university. Only about 30% of the gender gap in university entry is due to the fact that females have higher registration rates than males in each of the three achievement groups.

Of course it is possible to perform this simple decomposition the other way around and ask what would happen to the gender gap if males the same grade 9 course selections and grades as females. Performing this calculation we see that the predicted registration rate for males would be 40%.[19] Under this counterfactual scenario the gender gap in university registration would fall to 3.5 percentage points, or 32% of its actual 11-point value. Again, nearly 70% of the gender gap is attributed to the overrepresentation of males in the higher achievement groups, while only 30% is due to the fact that within each achievement group males have lower registration rates than females.[20]

Tracking Achievement Gaps from the Start to the End of High School

How much of the registration gap between females and males in the same grade 9 achievement group can be explained by subsequent track choices and grade outcomes in high school? Table 5 addresses this question, using a simple classification based on university-level math and language classes. We distinguish two end-of-high-school groups: (1) students with at least one university-level language class or university-level math class with a grade of 70 or higher; (2) students with no university-level language or math classes with a grade of 70 or higher. This very simple classification is motivated by the fact that most Ontario university programs base admissions on an average grade in university-level courses, coupled with distribution requirements in either languages or math.

[19] The shares of females in the three groups are 0.404, 0.236 and 0.359. The registration rates of males in these three groups are 69.2%, 37.5% and 9.0%. Thus the predicted overall registration rate is 0.404 × 69.2 + 0.236 × 37.5 + 0.359 × 9.0 = 40.0%.

[20] The two alternatives need not give the same decomposition and in general can only provide upper and lower bounds for the contribution of the differences in how males and females are distributed across groups. In this case the bounds are quite close.

Table 5: Postsecondary Outcomes of Males and Females by Grade 9 (Level 1) Course Information and Grade 12 (Level 4) Course Information

				Level 1 Groups, Based on Language/Math Track Choice and Grade Outcomes					
		Overall Cohort		Level 1 Academic Track Language AND Math with Grades ≥70		Level 1 Academic Track Language OR Math with Grades ≥70		No Level 1 Academic Track Language OR Math; or both Grades <70	
		Males	Females	Males	Females	Males	Females	Males	Females
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
All level 4 groups	# of students	67,391	68,107	19,606	27,508	13,344	16,088	34,441	24,511
	% register in university	32.1%	43.4%	69.1%	72.1%	37.5%	43.0%	8.9%	11.5%
	% register in college	26.9%	26.0%	14.1%	12.3%	31.7%	30.7%	32.4%	38.2%
By Level 4 Language/Math Course Selections and Outcomes									
At least one university-level English/Fr **or** math course with 70+	# of students	28,718	40,004	17,066	25,289	7,244	10,249	4,408	4,466
	Percent of column	42.7%	58.8%	87.0%	91.9%	54.3%	63.7%	12.8%	18.3%
	% register in university	70.1%	70.3%	77.4%	77.1%	62.6%	62.2%	53.9%	50.3%
	% register in college	14.1%	14.4%	9.4%	9.5%	19.2%	20.5%	23.8%	28.0%
No university-level English/Fr with 70+ AND **no** university-level math with 70+	# of students	38,673	28,103	2,540	2,219	6,100	5,839	30,033	20,045
	Percent of column	57.3%	41.2%	13.0%	8.1%	45.7%	36.3%	87.2%	81.7%
	% register in university	3.9%	5.2%	13.6%	15.7%	7.8%	9.4%	2.3%	2.8%

				Level 1 Groups, Based on Language/Math Track Choice and Grade Outcomes					
		Overall Cohort		Level 1 Academic Track Language AND Math with Grades ≥70		Level 1 Academic Track Language OR Math with Grades ≥70		No Level 1 Academic Track Language OR Math; or both Grades <70	
		Males	Females	Males	Females	Males	Females	Males	Females
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	% register in college	36.5%	42.4%	45.5%	44.0%	46.5%	48.7%	33.6%	40.4%
Counter-factuals based on Shares in Level 4 Language/Math Course Selection and Grades									
University registration Rate	Give females males' shares	32.1%	33.0%	69.1%	69.1%	37.5%	38.0%	8.9%	8.9%
	Give males females' shares	41.2%	43.4%	72.3%	72.1%	42.7%	43.0%	11.8%	11.5%

Notes: See note to Table 4 for description of level 1 course selection and outcome groups defined by column headings.

Columns 1 and 2 of Table 5 show the fractions of all males and females in our analysis sample who are classified into these two groups, along with the fractions in each group who register at university or college within five years. Notice that both males *and* females in the upper group based on end-of-high school course and grades have very high university registration rates – around 70% – whereas males and females in the lower group have very low registration rates – only 4 or 5%. Thus, knowing whether a high school student has at least one university-level language or math course with a grade of 70% or better provides crucial information on whether the student will register in university or not.

A second key fact is that males and females have very different shares in the two groups, with 16% fewer males in the upper group. As shown in the bottom two rows of the table, this difference explains nearly all of the gender gap in university registration. Assuming females had the same shares in the end-of-high school achievement groups as males, their university registration rate would fall to 33.0%, narrowing the gender gap to less than 1 percentage point. Alternatively, assuming males had the same shares as females, their university registration rate would rise to 41.2, again narrowing the gender gap to around a percentage point. We conclude that gender differences in end-of-high school course selection and grades accounts for most (>90%) of the gender gap in entry to university among Ontario students.

Columns 3-8 of Table 5 show level 4 outcomes for males and females in each of the three grade 9 achievement groups described in Table 4. Starting with the high achievement grade 9 group in columns 3 and 4, the fraction of males who end up in the upper group for level 4 is slightly lower than the fraction of females (87% versus 92%). This shortfall explains virtually all of the lower university registration rate for males who were in the highest achievement grade 9 group (see the counter-factual calculations in the bottom rows of the table).

As shown in columns 5 and 6, the gap in level 4 outcomes between males and females who start in the "middle achievement" group in grade 9 is larger: 54% of males from this group end up in the level 4 high achievement group versus 64% of males. Again, this shortfall in performance at the end of high school explains nearly all the gender gap in university registration for males and females in the middle achievement group in grade 9.

Finally, columns 7 and 8 show the level 4 outcomes for males and females who start in the "low achievement" group in grade 9. Relatively few of these students recover from this poor start to end up in the high-achievement level 4 group: only 13% of males versus 18% of females. As with the middle achievement grade 9 group, however, it seems that females are better able to compensate for a weak start in grade 9 and end up with level 4 outcomes than enable them to enter university.

Overall we reach three main conclusions from the results in Table 5. First, as has been shown in the US and the UK by Goldin et al. (2006) and Machin and McNally (2006), the gender gap in entry to university among Ontario high school students is essentially determined by the gender gap in end-of-high school performance. Second, much of the gap in end-of-high school achievement is traceable to gaps in course selection and grade outcomes at the beginning of high school. Third, there is a modest additional widening of the gender gap between the start and end of high school. Males who start off well in grade 9 are a little less likely to

maintain this performance than females, while females who start off in the middle or lower achievement groups in grade 9 are more likely to overcome their slow start than males.

A Closer Look at End-of-High School Outcomes

Some additional insight into the different paths that males and females take over high school is provided by the analysis in Table 6, which extends our "two-group" classification of level 4 choices and outcomes into a five-group classification. Specifically, we break down the higher achievement group in Table 5 into 4 subgroups: Group I – at least *one* university-level level 4 language class with a grade of 70 or higher and *two or more* university-level level 4 math classes with a grade of 70 or higher; Group II – at least *one* university-level level 4 language class with a grade of 70 or higher and *one* university-level level 4 math classes with a grade of 70 or higher; Group III – at least *one* university-level level 4 language class with a grade of 70 or higher and *no* university-level level 4 math classes with a grade of 70 or higher; Group IV – *no* university-level level 4 language classes with a grade of 70 or higher and *at least one* university-level level 4 math class with a grade of 70 or higher. As in Table 5, we add a final group (Group V) with *no* university-level language or math classes with a grade of 70 or higher.

Table 6: Postsecondary Outcomes of Males and Females by Grade 9 (Level 1) Course Information and Grade 12 (Level 4) Course Information

				Level 1 Groups, Based on English/Math Track Choice and Grade Outcomes					
		Overall Cohort		Level 1 Academic Track Language AND Math with Grades ≥70		Level 1 Academic Track Language OR Math with Grades ≥70		No Level 1 Academic Track Language OR Math; or both Grades <70	
		Males (1)	Females (2)	Males (3)	Females (4)	Males (5)	Females (6)	Males (7)	Females (8)
Total number of students in level 1 group		67,391	68,107	19,606	27,508	13,344	16,088	34,441	24,511
All level 4 groups	% register in university	32.1%	43.4%	69.1%	72.1%	37.5%	43.0%	9.0%	11.5%
	% register in college	26.9%	26.0%	14.1%	12.3%	31.7%	30.7%	32.4%	38.2%
By Level 4 English/Math Course Selections and Outcomes									
I. 1+ university-level English/Fr with 70+ AND **2+** university-level math with 70+	# of students	10,051	9,450	8,557	8,888	1,174	482	320	80
	Percent of column	14.9%	13.9%	43.6%	32.3%	8.8%	3.0%	0.9%	0.3%
	% register in university	88.2%	87.2%	88.4%	87.3%	87.6%	85.1%	86.3%	87.5%
	% register in college	2.5%	2.4%	2.4%	2.3%	2.9%	4.4%	3.4%	0.0%
II. 1+ university-level English/Fr with 70+ AND **1** university-level math with 70+	# of students	5,683	10,018	3,626	7,629	1,385	1,868	672	521
	Percent of column	8.4%	14.7%	18.5%	27.7%	10.4%	11.6%	2.0%	2.1%
	% register in university	73.7%	75.8%	74.3%	77.0%	72.7%	73.9%	72.9%	65.5%
	% register in college	12.1%	10.9%	11.2%	10.0%	13.2%	12.3%	14.7%	18.6%
III. 1+ university-level English/Fr with 70+; no university-level math	# of students	10,310	19,112	3,740	7,946	3,694	7,505	2,876	3,661
	Percent of column	15.3%	28.1%	19.1%	28.9%	27.7%	46.6%	8.4%	14.9%

				Level 1 Groups, Based on English/Math Track Choice and Grade Outcomes					
		Overall Cohort		Level 1 Academic Track Language AND Math with Grades ≥70		Level 1 Academic Track Language OR Math with Grades ≥70		No Level 1 Academic Track Language OR Math; or both Grades <70	
		Males	Females	Males	Females	Males	Females	Males	Females
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
with 70+									
	% register in university	53.9%	60.0%	60.2%	67.2%	53.1%	58.4%	46.7%	47.5%
	% register in college	24.0%	21.4%	20.5%	16.0%	24.8%	23.0%	27.5%	29.8%
	# of students	2,674	1,424	1,143	825	991	394	540	204
IV. No university-level English/Fr with 70+ AND **1+** university-level math with 70+	Percent of column	4.0%	2.1%	5.8%	3.0%	7.4%	2.4%	1.6%	0.8%
	% register in university	56.3%	57.2%	61.3%	62.7%	54.2%	50.6%	49.4%	47.5%
	% register in college	23.8%	24.1%	19.9%	19.7%	26.0%	29.4%	28.0%	31.4%
	# of students	38,673	28,103	2,540	2,219	6,100	5,839	30,033	20,045
V. No university-level English/Fr with 70+ AND **no** university-level math with 70+	Percent of column	57.4%	41.3%	13.0%	8.1%	45.7%	36.3%	87.2%	81.8%
	% register in university	3.9%	5.2%	13.6%	15.7%	7.8%	9.4%	2.3%	2.8%
	% register in college	36.5%	42.4%	45.6%	44.0%	46.5%	48.7%	33.6%	40.4%

Notes: See note to Table 4 for description of level 1 course selection and outcome groups defined by column headings.

This finer classification reveals an interesting pattern of gender-specific adaptation/specialization over the high school years. Looking first at the highest achievement grade 9 students (columns 3 and 4), notice that 44% of males in this group are in Group I, with 70+ grades in two or more math courses and one language course, versus 32% of females. Students in Group I have very high university registration rates (close to 90%) and are presumably the main entrants to science, technology, engineering or math (STEM) programs at Ontario universities.[21] In contrast, females from the top grade 9 achievement group are more heavily concentrated in groups II and III, with lower levels of math achievement.

A similar but even more striking pattern is evident for males and females who are in the middle achievement group in grade 9. These students are relatively unlikely to end up in Group I at the end of high school, or even Group II. Forty-seven percent of females from this group, however, are in Group III, with a 70+ grade in at least one university-level language course and no 70+ grades in math, compared to only 28% of males. Many of these students, who are relatively strong in languages and relatively weak in math, presumably enter humanities and social science programs at university. There is some evidence of the opposite form of specialization for males, who are more likely than females to end up in Group IV with at least one 70+ grade in university level math but no comparable language grades.

Looking at the lowest achievement grade 9 group (columns 7 and 8), we see a similarly important gender divergence in the fraction of students who end up in Group III. Indeed, conditional on starting in the lowest achievement grade 9 group it appears that the main way that students can recover enough to enter university is to earn at least one 70+ grade in languages. All but 5% of the students of either gender from the lowest grade 9 group end up either in Group III or Group V (the group with no grades of 70+ in university level math or languages). The 6 extra percentage points of females who end up in Group III versus Group V accounts for essentially all of the 2.5 percentage point gap in university registration for these students.

While the classification of achievement at the beginning and end of high school in Table 6 is quite simple, we believe it underscores the importance of language skill differences between males and females in mediating the gender gap in university entrance. There is a noticeable shortfall in males' relative performance in language-related courses at the end of high school, even controlling for their achievement in grade 9. This shortfall appears to explain the gender gap in the fraction of students who start off in the middle or lower achievement groups in grade 9 but finish high school with at least one grade of 70 or more in a university-level language course and are therefore able to enter university.

[21] Unfortunately, we do not have information on the university programs in which students register. We intend to address this question in future work.

V. Explaining Gender Differences in Track Choice and Grades at the Start of High School

The simple decompositions in Tables 4 and 5 point toward the very important role of the initial stages of a student's high school career in determining whether he or she will go on to university. Essentially, our results push back the determinants of the gender gap in university registration to the point of entry to high school, when students have to decide which courses to take and how hard to work to ensure successful progression to the later years of high school. The question that naturally arises is whether the gender gap in early high school course selection and performance is driven by differences that emerged *even earlier* or are mainly a reflection of choices made once a student has entered high school.

While the lack of information on pre-high school courses and test results in our data set limit our power to answer this question, we performed a second set of decompositions on measures of grade 9 course selection and performance to investigate the potential role of the gender gap in the fraction of students classified as special needs and in grade 6 reading and math scores, highlighted in Table 2. Since our main interest is in pre-high school determinants that vary continuously, rather than take on a few discrete values we use a regression based decomposition approach (see Fortin, Lemieux & Firpo, 2011), rather than the reweighing style decompositions used in Table 4 and 5.

Specifically, consider an outcome variable (Y) that is measured for each individual and let $\overline{Y}_B$ and $\overline{Y}_G$ represent the means of this outcome for males and females. Then the gender gap in the mean outcome, $(\overline{Y}_B - \overline{Y}_G)$ can be decomposed as:

$$\overline{Y}_B - \overline{Y}_G = (\overline{X}_B - \overline{X}_G)\beta_G + \overline{X}_B(\beta_B - \beta_G) \ ,$$

where X is a set of explanatory variables, including a constant, $\overline{X}_B$ denotes the mean value of the X's for males, β_B denotes the estimated coefficient vector of the X's for males, and $\overline{X}_G$ and β_G are the corresponding mean of the X's and estimated regression coefficient vector for females.

The first term can be interpreted as the gap in outcomes that would be observed if females were given the same mean characteristics as males (the same counterfactual shown in the bottom of Table 5). The second term represents the gap that would be observed if both males and females were given the same mean characteristics as males. This provides a summary measure of how males and females react differently to the same background factors. Since our main focus is on differences in background factors, we report the share of the gap that can be explained by the first term.[22]

[22] It is possible that males and females are affected differently by the same individual, neighbourhood or school factors, as argued recently by Legewie and DiPrete (2012), for example. Such effects will be captured in the second term.

We apply this technique to analyze the gender gap in the fractions of males and females who fall in each of the three grade 9 "achievement groups" used in Tables 4-6: high achievers, who score 70 or higher in both academic track English/French and academic track math; middle achievers, who score ≥70 in one of these courses; and low-achievers, who either do not take academic track language and math classes or who score less than 70 in both. For each outcome we show three decompositions. Decomposition 1 uses only student characteristics (indicators for special needs status, gifted status, "second language" status, immigrant status and Native Canadian ethnicity). Decomposition 2 adds school and neighbourhood characteristics described in Table 2.[23] Finally, Decomposition 3 adds the student's imputed grade 6 EQAO test scores in reading and math, which are based on average scores of students of the same gender, from the same local area (who are likely to attend the same high school) who wrote the same version of the grade 9 math test (either academic or applied).

Table 7: Decomposition of Gender Gap in Course Selection and Grades in Grade 9

	Share with Level 1 Academic Track Language AND Math with Grades ≥ 70	Share with Level 1 Academic Track Language AND Math with Grades ≥ 70	No Level 1 Academic Track Language OR Math; or both Grades <70
	(1)	(2)	(3)
Mean for males	0.291	0.198	0.511
Mean for females	0.404	0.236	0.360
Male–Female gap	-0.113	-0.038	0.151
Decomposition 1: Using Student Characteristics[1]			
Share explained by characteristics	**12.0%**	**20.5%**	**14.1%**
Decomposition 2: Using Student and School Characteristics[2]			
Share explained by characteristics	**11.6%**	**20.7%**	**13.9%**
Decomposition 3: Using Student/School Characteristics and Imputed Grade 6 EQAO Scores in Reading and Math[3]			
Share explained by characteristics	**41.4%**	**37.6%**	**40.4%**

[23] At the school level we include a dummy for Catholic schools and measures of the fractions of ESL/FSL, Native Canadians and visible minorities in the student's school in 2005-2006. At the neighbourhood level we include measures of the distance to the nearest four-year college and university, total population and fraction of the population in the 15-24 age range in local area (FSA, which is the level of tabulation of the Census characteristics), as well as visible minority share, mean household income (and its square) and fraction of single-parent households in FSA.

Notes: Table shows decompositions based on linear regression models for outcome in column heading. All outcomes refer to courses taken in grade 9 in 2005-2006.

[1]Student characteristics are described in note 1 to Table 2.

[2]School and neighbourhood characteristics are described in note 2 to Table 2.

[3]Model includes imputed scores in grade 6 EQAO tests in reading and math. Scores are imputed based on gender and neighbourhood.

Column 1 of Table 7 presents the results for the fraction of students in the high achievement group. As noted in Table 4, males are 11.3 percentage points less likely to be in this group. About 12% of this gap is explained by student characteristics – mainly the special needs indicator, which is negatively correlated with academic track choice and grades, and also has a lower mean for females than males. As shown by Decomposition 2, the addition of school and neighbourhood characteristics adds nothing to the explanatory power of the characteristics as a whole. Adding imputed grade 6 EQAO test scores in reading and math (see Decomposition 3) adds significantly to the explanatory power of the models. In particular, grade 6 reading scores are positively correlated with the probability of being in the high achievement group and the mean scores are higher for females than males, so a portion of the gap is attributed to grade 6 reading scores, suggesting that approximately 41% of the gap is attributed to underlying student characteristics, school characteristics and our proxies for student performance prior to entering grade 9. A potential concern with the model used in Decomposition 3 is that math and reading scores are imputed using information on gender and school location. It would be better to have information on the grade 6 test score for the students. As we cannot capture this information on the students, our proxy for grade 6 test scores represents both information on prior performance and student characteristics of the peers the student likely encountered prior to high school.

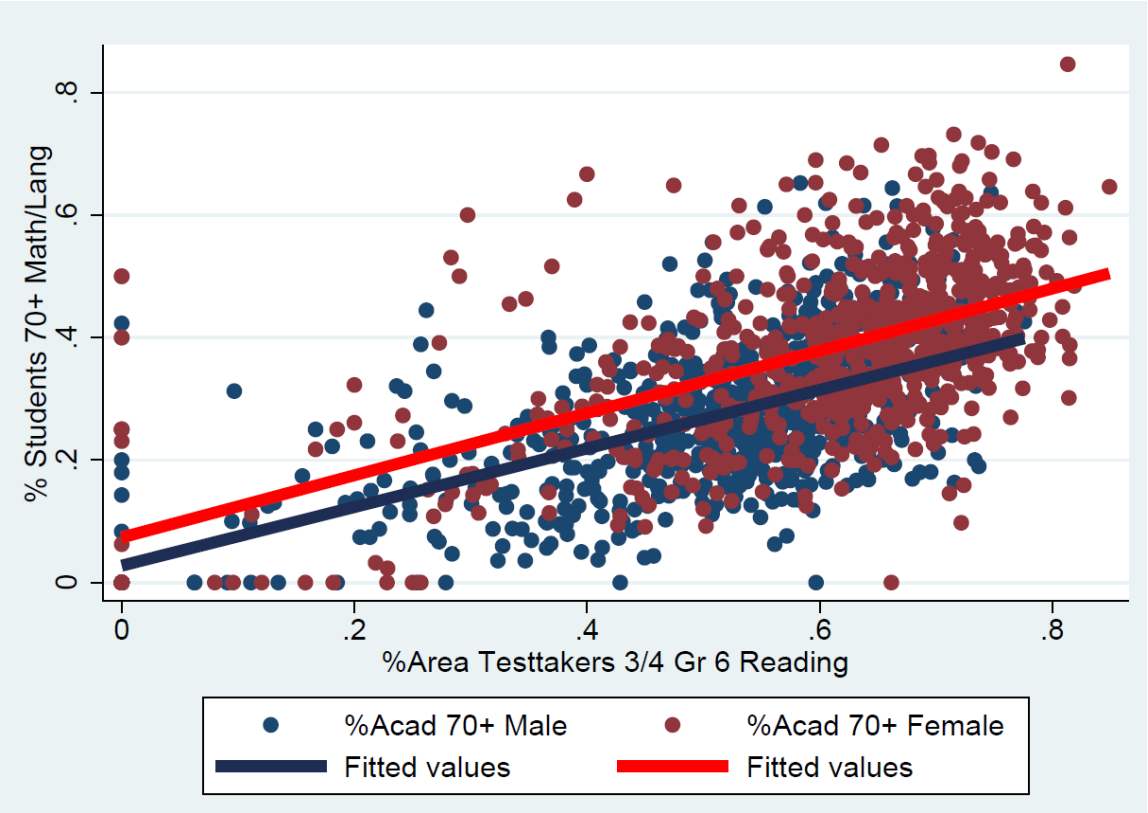
The decomposition results for the low achievement group (see column 3) are broadly similar, reflecting the fact that gender gap in the share of low achievers is largely the mirror image of the gap in the faction of high achievers. The results for the middle achievement group are a little different. Our models suggest that a relatively higher fraction of the excess share of females in this group is explained by student characteristics (21% versus 12-14% for groups 1 and 3), whereas grade 6 scores add an additional 17 percentage points of explanatory power.

We explore the relationship between grade 6 reading score performance and observing the students in the highest achievement group in Figure 1. Each point represents students by geographic area, differentiating between males and females. The measure for the x-axis is the share of students in the area that received a score of 3 or 4 on the grade 6 EQAO reading test. The measure for the y-axis is the share of students observed in our highest achievement group. For both males and females there is an upward trend – students in areas with higher proportions of students performing well on the grade 6 test are also likely to be observed in the highest achievement group. The gap between males and females, however, is relatively

consistent across all areas. Similar to the finding in Card, Payne and Sechel (2011), there does not appear to be any geographical or schooling differences in the gaps in performance.

We have also conducted similar decomposition exercises for a number of other grade 9 outcomes, including the number of academic track classes taken in grade 9, grades in level I math and English/French courses, and overall average grades (across all standardized track classes) in grade 9. Results for these outcomes are broadly similar to those shown in Table 7. A modest share of the gender gap (5-15%) is attributed to differences in student characteristics, mainly the fraction of special needs students, while another 15-25% is explained by imputed grade 6 scores.

Figure 1: Grade 6 Reading vs. 70+ Marks in Level 1 Academic Math and Language Courses



Overall we conclude that a potentially important share – up to one-third – of the gender gap in grade 9 course choices and course outcomes can be attributed to differences between males and females that have emerged prior to high school. As noted, our analysis is limited by the lack of information on individual-level grade 6 test scores, so our conclusions must be stated cautiously. Nevertheless, females are less likely to be classified as special needs students and score higher on grade 6 reading tests – two factors that are important predictors of the probability of choosing academic track classes and of average course grades in

grade 9.

VI. Summary and Conclusions

We use data for a large sample of Ontario students who are observed over the five years from their initial entry to high school to study the impact of course selections and outcomes in high school on the gender gap in PSE enrolment. Among students who start high school "solidly" with both a math class and a language class (either English or French) in grade 9 and who are observed taking classes over the next four years, we find an 10 percentage point gap in the fraction of females versus males who register for university or college (69% versus 59%), attributable to the gender gap in entry to four-year universities (43% for females versus 32% for males). We then show how the gender gap in university registration is related to the gender gaps at two earlier stages: (1) the first year of high school, where students can select either academic or applied track classes in core subjects including math and languages; (2) the final year(s) of high school, where students who intend to enter university must complete a minimum number of university-level classes.

We find that individual students' progress through high school and on to university exhibits strong serial persistence. Simply knowing whether a student had "good grades" (a score of 70 or higher) in academic-track math and language courses in their first year of high school is highly predictive of course selection and grades at the end of high school and of university entry. In this setting, the large differences between females and males in early high school course choices and outcomes translate directly to large differences in entry to university.

Overall, we find that gender differences in track selection and grades in grade 9 math and language courses explain 70% of the gender gap in university registration. Another 20-25% is explained by differences in end-of-high-school course choices and grades among females and males with similar track choices and grades in grade 9. Females who start off with high achievement in grade 9 are more likely to stay "on track" than males and perform well enough in university level classes in the last year of high school to ensure a high probability of entry to university. Conversely, females who start off with lower achievement are better able to get "back on track" than males and complete high school with enough university-level courses to enter university. Thus, nearly all of the gender gap in entry to university is explained by choices and outcomes in high school, with the majority traceable to decisions and performance in the first year of high school.

We also investigate the impact of pre-high school differences between females and males on course selection and grades in the first year of high school. We find that differences student characteristics – specifically, the fraction of males versus females who are classified as "special needs" students – together with the gender gap in average grade 6 reading scores can explain up to one-third of the key differences in grade 9 track choices and outcomes between females and males.

Our findings raise a number of important questions for further work. One question is whether the strong predictability of PSE outcomes from grade 9 course choices and course grades is due in part to the tracking system in Ontario schools, or whether similar persistence is exhibited in other schooling systems. A second question is how gender differences in high school relate to the types of university and college programs that

students enter. There are large differences in the university programs selected by males and females that appear to be strongly correlated with subsequent labor market outcomes (see e.g., Altonji, Blom & Meghir, 2012). Our analysis has uncovered some interesting gender differences in end-of-high school courses that may shed some important light on not only the higher rate at which females go on to university, but also the gender gaps in participation in STEM fields noted by Smith and Vishkin (2013) and other researchers.

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