# University Participation and Income Differences: An analysis of applications by Ontario secondary school students

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for the Higher Education Quality Council of Ontario

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# Introduction

Postsecondary educational attainment is important for both the individual and society**.** A dilemma postsecondary educational institutions and provincial governments often face is how best to price the cost of attending a postsecondary educational institution. On the one hand, it has generally been shown that students with a postsecondary education earn more than those with no postsecondary education. But, on the other hand, it is believed that economic growth hinges on having a well educated society. The former argument leads one to argue for the student paying for tuition while the latter argues for subsidized tuition.

Tied into the debate about pricing postsecondary educational costs and promoting financial assistance programs is how best to encourage postsecondary education participation by students from economically disadvantaged households. Promoting equal access to higher education regardless of financial constraints promotes intergenerational income mobility, especially for students from less privileged backgrounds.

This report focuses on the link between postsecondary education participation and family income status as it relates to applications to Ontario universities. An equally important consideration would be to explore trends in applications to colleges and to explore the differences in application rates between colleges and universities across the income groups. In the future we plan to explore the dynamics between university and college applications across income groupings. Understanding these dynamics would be especially interesting if one could study overall differences between university and college application rates and also study differences between similar programs and differences based on tuition changes.

During the 1990s and early 2000s, secondary school students applying to Ontario universities experienced two major provincial policy changes and one university based

policy change.[1] The first provincial policy change was a 1997 announcement that permitted the move towards deregulated tuition rates for bachelors and advanced degree programs in areas such as engineering, law, commerce, and medicine.[2] Tuition rate hikes resulting from this announcement started to take effect in the 1998 and 1999 academic school years. The second provincial policy change was a reorganization of the secondary school curriculum and the elimination of the Ontario Academic Crecit (OAC) year.[3] The elimination of the OAC year most dramatically affected postsecondary applications in 2003 when both graduates of the OAC year and grade 12 were scheduled to proceed to university. Also during this time frame, many universities initiated scholarship programs that awarded scholarships to all registered students that entered university with an average of 80 per cent or higher. The universities differed in the levels of the scholarships, the grade cut offs to qualify for the scholarships, and the year in which these scholarships were adopted.[4]

These policies potentially affected applications by students from different family backgrounds. Students from low income backgrounds were potentially negatively affected by high tuition rates. The higher achieving students from low income backgrounds, however, were also potential beneficiaries of the university merit based scholarships. One would expect that students from higher income backgrounds, would not be as affected (at least in regard to whether to apply) by the higher tuition rates. High achieving students from moderate income backgrounds who qualify for only student loans or for no form of needs-based aid, could benefit dramatically from the merit based scholarships. The potential effect from the curriculum change eliminating the OAC year on students from different family backgrounds is less clear. Differential effects on students could result from the curriculum changes resulting in adjustments in student

[1] In addition there were a number of changes during this period to the Ontario Student Aid Program that also affected access to financial aid. For example, a major switch in the program was to require that all students qualifying for financial assistance first qualify for a student loan and, only secondarily, qualify for grants. A study of the effects of the student aid program on university participation, however, is outside of the scope of this report.
[2] In 2004 and 2005, the province instituted a tuition freeze, temporarily stemming tuition hikes universities might have imposed as result of the tuition deregulation policies introduced in the late 1990s.
[3] The OAC year refers to the former OS:IS curriculum in which students needed to complete 6 OAC credits to apply to university. This generally took the form of a fifth year and was often referred to as grade 13.
[4] See Dooley, Payne and Robb (2008) for more detail on these scholarships. In addition, in 1998 the Canada Millennium Scholarship Foundation was created and in 2005 the Ontario Access Grant was introduced.

demand for courses needed for entry into university, delays in entering postsecondary education, among other things.

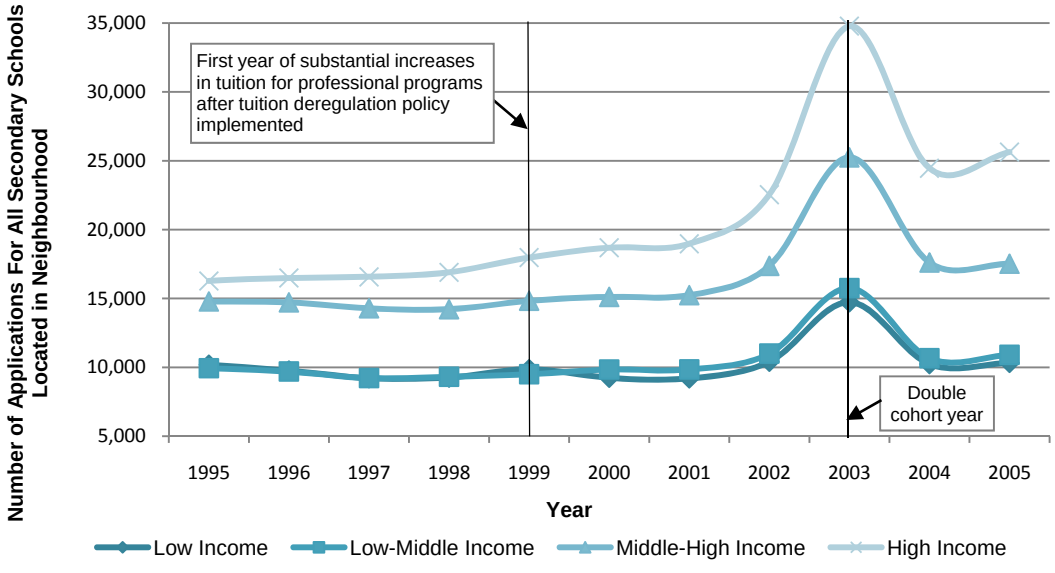
There is a substantial set of research papers that study the relationship between family income or family educational background and participation in postsecondary education (see e.g., Bouchard and Zhao, 2000; Christofides, Cirello and Hoy, 2001; Corak, Lipps and Zhao, 2003; Bowlby and McMullen, 2002; Tomkowicz and Bushnik, 2003; Barr-Telford et al., 2003; and Drolet, 2005).[5] The strong consensus in this literature is that there is a positive and sizeable relationship between post secondary participation and family background. Students from higher income backgrounds are much more likely to go on to university than are students from lower income backgrounds. There has been less success in this literature in finding any link between increased tuition at universities and a growing gap in participation rates between students from low income and high income backgrounds. One exception to this is the recent paper by Marc Frenette who finds that "enrolment patterns by socioeconomics background changed substantially in Ontario, where the deregulation of professional programs was most prominent".[6] His focus is on Law, Medicine and Dentistry where tuition in Ontario increased three to five-fold over the period he studied. Moreover, rather than studying participation, he studies whether graduates from university would go on to these 'second-degree' professions. While these second-degree professional programs had extremely large tuition increases, some first-degree professional programs (mainly Business and Engineering) were also deregulated in the late 90s and this might well have impacted the allocation of students of low income parents to academic programs in Ontario. Moreover, tuition fee increases in other programs could have made it more difficult for students of low income parents to proceed to university. This paper attempts to shed light on these issues.

Figure 1 plots the number of applicants to Ontario Universities by income quartile and shows results similar to the participation rate findings referred to above.[7] In this figure we grouped applications for full-time admission to Ontario universities by students attending

[5] This research has relied primarily on data sets from surveys that capture information on students across all of Canada, including data from the Survey of Consumer Finances, the Survey of Labour and Income Dynamics, and the General Social Survey.
[6] Frenette (2008), p.89.
[7] Data sources are discussed fully in the section on 'Data Set Development' below.

an Ontario secondary school into four quartiles based on the income characteristics of the neighbourhood in which their secondary school is located. Consistent with previous studies, the greatest number of applications are from secondary schools located in the neighbourhoods in the highest income quartile. The fewest applications are from secondary schools located in the two lowest income quartiles. Around the time that the tuition deregulation policy took effect, applications by students across all income quartiles remained relatively flat.

**Figure 1**. Total Number of Applications* to Ontario Universities, Secondary Schools Grouped by Income Level




*Note: Applications by students attending a publicly funded English language secondary school and seeking full time

The most obvious feature of this figure, however, is the spike in applications in 2003, known as the double cohort year. There is a clear spike in the graphs of all four income quartiles in 2003 and smaller increases in 2002 and 2004. These latter effects, which are often referred to as "the shoulders" are thought to represent applicants who attempted to avoid the competition and crowding of the double cohort by applying earlier or later than

the 'normal' progression through secondary school.[8] It would appear that the double cohort increase is larger in the high and middle-high income secondary schools than is the increase for the two lower income quartiles.

Outside of the double cohort period, the trend in applications within each income quartile differs across the four groupings. The number of applications from students in secondary schools in the highest income quartile gradually increased. Between 1995 and 2005, the number of applications increased from slightly more than 15,000 to 25,000 applications, representing a 67 per cent increase in annual applications. Applications from secondary schools in the second highest income group also have increased, but at a much more modest rate. Total applications within this group increased from approximately 15,000 to 17,500, representing a 17 per cent increase in annual applications. For the two lowest income quartiles, the annual number of applications has, for the most part, remained flat. Figure 1 suggests two potentially disturbing issues: first, there is a significant gap between applications to university by students based on the income quartile in which their secondary school is located, and, second, this gap appears to be increasing. This figure alone, however, only tells a partial story. Missing is information about the potential pool of students that could apply to university and how this pool has changed over the period under study. Also missing is any analysis that explores non-income measures that could be correlated with income and could help explain differences in application rates and their trends as well as a more detailed analysis of the differences in program and location choices made by students.

This report explores these two issues in greater depth. We explore the trends in university applications and registrations in Ontario between 1995 and 2005. Our analysis focuses primarily on discerning differences attributable to differences in household income. Beyond Figure 1, we confirm that there have been differences in the rate of applications across income groups and that the gap between low and high income groups widens in more recent years. We find, however, little discernable evidence that

[8] In addition, students may have needed to apply more than one year for university admission given space was limited.

registration rates (conditional on application) vary across income groupings. Thus, the bigger policy issue concerns the decision to apply to a university.

While overall application rates do not seem to react to increases in tuition rates, there is some evidence to suggest that the tuition increases have had some effect on the distribution of students across programs of study. The two programs we study that have experienced the greatest increases in tuition are commerce and engineering.[9] There is a noticeable decline in the application rate of students in low income neighbourhoods to commerce programs. However, we discern little difference in the application rate of students from low income neighbourhoods to engineering programs. We have observed that a high proportion of applicants to engineering programs have a secondary school average that is greater than 85 per cent. Thus, many of these applicants would qualify for the university merit scholarships that are based on secondary school averages. In our analysis, we explore whether the fairly constant trend in applications to engineering programs across income groupings is attributable to these merit scholarships.
As will be explained in more detailed below, this study has been limited by data availability. Under ideal circumstances, one could track students through secondary school and for the first several years after secondary school. With this tracking, one could observe the course options available to students in a given secondary school, the course selections by the students, student performance in these courses, and then the application and registration by the students into postsecondary institutions within a few years of leaving secondary school.

There are two studies that have gathered information from various sources to capture most of the transitions identified above. For example, King, et al. (2005) studies the effects of the elimination of the OAC year and associated curriculum changes on student applications to colleges and universities in 2003. Their research involved data gathered in 2000 and later years concerning student marks and applications/registrations to Ontario's colleges and universities but does not specifically look at links between neighbourhood characteristics and postsecondary education participation. Researchers affiliated with

[9] We focus on entrance to first year undergraduate studies, and are not considering the medical, law and dental programs which are the main focus of Frenette's (2008) study and which had even more substantial fee increases.

the Toronto District School Board have, in more recent years, linked secondary school student performance, neighbourhood characteristics, and applications to postsecondary educational institutions (see e.g., Brown, 2005). Their studies, however, have been limited to those students attending a secondary school within their board.

These studies illustrate that it is possible to link administrative data across several sources to build a comprehensive set of measures at the student level. But to date, these studies have limited the period of coverage and/or the set of students studied. Given the richness of the administrative data that have been collected by Provincial ministries, school boards, postsecondary institutions and other organizations in Ontario, one could build and maintain a research ready data set on Ontario students. Such a data set could be accessed by researchers to study important issues that would help us to understand issues that affect access to postsecondary educational institutions.

This report is organized as follows. First we describe the data used for this report. Second, in three sections we analyze the data using a variety of statistical techniques. Finally, we discuss our analysis from a policy context and briefly conclude.

# Data Set Development

This section contains a brief description of the data used for this report. More detailed information is available from the authors of this report. There are three key data sources used for our study: student level applications from the Ontario University Application Centre (OUAC); grade and school level measures for publicly funded secondary schools in Ontario from the Ministry of Education; and neighbourhood socio-economic characteristics obtained from the 1991, 1996, 2001 and 2006 Censuses from Statistics Canada.

The OUAC data cover applications by all Ontario secondary school students who applied for full time admission in the fall of 1995 through 2005. We study only students from secondary schools that contain a regular progression from elementary to secondary school to focus on a subset with a relatively homogeneous educational background. We

exclude students from adult education centers, treatment schools, night schools, and special education schools.

We confined our analysis to students attending a publicly funded secondary school in the English system. Across Ontario, less than 5 per cent of secondary school students attend a private school. While a publicly funded school will draw heavily from the residents that live close to the school, this is not necessarily the case for a private school. This is the primary reason for our exclusion of private secondary schools from our analysis which relies on neighbourhood characteristics.

Our focus on the English speaking system is due to the difference in postsecondary options for English speaking and French speaking students. Francophones seeking a postsecondary education in institutions in which the courses are taught in French have relatively few options in Ontario. More options can be found in neighboring Quebec. As we do not have information about applications to Quebec universities by Ontario secondary school students, we are limited in what can be done to understand better the application decisions of francophone students. Moreover, given the distance many Francophone students must travel to attend a Francophone secondary school (within some regions of Ontario), the link between the neighbourhood characteristics in which a school is located and a student's residential characteristics may be more tenuous than for the English speaking students. With greater information, it would be beneficial to study application patterns by students attending francophone schools.

For each Ontario secondary school we have the reported enrolments by grade level, the type of school (e.g., Public, Separate [Catholic]), and the results of the grade 9 math exam administered to all students since 1998 by the Educational Quality Accountability Office (EQAO). We created a variable based on the share of the grade 9 students at the secondary school that received a level 3 or 4 (the top two grades) on the province wide exam.[10] As our application data covers a period prior and subsequent to the introduction of the EQAO tests, we construct a measure that is an average for the years for which we have data for the secondary school in question.

[10] We discuss the role for and rationale of this variable later when we introduce it in the multivariate analysis.

Using the first three characters of the secondary school's postal code, we identified the Forward Sortation Area (FSA) in which the secondary school is located.[11] We matched the census data for the FSA to the secondary school to capture the socio-economic characteristics of the residents living near each secondary school.[12] We matched the schools to the 1991, 1996, 2001, and 2006 censuses. We then developed a linear interpolated set of measures that allow the census measures to vary on a yearly basis. All dollar amounts used were adjusted to a real value using 2002 as the base year. The median number of households within an FSA is 10,598. The number of households in an FSA based on 2001 figures ranges from 365 to 53,665. We grouped the secondary schools, based on the average household income for the FSA in 2001, into four quartiles.[13] Secondary schools in the lowest quartile ("low income") are those with an average household income that is less than $54,503 (in 2001 dollars). Secondary schools in the next lowest quartile ("low-middle income") are those with an average household income that ranges between $54,503 and $60,000. Secondary schools in the third quartile ("high-middle income") are those with an average household income that ranges between $60,000 and $75,196. And secondary schools in the highest quartile ("high income") are those with an average household income that is greater than $75,196.[14]

[11] An FSA is the first three characters of the postal code (e.g. "M6S" of postal code "M6S 1H6"). These designations are defined by Canada Post and represent the postal facility from which mail delivery originates. In 2001, there were 510 FSAs in Ontario. The neighbourhood measures help to control for the socio-economic characteristics of the residents in the area in which a school is located. In some instances, the students attend a high school from an area that extends beyond the school's forward sortation area.

[12] Alternatively, the postal code of the secondary school could be matched with to a census enumeration area (EA). EAs cover a much smaller geographic area than FSAs. A given secondary school, however, will draw students from multiple EAs. In comparing basic socio-economic characteristics across EAs affiliated with a given FSA we have found little significant difference in these characteristics across the EAs. We, therefore, opted to use a geographic coverage that was more likely to approximate a secondary school's catchment area.

[13] For all schools in our sample we used one observation, the 2001 FSA average household income. In instances where there are multiple schools located in a given FSA, the average income measure for that FSA is used more than once in creating the quartiles.

[14] By using only the household income for 2001 we are fixing the quartile into which a secondary school is placed. Alternatively, we could have allowed the quartile for the schools to vary across the sample period. Most FSAs, however, remain within the same quartile over time. Using this alternative method for allocating schools across the income distribution does not significantly change the analysis in this report.

This results in the following distribution of secondary schools across the income quartiles:[15]

| | Number of Public Secondary Schools | Number of Separate Secondary Schools |
|---|---|---|
| ***Low Income*** | 125 | 45 |
| ***Low-Middle Income*** | 131 | 33 |
| ***High-Middle Income*** | 123 | 44 |
| ***High Income*** | 106 | 60 |

Of the 667 schools under study, 115 are located in FSAs with only one school. Another 151 schools are located in an FSA that contains 2-3 secondary schools. This latter phenomenon can be partly attributed to public and separate secondary schools with overlapping catchment areas and some specialized secondary schools that are located near traditional secondary schools. The FSAs that contain many secondary schools are located in the rural areas of Ontario.

Across the quartiles, the distribution of Public and Separate secondary schools varies. The distribution of the public schools is roughly the same for the lower three quartiles, with slightly fewer (22 per cent) located in high income neighbourhoods. A higher share of the Separate secondary schools are located in the high income neighbourhoods (33 per cent). The low income and middle-high income neighbourhoods have roughly the same number of separate secondary schools, with the low-middle income neighbourhoods having the fewest separate secondary schools.
For each secondary school we calculated the distance to the closest college and university campus. Based on these distances we developed two measures: one to indicate if the university was located within 40 kms and one to indicate if the college was located within 40 kms.

As income measures may also be correlated with other socio-economic characteristics of the neighbourhood, we also developed the following measures to reflect these other characteristics using the census data: an indicator variable equal to 1 if the share of the

[15] The schools are not equally distributed across the quartiles because more than one school may be affiliated with the same FSA and we chose not to randomly allocate the schools at the margins to different quartiles.

population aged 15-19 is above the median; an indicator variable equal to 1 if the share of one-parent families is above the median; an indicator variable equal to 1 if the FSA is in a rural area (the second character of the FSA is "0"); and separate measures for the share of the population that is of European descent, the share that is of South-West Asian descent, and the share that is of East-Asian descent.[16]

The table below reflects the differences in the means of these measures across the income quartiles. There are more secondary schools with a low share of the population aged 15-19 in the low income quartiles than in the others. The neighbourhoods of schools in low income quartiles have a very high share of one-parent households, especially when compared to the schools in the high income neighbourhoods. While there is relatively little variation in the average share of the population of European descent, there are lower average shares of the population of South-West Asian and East Asian descent in the bottom two quartiles than in the upper two quartiles. There are very few schools in rural areas in the high income neighbourhoods.

[16] These shares are based on the Statistics Canada definitions. Our excluded category in our analysis are all other ethnic descents. From previous research, we found that including shares for ethnic descents that are underrepresented in the population does not affect the analysis dramatically as there tends not to be sufficient variation in the shares. The bulk of the share of the population that is in the excluded group are those from North America.

| *Average Statistics Reported* | Low Income | Low-Middle Income | Middle-High Income | High Income |
|---|---|---|---|---|
| ***Share of Population Aged 15-19 is Above Median*** | .31 | .53 | .52 | .66 |
| ***Share of Families with One Parent is Above Median*** | .73 | .54 | .49 | .14 |
| ***Share of Population of European Descent*** | .25 | .31 | .26 | .28 |
| ***Share of Population of South-West Asian Descent*** | .03 | .03 | .06 | .06 |
| ***Share of Population of East Asian Descent*** | .03 | .03 | .08 | .08 |
| ***Share of Schools in Rural Area*** | .18 | .25 | .19 | .03 |
| ***Share of Schools with High Proportion of High Performance on EQAO Grade 9 Test*** | .39 | .55 | .50 | .78 |
| ***Share of Schools with Low Enrolments*** | .12 | .17 | .09 | .02 |

From the Ministry of Education we incorporated information on pupil assessments (as measured by the EQAO grade 9 math test results) and on small-sized schools. We developed an indicator variable for school performance which is equal to 1 if the school has more than 50 per cent of high performing students (level 3 or 4). Across the income groupings, the share of schools with a high proportion of high performance on the EQAO grade 9 tests is lowest in the low income neighbourhoods and highest in the high income neighbourhoods. Identification of low enrolment schools is important for two reasons. First, with lower enrolments schools are less able to offer a variety of courses which can limit a student's options for pursuing courses that would allow him or her to go onto university. Second, with lower enrolments there can be bigger yearly swings in the university application rate. Our low enrolment measure is an indicator variable that equals 1 if the school's enrolment is in the smallest 10 per cent of all schools under study in that year. Similar to our measure that identifies schools in rural areas, there is a higher proportion of low enrolment secondary schools in the bottom two quartiles than in the upper two quartiles.

We could readily identify the annual number of university applicants (and registrants) for each of the secondary schools under study from the OUAC data. In developing an applicant rate we faced two challenges. The first challenge was to identify an appropriate denominator to reflect the potential pool of students that could apply to university. In

Ontario, students must decide in grade 9 and/or grade 10 to pursue a stream of courses that will allow them to apply for university admission. As courses in grades 11 and 12 often have prerequisites, a decision not to pursue the grade 9/10 university level courses could make it onerous for a student to take the courses in grades 11 and 12 (and 13 in earlier years) that would allow them to gain admission into an Ontario university. One option might be to develop a denominator that is based on the number of students within a secondary school that are eligible to apply to university based on having taken courses within the university stream. We think, however, that using such a measure for the denominator takes too narrow a view of the access problem as it ignores students that could have applied if they had taken the right types of secondary school courses and it ignores students that drop out of secondary school.

We use as a proxy for the potential applicant pool the number of students who were enrolled in grade 10 for the cohort of applicants under study.[17] Prior to the elimination of the OAC year, our denominator would be the grade 10 enrolment three years prior to the application year. We chose grade 10 enrolments as we wanted to ensure that we include students prior to the age at which they may drop out of secondary school.

Our second challenge was to address how best to deal with the elimination of the OAC year during our sample period. The last official year of offering the OAC year was in 2002. If the elimination had occurred discretely, for students enrolling into university in the fall of 2003, we should have expected there to be two cohorts of applicants in 2003 – those graduating after having completed the OAC year (the grade 10 class of 2000) and those graduating after having completed grade 12 (the grade 10 class of 2001). The transition from the elimination of the OAC year, however, was not so discrete. Instead, the move from a 5- to a 4-year secondary school attendance was adopted more gradually. This delayed transition affected our calculation of an appropriate denominator for the transition period.

[17] A downside to using the grade 10 enrolments for a cohort of applicants is that students may move into or out of a given secondary school between grade 10 and the year of application. Our assumption is that there are relatively stable enrolments in the secondary school for a given cohort of students. With better data, we could observe student enrolment patterns and develop a more refined measure of our applicant rates.

Prior to the application year of 2002, our denominator is the grade 10 enrolment for the secondary school three years prior to the year of application. For example, for application year 2001, we use the grade 10 enrolment for the secondary school in 1999.[18] Starting in application year 2002, our denominator needed to reflect both the proportion of grade 10 students that could be expected to apply to university during grade 12 and the proportion of grade 10 students that could be expected to apply to university during the OAC year. The application year 2002 was the year just before the double cohort year. Thus, while most students applying in 2002 would be in the OAC year, there was a small proportion of students finishing early (think of them as being in grade 12) that applied early in order to avoid the congestion in applications expected in the double cohort year. During the double cohort year (2003), there were students applying from the first cohort completing the new curriculum and graduating from grade 12 and the last cohort finishing the OAC year. This year represents the biggest bulge in applications across the two cohorts of students. Subsequent to 2003, there continued to be students applying from two cohorts.[19] Thus, to create an appropriate denominator, for each grade 10 cohort subsequent to 1999 we needed to allocate a proportion of the students to the grade 12 application year for that cohort and allocate the remaining students to the OAC application year.

To develop the allocation proportions, we examined the birth years of the observed applications: essentially we compared proportions of 17, 18 and 19-year-olds in each application pool. Based on this information, we developed the proportions of grade 10 enrolments as reflected in the following table. Starting with the 2002 application year, a given grade 10 cohort enrolment is allocated across two application years. For example, the 2000 grade 10 enrolment is allocated across the 2002 (15 per cent) and 2003 (85 per

[18] Note that the application year represents the year in which a student would be enrolled in university. Thus the year of application is during the spring of the student's final year in secondary school. The secondary school enrolment data is usually as of the fall year of the secondary school. To make the comparisons between secondary school year and enrolment year comparable, we use the year as of the spring term of the secondary school enrolment. For example, for school year 2000/2001, our enrolment year is identified as being 2001.

[19] There would be students following the new curriculum completing on time (12 years of schooling) and some who chose to do the courses a bit more slowly thereby completing a year late so as to avoid the double cohort. As well there would be some students repeating courses to get a better university placement given that they could not get the program of choice in the double cohort year.

cent) application years. We applied the same enrolment shares across all secondary schools.[20]

| *Year of graduation/application* | Share of Grade 10 Enrolment 3 Years Before Application (Year of Grade 10) | Share of Grade 10 Enrolment 2 years Before Application (Year of Grade 10) |
|---|---|---|
| ***1995-2001*** | 100% | 0% |
| ***2002*** | 100% (*1999*) | 15% (*2000*) |
| ***2003*** | 85% (*2000*) | 80% (*2001*) |
| ***2004*** | 20% (*2001*) | 88% (*2002*) |
| ***2005*** | 12% (*2002*) | 92% (*2003*) |

In the analysis that follows, we developed three types of key measures for each secondary school:

- A Smoothed Application Rate. The number of applicants in a particular year divided by the corresponding smoothed (grade 10) denominator (as explained above).

- The Registration Rate: The number of university registrations reported (Ontario universities only) in a given year from a given secondary school divided by the number of applications in the secondary school. Note, the product of this registration rate and the smoothed application rate would yield a smoothed registration participation rate which would measure the fraction of grade 10s in a school that subsequently go on to register.[21]

[20] For a small proportion of schools, namely those that opened during the period under study, we adjusted the calculation of the denominator to reflect grade 11 and/or grade 12 enrolments if the information from the grade 10 enrolments and/or grade 11 enrolments were not available.
[21] This would not include, however, students who sat out for a year or two between secondary school and university as we deal here only with direct applicants to universities.

- Smoothed Application Rates by Program of Study (based on the applicants' first choice selection).[22] We group the application based on the first choice program to which an applicant applies and divide this number of applicants by the smoothed grade 10 cohort enrolment. The programs have been grouped as follows: Arts, Science, Commerce, Engineering, and Other. The category 'Other' includes programs that are direct entry programs such as Math, Education, Journalism, and Nursing.

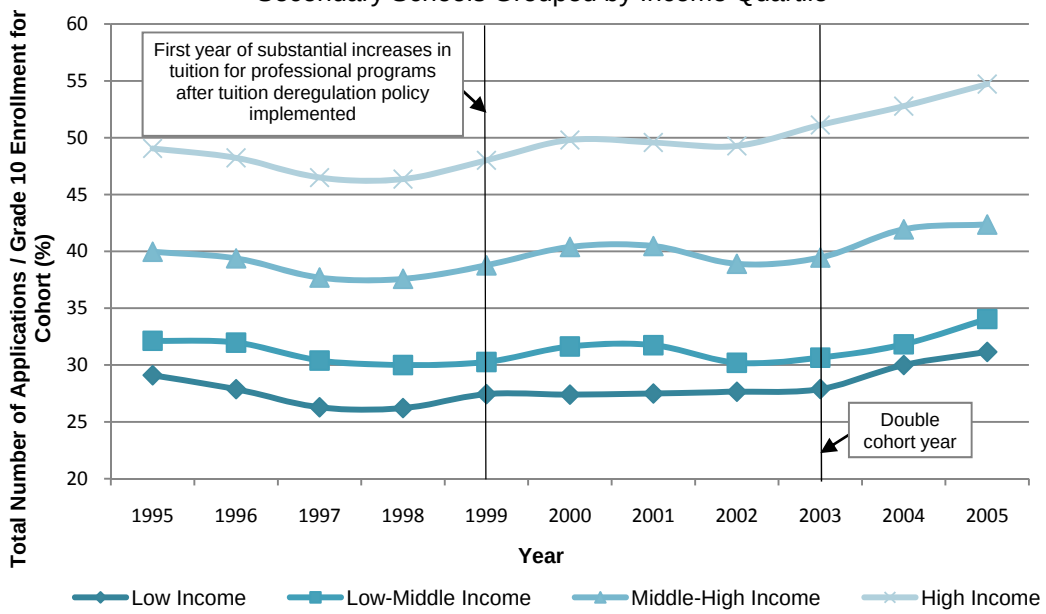
# Overall Trends in University Applications

The first stage in our analysis is to examine the differences and trends in applications and registration rates after grouping the secondary schools into our four income quartiles. As explained in the introduction, studying only total applications by income quartiles provides only a partial story. In the analysis that follows, we use three figures to explore trends in overall application and registration rates.

Figure 2A graphs the smoothed application rates by income quartile. A smoothing algorithm, as explained in the last section, has been employed to attempt to remove the effect of the double cohort by recognizing that, in 2003, two cohorts of secondary school students were finishing up secondary school and applying to university. The graphs of these smoothed application rates show no evidence of the spikes in 2003 that were apparent in the number of applicants and we would argue that our method of smoothing has been successful. Moreover, that the observations for 2003 seem 'on the trend line' is further support for this approach.

[22] Applicants rank their choices of program and university and have three choices for one application fee. In recent years, additional choices could be purchased at the time of application. First, second and third choices could all be at the same university in different programs or in the same program at different universities.

**Figure 2A.** Trends in Adjusted Application Rates*, Secondary Schools Grouped by Income Quartile

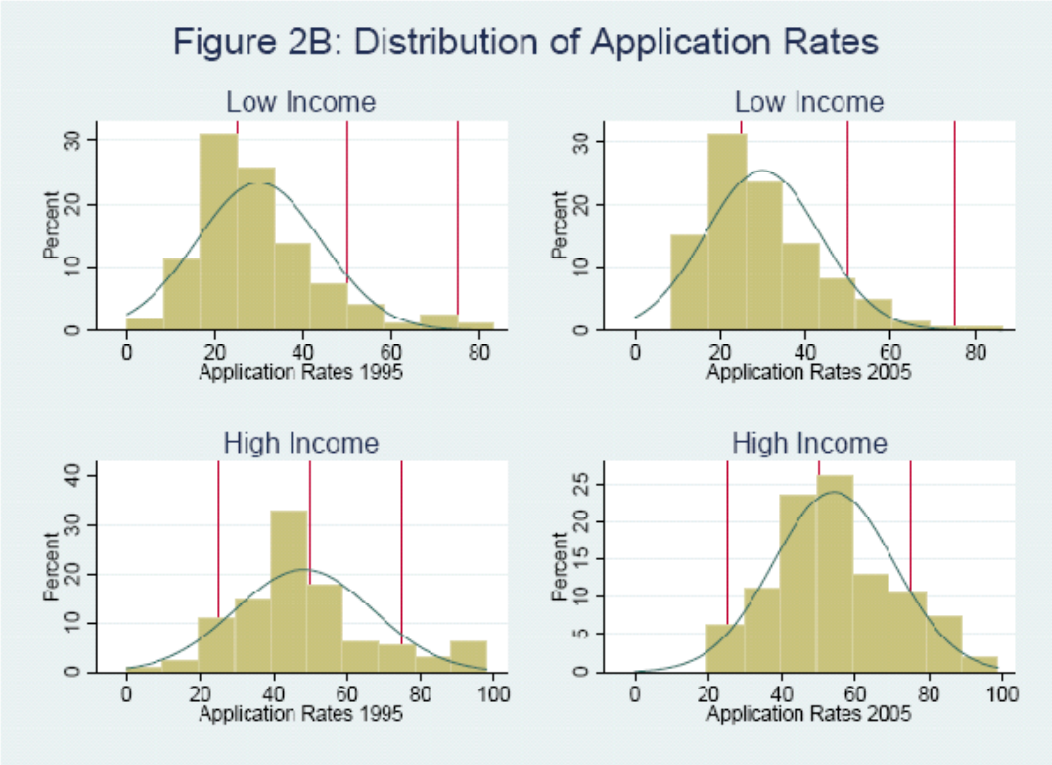



*Note: Adjusted to smooth denominator during period of elimination of the OAC year

Figure 2A has not, however, removed the implication that schools located in higher income areas have higher application rates. There is a strong rank ordering of the application rates across the four income groupings. The application rates for the schools in the highest income quartile were close to 50 per cent during the 1990s and reached 55 per cent by 2005. In contrast, the application rate for the second highest income quartile hovers around 40 per cent throughout the period. The application rate for the two lowest income quartiles for most of the period is just above 30 per cent and just below 30 per cent for the second and lowest quartiles, respectively. What might account for these differences? As previous literature has demonstrated, there are a number of explanations that can be offered: the ethnic mix of the neighbourhood, the size of the school, the closeness of postsecondary institutions, whether students are in a separate secondary school, and so on. Any of these variables could be correlated with income of the school catchment area. We explore these alternatives in the next section, using a multivariate analysis.

Figure 2A also reveals that over the period shown application rates (as well as applications) have increased among schools in all income quartiles. The increases in the top two quartiles began in the late 1990s while application rates of the lower two quartiles remained roughly constant until the last two years when they have risen somewhat. The increases are somewhat larger in the higher income schools.

The application rates depicted in Figure 2A reflect the average rate that is observed for each income quartile across all schools. Within an income quartile, do all schools experience a similar application rate? In Figure 2B we explore the distribution of application rates in 1995 and 2005 for the bottom and top income quartiles. In each panel, the x-axis identifies the application rate; the y-axis depicts the share of schools for the group for each application rate. The distributions of the application rates for 1995 are depicted in the two left panels. These distributions are markedly different between the low and high income quartiles. The application rate distributions for the schools in the low income quartile are left-skewed, with more than 40 per cent of the schools having an application rate at or below 25 per cent. In contrast, the distribution of schools in the high income quartile is much more a symmetric distribution with a good proportion of the secondary schools centered on an application rate of about 50 per cent.

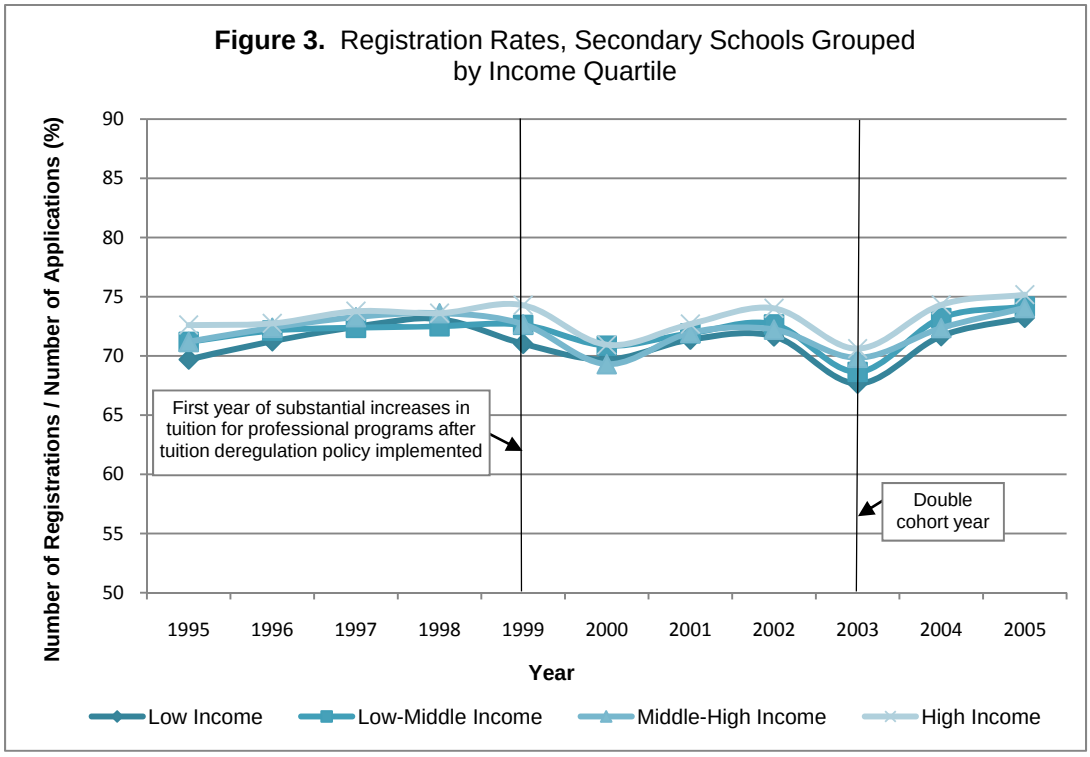



The distributions of the application rates for 2005 are depicted in the two right panels. The shapes of the distributions for the low and high income quartiles are similar to those depicted for 1995 applications. The distribution of the schools in the low income quartile, for the most part has moved ever so slightly to the right. The distribution of the schools in the high income quartile has moved quite noticeably to the right. In 1995, between 50 and 60 per cent of the high income secondary schools had an application rate of less than 50 per cent. In 2005 less than 40 per cent of these secondary schools had an application rate of less than 50 per cent.

Figure 2B illustrates that the propensity to apply to university across the secondary schools varies differently across the income quartiles and that the trend in application rates for the low income secondary schools has uniformly been different from the high income secondary schools. With more information about the secondary schools and the students attending these schools, one could explore the reasons for this difference. For

example, one could explore differences in secondary school course selection, secondary school counseling, and other policies that could promote greater university participation. Figure 3 turns to registration rates – the fractions of applicants who end up registering in an Ontario university in the year in question. Here we see that a high proportion of the applicants register and that the differences between the low income and high income registration rates are tiny when compared to the differences in application rates.[23] The difference here is about 2 percentage points whereas the difference between application rates of high and low income schools is larger than 20 percentage points.[24] The key difference across income groupings is on the rate of application, not registration. In the remaining sections of the paper we will focus on the application rates.[25]

**Figure 3.** Registration Rates, Secondary Schools Grouped by Income Quartile




[23] Each applicant can make multiple applications. The denominator here is the number of applicants, not the number of applications

[24] For the most part the registration rates across programs are similar to that reported in Figure 3.

[25] Even if applications from a secondary school and registrations from that secondary school are quite similar, overall, across income groups, had we focused instead on registrations, the allocation to different programs (Arts, Science, etc.) might have been different.

Before moving on from Figure 3, we want to draw attention to the dip in registration rates (at all school income levels) in 2003. This may be because in the double cohort year students may have had difficulties in getting an offer due to university capacity constraints and either deferred their registration to university or selected an alternative postsecondary institution such as a college or a university in another province or state. It may be too that very good students (who tend to have higher registration rates, given an application) were more concentrated in the 2002 application year. This would have the effect of raising the registration rates in 2002 and lowering them in 2003 – that is, a composition effect. It will be difficult to distinguish between these two possible effects with the data available.

## Multivariate Analysis of Overall Application Rates

In the last section we explored various differences and trends in application rates using a categorization of Ontario secondary schools based on the average income for the neighbourhood in which the secondary schools are located. The similarities/differences we noted across such categories may be attributable to income. There are, however, a number of other factors that are correlated with income and that could help explain the differences in application rates. To explore more broadly the correlation among income and other socio-economic and school characteristics, in this section we report the results from a multivariate regression analysis. We regress the yearly smoothed application rate of the secondary school on a series of correlates. Our goal is to better discern the differences in application rates that may be attributable to differences in income.

In Tables 1 and 2, the dependent variable is the smoothed application rate as described in the data development section above. Column 1 of Table 1 reports the simplest regression[26] – one with only dummy variables to indicate the income quartile from which

[26] Although simple in terms of the number and variety of regressors, it should be noted that the analysis takes account of non-independence of observations within school (clustering at the school level) and calculates robust standard errors using a Huber/White/sandwich estimator.

the observation is drawn.[27] As before, the four quartiles are named 'Low', 'Low-Middle', 'Middle-High', and 'High'. The 'Middle-High' income dummy is omitted to avoid a well-known singularity problem and the coefficients on the dummy variables of the other income groups indicate the difference from the Middle-High group. The interpretation of this first regression is that applications from the 'Middle-High' group of schools are at about 39 per cent of the 'potential applicants', while applicants from the lowest income group run at about 10 percentage points ***lower*** than that rate and applicants from the highest income schools run close to 12 per cent higher.[28] There is a clear progression in these rates by income group and the differences are statistically significant (that is, different from the omitted category). Since there are no other 'controls' in this regression, this is basically putting numerical estimates to the differences in heights of the graphs in Figure 2A. The remaining columns of Table 1 explore additional correlates of the application rates and allow us to see whether or not the differences between income levels are moderated as we control for other variables.

[27] There are also dummy variables (fixed effects) for each of the years in this as well as in later regressions. The coefficients on these 'year effects' are not reported in the tables but are available from the authors. In this first regression, and in most others, the dummies indicate an initial decline in application rates followed by increases in the last two years. These are much like the results reported in the charts.

[28] These estimates apply to the first year of the data since the dummy variable for that year is the excluded category. The effects in other years would be shifted up or down depending on the sign and size of the 'year effect'.

**Table 1 - University Application Rates**

| | smoothed application rate | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| Type of Secondary School | | | |
| Secondary school in low-income quartile | **-9.93** | **-5.81** | |
| | (1.48) | (1.17) | |
| Secondary school in low-middle income quartile | -7.75 | -3.63 | |
| | (1.49) | (1.08) | |
| Secondary school in high income quartile | **11.55** | **7.78** | |
| | (1.80) | (1.46) | |
| Secondary school in area with lowest quartile of adults with university degree | | | **-8.50** |
| | | | (1.00) |
| Secondary school in area with 2nd lowest quartile of adults with university degree | | | **-4.93** |
| | | | (0.87) |
| Secondary school in area with top quartile of adults with university degree | | | **11.03** |
| | | | (1.28) |
| Census Neighbourhood Characteristics | | | |
| Above median for share of population aged 15-19 | | **-2.50** | -0.17 |
| | | (0.83) | (0.70) |
| Above median for share of families with one parent | | 0.36 | **-2.92** |
| | | (0.97) | (0.85) |
| Share of population of European descent | | **-10.69** | -0.88 |
| | | (5.34) | (5.08) |
| Share of population of Southwest Asian descent | | 8.59 | 11.10 |
| | | (5.91) | (5.92) |
| Share of population of East Asian descent | | **55.22** | **34.78** |
| | | (8.06) | (7.28) |
| Secondary School Characteristics | | | |
| More than 50% of EQAO grade 9 test takers with a score of 3 or 4 | | **9.81** | **8.07** |
| | | (0.86) | (0.81) |
| Separate secondary school | | **2.07** | **1.95** |
| | | (0.94) | (0.85) |
| School has low enrollment (enrollment within year's 10th percentile) | | -1.97 | -2.23 |
| | | (1.31) | (1.19) |
| School in rural postal code | | **-3.63** | **-3.12** |
| | | (1.00) | (0.91) |
| University within 40 kms of secondary school | | **4.24** | **2.04** |
| | | (0.95) | (0.91) |
| College within 40 kms of secondary school | | 1.91 | **3.30** |
| | | (1.10) | (1.02) |
| Constant | **39.08** | **28.63** | **29.50** |
| | (1.25) | (2.14) | (1.95) |
| Number of Observations | 6826 | 6826 | 6826 |
| Number of secondary schools | 667 | 667 | 667 |
| R-squared | 0.23 | 0.49 | 0.54 |
| Other co-variates | Year effects | Year effects | Year effects |

Note: robust standard errors clustered at the school level in parentheses
Coefficients that in bold are significant at a p-value <5%

Column 2 of Table 1, in addition to income, controls for population and school characteristics. First let us examine how the coefficients for the income groups are changed. There is little change in the significance of the coefficients but there is a noticeable change in magnitude. The table below makes it easy to appreciate these changes by showing the 'predicted' application rates by income quartile with and without the other control variables included in the regression.[29] Within each income group, the share of applicants that is attributable to the income measure decreases once we add in the controls. The reason for this is that income can serve as a proxy for other types of socio-economic measures when they are not included in the analysis. When we control for these socio-economic measures, the association between income and the application rates decreases. Across the income groups there are differences in application rates. The differences across the income groups are clearly smaller when the controls are included indicating that some of the differences observed initially in Column 1 are accounted for by the other factors included in the regression reported in Column 2. Nevertheless, the differences remain substantial with the application rate from the high income schools being about three-fifths larger than the application rate from the low income schools. In all cases, both with and without controls, the standard errors are small relative to the size of the coefficient and one would conclude that the differences are statistically significant.

| ***Income Quartile*** | **Coefficient from Regression with No Controls** | **Coefficient from Regression with Controls** |
|---|---|---|
| ***Low*** | 29.2 | 22.8 |
| ***Low-Middle*** | 31.3 | 25.0 |
| ***Middle-High*** | 39.1 | 28.5 |
| ***High*** | 50.6 | 36.4 |

How are the controls themselves related to the application rates? The first 5 additional variables represent aspects of the demographic profile in the area in which the schools

[29] Note that the range shown sets all variables other than income variables (and the constant) to zero. Setting these variables to their means would just add to (or subtract from) each number above and leave the range unchanged.

are located. The first variable in the list (above median for share of population aged 15-19) is a variable that takes the value of one if the area has an above median fraction of 15 to 19- year- olds and zero otherwise.[30] Having a large concentration of 15 to 19-year- olds is associated with a lower application rate to university. This may be a financial issue (some families may have too many children to think of sending any to university) or may reflect cultural or ethnic differences (less educated parents are less likely to send children to university and have larger families) or reflect some other aspect of communities. In any event it is a statistically significant effect.

The next variable (above the median for share of families with 1 parent) is also a dichotomous variable taking the value of 1 for areas with a large share of single parent families. This variable too might have mattered because financial considerations may differ between families with one or two parents with respect to university participation. In this specification, the correlation with application rates is slightly positive but not statistically significantly different from zero (no correlation).

The next three variables represent the demographic background of individuals living in the area in which the secondary school is located. These variables too are from the census and are based on questions about ancestral ethnic background.[31] It is well known that future educational attainment of children is differentiated by ethnic background so it made sense to control for these differences so as not to confuse income group differences with ethnicity. Geographic areas with heavy concentrations of individuals with European backgrounds have lower application rates while areas with a heavy East Asian population have much higher application rates.[32] Large shares of Southwest Asian descent do not lead to statistically significant differences in application rates.

[30] To be more specific, this variable (and the following four demographic variables) is based on values for the 1996, 2001 and 2006 censuses. We use a linear interpolation to create annual values for these measures. The census subdivisions in which the school is located are ranked by the proportion of 15 to 19-year-olds resident therein. Those in the top half of the ranking are assigned the value 1 while those in the bottom half are assigned the value zero.
[31] The question asked was: “To which ethnic or cultural groups(s) did this person's ancestors belong”?
[32] Note that the variable is a fraction such as 0.10 if the population makes up 10 per cent so that the size of the coefficients should be reduced to reflect this share (e.g. 53*.10 = 5.3). The large coefficients would be typically multiplied by a small number in calculating the size of any effect.

The next few variables represent aspects of the schools themselves. The first is based on secondary school math EQAO performance in grade 9. As explained above, the EQAO performance in a secondary school is observed for only a few years during the period under study. For the period 1998 to 2001, we attribute the performance of the students based on this short period across all years. The purpose of using this measure is to attribute a potential difference between schools within the income quartiles that is reflective of a measure of student preparedness at the beginning of a student's secondary school career. The measure used in the regression analysis is a dichotomous variable with a value of 1 for schools with high performance in the EQAO tests and its association with application rates is as one might expect. Schools with a better prepared group of pupils tend to have higher rates of application to university. This effect is quite large. In this regression, the estimated difference between application rates from low and high income group schools is about 14 percentage points. Being in the top half of the distribution of EQAO scores would more than offset half of this difference.[33]

The next variable is an indicator variable for a Public or Separate school with the value set to 1 for a Separate school. The coefficient suggests that application rates are slightly higher for students attending a Separate secondary school (given all the other characteristics). Whether this has to do with 'selection of students', differences across the two systems with respect to the preparation for university by the secondary schools, or the type of communities separate schools find themselves in, is not explored.
Do smaller secondary schools and schools in rural areas have different application rates? The next two variables explore these aspects. Low enrolment does not seem to play a statistically significant role, but being in a rural area does seem to reduce the likelihood of university application. Whether this has simply to do with rural life and career choice or has to do with postsecondary institutions being distant is explored in the next two variables. These are dummy variables taking the value of 1 if there is a university or

[33] We explored whether the EQAO measure affected schools in low income neighbourhoods differently from the other schools. We could not find a statistically significant difference. In general, the application rates in schools with better prepared students are higher, regardless of the average income of the neighbourhood in which the school is located. This result also leads to a rejection of the view that it is just the low incomes that are leading to the low EQAO scores and the scores are not an independent measure.

college within 40 kms of the secondary school.[34] For the most part, if a secondary school is near a university, it is also near a college. We did not expect to measure statistically different effects for both of these measures. As per our expectations, the coefficient on the measure for being close to a university is positively correlated with a higher application rate. The coefficient on the measure for being close to a college, however, is not statistically significantly different from zero. Our conclusion is that being close to a postsecondary institution is positively correlated with higher application rates.

It is always difficult to disentangle the effects of parental income and parental education on the educational activity of children and so we present in Column 3 an alternative analysis based on the education of adults over 25 living in the geographic areas in which the secondary schools are located. The adult education variables we include in Column 3 are based on the proportion of adults in the area of the secondary school with a university degree. Parallel to what we have done with income, we assign the secondary schools to quartiles based on the proportions of adults with university degrees and create dummy variables for the four groups. Again, we omit the middle-high dummy and this category serves as the base case. In general, the results of this analysis are very similar to the analysis based on income. The range of estimated application rates across these groups is from about 21 per cent to just over 40 per cent which is not far off the range of about 22 per cent to 36 per cent in the case of income variables.[35]

Most of the control variables reported in Column 3 have effects similar to those in the case of income. The ones that change are three of the demographic variables (youth, population share and shares of European descent) which lose significance in this specification. We expect that the reason for this is that the education level of adults in the area is more closely linked to these other demographic variables than is income. In contrast, the coefficient on the measure for single parent families becomes significant, suggesting that single parent status is closely correlated with income but not educational background. To explore further these differences would require more detailed data at the

[34] The 40 km cut-off was chosen because it is an important parameter of the Ontario Student Assistance Program (OSAP) funding formula. If a student must travel more than 40 km to university, he/she is eligible for funding of living expenses through OSAP.
[35] The control variables are set to zero in this calculation as in earlier calculations as explained in a footnote.

applicant level. In any event, the main message is still clear. Secondary schools located in areas with low income or low education attainment of the adult population have much lower application rates than secondary schools located in high income or high education attainment geographic areas.[36]

Table 2 considers some other specifications of the university application rate equation. Column 1 includes interactions between being in the lowest income quartile and the variable indicating the secondary school is in an area with the highest quartile of adults with a university degree. The interaction term has a strong positive effect. In fact, the effect is large enough to more than offset the disadvantage of being in the lowest income quartile. While this is a striking finding, of the secondary schools that fall in the low income category, approximately only 5 per cent (nine schools) are located in areas that are in the highest quartile of adults with a university degree. Thus, given there are few schools that are low income in high educational background neighbourhoods, it is difficult to draw any strong conclusions from this coefficient. It does support, however, the notion that future studies of schools in low income neighbourhoods should consider carefully the role played by other socio-economic characteristics such as educational attainment. At the same time, there is very little change in the estimated effects of the other variables in the equation (compare this to Column 2 of Table 1).[37]

[36] We have also looked at an analysis based on an education measure of the numbers of adults without secondary school education (not shown) and come to much the same conclusion.
[37] We explored additional specifications that interact the lowest income quartile measure with some of the other control variables. In all cases, the coefficient on the interaction term was not statistically significantly different from zero. Results from this specification are available from the authors.

**Table 2 - University Application Rates by Grouping**

| Coverage of Secondary Schools | All<br>(1) | Within 40 km of University<br>(2) | Outside 40 km of University<br>(3) |
|---|---|---|---|
| Secondary school in low-income quartile | **-6.89** | **-6.93** | **-2.30** |
| | (1.09) | (1.55) | (1.15) |
| -- interacted with being in top-quartile of adults with university degree | **16.40** | | |
| | (4.22) | | |
| Secondary school in low-middle income quartile | **-3.73** | **-4.49** | -1.10 |
| | (1.08) | (1.42) | (1.14) |
| Secondary school in high income quartile | **7.93** | **7.06** | |
| | (1.46) | (1.60) | |
| ***Census Neighbourhood Characteristics*** | | | |
| Above median for share of population aged 15-19 | **-2.37** | **-2.65** | -1.14 |
| | (0.82) | (1.09) | (0.97) |
| Above median for share of families with one parent | 0.32 | 1.17 | -1.82 |
| | (0.97) | (1.36) | (0.92) |
| Share of population of European descent | **-11.11** | -7.98 | -7.84 |
| | (5.33) | (6.72) | (5.56) |
| Share of population of Southwest Asian descent | 8.04 | **13.02** | 248.43 |
| | (5.88) | (6.07) | (188.02) |
| Share of population of East Asian descent | **53.48** | **52.90** | 32.69 |
| | (7.79) | (8.04) | (115.52) |
| ***Secondary School Characteristics*** | | | |
| More than 50% of EQAO grade 9 test takers with a score of 3 or 4 | **9.44** | **12.15** | **4.00** |
| | (0.82) | (1.14) | (0.95) |
| Separate secondary school | **2.05** | 0.87 | **7.29** |
| | (0.92) | (1.10) | (1.18) |
| School has low enrollment (enrollment within year's 10th percentile) | **-2.35** | -2.77 | **-2.25** |
| | (1.14) | (2.94) | (0.95) |
| School in rural postal code | **-3.60** | **-4.63** | **-2.12** |
| | (1.00) | (1.69) | (1.05) |
| University within 40 kms of secondary school | **3.89** | | |
| | (0.94) | | |
| College within 40 kms of secondary school | 1.67 | | |
| | (1.10) | | |
| Constant | **29.58** | **33.55** | **27.26** |
| | (2.08) | (2.69) | (1.81) |
| # of Observations | 6826 | 4986 | 1840 |
| R-squared | 0.50 | 0.43 | 0.23 |
| # of Secondary Schools | 667 | 487 | 180 |
| Year fixed effects | Yes | Yes | Yes |

Note: robust standard errors clustered at the school level in parentheses
Coefficients that in bold are significant at a p-value <5%

Columns 2 and 3 of Table 2 show separate regressions for schools near (Column 2) and distant (Column 3) from a university. To be close to a university, the secondary school

needed to be within 40 kms of any university campus. Over 70 per cent of Ontario secondary schools are located within 40 km of a university and the results for this group of schools are much the same as are the results for all schools. The range of income effects is of the same order and the other control variables have quite similar effects. The analysis of the secondary schools that are far from a university is for a much smaller group of schools. The measure for the high income quartile variable has to be omitted because there are too few schools in that category.[38] While the lowest income group of schools still has a significantly negative effect, the effect is much smaller than in any of the other regressions. Moreover, fewer of the other control variables show significant effects. There are clearly major differences between schools close to universities and those further afield and this might warrant further investigation in the future. For the concerns of this project, however, the message of importance is that both low income 'near' and 'distant' schools have lower application rates than higher income schools.

Table 3 presents regression results for the four income quartiles separately. This allows an exploration of whether the application rates for the schools in the different income areas have different correlations with the other control variables. With a few exceptions, the sign and size of the coefficients are quite similar though the level of significance varies. The largest and strongest correlations across all income groups are for the variables for the share of East Asian descent and for school quality, both of which are strongly positively correlated with the application rate. Some of the noteworthy differences across income groups are as follows: for the lowest income group, having a large youth population matters more (in a negative way) than for other groups; being a separate secondary school leads to higher application rates in the two lowest income quartiles but not in the two highest; low enrolment schools have a negative relation with application rates in the two middle income groups but are not significant in either the highest or lowest income groups; and finally, having a university nearby increases applications at middle income schools but does not appear to be significant in the highest or lowest income group. Although we cannot confirm this, one potential explanation for the lack of statistical significance of this measure for the schools located in the low

[38] This can happen because the division into income quartiles is done for all schools not separately for the 'distant' schools in this regression.

income quartile is that students in these areas are more likely to qualify for grants and loans under the student aid program, and thereby face a lower cost for attending university, even in areas in which the student is likely to have to move away from home in order to attend.

**Table 3 - University Application Rates By Level of Household Income**

| Location of Secondary School | Low Income | Low-Middle Income | Middle-High Income | High Income |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| ***Census Neighbourhood Characteristics*** | | | | |
| Above median for share of population aged 15-19 | **-3.96** | -1.39 | -2.77 | -3.43 |
| | (1.33) | (1.39) | (1.43) | (2.52) |
| Above median for share of families with one parent | 0.58 | **3.19** | 2.81 | -4.62 |
| | (1.36) | (1.44) | (1.51) | (3.69) |
| Share of population of European descent | -15.34 | -13.31 | -8.22 | -4.44 |
| | (9.72) | (6.77) | (11.07) | (13.53) |
| Share of population of Southwest Asian descent | 0.60 | 9.96 | 7.19 | -11.42 |
| | (11.02) | (12.03) | (10.14) | (14.89) |
| Share of population of East Asian descent | **66.94** | 37.75 | **42.99** | **94.31** |
| | (28.70) | (23.01) | (10.29) | (15.08) |
| ***Secondary School Characteristics*** | | | | |
| More than 50% of EQAO grade 9 test takers with a score of 3 or 4 | **9.37** | **9.23** | **9.86** | **10.00** |
| | (1.64) | (1.35) | (1.77) | (2.48) |
| Separate secondary school | **5.17** | **4.10** | 1.68 | -1.99 |
| | (1.66) | (1.61) | (1.80) | (1.93) |
| Secondary school has low enrollment (enrollment within year's 10th percentile) | 2.86 | **-6.00** | **-4.40** | -7.51 |
| | (2.09) | (1.46) | (1.57) | (10.01) |
| Secondary school in rural postal code | -2.67 | 0.21 | -2.84 | **-7.87** |
| | (1.57) | (1.54) | (1.76) | (3.64) |
| University within 40 kms of high school | 2.84 | **3.49** | **6.76** | 1.07 |
| | (1.62) | (1.60) | (1.68) | (9.20) |
| College within 40 kms of high school | 1.55 | **3.22** | -0.68 | 17.51 |
| | (1.62) | (1.52) | (2.52) | (9.80) |
| Constant | **24.21** | **23.62** | **28.45** | **22.86** |
| | (2.97) | (2.72) | (3.35) | (6.40) |
| # of Observations | 1800 | 1716 | 1745 | 1565 |
| # of Secondary Schools | 170 | 164 | 167 | 166 |
| R-squared | 0.32 | 0.36 | 0.48 | 0.32 |
| Year fixed effects | Yes | Yes | Yes | Yes |

Note: robust standard errors clustered at the school level in parentheses
Coefficients that in bold are significant at a p-value <5%

# Trends and Differences Based on Program of Study

Our study, thus far, has focused solely on the overall university application rate. Students, however, apply to specific programs. Within and across universities, programs can attract different types of students. In one respect, students of higher ability may, on average, seek university admission into a set of programs that are different from students of lower ability. During the period under study there were changes to secondary school curriculum which could have differential affects on applications across the programs. Moreover, there were policy changes during the period under study that allowed for the deregulation of tuition rates. More professional programs (e.g., engineering and commerce) had greater latitude over raising tuition than programs in the arts and sciences. These changes in tuition policy could have had differential effects on applications by students from different income levels.

This section is focused on exploring how the rates of application to specific programs have varied over time and across income groupings. As explained above, our focus is on five groupings of programs: arts, science, commerce, engineering, and other programs. In 1995, across all programs the minimum amount charged for tuition and mandatory fees was the same across all programs. The maximum charged for tuition and mandatory fees across all programs except engineering ranged by no more than $200; the maximum charged for engineering had a slightly wider range. By 2005, the range of tuition and fees (in real terms) for arts and science programs was $4,080 to $4,882. The range for commerce programs was $4,080-$8,080, and the range for engineering programs was $4,408 and $7,799.[39]

In addition to provincial policy changes regarding the setting of tuition and fees, many universities in the 1990s and 2000s introduced scholarships based on the applicant's

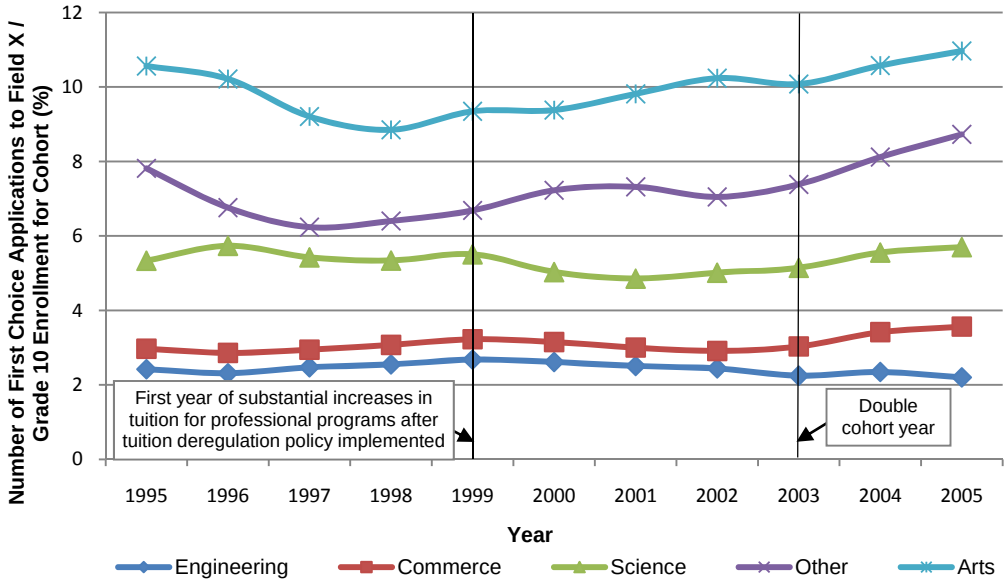
[39] We do not provide a range for other programs as these programs are diverse and would fall in to areas with more and less tuition deregulation in the more recent years.

secondary school average that covered all students, regardless of program. The value of the scholarship ranged across institutions as well as across grade level. These two changes may have affected the distribution of applicants across the different programs. For example, on average, 17 per cent of the applicants to Arts programs have an average of 85 per cent or better; 5 per cent of the applicants have an average of 90 per cent or better. Science and engineering have the highest average share of applicants with an average of 85 per cent or better, 35 and 44 per cent respectively; 16 and 22 per cent of the applicants in science and engineering have an average of 90 per cent or better, respectively. Approximately 21 per cent of the commerce applicants have an average of 85 per cent or better; 7 per cent of the commerce applicants have an average of 90 per cent or better.

The remainder of this section is focused on discerning the trends in applications across program groupings and income quartiles. Using the same base of student enrolments (the smoothed denominator) we can calculate the application rates in each secondary school for each year, by the field of student's first choice application.[40] Figure 4 graphs the application rates by field of study for secondary schools located in the lowest income quartile. It shows, for example that just over 2 per cent of the applicants throughout the period applied to programs in the engineering field of study, while around 10 per cent applied to programs in the broad field of arts. The vertical sum of the graphs would give the overall application rate and would correspond to the bottom line in Figure 2. The slight increases in application rates over the period for this income group seemed to be concentrated in the arts and the other categories though this increase was not smooth throughout the period. There were initial dips with the rates bottoming out in 1997-1998 followed by slightly larger increases in the latter part of the period.

[40] Students applying through the application centre rank their choices of program (field of study refers to the collection of programs in, say, the engineering faculty) and university. Here, and wherever we consider field of study, we look only at the applicant's first choice.

**Figure 4.** Application Rates, by Field of Study, for Secondary Schools in Low Income Neighbourhoods

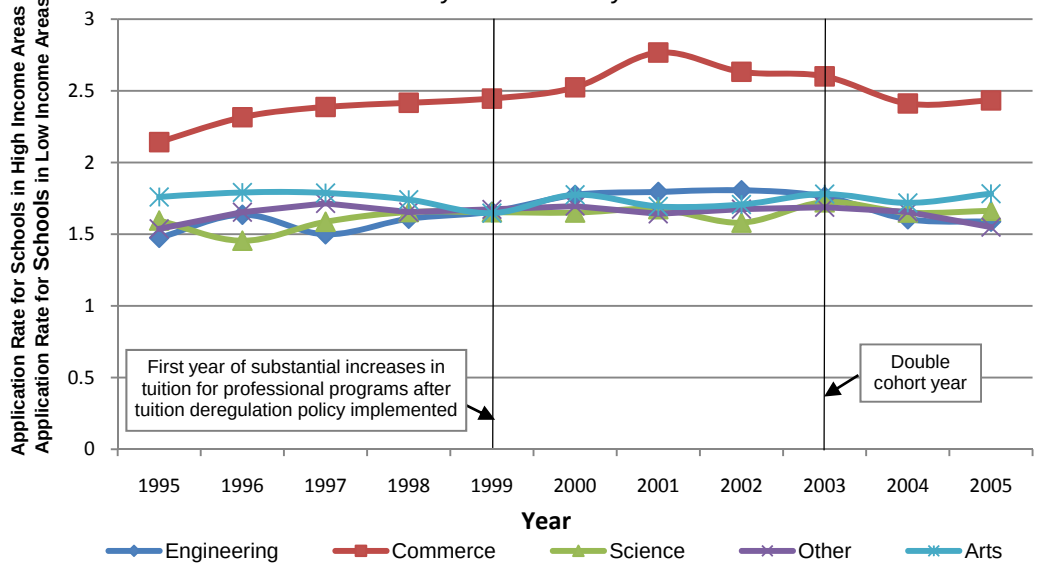



The ranking of choices across the programs is similar for the other income quartiles with arts at the top and engineering at the bottom in every case. The one exception is in the highest income level where commerce first choice applications started higher (relative to the other fields and the other income groups) and grew faster during the period and overtook science applications around the 2001-2002 period.

The differences in field of choice by income quartile of the secondary school is best illustrated in Figure 5 which shows the ratios of application rates for the highest to the lowest income quartile by field of study. Commerce, science, arts and other are clustered around the 1.6 level. Rates for the highest income quartile are about 1.6 times as high as for the lowest income quartile. These ratios are fairly constant over the period. In contrast, commerce application rates among the highest income secondary schools are over twice the rates of the lowest income secondary schools and grow noticeably over the period. As to the choice of field of study, the intermediate income level secondary schools (not shown) have application rates that look quite similar in structure to the low

income secondary schools shown in Figure 4, though with commerce applications being closer to midway between engineering application rates and Science application rates.

**Figure 5.** Ratio of Application Rates for Secondary Schools in High Income Areas to Secondary Schools in Low Income Areas, by Field of Study




For each secondary school we pooled the program-based application rates (5 per year) and ran a multivariate regression including the same control variables in our previously reported analyses. The dependent variable used in this analysis, however, is smaller (given it is the share of applications by program level divided by the smoothed secondary school cohort enrolment). Thus, the coefficients on the income quartiles will be lower.

To capture the differential effects of program applications across the income quartiles, we interact the income measures with indicator variables that identify the program to which the application rate applies. To capture differences in the potential impacts of the policy changes on application rates, we use two measures for each program and income quartile. The first measure captures the average program application rate for the period 1995-1998, prior to any major policy change. The second measure captures the average

program application subsequent to 1998. We allow for a base value that is attributable to the arts programs. We exclude the base value for the middle-high income quartile.[41]

In Table 4, we do not report the regression coefficients and the standard errors as we did in the previous tables. Instead, for each program category and income quartile, we report the coefficient for the application rate for each program and income quartile for the period prior to 1999 and the change in the coefficient for the post-1999 period from the pre-1999 period coefficient. Thus, the first measure in each pair of rows captures the application rate by program within an income quartile prior to any major policy changes. The second measure captures the changes in these rates after the policy changes took place.

**Table 4: Differences and Trends in Application Rates by Program**

| Location of Secondary School | Low Income (1) | Low-Middle Income (2) | Middle-High Income (3) | High Income (4) |
|---|---|---|---|---|
| Base Rate (Arts) by Program Before 1999 | -2.30 | -1.54 | 0 (Omitted) | 4.00 |
| Difference for Period After 1999 (Post - Pre) | 0.02 | 0.05 | -0.02 | -0.19 |
| Differential Effects by Program | | | | |
| Science Before 1999 | -4.40 | -5.19 | -5.95 | -8.68 |
| Difference for Period After 1999 (Post - Pre) | -0.29 | -0.30 | 0.08 | -0.19 |
| Commerce Before 1999 | -6.84 | -6.96 | -7.86 | -10.40 |
| Difference for Period After 1999 (Post - Pre) | 0.09 | -0.28 | 0.25 | 0.82 |
| Engineering Before 1999 | -7.50 | -8.12 | -9.83 | -13.60 |
| Difference for Period After 1999 (Post - Pre) | 0.00 | -0.22 | 0.20 | 0.26 |
| Other Before 1999 | -5.60 | -5.43 | -7.16 | -10.39 |
| Difference for Period After 1999 (Post - Pre) | 0.35 | -0.17 | 0.21 | 0.30 |

Note: These are based on a regression of the high school application rate (by program) on two sets of measures for income groupings, neighbourhood, and school correlates. The income grouping measures are: type of program*income quartile for the period prior to 1999 and type of program*income quartile for the period subsequent to 1998. The measure reported in the first row is the coefficient for the measure that captures the period prior to 1999; the measure reported in the second row is the difference between the coefficient post 1998 and the coefficient pre 1999.

Across all income quartiles, our base rate captures the application rate for the Arts programs and represents the baseline rate that is common across all program categories.

[41] Given we are allowing the application rate to vary over two time periods, we exclude the dummy variables representing each application year in this part of the analysis.

As we excluded the measure for the middle-high income quartile (it can be thought of as having a value of zero and all the other numbers are relative to it), the coefficients for the other three income quartiles reported in the first row also reflect the differences from this income quartile. Turning to the second column of the first row, the coefficient of -2.30 suggests that, on average, prior to 1999, the Arts application rates for students in low income secondary schools is 2.3 per cent lower than the rate for students in the middle-high income schools. Across the income groupings, the Arts application rates vary positively with the income quartiles.

The second row of Table 4 reports the difference between the post-1999 and pre-1999 application rates for the arts programs. Except for the high income quartile, there is very little difference in the average application rates for arts programs for these two periods. There is a slight decline of 0.19 per cent in arts applications for the secondary schools in the high income neigbourhoods. Across all of the income quartiles, the application rates for the other program areas (science, commerce, engineering and other) are all lower in the period prior to 1999 relative to the arts application rates for each income quartile (see the first in each pair of rows). For the most part, the two lowest rates are for commerce and engineering. After 1999, for the low income quartile, the application rates for science declined. The rates for commerce and engineering remained relatively constant even though these two programs fell under the tuition deregulation policy and had increased tuition. If one compares the application rates for Commerce across the four income quartiles, the lowest share of applicants applying to commerce is for the low income quartile. However, for the low income quartile, there are even fewer applications to engineering.

The application rate for commerce fell for the lower-middle income quartile and increased for the middle-high and high income quartiles. A potential explanation for this is that students attending secondary schools in low income neighbourhoods may be more likely to qualify for financial aid and so may be less sensitive to tuition increases than the students attending secondary schools in slightly higher income neighbourhoods as these students may be more affected by the tuition increases if they do not qualify for financial aid. Students attending secondary schools in the high income neighbourhoods may be

the least price sensitive, thus providing a possible explanation for the increase in the application rate for commerce.

The difference between the application rates for engineering for the later and earlier periods is similar for the two lower income quartiles (constant or falling). The difference, however, is positive for the two higher income quartiles, but not as large as for the commerce programs. This also potentially can be explained by differences in the sensitivity to increases in tuition. Because a good proportion of students that apply to engineering possess an average of 85 per cent or higher, many of these students would qualify for the university merit scholarships, ameliorating some of the tuition increases introduced after 1999.

What is a bit puzzling, however, are the declines in most quartiles in the post-1999 science application rates and a lower increase in the engineering application rate relative to the commerce application rate for the high income quartile. A potential explanation is that students are choosing not to take all of the required secondary school courses needed to apply for these programs after the provincial changes to the curriculum and the elimination of the OAC year. More data, however, would be needed to further explore this possible reason or any reasons that might be related to changes in the employment market for students.

Table 4 confirms that after controlling for secondary school and neighbourhood characteristics, application rates by program vary across income quartiles. The application rates after the introduction of several policies have changed in slightly different ways for the lower and higher income groups. Part of these differences may be attributable to differences in the sensitivity to tuition increases; part of these differences may be attributable to changes in secondary school curriculum changes and course selection. Without more data, we are limited in our analysis.

# Policy Discussion and Conclusion

Similar to studies that use survey data for all provinces, we confirm that application rates of students in low income neighbourhoods are significantly lower than the corresponding rates of students in higher income neighbourhoods. Using data that span more than a decade, after controlling for school and neighbourhood characteristics, we show that there is about a 13 per cent difference in application rates between students attending secondary schools in the lowest income quartile and students attending secondary schools in the highest income quartile. These differences are strongest in areas where a secondary school is within a reasonable distance (40 kms) of a university.

The more disturbing aspects of the analysis is that the gap in application rates has remained relatively constant over the last decade; or perhaps has increased slightly. Part of the slight increase in the gap is most likely attributable to the deregulation of tuition rates for the professional programs and changes in the financial aid programs available to students. But this is not the only explanation. In addition to the deregulation of tuition rates, Ontario's secondary school curriculum changed and many Ontario universities have implemented scholarship programs that are based solely on a student's secondary school average. Thus, for the higher achieving students, tuition costs have declined somewhat at many of the Ontario universities.

This report represents an initial exploration of the dynamics of the university application process along the dimension of income within Ontario. Future studies should consider the dynamics of the college application process and the interaction between a student's progression through secondary school and the decision to apply to either a college or university. Future studies should also explore specific subgroups of the Ontario population such as Francophone students, Aboriginal students, and students seeking admission to college and/or university later in life.

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