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# The Impact of Scholarships and Bursaries on Persistence and Academic Success in University

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# Executive Summary

This paper provides one of the first analyses of the benefits to the university student of scholarships and bursaries in Ontario and Canada and has potentially important policy implications. Entry scholarships and bursaries have two main potential benefits: 1) they may attract stronger students to a given university, and 2) they may promote better performance in university. The first type of benefit mainly accrues to the individual school and not to the student or the province as a whole. The second type of benefit, however, may apply to all students who receive entry scholarships and hence leads to improved academic performance throughout the system.

This study uses data from two universities in Ontario to analyze the relationship between entrance financial aid awards and success in university. We report separate estimates for each university due to the differences in the nature of the financial aid data provided. While one university provided data on the value of merit-based awards, commonly referred to as “scholarships,” the second university provided data on the combined value of merit-based awards and needs-based awards, commonly referred to as “bursaries.”

In our simple regressions, first-year (entrance) scholarships and bursaries at both universities have only modest effects on student grades and credits earned and generally no association with persistence and degree completion among students as a whole. One must interpret these simple regression findings with caution, however, as we have a limited set of controls for the variables correlated with both financial awards and persistence. Hence, omitted variables may cause these coefficients to be biased in explaining the causal impact of financial aid on university outcomes. For this reason, we used regression discontinuity analysis to obtain estimates of the causal effects that one might expect to be freer of bias.

The regression discontinuity results offered little support for the proposition that entrance scholarships and bursaries have an important causal impact on the university outcomes studied. This is even true of entry scholarships that are guaranteed to be renewable in subsequent years given satisfactory performance in year one. Hence neither set of regression estimates offers much support for the proposition that entrance scholarships and bursaries have sizable impacts on any of the university outcomes considered in this study. The simple regressions implied small effects on first-year grades and credits earned, but even these results were not supported by the IV regressions. Importantly, these findings are just as true for students from low-income neighbourhoods as for students from more advantaged areas.

So why should universities continue to offer scholarships and bursaries, especially to entering students? It may be that the principal benefit to universities of these forms of financial aid is that they attract stronger students to the university, especially those from lower-income families, rather than help the students to succeed once enrolled. As stressed above, however, this is a benefit to the individual school and not to individual students or to Ontarians as a whole. The shortcomings in our data have limited the extent to which we can identify a causal effect. Further study is clearly warranted, but our findings, drawn from a rich data set, offer important insights into a key policy question that has previously received little attention.

# 1. Introduction

In a recent report funded by the Higher Education Quality Council of Ontario (HEQCO) (Dooley, Payne and Robb 2011), we addressed the question of what characterizes those students who achieve academic success as measured by grade averages, credits passed, continuity of registration, and degree completion. We examined persistence and success using a rich administrative data set that linked information on individual students at four Ontario universities with information on the high school performance of these students, the high school that they attended, and the neighbourhood in which they grew up.

We reported that the high school grade point average (GPA) is a strong predictor of success in university. In our analysis, a student's high school GPA had much more explanatory power than other factors such as university program, gender, and neighbourhood and high school characteristics.

As a measure, however, high school GPA is likely a proxy for many other factors that contribute to student performance in university, one of which may be access to merit-based awards, commonly referred to as scholarships, and to needs-based awards, commonly referred to as bursaries. In this report, we extend our analysis to consider the impacts of these two forms of financial support on university success using data from the two universities for which this information was made available in the previous study. We report separate estimates for each university due to the differences in the nature of the data provided. While one university provided data on the value of scholarships, the second university provided data on the combined value of scholarships and bursaries. The awards to academically weaker students at this second university consist almost solely of bursaries and we use this information in our analysis.

Our data set does not contain information on loans and non-repayable grants received from non-university sources such as the Ontario Student Assistance Program (OSAP). OSAP is the largest source of loans and non-repayable grants for students in Ontario. All Ontario universities, however, attempt to make sure that the scholarships and bursaries that they provide actually supplement rather than replace scholarships and grants from non-university sources. In other words, the university scholarships and bursaries reported in our data add to rather than substitute for funds from other sources (Dooley, Payne and Robb 2012). Throughout the last two decades, there has been a steady increase in the proportion of Ontario universities that guarantee entry scholarships to students with strong marks in high school. In some cases the awards are only guaranteed in the first year of university study and in other cases the awards are "renewable," meaning that they are guaranteed for two to four years provided the student maintains a minimum GPA.

Why might a university offer these scholarships and bursaries? One reason is to attract academically stronger registrants. Academically strong students are more likely to enroll in an honours program, which brings a higher subsidy from the Ontario government, and are less likely to drop out, thereby lowering turnover costs (Dooley, Payne and Robb 2011). Anecdotal evidence suggests that such students also help to teach weaker students, appeal to donors, and ultimately become more influential and affluent alumni. In Dooley, Payne and Robb (2012), we reported that the introduction of these entry scholarships has had only small effects on the distribution of academically strong students across Ontario universities. Hence it is not clear that these entry scholarships have enabled universities to increase their share of high-achieving students from Ontario high schools.

A second reason for offering entry scholarships or bursaries is to increase student persistence and success. Why should an entry scholarship lead a given student to attain a higher level of academic success in university? There are at least two plausible reasons. Greater financial resources mean that the student, especially one from a lower-income family, may have to devote less time to paid work and hence more time to academic work. There is a second reason if the scholarship is renewable. Since all renewable entry scholarships require that the student maintain a minimum first-year GPA, a student with a renewable entry scholarship may have a stronger financial incentive to succeed academically in year one than does a student whose entry scholarship is not guaranteed to be renewable, although this would depend on the specific conditions attached to second-year scholarships.

This paper provides one of the first analyses of the benefits of scholarships and bursaries to the university student in Ontario and Canada and has potentially important policy implications. As indicated above, entry scholarships and bursaries have two main potential benefits for a university: 1) they may attract stronger students to a given university, and 2) they may promote better performance in university. From the point of view of the province as a whole, the first type of benefit is what social scientists would call a "zero-sum game." Since almost all university students from Ontario go to a publicly funded university in Ontario (Dooley, Payne and Robb 2011), a larger share of stronger students for University X necessarily means a smaller share for University Y. The main benefit accrues to the individual school and not to the province as a whole. The second type of benefit, however, may apply to all students who receive entry scholarships and hence lead to improved academic performance throughout the system. Of course, there is a cost to such aid. The substantial funds devoted to entry scholarships could be used, for example, for higher quality programs and more instructors. If these scholarships have little impact on performance, we should consider whether there are better alternative uses to which the resources should be allocated.[1]

All studies of this topic must confront a key methodological challenge: the individual characteristics that are positively correlated with receiving a scholarship or bursary, such as being from a low-income family or having good high school grades, are also likely to be associated with university outcomes. As a result, a simple comparison of scholarship and bursary recipients with non-recipients will not necessarily reflect the causal impact of financial aid on these outcomes. Furthermore, researchers will likely not have satisfactory controls for all variables correlated with both financial aid and persistence in university. Some factors, such as high school grades, may be readily measurable, but others, such as work habits and motivation, are usually not. These unmeasured or "omitted" variables may result in biased estimates of the true impact of scholarship and bursaries on university outcomes.

In this paper, we first present estimates of simple regression models that make no correction for such omitted variable biases. We then present estimates based on an increasingly popular method of controlling for omitted variable bias known as regression discontinuity (RD) analysis. Entry scholarships at Ontario universities are usually awarded on the basis of high school grades alone. The value of an entrance scholarship typically depends on the student having a high school grade average that is above a definite threshold, such as 80, 85, 90 or 95%. The RD approach is based on a comparison of students who have a high school grade average that falls just below and above these thresholds. Such students are assumed to be quite similar with regard to the unmeasured determinants of university outcomes. As a result, differences in these outcomes can be more confidently attributed to the presence or absence of the scholarship.[2]

[1] It is also important to note what this report does not do. In this report, we do not explore the impacts of scholarships and bursaries on the decision to attend university. We also do not explore longer-term impacts on such activities as graduate study, employment and income.

[2] In both the simple and RD regressions, we are studying students who have chosen to attend two universities. These students could have chosen to attend other universities in Ontario or outside of Ontario. Thus our sample of students is not a random selection of university students. We encourage more research on the question using data from other institutions. We are also studying the impacts of scholarships and bursaries at certain grade cut-offs. This means that we are able to estimate what is known as a "local effect." We are not drawing conclusions across the entire distribution of grades, although we do use four different grade cut-offs.

Section 2 contains a brief review of the literature on the link between financial aid and persistence in university. The data, measures and summary statistics for this study are described in Section 3. The simple regression estimates are discussed in Section 4 and the results of the RD analysis in Section 5. Section 6 provides a summary and conclusion.

# 2. Review of the Literature

Two recent reviews observe that the bulk of research on financial aid in U.S. postsecondary education has focused on student access rather than persistence (Long, 2008; Goldrick-Rab, Harris and Trostel, 2009). Mueller (2008b) confirms that the same is true of the Canadian literature.

Canadian studies of persistence that use survey data such as the Youth in Transition Survey (YITS) are subject to the problem of omitted variable bias described in the introduction. For example, Bowlby and McMullen (2002) use the YITS and find greater degree completion rates among those students who both reported greater parental income and received scholarships. In a similar vein, Mueller (2008a) reports that finances play a weak role in persistence, but that the evidence is largely drawn from surveys that ask students their reasons for dropping out. One possible solution for the problem of omitted variables is to use a natural experiment. The term “natural experiment” refers to a policy change that can be thought of as approximating the conditions of a true experiment, most importantly in that the policy change is not correlated with the unobserved individual determinants of the outcome of interest.[3] For example, Johnson (2008) used the YITS and found no evidence that differences in average tuition levels between provinces are associated with the probability of leaving university without a degree. He was able to control for inter-provincial differences in both compulsory fees and associated tax reductions but not for inter-provincial differences in financial aid. In another natural experiment, Chemin (2009) found that a 2001 increase in the value of student grants in Quebec increased postsecondary education participation rates but not graduation rates relative to other provinces.

Goldrick-Rab et al. (2009) report that the existing U.S. estimates of the effect of financial aid on enrollment and persistence are so widely scattered due in part, they believe, to the omitted variable problem. They also report that “the more rigorous studies” that directly address the omitted variable problem with U.S. data suggest positive impacts of financial aid on persistence. For example, Dynarski (2003) studied the natural experiment provided by the elimination of the Social Security Student Benefit Program in 1982, which she characterized as one of the largest and sharpest changes in grant aid for university students that has ever occurred in the United States. She reports that $1,000 in aid increased first-year retention by 3.6 percentage points and the duration of education by 0.16 years. Singell (2004) uses a highly detailed administrative data set and finds that a $1,000 increase in aid was associated with a one to five percentage-point impact on yearly retention. Alon (2007) employs an instrumental variables strategy with data from the College & Beyond database to determine that a $1,000 increase in aid is associated with a 1.5 percentage-point increase in the likelihood of completing a degree.

Finally, Dynarski (2005) examined the consequences of the natural experiment provided by the introduction during the 1990s of large-scale merit aid programs in a series of U.S. states. These programs waive tuition and fees for students who achieve a minimum GPA in high school (typically a 3.0 on a 4-point scale) and maintain a minimum GPA in college (typically 2.5 to 3.0). Arkansas started the trend in 1991 and Georgia followed in 1993. Dynarski estimates the impact of these programs using cross-cohort comparisons in college completion in these two states relative to others without such aid. The scholarship programs appear to increase the share of young people with a college degree by three percentage points, from approximately 27 to 30%.

A random assignment experiment evaluating the impact of financial aid policy could improve our knowledge, but Goldrick-Rab et al. (2009) cite only three small experimental trials that were performed. One of these was

[3] See Meyer, 1995 for an extensive discussion of natural experiments.

the Canadian Student Achievement and Retention (STAR) demonstration project, in which merit-based financial aid and academic services (peer advising and facilitated study groups) were randomly assigned to first-year students at a large university (Angrist et al., 2009). Women who received both money and support services earned higher grades by the end of their second year of study than did women who received neither, but there were no such effects for men. A second such trial was the Opportunity Knocks (OK) demonstration project, in which first- and second-year students receiving financial aid were offered monetary incentives to achieve grades of 70% or better in each of their courses (Angrist, Chambers, Oreopoulos and Williams, 2010). OK participants selected for treatment were also assigned a peer advisor of the same gender. OK sign-up rates were high and program participants were often enthusiastic about the experience. However, overall program effects on achievement were modest.

In sum, the North American literature reflects a wide range of estimates of the association of financial aid and persistence in university but suffers from a common and potentially quite serious problem of omitted variable bias. The subset of more rigorous studies tends to show a positive effect of aid on persistence, but the size of these effects was not large in the two Canadian experiments.

# 3. Data and Measures

## 3.1 University Administrative Data and Persistence Measures

Two of the four Ontario universities we studied earlier provided us with student-level data that included information on scholarships and bursaries. As in the earlier study, our data set is limited to students who entered a full-time university degree program directly from an Ontario high school in September. Such students comprise over 90% of entering undergraduates at Ontario universities (Dooley, Payne and Robb, 2011). One of our universities provided data for entering cohorts in September of 1994 through 2004 and the other for entering cohorts in September of 1999 through 2006.

We categorize students based on four academic programs of study upon entry: Arts, Science, Business, and Engineering. Students in smaller programs were assigned to one of these four (e.g., students in Kinesiology were assigned to Science and those in Music to Arts). The universities provided information on credits earned and grade averages for each student by academic term (fall, winter and summer). In this report, as in Dooley, Payne and Robb (2011), we measure these indicators on a twelve-month (September through August) basis to accommodate coop students, whom we cannot directly identify and who are both less likely than non-coop students to be enrolled in fall and winter terms and more likely to be enrolled in the summer term.

We use a variety of measures of academic persistence and success including grade averages, credits earned, departures during year one, and completion of a degree within six years of entry. We use the term “departure” rather than “drop-out” because our data do not reveal if the student discontinued university study or transferred to a different institution. Table A-1 provides definitions and sample means for all variables used in our analysis.

Each university provided us with the dollar value of support provided to each student in years one, two and three. As indicated above, the award values reported by University A were scholarships and those reported by University B combined scholarships and bursaries. First-year scholarships at both universities were awarded almost solely on the basis of high school grade point average. The minimum average needed for an entry scholarship and the values awarded to different levels of GPA varied between universities and over time. The highest minimum average needed over our data period was 90 and the lowest was 80. For students with a GPA of 95 or better, University A also provided scholarships that were renewable for up to four years if a minimum university GPA was maintained. At both universities, however, most scholarships beyond year one depend on factors other than university GPA, such as academic achievement in a particular program or non-academic considerations such as leadership or extra-curricular activities. As a result, we could only use entrance scholarships in our RD analysis and we concentrate on the effects of such scholarships in our multivariate analysis below.

From 1999 to 2003, the policy at University A was to grant an entry scholarship to all students with an average grade of at least 80 in their best six Grade 12 or 13 courses. The value of the award also depended on this grade point average. This minimum grade necessary to receive a scholarship increased to 85 in 2004. We calculated each student’s high school grade point average using OUAC data. Figure 1a depicts the proportion of entering students who received a scholarship at University A. Throughout the period that our data spans, virtually all students for whom we calculated a GPA of 90 or better received a scholarship. However, only 90% of students with a GPA of 80 to 90 in our data received a scholarship between 1999 and 2003, even though the official minimum GPA required to earn a scholarship during this period was 80. Why does this discrepancy exist? One possibility is reporting or rounding error. A more likely explanation, we believe, is that there may have been minor differences between the grades and/or course weights reported to us and those used to determine eligibility for an entrance scholarship. Universities initially receive intermediate grades and use these to determine students' eligibility for admission and entry scholarships. The stated policy has always been that such scholarship awards are always conditional on final grades, but minor differences may have been overlooked. A second source of discrepancy is that students sometimes repeat courses either during a "victory year" or a summer term in order to improve their grades. They can and sometimes do take the same course again for more credits. Our practice was to use the highest grade earned in a course (and the associated credits) but university practices may have differed. This possible discrepancy between our calculated grade averages and those used by the universities also likely accounts for the few students at University A whom we calculated should not have received a scholarship but did.

Figure 1a shows that the share of all students at University A receiving a scholarship increased from 60% in 1999 to well over 90% in 2003, as entering high school averages rose steadily and peaked in the double cohort entry year.4 Between 2004 and 2006, the proportion of all students and of those with a GPA between 80 and 90 who received a scholarship fell, as the minimum average needed for an entry scholarship increased to 85 and average entering grades declined with the passing of the double cohort.

**Figure 1a: Proportion of Students with Scholarship at University A by High School GPA**

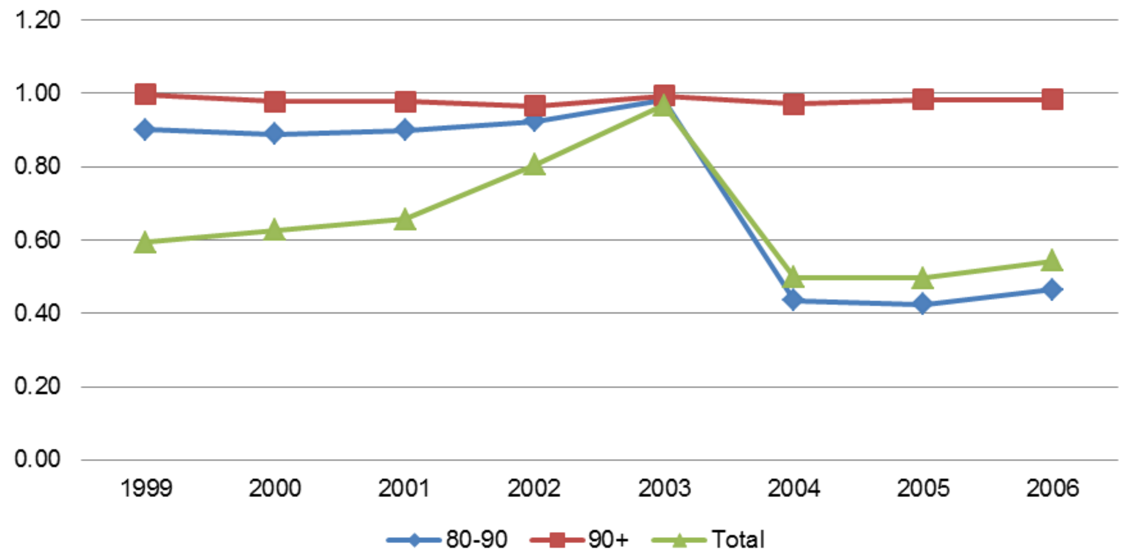



Figure 1b shows the mean value of scholarships awarded to students at University A among students with a scholarship. The average value of scholarships awarded to students with a GPA of 90 or better declined between 1999 and 2003. This occurred not because of a change in the guaranteed scholarship value for such students, which remained at $2,000, but because of a decline in the number of students who received more than the minimum amount. Also, some students with a GPA of 90 or more received less than $2,000 due to

[4] In 2003, a major change in the secondary school curriculum shortened the normal number of years of high school for university-bound students from five to four. This also resulted in a "double cohort" of students who entered university in 2003.

the grade discrepancy problem described above. This decline did not continue beyond 2003, due in part to the increase in the minimum scholarship amount for students with a GPA of 95 or more to $2,500.

**Figure 1b: Mean Value of Year 1 Scholarship Among Students with a Scholarship at University A by High School GPA**

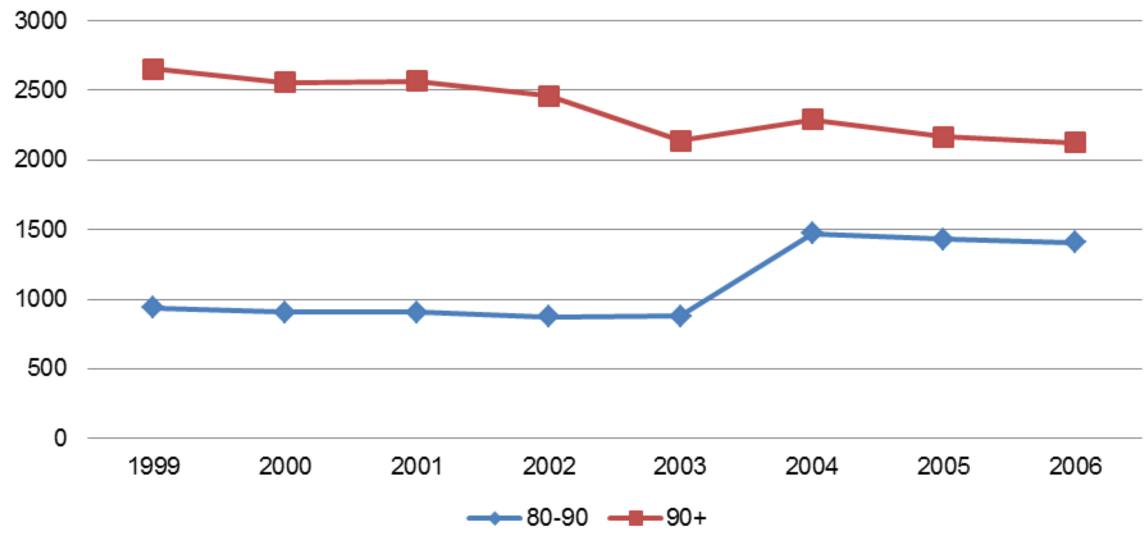



Figure 1b also shows that the average value of scholarships awarded to students at University A whose high school GPA was in the 80 to 90 range changed little between 1999 and 2003. Most of these students received the minimum of $750 for a GPA of 80 to 85 and $1,000 for 85 to 90. In 2004, entry scholarships were eliminated for students with a GPA of 80 to 85 and increased to $1,500 for students with a GPA of 85 to 90. The result was an increase in the average scholarship value, as shown in Figure 1b. Throughout this period, tuition for Arts and Science programs at both University A and University B remained constant in real terms at approximately $4,500 in $2002. In Business and Engineering programs, real tuition increased from $4,800 to $5,700. For students at University A with a GPA of 90 or better, the proportion of tuition paid by the average scholarship declined from about 60% in 1999 to about 45% in 2006 for Arts and Science programs and to about 35% in Business and Engineering programs. For students at University A with a GPA of 85 to 90, the proportion of tuition paid by the average scholarship remained constant at about 20% in Arts and Science programs and declined from 20% to about 17% in Business and Engineering programs.

We indicated above that only entering students at University A with a high school GPA of 95 or better received a guarantee of a renewable scholarship conditional on maintaining a minimal university GPA. Table 1 shows that this guarantee mattered. This table uses data from all sample years and presents the proportion of students who received a scholarship in their second year of study among students who had a high school GPA of 90 or more. Virtually all such students received an entry scholarship. The rows categorize students by their first-year cumulative GPA. Virtually all students with a first-year GPA of 95 to 100 (there are few of the latter) received a second-year scholarship. However, only 59% of students with a first-year GPA of 90 to 95 who had a high school GPA of 90 to 95 received a second-year scholarship; this same proportion was 92% among students with a high school GPA of 95 to 100. This difference is even greater among students with a first-year GPA from 80 to 90. Among students with a first-year GPA of 80 to 85, only 17% of students with a high school GPA of 90 to 95 received a second-year scholarship; this same proportion was 83% among students with a high school GPA of 95 to 100.

**Table 1: Proportion of Students at University A with Scholarship in Years 1 and 2**

| | High School GPA | |
|---|---|---|
| Year 1 University GPA | 90 - 95 | 95 - 100 |
| <80 | 4% | 26% |
| 80 - 85 | 17% | 83% |
| 85 - 90 | 44% | 93% |
| 90 - 95 | 59% | 92% |
| 95 - 100 | 100% | 100% |

One reason for the differences between the columns in Table 1 is that, within any of our first-year GPA grade categories, students who did better in high school also did better in first-year university on average. The key explanation, however, is that the students with a high school GPA of 95 to 100 had a guarantee of renewability whereas those with a high school GPA of 90 to 95 did not. The former clearly had a stronger financial incentive to perform well in their first-year classes.

We have a longer data period and a different award measure for University B. Furthermore, the scholarship policy differed by academic program at University B. From 1994 to 1997, the minimum high school GPA needed for an entry scholarship at University B in either Arts or Business programs was 90. In 1998, this was lowered to 85 in Arts programs and to 87.5 in Business programs. For Arts programs, this GPA minimum was lowered further to 80 in 2000 and raised back to 85 in 2003. The minimum in Business was raised back to 90 in 2003. University B has relatively small programs in Science (and none in Engineering) and we had trouble verifying the entry scholarship minimum for Science programs in our data. As a result, we have restricted our analysis to Arts and Business students at University B.

Figure 2a depicts the proportion of entering students who received a scholarship and/or a bursary in Arts programs at University B. Only one-third or less of entering students received these types of support prior to 1998. From 1998 to 2003 (the double cohort year), this proportion varied between two-thirds and three-quarters and then fell to one-half by 2005. All of the fluctuation in the incidence of awards occurred among students with a GPA under 90. As indicated above, in all sample years all awards to students with a GPA of less than 80 were needs-based and the proportion of such students receiving a bursary varied from 5% to 55% over the sample period. Awards to students entering with a high school GPA between 80 and 90 combined bursaries and scholarships, the incidence of which varied from a low of 17% in 1994 to a high of 99% in 2000 and 2001. Additional information provided by University B indicated that the fluctuation in the incidence of awards to students in the 80 to90 GPA range reflects fluctuation in the incidence of both scholarships and bursaries.

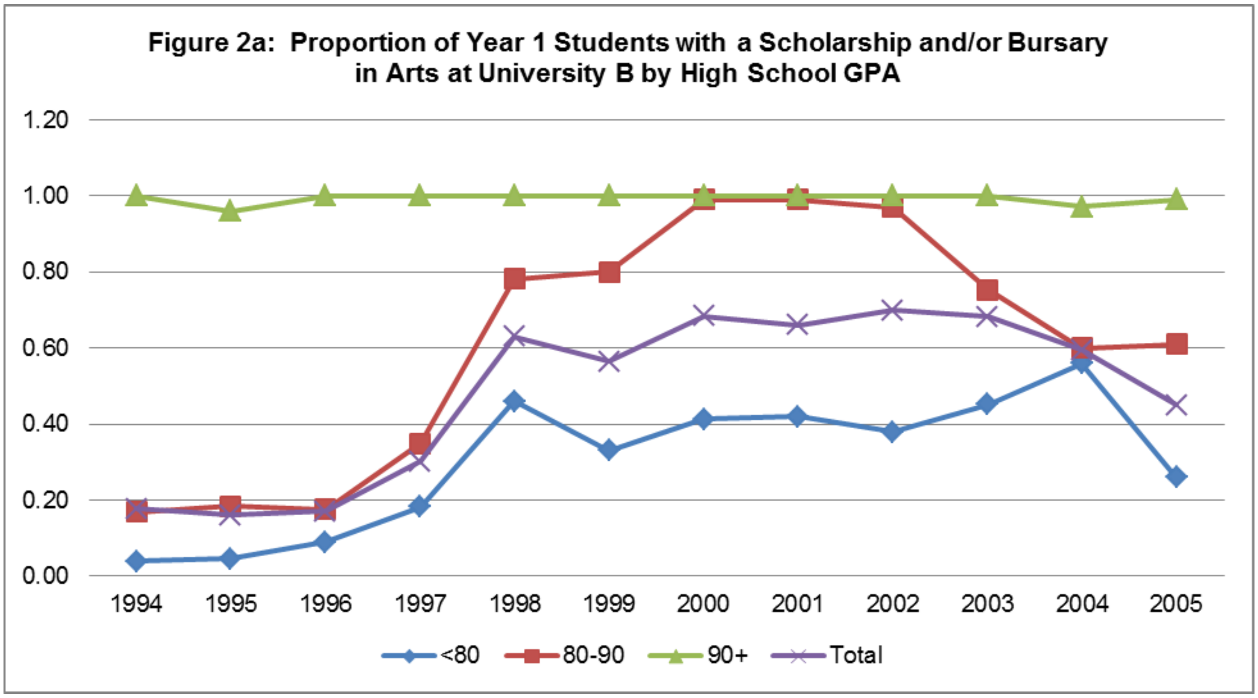
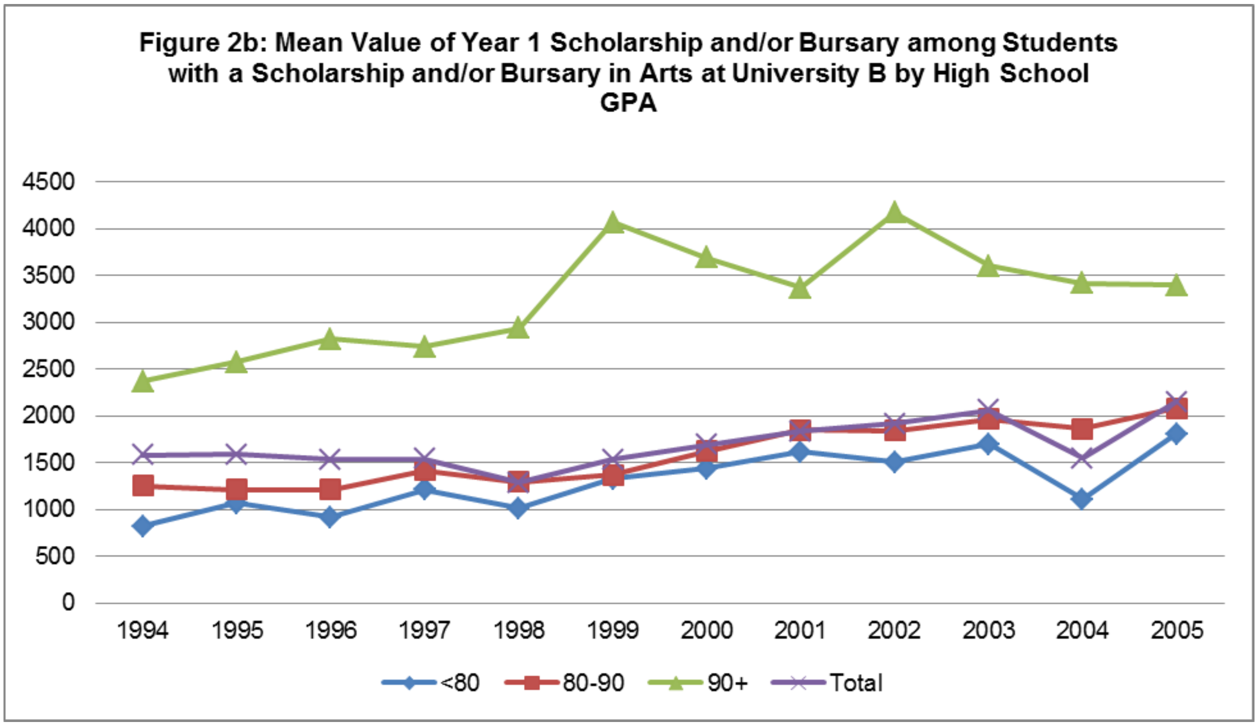



Figure 2b reports the mean value ($2002) of the first-year awards to students in Arts programs at University B among students receiving an award. The value of these awards increased over the sample period in all grade categories by 75 to 100%. The rising incidence of awards (at least up through 2002) and the rising value of the average award means that University B was substantially increasing its aggregate spending on scholarships and bursaries. This was true of all Ontario universities and reflected, in part, a requirement by the provincial government that financial aid programs be expanded in return for permission to increase tuition (Dooley, Payne and Robb, 2012). As indicated above, tuition levels were similar at Universities A and B. As a result, the average scholarship plus bursary amount covered a larger proportion of tuition at University B than was covered by just the scholarship at University A. Entry scholarship levels at University B were the same or slightly lower than at University A.




Figures 3a and 3b depict the proportion of entering students who received a scholarship and/or a bursary in Business programs at University B. There are very few entrants to these programs with a high school GPA under 80. We are not sure why fewer than 100% of the entrants with GPA of 90 or better received an award between 1995 and 1998. The proportion of students with a GPA in the 80 to 90 range receiving a scholarship and/or a bursary is lower in Business programs as compared to Arts programs in the latter part of our data period. Figure 3b reports the mean value ($2002) of the first-year awards to students in Business programs at University B among students receiving an award.  The changes over time are similar to those for entrants to Arts programs. On average, award values for Business students are a bit lower in the 90 to100 GPA range and a bit higher in the 80 to 90 GPA range as compared to those for Arts students.

**Figure 3a: Proportion of Year 1 Students with a Scholarship and/or Bursary in Business at University B by High School GPA**

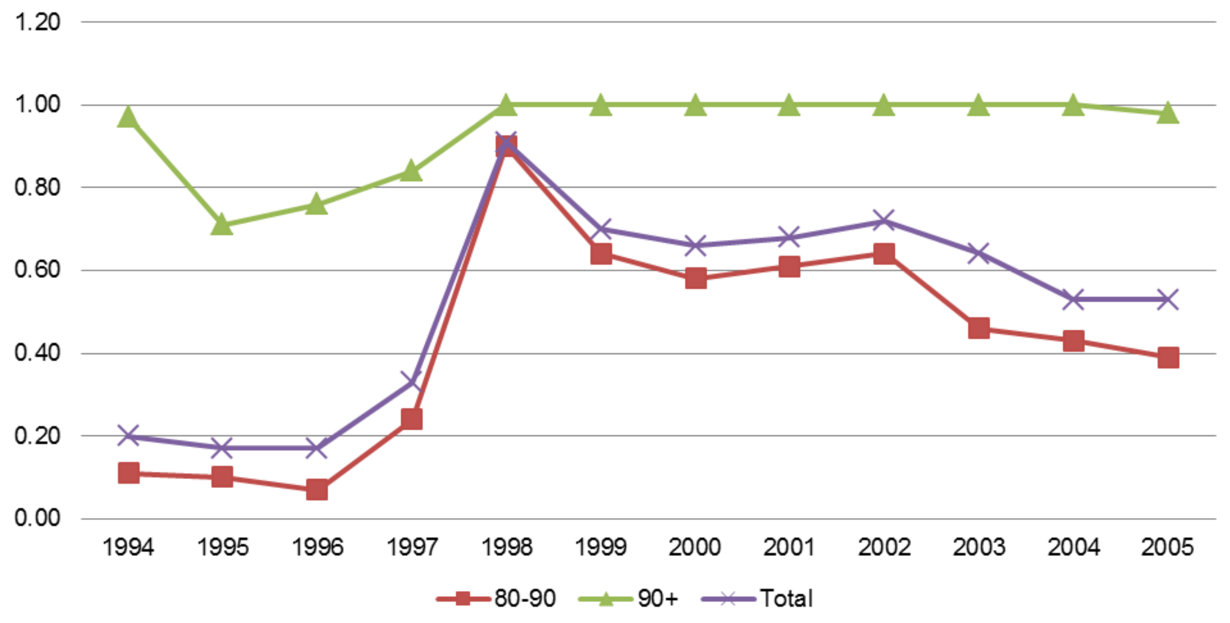
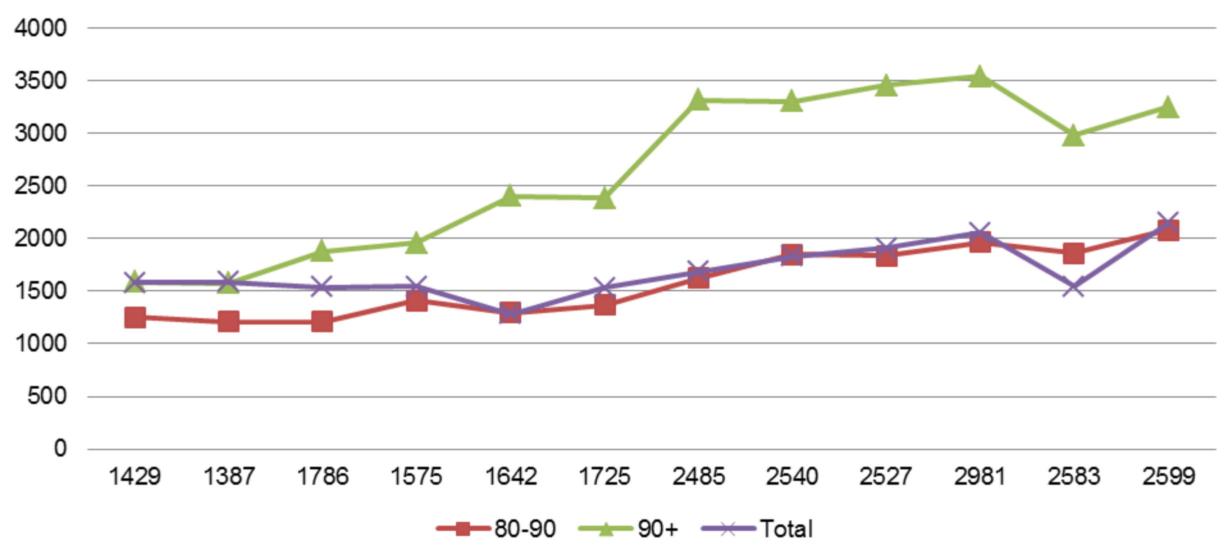



**Figure 3b: Mean Value of Year 1 Scholarship and/or Bursary among Students with a Scholarship and/or Bursary in Business at University B by High School GPA**




### 3.2 Individual, Neighbourhood and High School Characteristics

We used variables in our regressions from a number of sources aside from the university records. All Ontario students applying to Ontario universities directly from high school submit a common application form to the Ontario Universities Application Centre (OUAC).[5] The OUAC provided us with information on age, sex, mother tongue, citizenship and location of the home residence at the time of application. The OUAC also transmitted to us grade data provided directly by the high schools. Our measure of high school performance is the average grade in the student's best six Grade 12/13 University level courses, which is the generally accepted admission average for Ontario universities.[6] The details of how we performed the linkage between the university administrative data and the OUAC application data are available in Dooley, Payne and Robb (2011).

The postal code in the OUAC data allows us to link the residence of the student's family at the time of application to the corresponding census neighbourhood data for Enumeration Areas (EA) in 1996 and Dissemination Areas (DA) in 2001 and 2006. These EA and DA areas are the smallest for which published census data are available and we refer to these areas hereafter as `neighbourhoods.` The details of how we performed the linkage between the residence and the neighbourhood are available in Dooley, Payne and Robb (2011). The key income measure in our regression analysis is "average equivalent income," which is average neighbourhood income divided by the square root of the neighbourhood average number of persons per household.[7] The principal income indicator that we use in this paper is whether a student is from a low-, middle- or high-income neighbourhood as judged by the terciles of the provincial distribution of "average equivalent income." (see Dooley, Payne and Robb, 2011, for more details). Table A-1 indicates that approximately one-half of the students in our sample come from high-income areas. Other neighbourhood characteristics that we use in our regressions are the proportion of the adults with a bachelor's degree education or above, the proportion of families headed by a lone mother, the proportion of persons with English as a mother tongue, the proportion of persons who have immigrated to Canada since 1981, and the proportion of adults who are unemployed.

We also have information on the characteristics of our students' high schools from the Ontario Ministry of Education for the years 2000 through 2003 (our data are incomplete over other years). A key variable that we use to assess the academic quality of a high school is the proportion of students taking the Grade 9 standardized Academic Math Assessment that receive a "high score" (3 or 4).[8] The principal high school quality indicator that we use in this paper is whether a student is from a high school that was in the bottom,

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[5] Mature Ontario applicants and non-Ontario applicants follow a different application procedure, are relatively small in number, and come from very heterogeneous academic backgrounds.

[6] In 2003, a major change in the secondary school curriculum shortened the normal number of years of high school for university-bound students from five to four. Our grade average is calculated using six Grade 13 courses (OAC courses) for students from pre-reform cohorts and six Grade 12 University (or U/M) level courses for students from post-reform cohorts. This also resulted in a "double cohort" that entered university in 2003. Different universities may calculate the scholarship average slightly differently (how repeated attempts are treated, for example).

[7] Standardizing households of different sizes by use of an 'equivalence scale' is now quite common. The square root scale is one of the simplest and most commonly employed.

[8] The Grade 9 Math Assessment test is a province-wide assessment of the math skills students are expected to have learned by Grade 9. Students who are working toward their Grade 9 academic and applied math credit take different versions of this test. Our goal is to predict persistence and success in university. Most students even remotely considering university will take the Grade 9 academic math stream. Hence we focus in this paper on school performance on the academic version of the Grade 9 Math Assessment. These are commonly called EQAO (Education, Quality and Accountability Office) exams.

middle or top tercile of high schools based on the proportion of students taking the Grade 9 standardized Academic Math Assessment that received a high score. Table A-1 indicates that approximately 45% of the students in our sample come from high schools in the top tercile. Other high school characteristics that we use include the distance to the nearest university and nearest college, the type of high school (private, public, separate, Francophone), the size of the student body and the high school's location, in a rural or urban area.

# 4. Basic Regression Estimates

Our estimation uses the following model:

$$Y_i = B_0 + B_1 S_i + B_2' X_i + e_i$$

where Y refers to one of the following outcomes: GPA at the end of year one; accumulated credits at the end of year one; whether the student departed the university after year one; and whether the student completed a degree within six years. Our key policy measure is the value of the entrance scholarship (S), if any, received by the student. As discussed above, we also include a series of other characteristics (X) of the student (including high school GPA), the neighborhood in which the student resided at the time of application, and the high school which the student attended.[9]. We use all of these measures in both an Ordinary Least Squares (OLS) framework and in a Regression Discontinuity (RD) framework. We start with the OLS specification to provide a baseline set of analyses.

The coefficients and standard errors for the independent variables other than those measuring financial aid were all very similar to those reported in Dooley, Payne and Robb (2011). Hence, we refer the interested reader to that paper and confine our attention in this paper to the coefficients for scholarships and bursaries. Table 2 contains the estimated coefficients and standard errors for the scholarship and/or bursary measures. Each coefficient in Table 2 is from a different regression. Scholarships and bursaries are measured thousands of 2002 dollars. Column 1 identifies the university and, in the case of University B, the grade range for the regression. Column 2 identifies the award measure used in the regression:  scholarship, bursary or scholarship plus bursary. Columns 3 through 6 identify the four different dependent variables and the entries in these columns contain; the estimate, the standard error, and the number of observations on which the estimate is based.

Row 1 of Table 2 contains estimates of the impact of first-year scholarships at University A. The coefficients are significantly positive for both cumulative university GPA and academic credits earned at the end of year one. The coefficient on the GPA indicates that an increase in scholarship value of $1,000 is associated with a grade point increase of 0.3 points on a 0 to 100 scale. The standard deviation for first-year GPA across all students is 10, so the coefficient suggests that an increase in scholarship value of $1,000 represents 3% (=0.3/10) of a standard deviation. While this seems quite low, it is not uncommon to find an effect on the order of 10% of a standard deviation or less in most papers that examine effect of programs on student outcomes. The effect of a $1,000 scholarship on credits earned is 0.05 credits (5 units is a normal load), which is 5% of a standard deviation. The coefficients for the likelihood of a departure during year one and degree completion within six years are both quite small and not significant.

Row 2 contains the estimates obtained using the sample of students with a high school average between 70 and80 from University B. For these students, all awards are bursaries.  These estimates are very similar in size and statistical significance to those in Row 1 for University A. Row 3 contains estimates obtained using the sample of students with a high school average of between 80 and100 from University B. For these students, awards are a combination of scholarships and bursaries. These estimates are very similar in statistical significance to those in Rows 1 and 2 but are even smaller in size.

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[9] See Dooley, Payne, and Robb (2011) for a more complete description.

**Table 2: OLS Regression Estimates for Year 1 Scholarships and/or Bursaries ($000)**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | | | Dependent Variable | | | |
| | Sample | Award measure | Year 1 GPA | Year 1 Credits | Year 1 Departure | Degree in 6 Years |
| (1) | University A | Value of Scholarship | 0.329*** | 0.048*** | -0.001 | -0.003 |
| | | | (0.077) | (0.008) | (0.002) | (0.005) |
| | Observations | | 27,693 | 27,693 | 24,153 | 9,610 |
| (2) | University B | Value of Bursary | 0.303*** | 0.038*** | -0.004 | 0.007 |
| | High School GPA: 70-80 | | (0.092) | (0.014) | (0.005) | (0.013) |
| | Observations | | 7,999 | 7,999 | 6,905 | 3,431 |
| (3) | University B | Value of Scholarship plus Bursary | 0.125*** | 0.018*** | -0.001 | -0.001 |
| | High School GPA: 80-100 | | (0.038) | (0.004) | (0.001) | (0.004) |
| | Observations | | 14,995 | 14,995 | 13,403 | 6,869 |

Standard errors in parentheses, *** p<0.01, ** p<0.05, *p<0.10. Scholarships and bursaries are measured 000s of $2002.
Estimates for other variables are similar to Dooley, Payne and Robb (2011). See Table A-1 for definitions and sample means.

We also estimated separate OLS models for students from low-income, middle-income and high-income neighbourhoods. In results not shown here, we found no systematic evidence of variation in the size of the effect of a scholarship or bursary by the student's neighbourhood average income. In summary, first-year (entrance) awards at both universities appear, on the basis of our OLS analysis, to have only modest effects on student grades and credits earned and generally no association with persistence and degree completion among students as a whole.

# 5. Regression Discontinuity Estimates

## 5.1 A Brief Introduction to Regression Discontinuity Analysis

As indicated earlier, researchers generally do not have satisfactory controls for all variables correlated with both financial aid and persistence in university. Some of these factors, such as high school grades, may be readily measurable, but others, such as work habits and motivation, are usually not. These unmeasured or "omitted" variables may result in biased estimates of the true impact of scholarship and bursaries on university outcomes. The "gold standard" of causal analysis is an experiment in which a treatment is randomly assigned. In fields of study in the social sciences, including higher education, however, random experiments are typically not feasible either due to cost considerations or ethical reasons (e.g., it is not feasible to use random assignment to decide which students go to university and which do not). In situations where random experiments are difficult, researchers have resorted to other statistical methods to try to establish a causal claim. One type of analysis that has become increasingly popular is regression discontinuity (RD) analysis or RD design. The RD design is a quasi-experimental method in which subjects are assigned to "treatment" and "control" groups based on some pre-specified criterion such as having a high school GPA above the threshold or cut-off for an entry scholarship. RD designs copy some of the desirable properties of randomized experiments and are based in part on verifiable assumptions.[10] The basic idea is that candidates for an entry scholarship just below and just above the cut-off can be assumed to be similar in respect to observables (other than the treatment) and unobservables, so that differences in behaviour between the two groups at the cut-off can be attributed to the "treatment."

A classic RD design is one in which the likelihood of assignment to a treatment is fully determined by the value of some criterion such as high school GPA. The likelihood of the "treatment" goes from 0 to 100% at the cut-off point. A so-called Fuzzy RD design is one in which the probability of the treatment jumps discontinuously at the cut-off value but not from 0 to 100. Figure 4a portrays the situation for entrants to University A during those years in which the minimum high school GPA for an entry scholarship was equal to 80 or more. Figure 4b portrays the situation for entrants to an Arts Program at University B during those years in which the minimum GPA for an entry scholarship was equal to 85 or more. At University B, different scholarship cut-offs were used for different programs. Hence, we analyze the data for entrants to the Arts and Business programs separately. The number of entrants to the Science programs was too small to permit separate analysis.

Figure 4a shows that the likelihood of a scholarship goes from approximately 10 to 80% for entrants at University A, which clearly classifies the results as a Fuzzy RD design. For an explanation of why this likelihood does not go from 0 to 100%, please see the discussion in Section 3.1 concerning minor discrepancies between our assessment of which students should be receiving an entrance scholarship and the actual values reported in the data.

[10] See McCall and Bielby, 2012, and Schochet, P. et al., 2010, for excellent reviews.

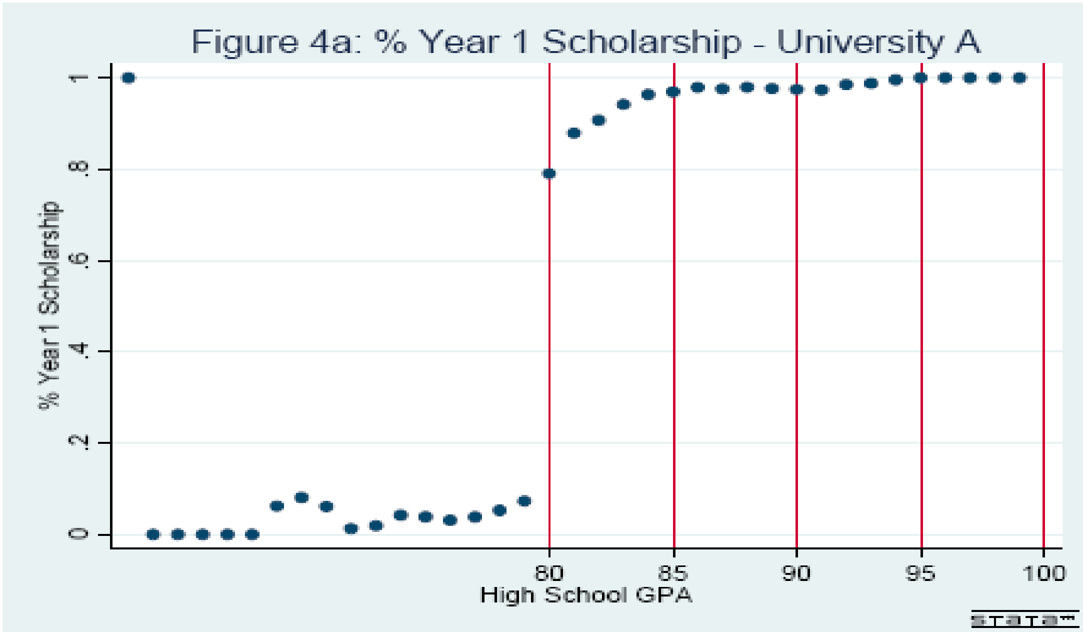
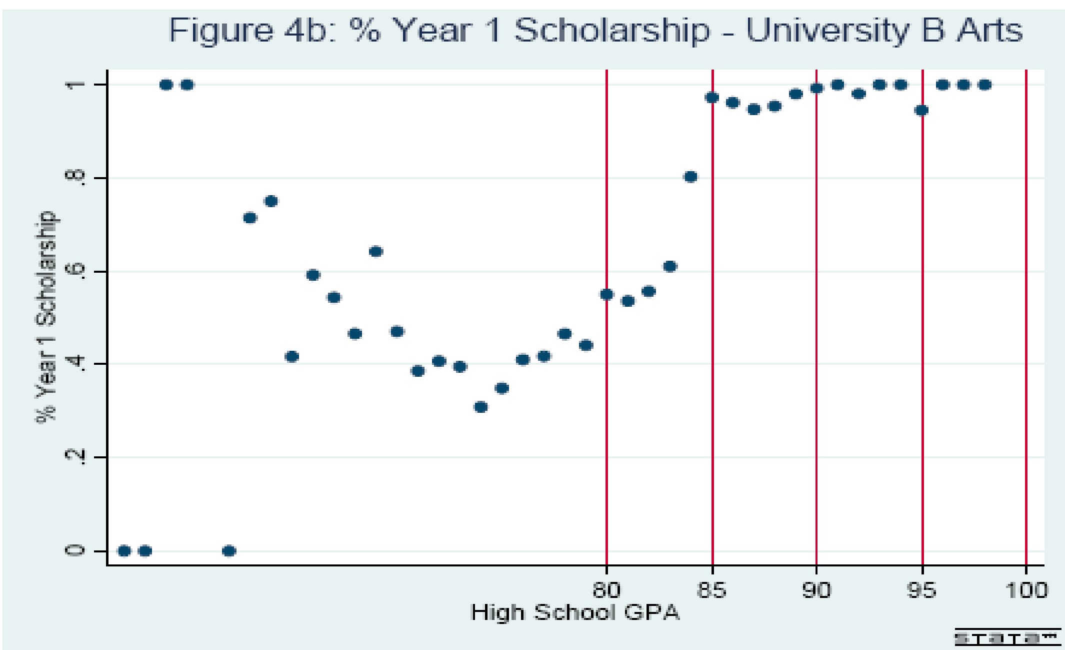



Figure 4b portrays the likelihood that a student received an entry scholarship and/or a bursary in an Arts programs at University B. This likelihood clearly jumps at a GPA of 85 but only from about 60% to almost 100%. The main reason why this likelihood does not jump from 0 to 100% is that the data reflect the receipt of both scholarships and bursaries and, as Figure 4b clearly reveals, many students with a GPA below 80 receive a bursary at University B.




In our RD estimation procedure, we employ not just the minimum GPA needed for an entry scholarship but also the cut-offs used to determine the value of the guaranteed entry scholarship. The schedule of guaranteed entry scholarships is a step function in which higher grade ranges are associated with larger scholarship values (e.g., $1,000 for 80-85, $1,500 for 85-90 and $2,000 for 90-100). We can use differences in outcomes between students who fall below and above each of these steps to assess the causal impact of scholarships.

The goal of RD analysis is to lessen the bias in our estimates. Unfortunately, there is commonly a trade-off with precision. Specifically, as one restricts the sample to those observations that are "close" to treatment threshold, one reduces both sample size and the range of the independent variables. Both of these factors tend to increase the standard errors. Fortunately, our administrative data sets are quite large. The other trade-off with using observations that are close to the treatment threshold is that the results are particular to that range of observations and not necessarily to the entire sample of students. The implications for policy analysis is that, when using an RD design, one must consider how the students analyzed near the threshold differ from those the potential policy prescriptions intend to target.

## 5.2 Testing the Underlying RD Assumptions

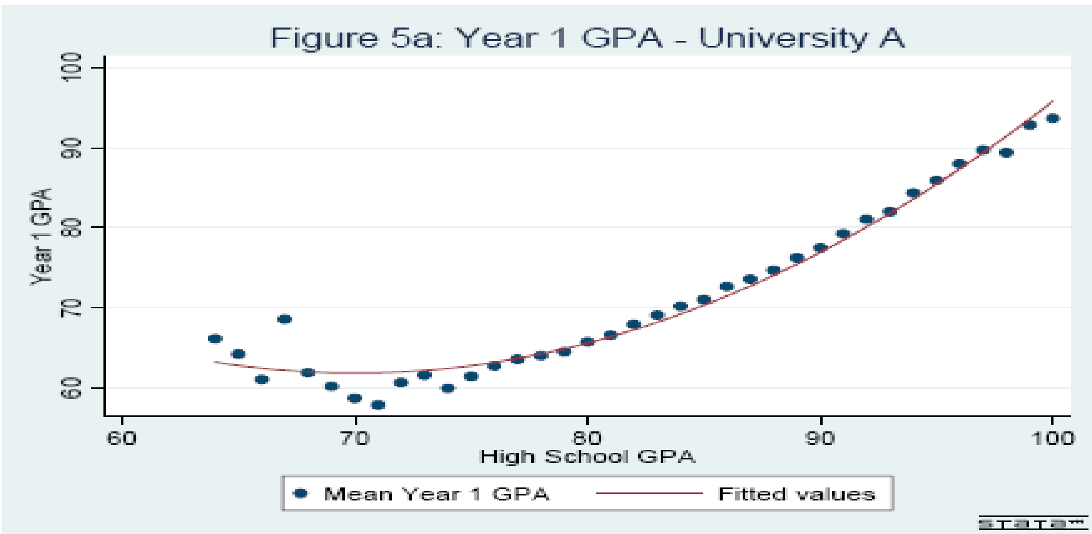
A key assumption underlying our RD design is that, at the scholarship cut-off points, there is a discontinuity in the value of a scholarship awarded but not in the value of other background variables that are associated with university outcomes. The background variables used in this paper are described in more detail in Dooley, Payne and Robb (2011) and include personal characteristics (such as sex and entry program), neighbourhood characteristics (such as average income and the proportion of adults with a bachelor's degree education or greater), and high school characteristics (such as total enrollment and average performance on a standardized test). For observable background characteristics, one can explicitly test for discontinuities and we have undertaken a series of such tests. We briefly describe the results of these tests below.

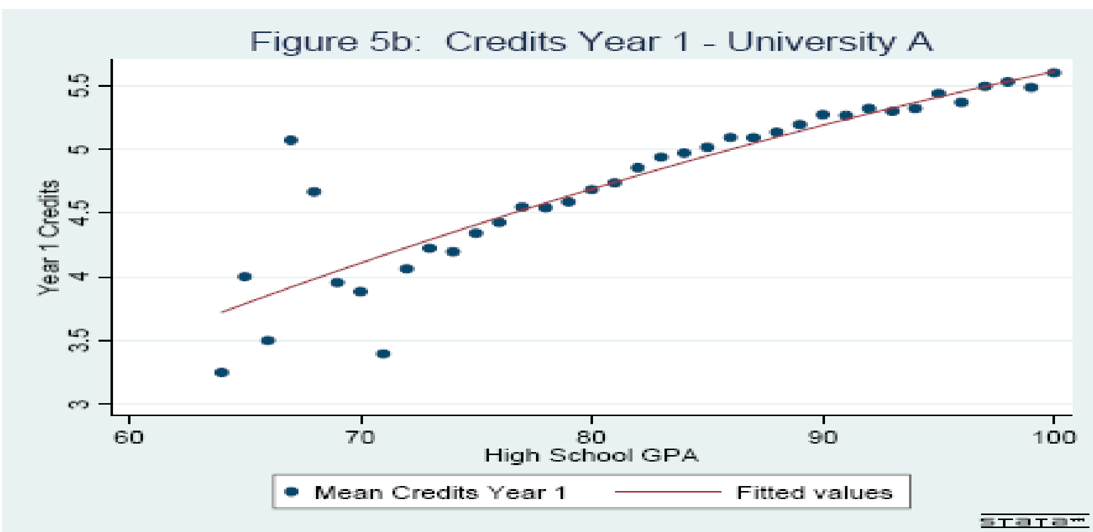
The simplest such test is to compare the mean values of these background characteristics on either side of a grade cut-off. This is a cumbersome test given the long list of background characteristics, but our examination of a large number of these reveals no such jumps in value at various cut-off points. A more comprehensive test is first to regress one of our university outcomes, such as first-year GPA, on the background characteristics and calculate the predicted first-year GPA for each observation. Next, one plots the mean predicted first-year GPA by high school GPA and tests to see if there is any discontinuity in the prediction at the scholarship cut-offs. Our analysis reveals no such jumps for any university outcome.

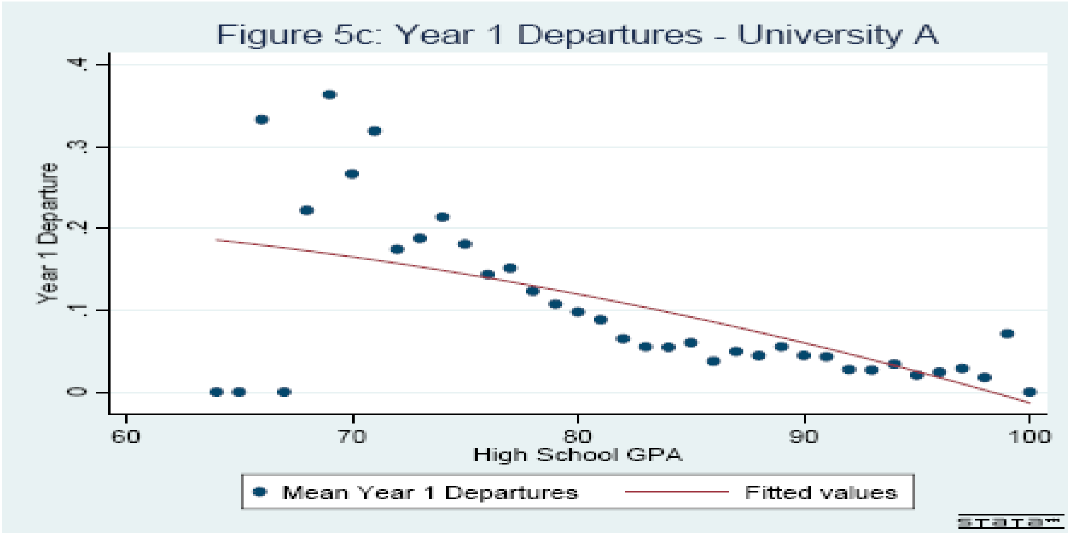
A final test is to regress a binary measure of being just above the scholarship threshold on a list of background characteristics using a sample of observations that are within one or two high school average grade points of a threshold. One can then assess how well the background characteristics either individually or jointly predict the probability that an individual is above or below the cut-off in such a sample. Our analysis reveals that our background characteristics do a very poor job of predicting in this type of sample.
More details on any of the above tests of the underlying assumptions of our RD model are available upon request. It is also important to note that the most important assumption of our RD model is that there is no discontinuity in the distribution of the unobserved determinants of our university outcomes at the scholarship thresholds. By definition, this assumption is not testable. However, the consistent failure of our data to reveal discontinuities in the distribution of observed background factors lends support to the assumption that the same absence of discontinuities is true of unobserved background factors.

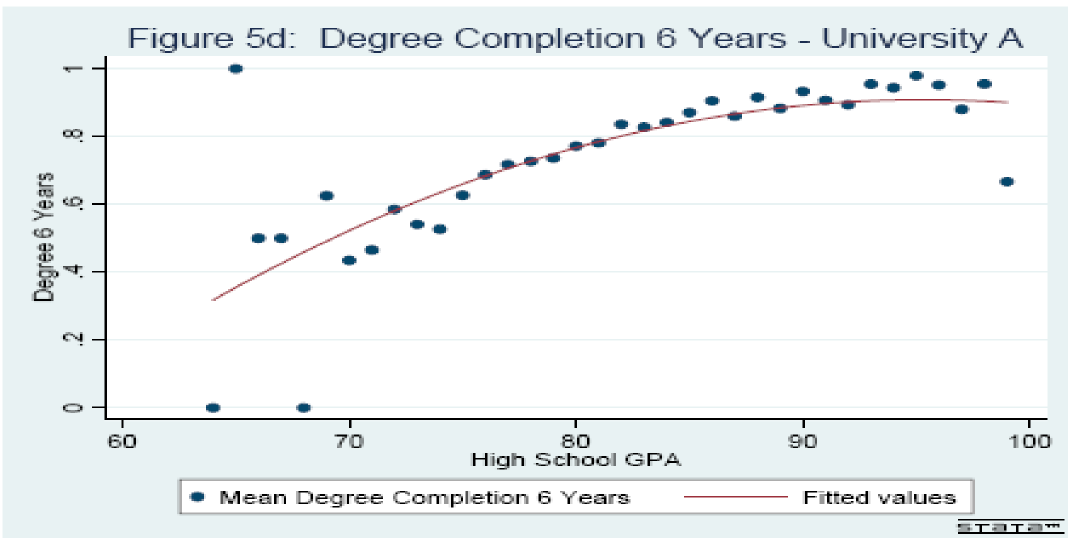
## 5.3 RD Estimates

The simplest form of RD test is to plot the average value of the university outcomes by high school GPA and observe if there are any jumps at the scholarship threshold values. Figures 5a through 5d show such graphs for University A using all four of our outcomes. These figures also contain a quadratic function fit to the data points. This function shows the predicted values provided by a regression of the outcome variable on the high school average plus the square of the high school average. There are no obvious jumps or discontinuities at the scholarship thresholds of 80, 85, 90 or 95. These figures use data from all available years but a similar picture emerges if one draws the same graphs by individual entry year. The same is true of University B (not shown here). This simple test, however, does not control for the other personal, neighbourhood and high school variables that are known to be associated with university outcomes.






In order to estimate a fuzzy RD multivariate model, we use instrumental variable (IV) estimation where we instrument for the value of the scholarship and/or bursary received using dummy variables for whether or not the student's high school GPA is greater than or equal to the relevant thresholds in place in the year when the student entered university. We present estimates obtained with our entire sample and estimates obtained using only those observations that have values of the high school GPA "close" to one of the scholarship thresholds.

Table 3 contains the IV estimated coefficients and standard errors. As in Table 2, each coefficient in Table 3 is from a different regression and the sample sizes are noted. Each regression also contains the same set of additional variables as in Table 2 including a quadratic in the high school GPA. Columns 1 through 4 identify the four different dependent variables.

**Table 3: IV Regression Estimates for Effect of Year 1 Scholarships and/or Bursaries ($000)**

| | VARIABLES | (1)<br>Year 1 GPA | (2)<br>Year 1 Credits | (3)<br>Year 1 Departure | (4)<br>Degree in 6 Years |
|---|---|---|---|---|---|
| **University A: Coefficent for Value of Scholarships** | | | | | |
| (1) | Total Sample | 0.839** | 0.052 | -0.023* | 0.018 |
| | | (0.366) | (0.044) | (0.013) | (0.016) |
| | Observations | 27,693 | 27,693 | 24,153 | 9,610 |
| (2) | HS GPA 75-85 | 0.124 | -0.015 | 0.006 | 0.045 |
| | | (0.380) | (0.051) | (0.014) | (0.039) |
| | Observations | 14,099 | 14,099 | 12,630 | 5,813 |
| (3) | HS GPA 80-90 | 0.187 | 0.027 | 0.012 | -0.040 |
| | | (0.248) | (0.027) | (0.009) | (0.112) |
| | Observations | 17,051 | 17,051 | 14,723 | 4,997 |
| (4) | HS GPA 85-95 | 0.022 | 0.170** | -0.007 | -0.004 |
| | | (0.750) | (0.071) | (0.022) | (0.041) |
| | Observations | 12,168 | 12,168 | 10,219 | 3,030 |
| (5) | HS GPA 90-100 | -1.390 | 0.068 | 0.047 | -6.597 |
| | | (1.602) | (0.145) | (0.058) | (382.283) |
| | Observations | 4,950 | 4,950 | 4,175 | 1,253 |

| | VARIABLES | (1)<br>Year 1 GPA | (2)<br>Year 1 Credits | (3)<br>Year 1 Departure | (4)<br>Degree in 6 Years |
|---|---|---|---|---|---|
| **University B, Faculty of Arts: Coefficent for Value of Scholarships Plus Bursaries** | | | | | |
| (6) | Total Sample | 1.041* | 0.114* | -0.025 | 0.008 |
| | | (0.560) | (0.063) | (0.023) | (0.044) |
| | Observations | 14,221 | 14,221 | 12,399 | 5,795 |
| (7) | HS GPA 75-85 | -0.519 | -0.012 | -0.024 | 0.093* |
| | | (0.480) | (0.063) | (0.020) | (0.049) |
| | Observations | 9,083 | 9,083 | 7,918 | 3,857 |
| (8) | HS GPA 80-90 | -2.327 | -0.444* | 0.132 | -0.281 |
| | | (1.824) | (0.231) | (0.090) | (0.354) |
| | Observations | 6,840 | 6,840 | 6,063 | 2,816 |
| (9) | HS GPA 85-95 | -0.704 | -0.006 | 0.038 | 0.071 |
| | | (1.016) | (0.095) | (0.044) | (0.270) |
| | Observations | 2,485 | 2,485 | 2,165 | 904 |
| (10) | Total Sample | 2.432 | 0.094 | -0.074 | -0.012 |
| | | (1.611) | (0.119) | (0.059) | (0.166) |
| | Observations | 5,898 | 5,898 | 5,377 | 3,107 |
| (11) | HS GPA 82.5-92.5 | -0.353 | -0.017 | 0.002 | -0.058 |
| | | (0.533) | (0.041) | (0.020) | (0.040) |
| | Observations | 4,902 | 4,902 | 4,491 | 2,559 |
| (12) | HS GPA 85-95 | -0.053 | 0.043 | -0.014 | 0.250 |
| | | (0.548) | (0.039) | (0.016) | (0.303) |
| | Observations | 3,919 | 3,919 | 3,594 | 1,928 |

Standard errors in parentheses, *** p<0.01, ** p<0.05, *p<0.10. Scholarships and bursaries are measured in 000s of $2002. Other estimates are similar to Dooley, Payne and Robb (2011). See Table A-1 for definitions and sample means.

The first five rows contain the estimates for University A. The estimates in Row 1 use the entire sample and the instrumental variables are all four scholarship thresholds (80, 85, 90 and 95). The coefficients for both first-year GPA and Departures are significant. The coefficient value for first-year GPA represents a change of about 8% of a standard deviation. The coefficient in Column 3 is weakly significant and implies that a $1,000 scholarship increase is associated with a 2.3 percentage point drop in the departure rate.

The key estimates for the RD analysis, however, are in Rows 2, 3, 4 and 5. These coefficients are from regressions estimated with the indicated samples which, in each case, include all observations that are five grade points above or below each of the 80, 85, 90 and 95 grade cut-offs for various scholarship values. There is some overlap in these samples. The only instance of a significant coefficient is that for Year 1 Credits in Row 4 (HS GPA of 85-95 with cut-off at 90). The numbers of observations imply that the lack of statistical significance is not due to small sample size. We note, in particular, the estimates in Row 5, which utilizes the differences between students who were eligible for a guaranteed renewable entry scholarship and those who were not. These estimates fail to support the hypothesis that renewability is associated with better academic outcomes.

Rows 6 through 9 contain the estimates for students entering Arts programs at University B. The coefficients for GPA and Year 1 Credits are both significant and somewhat larger than in Table 2 but still reflect changes of only about of ten percent of a standard deviation. The estimates in Rows 7, 8 and 9 are from regressions estimated with the indicated samples which, in each case, include all observations that are five grade points above or below the scholarship cut-offs of 80, 85 and 90. There were no guaranteed renewable entry scholarships at University B during our sample period. In Table 2, we estimated a regression with entrants at University B who qualified only for a bursary by virtue of having a high school GPA of less than 80. The RD approach, however, requires that the sample contain both students who qualify and students who do not qualify for a scholarship. Hence, we cannot use a sample of students with a high school GPA of less than 80 as we did in Table 2. There are only two significant coefficients in Rows 7, 8 and 9. One is a large coefficient for degree completion among students with a high school GPA between 75 and 85. The other significant result in the middle panel is the unexpectedly negative coefficient for Year 1 Credits in Row 9.

The estimates in Rows 10, 11 and 12 are for students entering the Business program at University B. The minimum high school GPA needed for an entrance scholarship to this program over our data period was 87.5 (and 90 in some years). Hence, the estimates in Rows 11 and 12 are from regressions which include all observations that are five grade points above or below 87.5 and 90 in the relevant years. There are no significant coefficients in any of Rows 10, 11 or 12. Note that the regressions for University B, like those for University A, are also estimated with reasonably large samples.

We undertook a series of sensitivity tests of the estimates in Table 3. First, we estimated separate RD models for students from low-income, middle-income and high-income neighbourhoods. In results not shown here, we found no systematic evidence of variation in the size of the effect of a scholarship or bursary by the neighbourhood average income of the student. Next we estimated the IV regressions in Table 3 using samples which include only observations that are two grade points above or below the various scholarship cutoffs. These samples are somewhat smaller but are never less than 1,000 observations except in the case of the highest grade range for students entering an Arts program at University B. These coefficients are statistically significant in only three instances. Only one of those three is of the expected sign. As a third check, we also estimated the IV models in Table 3 by Faculty for University A. This produced a large number of estimated scholarship coefficients only a few of which were significant.

# 6. Summary and Policy Discussion

We have used data from two universities in Ontario to analyze the relationship between entrance financial aid awards and success in university. We report separate estimates for each university due to the differences in the nature of the financial aid data provided. One university provided data on the value of merit-based awards, commonly referred to as “scholarships” and the second university provided data on the combined value of merit-based awards and needs-based awards, the latter being commonly referred to as “bursaries”.

In our OLS regressions, first-year (entrance) scholarships and bursaries at both universities have only modest effects on student grades and credits earned and generally no association with persistence and degree completion among students as a whole. One must interpret these simple regression findings with caution. We have a limited set of controls for the variables correlated with both financial awards and persistence. Hence, omitted variables may cause these to be biased coefficients of the causal impact of financial aid on university outcomes. For this reason, we used regression discontinuity analysis in order to obtain estimates of the causal effects that one might expect to be freer of bias. These RD results, however, offered little support for the proposition that entrance scholarships and bursaries have an important causal impact on university outcomes. This is even true of entry scholarships that are guaranteed renewable in future years given satisfactory performance in year one.

In summary, neither set of regression estimates offers much support for the proposition that entrance scholarships and bursaries have sizable impacts on any of our university outcomes. The simple regressions implied small effects on Year 1 GPA and Credits but even these results were not supported by the IV regressions. This finding is just as true for students from low-income neighbourhoods as for students from more advantaged areas.

So why should universities continue to offer entrance scholarships and bursaries especially at the entrance level? It may be that the principal benefit to universities of these forms of financial aid is that they attract stronger students to the university, especially those from lower-income families, rather than help the students to succeed once enrolled. We were unable to test the “attraction” hypothesis with the data available in this paper but we did so with a different set of administrative data in Dooley, Payne and Robb (2012). It may be, of course, that shortcomings in our data have prevented us from uncovering the true causal effect. Despite the obvious strengths of accuracy and large sample size, our administrative data do have defects. For University A, we only have data on scholarships and not on bursaries. For University B we only have data on combined scholarships and bursaries. For both schools, we only have data on scholarships and bursaries provided by the university and lack information of levels of financial assistance available from other sources. We also lack information on the socioeconomic characteristics of the individual families from which these students come (although we have neighbourhood information). Finally, we have data from only two universities. We believe that these two institutions are representative of a substantially larger segment of the university sector in Ontario but we cannot claim they reflect all such schools and students.

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**Table A-1**

**Definition and Sample Means or Proportions of Variables**

| Variable Name | Definition: All Binary Variables Unless Otherwise Indicated | Sample Mean or Proportion | |
|---|---|---|---|
| | **Panel A: University Administrative Variables** | | |
| | | University A | University B |
| **Arts Entry Program** | Enrolled in an Arts program in Year 1. | 44% | 62% |
| **Science Entry Program** | Eenrolled in a Science program in Year 1. | 37% | 13% |
| **Business Entry Program** | Enrolled in a Business program in Year 1 | 13% | 25% |
| **Engineering Entry Program** | Enrolled in a Engineering program in Year 1. | 6% | --- |
| **GPA Year 1** | Cumulative grade point average at the end of year 1 among students observed for 1 or more years. | 71 | 72 |
| **Credits Passed Year 1** | Credits passed during year 1 for students observed for 1 or more years. | 4.9 | 4.7 |
| **% Departed During Year 1** | Proportion of students for whom we observe only missing values in the third calendar year after entry among students observed for 2 or more years. | 7% | 8% |
| **% of all students with Degree after 6 Years** | Proportion of students for whom we observe a degree earned at the end of 6 years after entry among students that we observe for 6 or more years. | 80% | 81% |
| **Year 1 GPA < 60** | Year 1 university GPA is less than 60 | 13% | 8% |
| **Year 1 GPA 60-70** | Year 1 university GPA is 60 to 70 | 32% | 31% |
| **Year 1 GPA 70-80** | Year 1 university GPA is 70 to 80 | 37% | 48% |
| **Year 1 GPA 80-90** | Year 1 university GPA is 80 to 90 | 16% | 11% |
| **Year 1 GPA 90+** | Year 1 university GPA is 90 and over | 2% | 2% |
| | **Panel B: Ontario Universities Application Centre Variables** | | |
| **Female** | Student is female. | 62% | 60% |
| **English Mother Tongue** | Student’s mother tongue is English. | 90% | 93% |

| | | | |
|---|---|---|---|
| **Canadian Citizen** | Student is a Canadian citizen. | 95% | 97% |
| **Distance to Campus** | Home is more than 50 km from campus. | 77% | 76% |
| **Age at Entry** | Age (in months) at entry to university | 19.1 | 18.7 |
| **Average HS Grade< 75** | Average HS grade is less than 75 (mostly greater than 70). | --- | 13% |
| **Average HS Grade >=75 and <80** | Average HS grade is equal to or greater than 75 and less than 80. | ---- | 22% |
| **Average HS Grade >=80 and <85** | Average HS grade is equal to or greater than 80 and less than 85. | 46% | 34% |
| **Average HS Grade >=85 and <90** | Average HS grade is equal to or greater than 85 and less than 90. | 34% | 23% |
| **Average HS Grade >=90 and <95** | Average HS grade is equal to or greater than 90 and less than 95. | 17% | 8% |
| **Average HS Grade >= 95** | Average HS grade is equal to or greater than 95. | 3% | 1% |
| **All University Courses** | Best six HS courses are all university level. | 62% | 75% |
| **Panel C: Neighbourhood Variables from Census Dissemination (Enumeration) Areas** | | | |
| **Low Income** | Student comes from a neighbourhood in the bottom tercile of the distribution of all neighbourhoods by average equivalent income. | 16% | 17% |
| **Middle Income** | Student comes from a neighbourhood in the middle tercile of the distribution of all neighbourhoods by average equivalent income. | 28% | 32% |
| **High Income** | Student comes from a neighbourhood in the top tercile of the distribution of all neighbourhoods by average equivalent income. | 56% | 51% |
| **% Bachelor's Degree** | Proportion of adults in the neighbourhood with a degree at the Bachelor's level or higher. | 25% | 20% |
| **% Lone Mother** | Proportion of families in the neighbourhood headed by a lone mother. | 10% | 10% |
| **% English** | Proportion of persons in the neighbourhood with English as mother tongue. | 90% | 92% |
| **% Recent Immigrant** | Proportion of persons in the neighbourhood immigrated since 1981. | 12% | 10% |
| **% Unemployed** | Proportion unemployed of adults in the neighbourhood. | 6% | 7% |

| Table A-1 (continued) | | | |
|---|---|---|---|
| **Panel D: Ministry of Education High School Variables** | | | |
| **% of High EQAO Scores in Bottom Tercile** | Proportion of High EQAO Scores (3 or 4) in the High School is in the Bottom Tercile of all High Schools with OUAC Applicants. | 20% | 19% |
| **% of High EQAO Scores in Middle Tercile** | Proportion of High EQAO Scores (3 or 4) in the High School is in the Middle Tercile of all High Schools with OUAC Applicants | 35% | 38% |
| **% of High EQAO Scores in Top Tercile** | Proportion of High EQAO Scores (3 or 4) in the High School is in the Top Tercile of all High Schools with OUAC Applicants. | 45% | 43% |
| **Missing EQAO Scores** | High school is missing EQAO scores. | 12% | 5% |
| **Distance to University** | Distance (km) from high school to nearest university. | 22 km. | 27 km. |
| **Distance to College** | Distance (km) from high school to nearest college. | 11 km. | 14 km. |
| **Private** | High school is private (not publicly funded). | 10% | 5% |
| **Public, English** | High school is public and English. | 74.40% | 74.40% |
| **Public, Francophone** | High school is public and Francophone. | 0.10% | 0.10% |
| **Catholic, English** | High school is (publicly funded) Catholic and English. | 25% | 24% |
| **Catholic, Francophone** | High school is (publicly funded) Catholic and Francophone. | 0.50% | 0.50% |
| **Rural** | High school is in rural area. | 16% | 22% |
| **Total Enrolment in Bottom Tercile** | Total High School Enrolment is in the Bottom Tercile of all High Schools with OUAC Applicants. | 27% | 25% |
| **Total Enrolment in Middle Tercile** | Total High School Enrolment is in the Middle Tercile of all High Schools with OUAC Applicants. | 33% | 31% |
| **Total Enrolment in Top Tercile** | Total High School Enrolment is in the Top Tercile of all High Schools with OUAC Applicants. | 40% | 44% |
| **Panel E: Entry Years** | | | |
| **1994 Entry Year** | Enrolled in Year 1 in Fall of 1994. | --- | 4% |
| **1995 Entry Year** | Enrolled in Year 1 in Fall of 1995. | --- | 5% |

| | | | |
|---|---|---|---|
| **1996 Entry Year** | Enrolled in Year 1 in Fall of 1996. | --- | 6% |
| **1997 Entry Year** | Enrolled in Year 1 in Fall of 1997. | --- | 6% |
| **1998 Entry Year** | Enrolled in Year 1 in Fall of 1998. | --- | 7% |
| **1999 Entry Year** | Enrolled in Year 1 in Fall of 1999. | 9% | 8% |
| **2000 Entry Year** | Enrolled in Year 1 in Fall of 2000. | 9% | 8% |
| **2001 Entry Year** | Enrolled in Year 1 in Fall of 2001. | 10% | 10% |
| **2002 Entry Year** | Enrolled in Year 1 in Fall of 2002. | 13% | 9% |
| **2003 Entry Year** | Enrolled in Year 1 in Fall of 2003. | 18% | 14% |
| **2004 Entry Year** | Enrolled in Year 1 in Fall of 2004. | 13% | 11% |
| **2005 Entry Year** | Enrolled in Year 1 in Fall of 2005. | 14% | 12% |
| **2006 Entry Year** | Enrolled in Year 1 in Fall of 2006. | 14% | ---- |

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