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Why Are Most University Students Women? Evidence Based on Academic Performance, Study Habits and Parental Influences

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Table of contents

Abstract

In this study, we use new Canadian data containing detailed information on standardized test scores, school marks, parental and peer influences, and other socio-economic background characteristics of boys and girls to try to account for the large gender gap in university attendance. Among 19-year-old youth in 2003, 38.8% of girls had attended university, compared with only 25.7% of boys. However, young men and women were about equally likely to attend college. We find that differences in observable characteristics between boys and girls account for more than three quarters (76.8%) of the gap in university participation. In order of importance, the main factors are differences in school marks at age 15, standardized test scores in reading at age 15, study habits, parental expectations and the university earnings premium relative to high school. Altogether, the four measures of academic performance used in the study—overall marks, performance on standardized reading tests, study habits and repeating grade—collectively account for 58.9% of the gender gap in university participation. These results suggest that understanding why girls outperform boys in the classroom may be a key to understanding the gender divide in university participation.

Keywords: university participation, gender gap, standardized test scores, school marks.

Executive summary

In recent history, universities have been the domain of male students. Over the last 30 years or so, however, a dramatic reversal has taken place on Canadian university campuses. According to the 1971 Census, 68% of 25- to 29-year-old university graduates then were male. Ten years later, women had more or less caught up to men as only 54% of graduates were male. By 1991, women had become the slight majority, comprising 51% of graduates. In the 2001 Census, universities had clearly become the domain of women, as they made up 58% of all graduates.

Despite its importance, very little is known about the gender divide in university participation. According to the Youth in Transition Survey, Cohort A, 38.8% of 19-year-old women had attended university by 2003, compared with only 25.7% of 19-year-old men. However, young men and women were about equally likely to attend college.

The focus of this study is to shed light on the gap in university attendance. To this end, we look at differences in academic performance and socio-economic characteristics of girls and boys. In general, girls perform better on standardized tests, have higher overall school marks, spend more time doing homework, are less likely to repeat a grade in school, have higher expectations placed upon them by their parents, and face higher economic returns to completing a university degree.

We find that differences in the characteristics of boys and girls account for more than three quarters (76.8%) of the gap in university participation. In order of importance, the main factors are differences in school marks at age 15 (31.8%), standardized test scores in reading at age 15 (14.6%), study habits (11.1%), parental expectations (8.5%) and the university earnings premium relative to high school (5.3%). Altogether, the four measures of academic performance used in the study—overall marks, performance on standardized reading tests, study habits, and repeating a grade—collectively account for 58.9% of the gender gap in university participation. Overall, marks account for a larger share of the gender gap in university participation than reading scores do. These results suggest that understanding why girls outperform boys in the classroom may be a key to understanding the gender divide in university participation.

1. Introduction

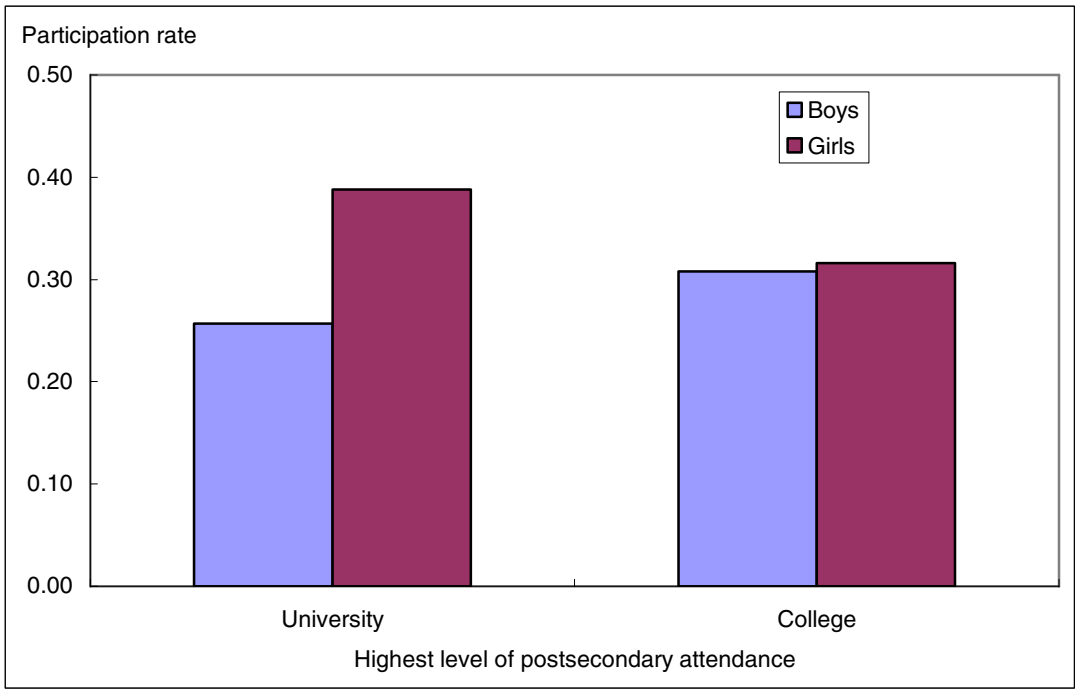
In recent history, universities have been the domain of male students. Over the last 30 years or so, however, a dramatic reversal has taken place on Canadian university campuses. According to the 1971 Census, 68% of 25- to 29-year-old university graduates were male. Ten years later, women had more or less caught up to men, as only 54% of graduates were male. By 1991, women had become the slight majority, comprising 51% of graduates. In the 2001 Census, universities had clearly become the domain of women, as they made up 58% of all graduates.[1]

In Canada, Christofides, Hoy and Yang (2006), examine the evolution of the gender gap in university participation with survey data. They find that more than one half of the increase in the gender gap can be attributed to the differential rise in the university earnings premium relative to high school. Unfortunately, their data do not contain very detailed information about youth. However, the authors examine a period of time when many factors were changing. For example, the proportion of boys under the age of 18 living with a lone mother rose from 9.4% in 1981 to 14.3% in 2001. This large increase in the incidence of boys not growing up with their father in the same household may partially explain why the university participation rate has not risen as quickly for boys. Moreover, educational attainment among women has risen rapidly over the last few decades. This may have benefited girls more than boys if one believes that mothers have a greater influence on girls than on boys. In fact, once paternal education is taken into account, maternal education is not associated with the educational aspirations of boys, but it is positively associated with the educational aspirations of girls (Looker and Thiessen 2004). Finally, there has also been a decline in the presence of male influences in high schools. According to census data, the proportion of male high school teachers declined from 58% in 1981 to 46% in 2001. The study by Christofides, Hoy and Yang (2006) did not *directly* account for any of these factors. Although a linear time trend was included in their regressions, these factors have not necessarily increased at a linear rate. Furthermore, to the extent that the rise in these factors is correlated with the rise in the university premium, then the coefficient of the latter may pick up the effect of the former. There are other factors that may come into play as well. For example, the academic performance and the behavioral/developmental aspects of girls and boys may have evolved at different paces. Since no single data source contains all of the above information over a long period of time, it is safe to say that, at best, research in this area may build a separate case for each of these factors without being able to formally test all of them in a competing framework. This was in fact the strategy applied in a recent paper in the United States by Goldin, Katz and Kuziemko (2006).

A more promising area of research is to try to understand the reasons for the gender gap in university participation at a point in time. Recent Canadian data on university attendance suggest that the female advantage is persisting. In 2003, 38.8% of 19-year-old women had attended university, compared with only 25.7% of 19-year-old men (Figure 1). However, that same year young men and women were about equally likely to attend 'college' (i.e., all forms of non-university postsecondary schooling).

1. The improvements registered by women were larger at the graduate degree level. In 1971, 22% of 25- to 29-year-olds with graduate degrees holders were women. This figure rose to 58% by 2001. By contrast, 35% of bachelor degree holders were women in 1971, compared with 58% in 2001.

Figure 1 University and college participation rates, by sex



Source: Statistics Canada, Youth in Transition Survey, Cohort A.

The large gender divide in university participation may have several important demographic and economic implications. First, completing university and starting a career may require women to delay their first child. Second, more and more professionals are female, which may have implications for skilled labour shortages. For example, the proportion of medical doctors who are women has increased in recent years. Given that female doctors tend to work far fewer hours than male doctors,[2] this may exacerbate the existing pressures to increase the number of doctors in light of the aging population and the associated increase in the demand for health care services. Third, the rising educational attainment of women may help reduce the raw (or unconditional) gender wage gap. Fourth, given educational assortative mating (i.e., the propensity of higher educated individuals to marry other higher educated individuals), this may lower marriage prospects for young men, or induce young women to modify their preferences (i.e., lead them to marry lower educated men at a greater rate than they currently do).

Despite its importance, very little is known about the gender divide in university participation. In the United States, Jacob (2002) examines the issue by using a survey containing detailed socio-economic information of youth. He is able to account for 90% of the gender gap in the university participation rate by differences in non-cognitive abilities (including school marks) and the university earnings premium relative to high school. However, the data Jacob uses date back to the early 1990s, a period when the gap in the university participation rate was only about 5 percentage points, which is quite small by today's standards. Explaining such a small gap may be less informative than understanding the larger gap that exists today.

2. Information on physician work hours by sex is available from the Canadian Medical Association at this link: www.cma.ca/multimedia/CMA/Content_Images/Inside_cma/Statistics/pwr-average1.pdf

The objective of the current study is to shed light on the large gender gap in university participation that exists at a point in time by using a new data source, namely the Youth in Transition Survey, Cohort A. This survey contains very detailed information on youth including school marks, performance on standardized reading tests, study habits, parental expectations, among many characteristics. Although the study largely follows Jacob (2002), it also adds to the literature in two important ways. First, it provides Canadian evidence on the topic. Second, it focuses on a more recent period (2003), when the gender gap in university participation was very large (13.1 percentage points).

In the next section, we describe the methodology employed in the study, as well as the YITS data in detail. To provide some context for the remainder of the study, the following section will piece together a profile of girls and boys from birth to age 15. In general, boys begin life at a disadvantage relative to girls in terms of physical, cognitive and emotional factors. As they progress through the school system, gender differences tend to bifurcate even more. By age 15, when many youth begin to think about life after high school, girls outperform boys in school by leaps and bounds, and tend to hold an advantage over boys on several other fronts. This brings us to the core of the study, where we examine the extent to which the advantages held by girls at age 15 account for the large gender gap in university participation at age 19. The result of this exercise suggests that more than three quarters (76.8%) of the gender gap in the university participation rate can be accounted for by differences in observable characteristics between boys and girls. In order of importance, the main factors are differences in school marks at age 15, standardized test scores in reading at age 15, study habits, parental expectations and the university earnings premium relative to high school.

2. Methodology

The goal of the study is to decompose the gap in university attendance into an explained component and an unexplained component (i.e., portions of the gap that are accounted for and not accounted for by differences in observable characteristics, respectively). The methods follow Jacob (2002), who examines the gender gap in university participation in the United States, and Frenette (2007), who considers the parental income gap in university participation in Canada. Blinder (1973) and Oaxaca (1973) suggest a simple approach to decompose the gap in the mean value of a dependent variable that is based on ordinary least squares (OLS).

We begin by regressing a dichotomous university participation variable, U, on a series of explanatory variables, X (described below), in separate models for females and males.[3] In OLS, the regression line (plane, hyperplane) passes through a point representing the sample means of all variables in the model. In other words, the following relationship holds for youth of sex s:

3. We apply ordinary least squares despite the dichotomous nature of the dependent variable (i.e., we estimate linear probability models). This is a reasonable approach when the empirical probability is not close to 0 or 1, which is the case here. Marginal probability effects from logit and probit models yield similar results. See Moffitt (1999) for more details on the appropriateness of the linear probability model and Fairlie (2003) for a decomposition technique that is useful when the empirical probability is close to 0 or 1. For examples of the Blinder–Oaxaca decomposition applied to binary outcomes, see Fairlie and Sundstrom (1997), Jacob (2002), Manning and Robinson (2004) and Frenette (2007).

(1) $$\overline{U}s = \overline{X}sb_S$$

Note that the mean of the dependent variable ($\overline{U}$) can be interpreted as the university participation rate. Applying simple algebra, the gap in the university participation rate between young men (*m*) and young women (*f*) can be written as follows:

(2) $$\overline{U}f - \overline{U}m = (\overline{X}f - \overline{X}m)b_f + \overline{X}m(b_f - b_m) : \text{Method 1}$$

Alternatively, it may be written as:

(3) $$\overline{U}_f - \overline{U}m = (\overline{X}f - \overline{X}m)b_m + \overline{X}f(b_f - b_m) : \text{Method 2}$$

In both cases, the first term on the right-hand side refers to the explained portion of the gap, while the second term on the right-hand side refers to the unexplained portion of the gap. Since we are dealing with a simple linear combination, the explained portion of the gap can be further decomposed by specific sub-components of explanatory variables.

The two alternate ways of expressing the gap can be distinguished by the weighting factors applied in each. For example, the method shown in Equation (2) (hereafter, Method 1) evaluates the gap in mean explanatory variables in the same way that the characteristics of females are evaluated (i.e., b_f is used as the weight). In Method 2, the weight is b_m. Since the two methods can yield slightly different results, we apply and show results from both techniques in this study.

However, to avoid ambiguity, the preferred results will follow from an extension of the basic Blinder–Oaxaca approach used by Neumark (1988) and Oaxaca and Ransom (1994). In this approach (hereafter, Method 3), the coefficients from a pooled model (*p*) of females and males are used as weighting factors for the explained portion of the gap:

(4) $$\overline{U}f - \overline{U}m = (\overline{X}f - \overline{X}m)b_p + \left[\overline{X}f(b_f - b_p) - \overline{X}m(b_m - b_p)\right] : \text{Method 3}$$

As before, the first term on the right-hand side denotes the explained portion, while the second term is the unexplained portion, which can be further broken down into the advantage (disadvantage) of men and women.

The data for the study are drawn from the Youth in Transition Survey (YITS), Cohort A, which was collected in conjunction with the Programme for International Student Assessment (PISA), a project of the Organisation for Economic Co-operation and Development. The target population consists of students enrolled in an educational institution in Canada on December 31, 1999 who were 15 years old on that day (i.e., they were born in 1984). Students living in the territories or on Indian reserves, as well as students who were deemed mentally or physically unable to perform in the PISA assessment and non-native speakers with less than one year of instruction in the language of assessment were excluded. Also excluded were various types of schools for which it would have

been unfeasible to administer the survey, such as home schooling and special needs schools. All of these exclusions represent less than 4% of 15-year-olds in Canada.

The survey design consisted of a two-stage approach. In the first stage, a stratified sample of schools was selected to ensure adequate coverage in all 10 Canadian provinces (including adequate coverage of minority school systems in certain provinces). The stratification was based on the enrolment of 15-year-olds in the school in the previous academic year. In the second stage, a simple random sample of 15-year-old students within the school was selected. To account for this complex survey design, all variance measures were bootstrapped with 100 replicate weights.

Students were initially interviewed in April or May 2000, and re-interviewed in February to May 2002 and February to June 2004. In the first cycle of data, parents and schools were also interviewed, but no follow-up was administered.

We selected all youth in the survey. In Frenette (2007), only students who had completed high school by age 19 were considered in the study. This was because the focus of that study was on illustrating to what extent financial constraints may or may not explain the income access gap in university participation. Since high school graduation is normally required to attend university,[4] it would be difficult to ascribe a lower university attendance rate for high school dropouts to financial constraints.

The main outcome is university participation by December 31, 2003. The main advantage of the data lies in the large number of explanatory variables. Four measures of academic performance are used in the study. The first is from PISA. The PISA assessment was conducted in 2000, and was administered in the language of instruction of the school, which was either English or French. It consisted of standardized tests in the areas of reading, mathematics and science. All students were assessed in reading, which was the main focus of the test. Half of the students were also assessed in mathematics, while the other half was also assessed in science (based on a random sub-sample of PISA students within schools). The assessment was based on a two-hour written test, and the reading component consisted of having students perform a range of tasks with different kinds of text, which included retrieving specific information, demonstrating a broad understanding of text, interpreting text and reflecting on the content and features of the text. The texts included standard prose passages and various types of documents, such as lists, forms, graphs and diagrams. Since Frenette (2007) demonstrates that performance in reading is more strongly associated with university participation than performance in mathematics or science, we focus exclusively on the reading component of PISA in this study. The second measure of academic performance that we use is the student's overall mark in school at age 15, which is self-reported by the student. Conditional on one's ability to perform on a standardized test, school marks may reflect one's ability to capitalize on these abilities in a more structured setting (Jacob 2002). Jacob even goes further and treats school marks as "non-cognitive" abilities, once cognitive abilities are taken into account. In the same vein, study habits may also be considered a form of "non-cognitive" abilities. It may in fact serve as a proxy for motivation to pursue further studies. To this end, YITS contains information on the number of hours the student spends per week doing homework, which we consider as a third measure of academic performance. The final measure of academic performance

4. Older high school dropouts may qualify to enter university as mature students.

is the ability to progress through the schooling system at the usual pace (i.e., whether or not the student repeated a grade). Jacob (2002) suggests that being held back may signal a lack of maturity.

Students were also asked how many of their friends were planning to pursue their education after high school. This information can capture peer influences on student educational outcomes. For the purposes of this study, the answers were grouped into three categories: *some or none*, *most* and *all*.

Finally, students may also consider the economic benefits of completing a university degree. To this end, we turned to the 2001 Census and calculated the ratio of mean earnings of university graduates to the mean earnings of high-school graduates who were paid employees and had no self-employment income during the year 2000.[5] For university graduates, we looked at 24- to 29-year-olds, while for high school graduates, we looked at 18- to 23-year-olds. This approach has been used to control for the expected differences in the number of years of experience between high school and university graduates (e.g., Burbidge, Magee and Robb 2002). We did this calculation for males and females in every city—i.e., census metropolitan area or census agglomeration area—and matched it to the sex and city of students in YITS. For students living outside of cities, we looked at the earnings ratio of each gender in all areas in the rest of the province—i.e., outside of all cities in the province. Although this measure does not draw its variation across the time dimension, which may yield more variability, it nevertheless has 135 potentially different values for each sex. Christofides, Hoy and Yang (2006) exploit national level time variation in the earnings premium, which yields 27 potentially distinct values from 1977 to 2003.

The parents of the students were also administered a questionnaire in 2000. Six pieces of information are used in this study: the presence of parents in the home—one parent present, two parents present but neither are birth parents, two parents present but only one is a birth parent, or two birth parents present; the sex of the parent most knowledgeable of the student; the highest level of education of either parent—no postsecondary certificate, a non-university postsecondary certificate, an undergraduate degree, or a graduate or professional degree; the quartile of total income in 1999—including earnings, investment income, and government transfer income;[6] parental expectations of the highest level of educational outcome of the child—a university degree or not; and, whether or not the youth repeated a grade in school.

3. A profile of girls and boys from birth to age 15

Gender differences in the early years

From birth, it would seem that boys generally lead a more tumultuous life than girls. This is true in the physical, developmental and behavioural aspects of life. Physically, boys are disadvantaged on several fronts. Out of every 1,000 live births, 5.8 boys die in the first year of life, compared with 4.7

5. We also used the ratio of median earnings and there was no discernable change to the results.

6. To account for differences in family size and their associated economies of scale, we calculated 'equivalent' income by dividing parental income by the square root of the family size. Based on equivalent income, students were categorized by quartile. The threshold levels of equivalent income for each quartile are $20,409 (25th percentile), $30,531 (50th percentile), and $41,000 (75th percentile). For a family of four, these are equivalent to twice these levels in unadjusted terms: $40,819 (25th percentile), $61,062 (50th percentile) and $82,000 (75th percentile). See Skuterud, Frenette and Poon (2004) for a more detailed discussion of equivalent income.

girls (Statistics Canada 2005). From the ages of 1 to 4, boys are considerably more likely to be hospitalized than girls. Specifically, 7,793 out of 100,000 boys are hospitalized during this period, compared with only 5,726 out of 100,000 girls (Canadian Institute of Child Health, 2000). According to the National Longitudinal Survey of Children and Youth (NLSCY), Cycle 4 (2000/2001), boys are also far more likely to be categorized as having activity limitations (15%) than girls (11%). Boys also lag behind girls on the developmental side of things in the early years. For example, from birth to three years only 12 % of boys are categorized as having advanced motor and social development, compared with 21% of girls (Canadian Institute of Child Health 2000). On average, five-year-old boys score 97.2 on a test of copying and symbol use compared with 104.3 for girls (Thomas 2006). Some 78 % of five-year-old boys often display independence in dressing compared with 87% of girls (Thomas 2006). Finally, boys have more behavioural problems than girls in the early years. For example, five-year-old boys display less attention (a score of 8.5) than girls (a score of 9.3), according to Thomas (2006). Some 16 % of 4- to 11-year-old boys display aggressive behaviour compared with only 9% of girls (Canadian Institute of Child Health 2000). Similarly, 14% of 4- to 11-year-old boys display hyperactivity compared with only 6% of girls (Canadian Institute of Child Health 2000).

Gender differences in the elementary school years

The relative challenges that boys face early in life may be exacerbated during the elementary school years for at least two reasons. First, 83% of elementary school teachers are women (2001 Census). This means that girls are far more likely to be taught by a same-sex teacher than boys during the first several years of school. A recent U.S. study using the National Education Longitudinal Survey found that both boys and girls benefited from a same-sex teacher (Dee 2005). The size of the effect was quite large. For example, it is estimated that just one year with a male English teacher would eliminate nearly one third of the gender gap in reading performance among 13-year-olds and would do so by improving the performance of boys and simultaneously harming that of girls. Similarly, a year with a female teacher would help girls partially catch up to boys in science and mathematics. Specifically, it would close the gender gap in science achievement among 13-year-olds by one half and entirely eliminate the smaller achievement gap in mathematics.

Second, independent of the teacher's gender, the natural assets of girls may be better suited for mainstream teaching *strategies*. In contrast, the natural assets of boys may be treated as problems in the school system. According to Julien and Ertl (2000), 10- to 11-year-old boys are less likely to work neatly and carefully (61%) than girls (82%), are more likely to get into many fights (35%) than girls (13%), are more likely to be restless, unable to sit still or display hyperactivity (49%) than girls (23%), and are less likely to show sympathy when someone else has made a mistake (32%) than girls (49%).

Gender differences in parental influences

Throughout the difficult early and elementary school years boys may be further harmed by the absence or lack of involvement of a same-sex parent. This is because of two reasons. First, following family dissolution, the mother is more likely than the father to take care of the children. According to the 2001 Census, 14.3% of boys lived with a lone mother, while only 2.9% of boys lived with a lone father. Furthermore, among two-parent families, the parent most knowledgeable of

girls is the mother in 78.7% of cases. By contrast, the father is the parent most knowledgeable of boys 24.3% of the time (YITS, Cohort A).

Gender differences at age 15

By age 15, boys and girls have very different characteristics (Figures A.1 to A.11 in the Appendix). We will now describe these differences in detail, using the main data source employed in this study (YITS, Cohort A). These differences will, in fact, serve to explain observed differences in university participation rates in the core of the paper.

On the academic stage, boys trail behind girls on several fronts. For example, boys have weaker performances on standardized reading tests (Figure A.1). Only 20.4% of boys score in the top 25% of the reading distribution. By contrast, 30.1% of girls score in the top 25%. Analogously, 30.3% of boys score in the bottom 25%, while only 19.5% of girls do so. There is an equally large gender divide in terms of overall school marks (Figure A.2). While only 31.9% of boys report marks of at least 80%, almost half of girls fall in the same category (46.3%). At the opposite end of the spectrum, 8.4% of boys report overall marks below 60%, compared with only 2.5% of girls. Boys and girls are also quite different in terms of the amount of time they spend on homework (Figure A.3). While 8.5% of boys spend no time on homework, only 2.5% of girls make the same claim. By contrast, only 30.3% of boys spend at least 4 hours per week on homework, compared with 41.2% of girls. Almost 1 in 10 boys (9.9%) repeat a grade in school, compared with 6.5% of girls (Figure A.4).

Boys and girls are also different in terms of their parental influences. Beginning with parental presence (Figure A.5), boys are less likely than girls to be in lone-parent families or in two-parent families where only one parent is biological. However, boys are more likely to be in two-parent families where neither parent is biological. In terms of direct parental influence, Figure A.6 suggests that the parent most knowledgeable of girls is far more often a parent of the same sex (79.8%) than in the case of boys (23.5%). In terms of socio-economic background, there is no clear advantage based on parental education (Figure A.7) or parental income (Figure A.8). However, Figure A.9 suggests that parents of 15-year-old girls are more likely to expect their 15-year-olds to complete a university degree (69.6%) than parents of 15-year-old boys (60.4%).

One's peers may also influence future plans. On that front, boys are once again at a disadvantage (Figure A.10). Boys are less likely to report that all of their friends plan on pursuing further education following high school (26.0%) than girls (36.1%). At the other end of the spectrum, boys are more likely to report that few or none of their friends plan on pursuing further education following high school (24.4%) than girls (15.8%). Finally, the direct economic benefits of completing a university degree are weaker for boys than for girls (Figure A.11). Specifically, the ratio of mean annual earnings of university graduates to the mean annual earnings of high-school graduates is smaller for males (2.55) than for females (2.81).

4. Results

The gender differences in socio-economic characteristics noted in the previous section may go some distance in explaining the gap in university participation, but only to the extent that the

characteristics themselves are associated with university participation. In Table 1, we show the results of regressing a binary university participation variable on the socio-economic characteristics of youth by gender and in a pooled model. In general, most of the characteristics are associated with university participation, and this is usually true for both genders. For example, performance on standardized reading tests, overall marks, and time spent doing homework are all positively associated with university participation. This is largely true for both boys and girls to the same extent. Not surprisingly, students who repeat a grade are less likely to attend university four years later, although the difference is not statistically significant, once factors such as overall marks and performance on the standardized reading test are taken into account. Girls and boys who grew up with two birth parents present are more likely to attend university than those who grew up with a lone parent. The sex of the parent most knowledgeable of the youth is positively associated with university participation for girls only. For boys, there is no significant association. As countless studies have found, parental education is positively associated with university participation. This is true for both girls and boys to the same extent. Parental income, on the other hand, is very weakly associated with university participation once other socio-economic characteristics are taken into account. However, the association is slightly stronger for girls than for boys. Boys in the second, third and fourth income quartiles are no more likely to attend university than boys in the first quartile of income. However, girls in the fourth income quartile enjoy an 8.2 percentage point advantage over girls in the bottom income quartile, after accounting for differences in other socio-economic characteristics. Even girls in the third quartile enjoy a 3.3-percentage-point advantage over girls in the bottom income quartile.

Another channel of influence of the parents is through their expectations of the child. Although increased parental expectations are positively associated with increased university participation, the relationship is stronger for girls. By contrast, the evidence on the influence of peers is much weaker. In fact, there is no significant statistical relationship between the future plans of peers and the probability of attending university. Finally, a higher university premium relative to high school is positively associated with a greater probability of attending university for boys, but not for girls. In other words, the relative economic benefits to a university degree are greater for girls (Figure A.11), but girls generally do not respond to these signals.

Table 1 Linear probability model results of university participation, by sex

	Boys		Girls		Pooled	
	b	t	b	t	b	t
P5≤Reading score<P10	0.006	0.31	0.072	1.78	0.024	1.21
P10≤Reading score<P25	0.018	1.08	0.040	1.16	0.017	1.14
P25≤Reading score<P50	0.053	3.46	0.089	3.13	0.058	4.11
P50≤Reading score<P75	0.075	3.98	0.159	5.22	0.106	6.40
P75≤Reading score<P90	0.161	7.17	0.215	6.03	0.175	10.23
P90≤Reading score<P95	0.163	4.74	0.225	5.48	0.183	8.14
Reading score≥P95	0.252	6.59	0.225	5.67	0.217	8.78
60%≤Overall mark≤69%	0.003	0.25	0.045	2.39	0.015	1.53
70%≤Overall mark≤79%	0.068	4.64	0.105	6.64	0.079	7.15
80%≤Overall mark≤89%	0.276	14.68	0.284	16.95	0.273	20.67
Overall mark≥90%	0.452	16.57	0.430	19.18	0.431	23.75
Does less than 1 hour of homework per week	0.023	2.47	0.017	1.25	0.011	1.41
Does 1 to 3 hours of homework per week	0.057	3.92	0.068	2.26	0.054	4.12
Does 4 to 7 hours of homework per week	0.098	6.34	0.111	3.75	0.096	7.09
Does 8 to 14 hours of homework per week	0.180	10.80	0.170	5.48	0.166	11.53
Does 15 or more hours of homework per week	0.164	4.64	0.154	4.44	0.146	6.64
Repeated a grade	-0.045	-0.76	-0.078	-1.50	-0.057	-1.45
Two parents, neither from birth	-0.002	-0.07	-0.106	-3.15	-0.025	-1.42
Two parents, one from birth	-0.021	-0.72	-0.025	-1.10	-0.025	-1.22
Two birth parents	0.037	2.05	0.036	1.92	0.035	2.46
Person most knowledgeable of youth is same sex	-0.007	-0.48	0.033	2.04	0.009	0.78
Parents have a non-university postsecondary certificate	0.032	2.81	0.020	1.25	0.028	2.75
Parents have an undergraduate degree	0.124	7.25	0.120	5.37	0.123	9.15
Parents have a graduate or professional degree	0.234	9.19	0.184	6.56	0.207	10.77
2nd parental income quartile	-0.013	-0.86	0.018	1.02	0.003	0.31
3rd parental income quartile	0.014	0.86	0.033	1.99	0.024	2.21
4th parental income quartile	0.009	0.51	0.082	4.08	0.044	3.69
Parents expect university degree	0.097	9.37	0.148	11.11	0.121	14.81
Most friends plan to further education after high school	0.001	0.06	0.000	0.01	-0.002	-0.15
All friends plan to further education after high school	-0.005	-0.31	0.023	1.33	0.011	0.90
University premium	0.045	3.67	0.022	1.16	0.027	2.18
Female	…	…	…	…	0.030	2.77
Intercept	-0.251	-6.67	-0.312	-4.09	-0.245	-5.97
Adjusted R^2	0.338		0.312		0.333	
Sample size	8,622		9,191		17,813	

… not applicable

Note: The t statistics are bootstrapped with 100 replicate weights. Percentiles are denoted by 'P.'

Source: Statistics Canada, Youth in Transition Survey, Cohort A.

We now proceed to decompose the overall gender gap in university participation. Recall that three methods are used, and although all results are shown in Table 2, our discussion will focus on the results from Method 3, where coefficients from the pooled model are used. From a qualitative point of view, the results are largely invariant to the choice of method. At the top of the table, we see that the overall gender gap in university participation at age 19 is 13.1 percentage points. This refers to the difference between the bars shown in Figure 1 in the introduction. The decomposition results

using Method 3 suggest that more than three quarters (76.8%) of this gap can be accounted for by differences in observable socio-economic characteristics. Results from methods 1 and 2 suggest that 94.0% and 71.2% of the gap can be accounted for by differences in socio-economic characteristics, respectively. Staying with Method 3, we note that the main factor is differences in overall marks. These differences account for nearly one third (31.8%) of the overall gap in university participation. Differences in performance on standardized reading tests account for a more modest 14.6% of the gap in university participation.

Table 2 Decomposition of the gender gap in university participation gap

	Method 1	Method 2	Method 3
Total gap in university participation at age 19	0.131	0.131	0.131
Explained proportion of gap	0.940	0.712	0.768
Unexplained proportion of gap	0.060	0.288	0.232
Proportion of gap explained by differences at age 15 in:			
Reading scores	0.160	0.142	0.146
Overall marks	0.306	0.336	0.318
Study habits	0.117	0.113	0.111
Repeated a grade	0.020	0.012	0.015
Parental presence	0.041	-0.015	-0.004
Sex of the person most knowledgeable of youth	0.144	-0.029	0.040
Parental education	0.001	0.003	0.002
Parental income	-0.014	0.000	-0.007
Parental expectations	0.104	0.069	0.085
Peer influences	0.018	-0.004	0.008
University premium	0.042	0.087	0.053

Note: In Method 1 (2), the explained portion of the gap is weighted by the coefficients from the male (female) regressions. In Method 3, coefficients from a pooled model are used.

Source: Statistics Canada, Youth in Transition Survey, Cohort A.

These results are interesting in light of a recent study investigating the main factors behind the income access gap (Frenette 2007). In that study, differences in performance on standardized reading tests accounted for a larger proportion of the gap than differences in overall marks between students from the top and the bottom income quartiles. In other words, the gender gap in university participation is more strongly linked to differences in performance at school, whereas the income gap in university participation is more strongly linked to differences in performance on tests of abilities that are not necessarily taught in school.

Another important factor behind the gender gap in university participation is the difference in study habits (i.e., time spent doing homework). This accounts for 11.1% of the gap in university participation. Note that in Frenette (2007), this factor had no explanatory power and was dropped early on in the study. The higher propensity of boys repeating a school grade only accounts for a negligible portion of the gap in university participation (1.5%).

Altogether, the four academic measures used in the study—overall marks, performance on standardized reading tests, study habits and repeating a grade—collectively account for 58.9% of

the gender gap in university participation. Another notable factor is differences in parental expectations. Overall, this accounts for 8.5% of the gender gap in university participation.

The other factors considered in the study each account for less than 6% of the gap. Included in this list is the difference in the university premium relative to high school, which accounts for only 5.3% of the gap. This is in contrast to a U.S. study by Jacob (2002) that finds that the university premium explains about one half of the gender gap. Aside from the fact that the Jacob study looked at U.S. data, the difference between his estimate and ours may largely relate to the time period examined. The Jacob study focused on the early 1990s, a period when the gender gap in university participation was much smaller (about 5 percentage points in the United States). By contrast, the gender gap in university participation in our study is more than 13 percentage points. It is also worth noting that the evidence in our study suggests that although the university premium is higher for women, they do not seem to respond to this signal. This was alluded to earlier in the discussion around Table 1. We noted that the university premium was positively associated with university participation among boys, but among girls there was no statistical association. Furthermore, girls report about the same level of importance of education in shaping their future career success as boys (Youth in Transition Survey, Cohort A). A final point relates to the importance one attaches to *relative* premiums. In absolute terms, boys actually gain more from a university degree compared with a high school diploma. The absolute gap for boys is $22,766, while for girls it is only $18,490. If youth are responding to absolute, rather than relative benefits, this would explain why the relative earnings premium does not account for a large portion of the gender gap in university participation. To test this hypothesis, we ran a pooled regression of boys and girls, and included both the relative and absolute premium variables. Although both coefficients were positive, only the coefficient for the absolute premium variable was statistically significant. This suggests that the differential absolute premium between boys and girls may actually work towards reducing the gender gap in university attendance. In fact, this is what a decomposition exercise suggests: the differential absolute premium accounts for -14% of the total gap in participation. The other results were invariant to replacing the relative premium with the absolute premium. The upshot of this discussion is that some doubt is cast on the notion that women are more likely to attend university because of the greater economic benefits of doing so, although further research is needed in the area to be more conclusive on the issue.

5. Conclusion

In 2003, some 38.8% of 19-year-old women had attended university, compared with only 25.7% of 19-year-old men. However, young men and women were about equally likely to attend college. Despite its importance, very little is known about the gender divide in university participation. In this study, we have used new Canadian data containing detailed information on standardized test scores, school marks, parental and peer influences, and other socio-economic background characteristics of boys and girls to try to account for the large gender gap in university attendance.

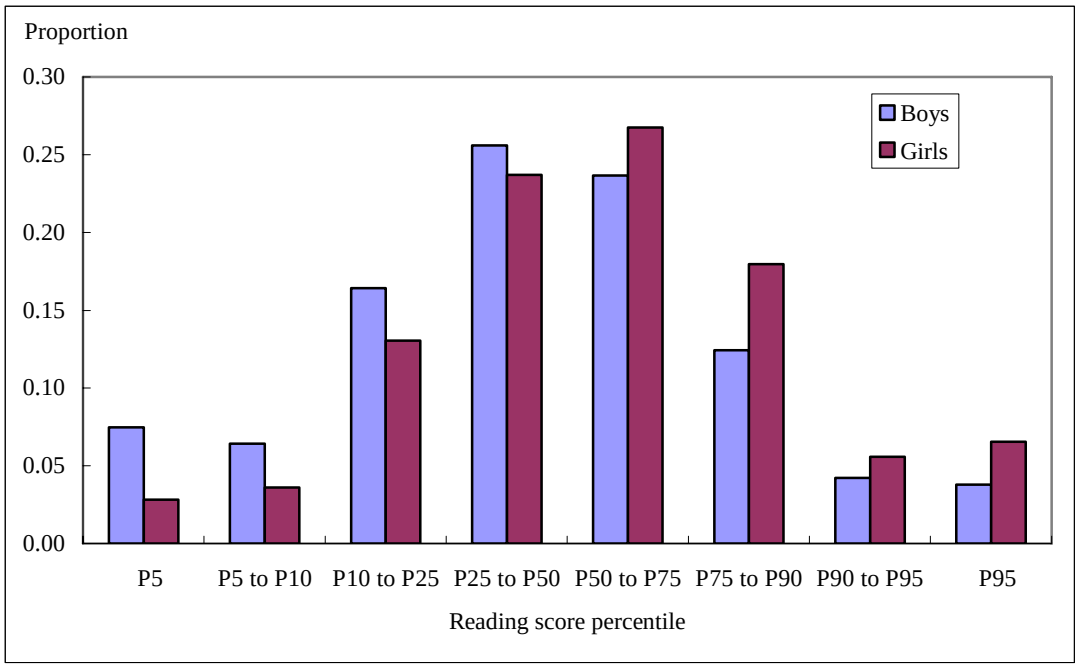
We find that differences in observable characteristics between boys and girls account for more than three quarters (76.8%) of the gap in university participation. In order of importance, the main factors are differences in school marks at age 15 (31.8%), standardized test scores in reading at age 15 (14.6%), study habits (11.1%), parental expectations (8.5%) and the university earnings premium relative to high school (5.3%). Altogether, the four measures of academic performance used in the

study—overall marks, performance on standardized reading tests, study habits and being held back a grade—collectively account for 58.9% of the gender gap in university participation. Overall marks account for a larger share of the gender gap in university participation than reading scores do.

Performance on standardized tests has been treated as an indicator of cognitive abilities (e.g., Carneiro and Heckman 2002). Overall marks, study habits and repeating a grade, on the other hand, have been treated as non-cognitive abilities by others, *once cognitive abilities are taken into account* (e.g., Jacob 2002). That is, overall marks may reflect one's ability to capitalize on cognitive abilities in a more formal setting, i.e., school. It may also reflect one's level of motivation or maturity, as can time spent on homework or repeating a grade. According to Heckman, Stixrud and Urzua (2006), cognitive abilities are only malleable in the early years, while non-cognitive abilities are malleable well into the teenage years. If this is the case, then it has important implications for the findings in this study, as well as in Frenette (2007). In that paper, performance on standardized reading tests accounted for a larger share of the income access gap in university participation than school marks. The implication, from a research point of view, is that the key to understanding the income access gap in university participation may lie in the early years—the pre-school years. By contrast, the findings in the current study suggest that a very large proportion of the gender gap in university participation relates to non-cognitive abilities displayed at school. As a result, understanding the female advantage in attending university may critically depend on understanding why girls outperform boys in elementary and high school.

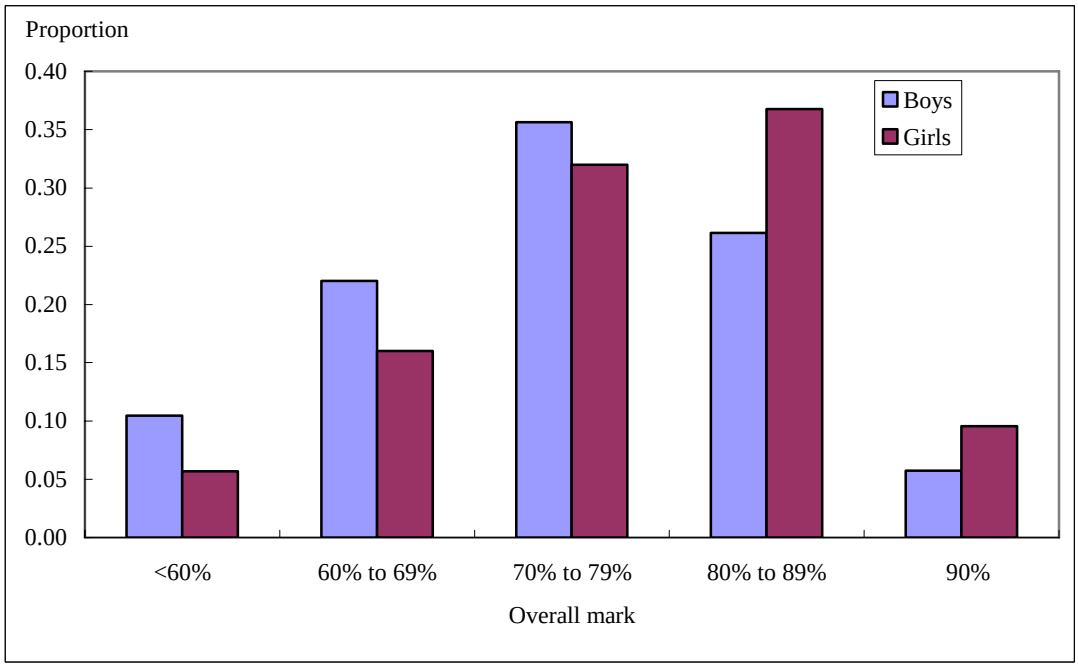
Appendix

Figure A.1 Distribution of reading score percentile, by sex



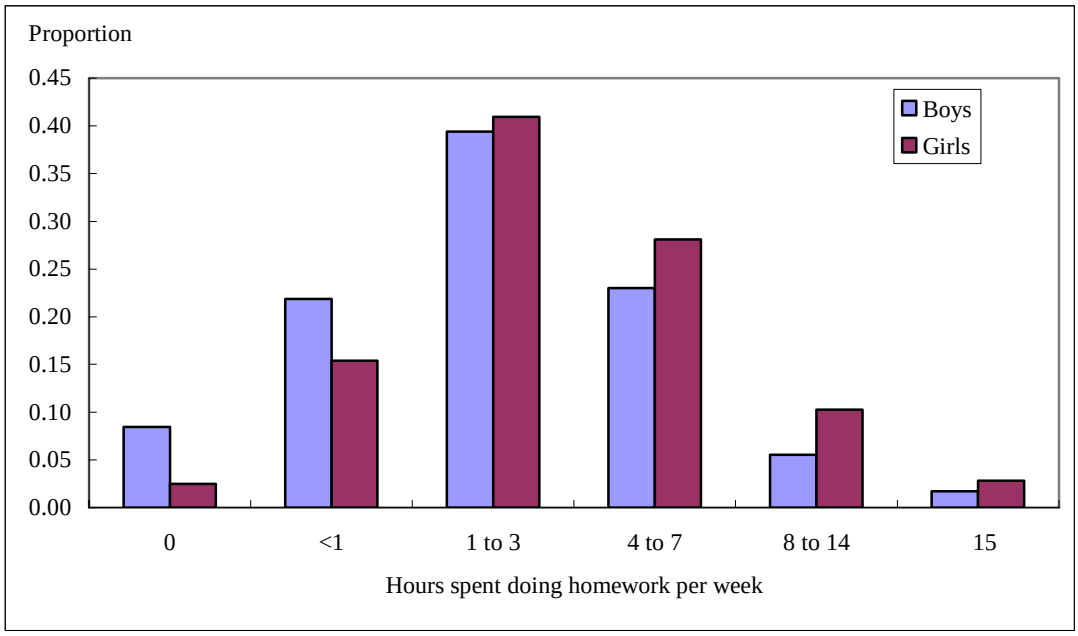
Source: Statistics Canada, Youth in Transition Survey, Cohort A.

Figure A.2 Distribution of overall mark, by sex



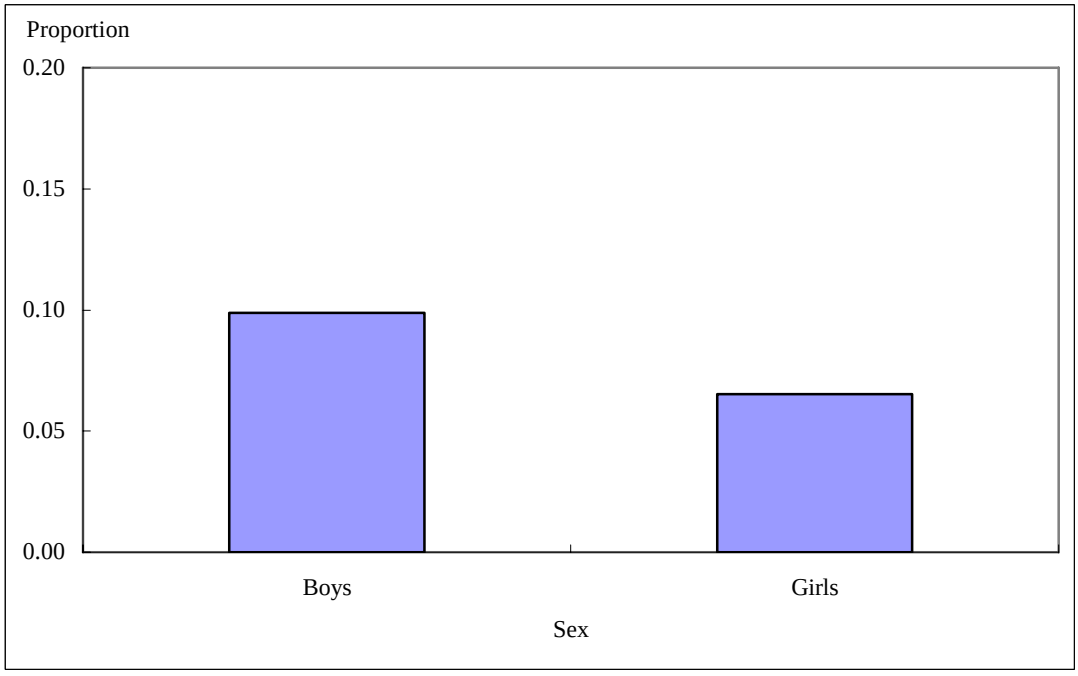
Source: Statistics Canada, Youth in Transition Survey, Cohort A.

Figure A.3 Distribution of hours spent doing homework per week, by sex



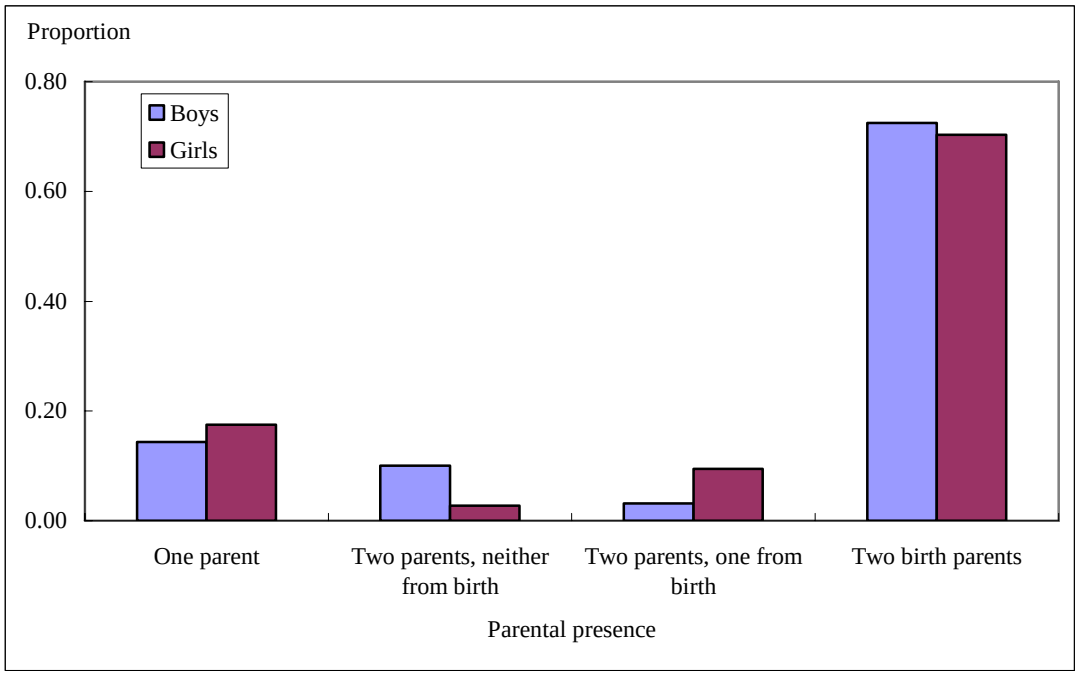
Source: Statistics Canada, Youth in Transition Survey, Cohort A.

Figure A.4 Proportion who repeated a grade, by sex



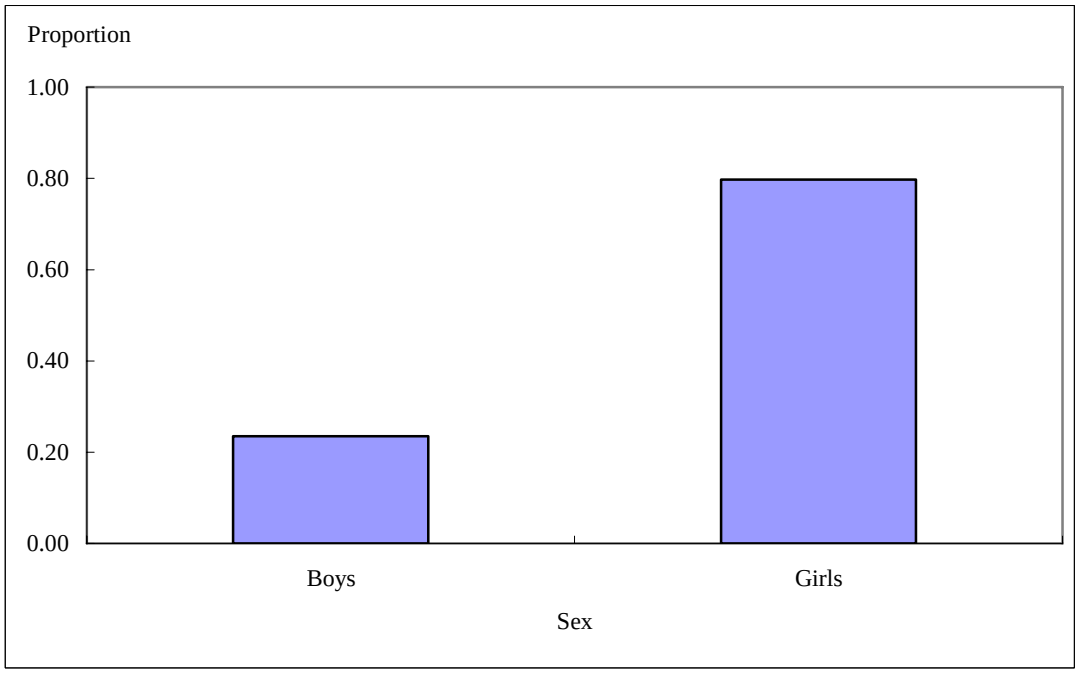
Source: Statistics Canada, Youth in Transition Survey, Cohort A.

Figure A.5 Distribution of parental presences, by sex



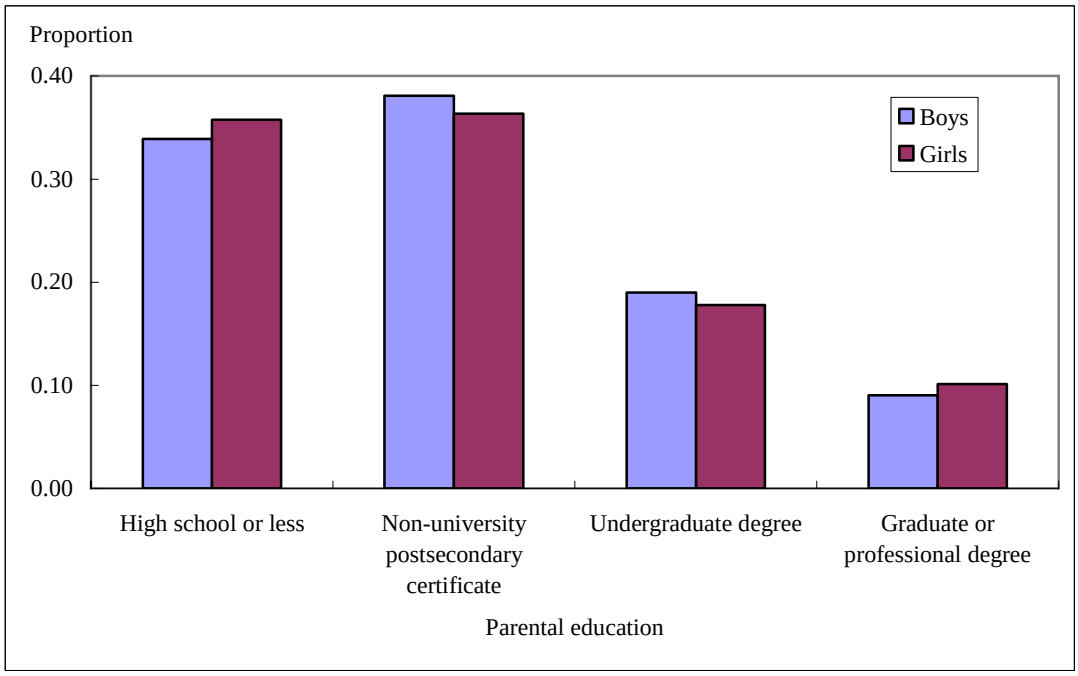
Source: Statistics Canada, Youth in Transition Survey, Cohort A.

Figure A.6 Proportion of youth whose parent most knowledgeable about the youth is the same sex as the youth, by sex



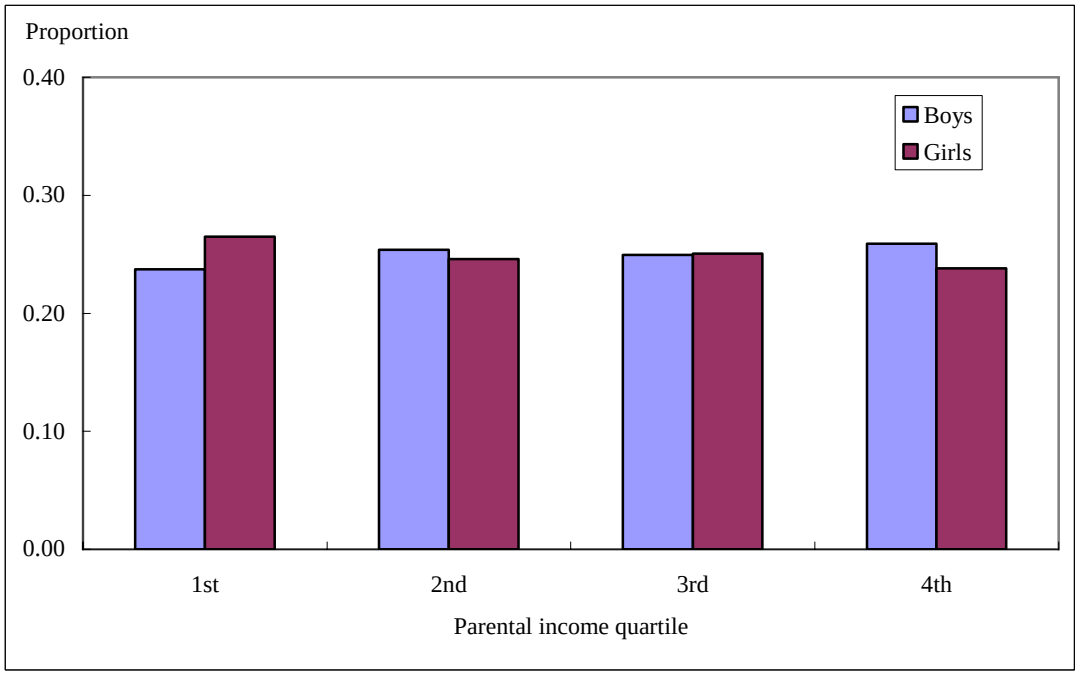
Source: Statistics Canada, Youth in Transition Survey, Cohort A.

Figure A.7 Distribution of parental education, by sex



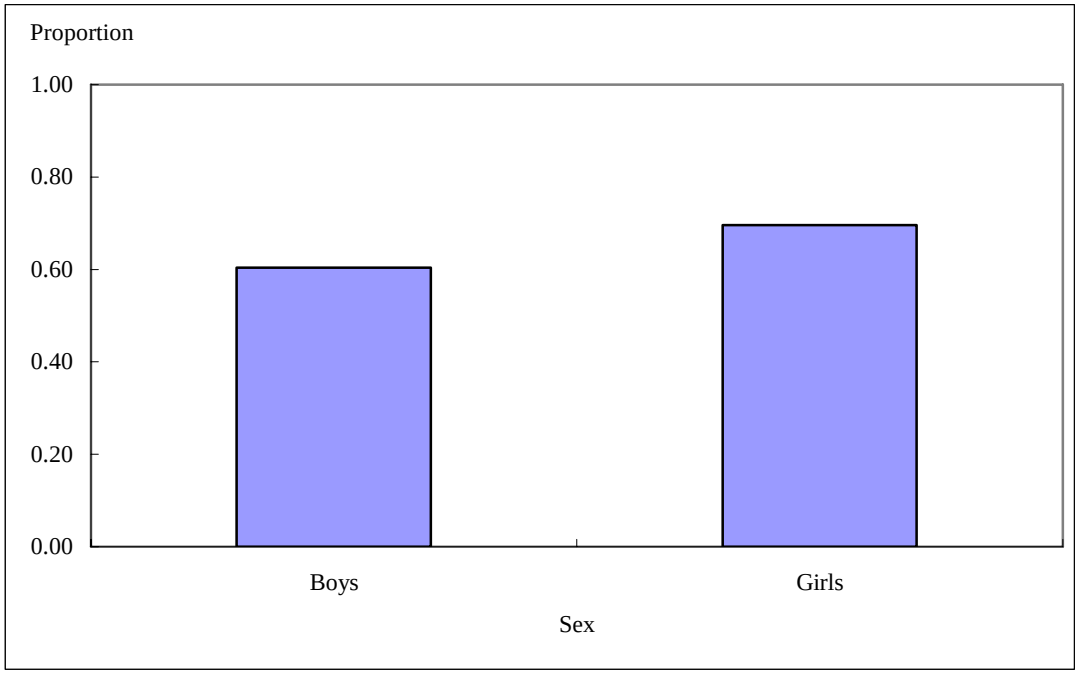
Source: Statistics Canada, Youth in Transition Survey, Cohort A.

Figure A.8 Distribution of parental income quartile, by sex



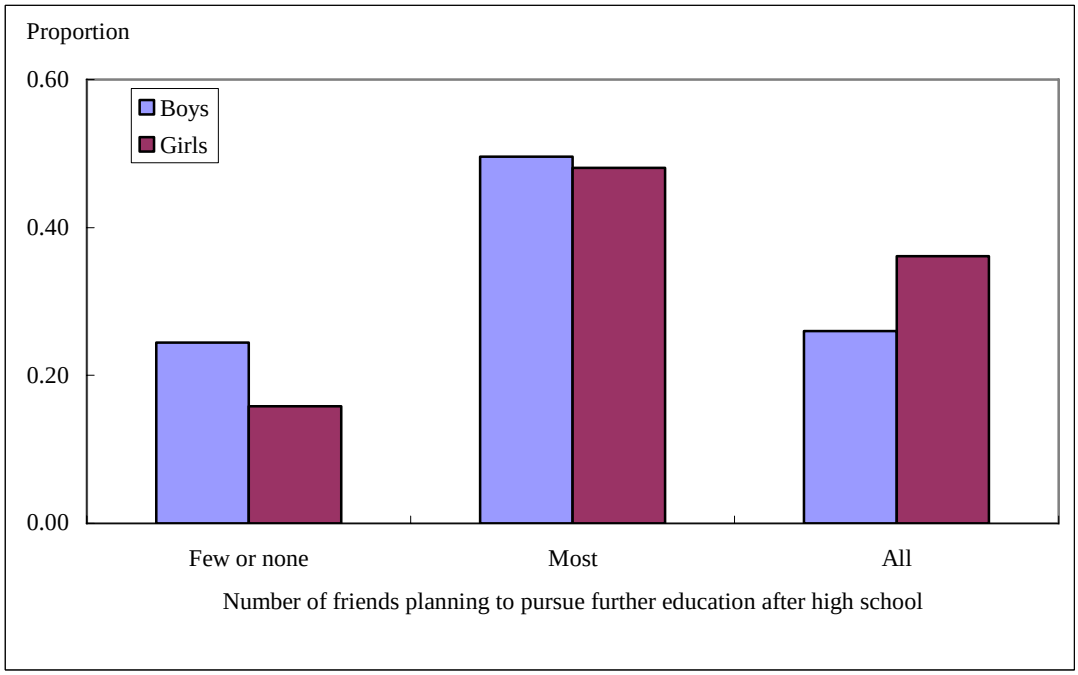
Source: Statistics Canada, Youth in Transition Survey, Cohort A.

Figure A.9 Proportion of youth whose parents expect them to complete a university degree, by sex



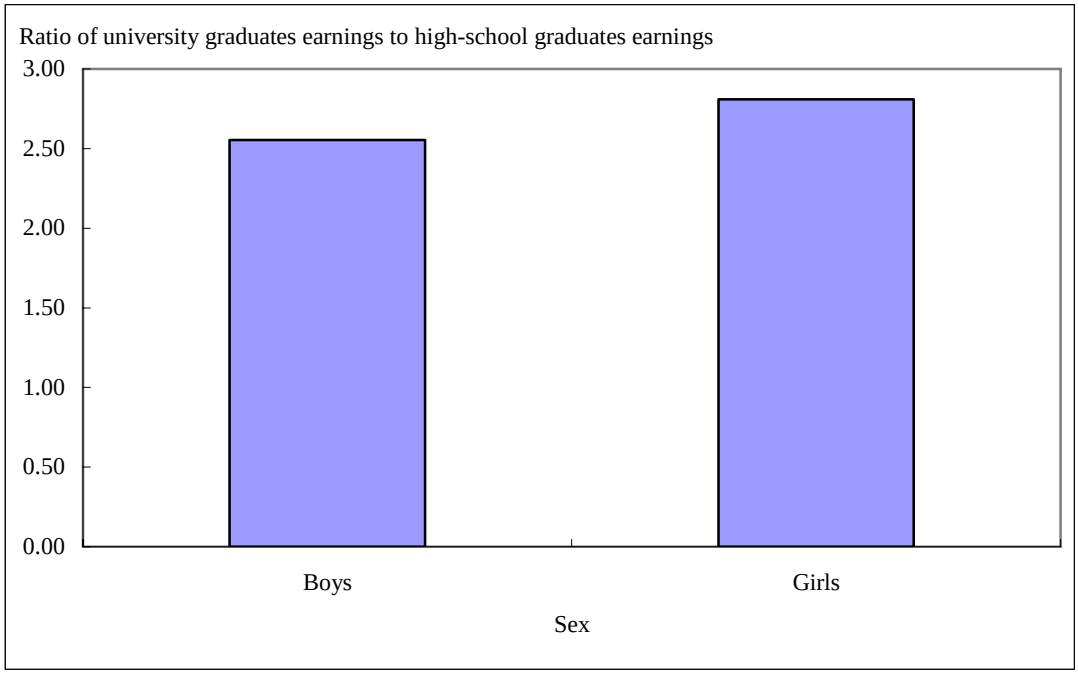
Source: Statistics Canada, Youth in Transition Survey, Cohort A.

Figure A.10 Distribution of the number of friends planning to pursue further education after high school, by sex



Source: Statistics Canada, Youth in Transition Survey, Cohort A.

Figure A.11 Ratio of university graduates earnings to high-school graduates earnings, by sex



Source: Statistics Canada, Youth in Transition Survey, Cohort A.

References

Blinder, A.S. 1973. "Wage discrimination: Reduced form and structural estimates." *Journal of Human Resources*. 8, 4: 436–455.

Burbidge, J.B., L. Magee and A.L. Robb. 2002. "The education premium in Canada and the United States." *Canadian Public Policy*. 28, 2: 203–217.

Canadian Institute of Child Health. 2000. *The Health of Canada's Children: A CICH Profile, 3rd Edition.* Ottawa: Canadian Institute of Child Health.

Carneiro, P., and J.J. Heckman. 2002. "The evidence on credit constraints in post-secondary schooling." *The Economic Journal*. 112, 482: 705–734.

Christofides, L.N., M. Hoy and L. Yang. 2006. *The Gender Imbalance in Participation in Canadian Universities (1977–2003)*. University of Guelph, Department of Economics Working Paper 2006-10. Guelph, Ont.: University of Guelph.

Dee, T.S. 2005. *Teachers and the Gender Gaps in Student Achievement*. National Bureau of Economic Research Working Paper No. 11660. Cambridge, MA: National Bureau of Economic Research.

Fairlie, R.W. 2003. "An Extension of the Blinder–Oaxaca Decomposition Technique to Logit and Probit Models." Yale University Economic Growth Center Paper No. 873. New Haven, CT: Yale Department of Economics.

Fairlie, R.W., and W.A. Sundstrom. 1997. "The racial unemployment gap in long-run perspective." *American Economic Review*. 87, 2: 306–310.

Frenette, M. 2007. *Why are Lower-income Students Less Likely to Attend University? Evidence from Academic Abilities, Parental Influences, and Financial Constraints*. Analytical Studies Research Paper Series. Catalogue no. 11F0019MIE2007295. Ottawa: Statistics Canada.

Goldin, C., L.F. Katz and I. Kuziemko. 2006. *The Homecoming of American College Women: The Reversal of the College Gender Gap*. National Bureau of Economic Research Working Paper No. 12139. Cambridge, MA: National Bureau of Economic Research.

Heckman, J.J., J. Stixrud and S. Urzua. 2006. "The effects of cognitive and non-cognitive abilities on labor market outcomes and social behaviour." *Journal of Labor Economics*. 24, 3: 411–482.

Jacob, B.A. 2002. "Where the boys aren't: Non-cognitive skills, returns to school and the gender gap in higher education." *Economics of Education Review*. 21, 6: 589–98.

Julien, A.-M., and H. Ertl. 2000. "Children's school experiences in the NLSCY, 1994/1995." *Education Quarterly Review*. 6, 2: 20–34. Statistics Canada, Catalogue no. 81-003-XIE. Ottawa: Statistics Canada.

Looker, D., and V. Thiessen. 2004. *Aspirations of Canadian Youth for Higher Education.* Final report. Learning Policy Directorate, Strategic Policy and Planning. Catalogue no. HS3-4/600-05-04E-PDF. Gatineau, Que.: Human Resources and Skills Development Canada.

Manning, A., and H. Robinson. 2004. "Something in the way she moves: A fresh look at an old gap." *Oxford Economic Papers*. 56, 2: 169–188.

Moffitt, R.A. 1999. "New developments in econometric methods for labor market analysis." In *Handbook of Labor Economics 3A*. Chapter 24. O. Ashenfelter and D. Card (eds.). New York: Elsevier.

Neumark, D. 1988. "Employers' discriminatory behavior and the estimation of wage discrimination." *Journal of Human Resources*. 23, 2: 279–295.

Oaxaca, R.L. 1973. "Male–female wage differentials in urban labor markets." *International Economic Review*. 14, 3: 693–709.

Oaxaca, R.L., and M.R. Ransom. 1994. "On discrimination and the decomposition of wage differentials." *Journal of Econometrics*. 61, 1: 5–21.

Skuterud, M., M. Frenette and P. Poon. 2004. *Describing the Distribution of Income: Guidelines for Effective Analysis.* Income Research Paper Series, 75F0002MIE2004010. Ottawa: Statistics Canada.

Statistics Canada. 2005. *Health Indicators.* 2005,1. Catalogue no. 82-221-XIE. Ottawa: Statistics Canada.

Thomas, E.M. 2006. *Readiness to Learn at School Among Five-year-old Children in Canada.* Children and Youth Research Paper Series. Catalogue no. 89-599-MIE2006004. Ottawa: Statistics Canada.