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Merit-Aid and the Distribution of Entering Students Across Ontario Universities*

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Abstract

Tuition levels at Ontario universities have risen along with the value of merit-based entry scholarships provided by the nineteen institutions in this relatively closed system. We use data on entering students from 1994 through 2005 and find that merit awards have at most a small effect on a university's share of academically strong registrants. Such aid, however, is strongly associated with an increase in the ratio of students from low-income neighbourhoods to students from high-income neighbourhoods. Finally, although more advantaged students are more likely to attend university, merit aid is not strongly skewed towards the more advantaged conditional upon registration.

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Executive Summary

The past decade witnessed steady increases in the real cost of tuition and fees at Ontario universities especially in professional programs such as Commerce and Engineering. These cost hikes were accompanied by large increases in financial aid often in the form of merit-based entry scholarships. This form of financial aid was not the norm at Ontario universities in the mid-1990's but now is offered by most of these institutions. Over this period there have been increases not only in the average value of such scholarships but in the variation among universities in the value of such merit aid. Virtually all Ontario universities are publicly funded and the system is quite self-contained. The main purpose of these scholarships is to attract academically strong students to the individual institution by lowering the net cost of attendance. This "sticker price" strategy may be especially appealing to lower income students but will also divert expenditures from other institutional features (class size, program diversity, etc.) that may hold more appeal for higher income students. Hence, we hypothesized that this strategy may end up altering the mix of students who register at a university.

We use data from the Ontario Universities Application Centre on student registrations from 1994 through 2005 to examine three questions. Does a lower net cost enable an Ontario university to attract a greater share of academically strong high school students? Does the impact of net cost on attendance vary by the socioeconomic background of the student? Is merit aid of disproportionate benefit to students from more privileged socioeconomic backgrounds?

Our regression estimates indicate no significant relationship between the net cost (tuition minus merit aid) of attending a given university relative to its competitors and the overall share of high school applicants with a high school grade average in the 80-90 range that the university is able to attract. For students in the 90-100 grade range, however, we find a statistically significant but very modest-sized impact for students in Arts, Science, and Commerce. For the Engineering students in this top grade range, however, the effect is substantially larger. Hence the answer to our first question is that, with one exception, merit scholarships have at most a small effect on the ability of a university to increase its share of academically strong students.

To answer our second question, we also estimated our regressions with interactions between net cost and the average income level of the neighbourhood in which the student's family resides. In the majority of cases, we find higher net cost is associated with a decrease in a university's share of students from low-income areas and an increase in the share from high-income areas. Our interpretation of the positive effect of higher costs on students from high-income neighbourhoods is that guaranteed entry scholarships channel funds away from other services that high-income students value more greatly, e.g., smaller classes, better facilities, etc. Our common finding is that a higher net cost is associated with an increase in the proportion of students from high-income areas relative to the proportion from low-income areas. In other words, merit aid influences not so much the number as the type of academically strong students that a university can attract.

To answer our final question, the data reveal that university registrants do indeed come disproportionately from higher income neighbourhoods. Conditional upon university registration, however, the differences in the proportions of students from low-income and high-income neighbourhoods that qualify for a merit-based entry scholarship at a given university is only one or two percentage points. Hence, among those students who make it to university, merit aid does not appear to be of disproportionate benefit to those from more economically advantaged backgrounds.

Further research on this topic is well warranted. Our findings would clearly be enhanced by additional controls for the characteristics of both universities and the characteristics of students and their families. It would also be very helpful to have data beyond registration that permitted one to assess the impact of merit aid on student progress once in university.

1. Introduction

Ontario has a large, publicly-funded and quite self-contained university system. Ninety-five percent of undergraduate university students from Ontario are enrolled at Ontario universities and 95% of Canadian undergraduate students (and 90% of all students) enrolled at Ontario universities are from Ontario (Statistics Canada 2008). [1] As a result, these institutions largely compete for the same pool of in-province students.

Price competition among Ontario universities is a relatively recent phenomenon. All tuition fees were regulated in Ontario prior to the mid-1990s. A subsequent deregulation process has permitted limited freedom to set fees in arts and science programs and greater freedom in professional programs. Over the same time period, a growing number of universities in Ontario made the decision to compete for academically strong entrants by instituting programs of guaranteed merit scholarships for incoming, and in some cases, continuing students. These programs are of the form that they guarantee a scholarship of $X to all applicants with a grade point average (GPA) of Y or better. Between 1994 and 2005, Ontario had, for the purposes of admissions and financial aid, 19 universities.[2] In 1994 only two of these universities had guaranteed entry scholarships for students with a high school grade point average (GPA) of 80 to 90 and another eight universities had guaranteed entry scholarships for students with a GPA of 90 to 100. By 2005, thirteen (sixteen) of the 19 universities had guaranteed entry scholarships for students with a GPA of 80 to 90 (90 to 100) or more.

The spread of merit aid programs has raised some concerns. First, merit aid is costly in terms of foregone

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[1] For convenience, we use the term "Ontario university" to refer to the publicly-funded universities in the province. The two privately-funded universities in Ontario account for less than 1% of total enrollment in the province, a figure that was calculated by the authors from enrolment data provided on the websites of the private universities and the annual universities issue of Maclean's magazine.

[2] Brock, Carleton, Guelph, Lakehead, Laurentian (including Algoma), McMaster, Nipissing, Ottawa, Queen's, Ryerson, Toronto (Mississauga), Toronto (St. George), Toronto (Scarborough), Trent, Waterloo, Western Ontario, Wilfred Laurier, Windsor, and York. Throughout this paper, we divide the University of Toronto into its three separate campuses in our analyses. We believe that this approach is clearly justified indicated by the differences in admissions procedures, merit aid programs and the academic records entering students at these campuses.

revenue. Hence individual universities are concerned that the benefits of this strategy, specifically the increase in academically strong registrants, be sufficient to justify this cost. Second, universities also generally prefer to attract and maintain a mix of students from different backgrounds. Such aid can be characterized as a form of "sticker price" competition which may have stronger appeal to students from less affluent families. Hence, this type of aid may also have an impact on the type of students that a university attracts. A final concern arises from the fact that merit aid ignores financial need and, hence, may be of disproportionate benefit to students from more affluent families.

In this paper, we use twelve years of data from the Ontario Universities Application Centre to answer three questions that correspond to the above concerns. First, does guaranteed merit aid enable a university to attract a larger share of academically strong students from Ontario? Second, is merit aid more successful at attracting students from low income neighbourhoods than from high income neighbourhoods? Third, are the students from high income neighbourhoods disproportionately likely to benefit from merit aid?

The next section provides a review of the literature. We provide a discussion of theoretical considerations in Section 3. The empirical model and data are presented in Section 4. Our regression results are presented and discussed in Section 5. A summary and conclusion are in Section 6.

2. Literature Review

Three recent Canadian studies have examined the determinants of choices concerning university applications and enrolment though none of these considers merit-based aid. Two of these studies used the university level data provided by the annual "universities" issue of Maclean's magazine. Mueller and Rockerbie (2005) report that the annual rankings in Maclean's magazine have a significant impact on both total applications and high school grade averages among first year students at Ontario universities for the period 1994 through 2000. This effect was strongest for Medical/Doctoral universities and weakest for Primarily Undergraduate universities. Kong and Veall (2005) use similar measures for all Canadian

universities over the period 1991 through 2004. They find that an increase in the Maclean's ranking is associated only weakly with an increase in high school grade averages among entering students at Medical/Doctoral universities and is not associated with increased enrolments at any category of university. Drewes and Michael (2004) use individual application data from the Ontario Universities Application Centre (OUAC) for Ontario students applying for admission in the 2001-2002 academic year. A low Maclean's ranking reduces applications from academically stronger students to Primarily Undergraduate universities but not at other institutions. They also report that applicants prefer universities that spend a larger proportion of their operating budget on scholarships and non-academic student services. To our knowledge, no papers prior to this one have analyzed the impact of merit aid at Canadian universities.[3]

A second strand of Canadian literature examines the relationship between family income and participation in postsecondary education (Bouchard and Zhao 2000, Christofides, Cirello and Hoy 2001, Corak, Lipps and Zhao 2003, Bowlby and McMullen 2002, Tomkowicz and Bushnik 2003, and Barr-Telford et al. 2003). Data from the Survey of Consumer Finances, the Survey of Labour and Income Dynamics and the General Social Survey have all indicated that rising levels of tuition and debt have not resulted in marked change in the differences in participation rates by level of family income over the past 10-15 years.

3. Theoretical Considerations

One assumption underlying our empirical approach is that high school students make application and registration decisions that maximize their individual utility subject to a personal or family budget constraint.

[3] See Frenette (2005) for a study of fee deregulation in postgraduate professional programs such as law and medicine. There is a substantial literature on university merit aid in the U.S. such as the HOPE program in Georgia. The US programs are different in structure and purpose than the Ontario programs that are the subject of this paper. The US programs were established by state legislatures to boost participation in post-secondary education and encourage high ability students to stay in state. Merit aid in Ontario has been established by individual universities in order to attract a larger share of academically strong students almost all of whom will pursue post-secondary education in province. Hence we do not summarize the findings from the US literature here.

Among the factors that will influence these student decisions are cost (tuition, fees, financial aid, travel, board and room, etc.), the quality and variety of academic programs, residency space, extracurricular activities, recreational facilities, and others. One approach would be to estimate a multinomial logit model of university choice using individual student observations. We do not take this approach for the following reasons among others. First, we have very few characteristics of the individual students in our data set. Second, there are a large number of universities in Ontario which would mean a very large number of estimates. Third, our data sharing agreement prohibits the identification of individual universities thereby limiting a key benefit of the multinomial approach.

The empirical approach we adopt is to take the university as the individual unit of observation and to model the effect of institutional characteristics, especially merit aid, on the share of academically strong registrants that the school is able to attract. Most universities, like other not-for-profit organizations, have a non-distribution constraint, that is, revenues may exceed costs but there are no owners to whom the excess revenues are distributed. As with other nonprofits, there is also no single simple alternative to profit maximization. Existing models of university behaviour recognize that decisions may be influenced by the utility functions of the members of at least four different parties: trustees, administrators, professional staff and students (Garvin 1980). Raines and Leathers (2003) point out that many decisions can be usefully explained in terms of a "convergence of elements" in the interests of those parties. These same authors highlight institutional prestige as a common element in the utility functions of these four parties. Prestige can bring not only psychic but pecuniary rewards, for example, higher salaries for administrators, larger research grants for faculty and better jobs for graduates. Winston (1999), Clotfelter (1996) and James (1990) all also refer to the "pursuit of excellence" or "prestige maximization" as a key objective of universities. These authors also stress the positional aspect of this goal (relative status matters) and the common use of quantitative measures to establish rankings. Many quantitative measures are used including the value of research grants, numbers of citations and, of particular relevance for this paper, the university's ability to attract academically strong applicants and registrants.

Universities compete for academically strong students for many specific reasons beyond general institutional prestige. Such students are more likely to enroll in honours programs which bring a higher subsidy from the Ontario government. Strong students are more likely to persist in their programs thereby lowering turnover costs. They are also often more pleasant to teach, help to teach weaker students, appeal to donors, and ultimately become more influential and affluent alumni.

Universities compete for academically strong students in different ways. Tuition, fees and guaranteed merit aid are all forms of "sticker price" competition. Other forms of competition include the quality and variety of academic programs, guaranteed residency space, extracurricular activities, recreational facilities, etc. Universities and students are heterogeneous in their qualities and interests. Hence, heterogeneity in competition strategies is to be expected. As indicated in the Introduction, we expect that "sticker price" strategies, such as merit aid, may appeal more strongly to students from less affluent backgrounds. Other strategies (class size, facilities, etc.) should appeal more strongly to students from more affluent backgrounds. Hence, one prediction from these assumptions is that an effective merit aid strategy should change the mix of the academically strong students that a university attracts along with, possibly, the overall proportion of such strong students in the province that attend the institution.

4. Data and Empirical Model

4.1 Tuition and Entry Scholarships Data

We have assembled information concerning tuition and mandatory fees from a variety of data sources including the Council of Ontario Universities, university web sites, and the Statistics Canada Survey of Tuition and Living Costs. For each university and year, the level of tuition and fees are identical for Arts programs and Science programs in any given university. Hence, we combine values for these two faculties in the figures below. The level of tuition and fees is higher in professional programs than in than Arts and

Sciences. The charges for Commerce and Engineering programs are not exactly the same but sufficiently similar that we have combined them in the figures below. Figure 1a provides the maximum, minimum and 25th, 50th and 75th percentiles of tuition and fees for students in programs in the Arts (Humanities and Social Sciences) and Sciences in 2001 dollars. The dollar values of each of these characteristics of the distribution increased by about 50% over our data period. The range was $585 in 1994 and increased to $801 by 2005. (For the editor and referees, Table A-1 in the Appendix is the basis for these figures.) Figure 1b provides the same information for Commerce and Engineering. In this case, the effect of deregulation is more apparent. The values of both the 75th percentile and the maximum value double while the increase is just over 50% at the 50th percentile and below. The range grew from $1245 to $4002 and the inter-quartile range increased from $228 to $1777 which is much larger than the inter-quartile range of $265 for Arts and Sciences in 2005.

Financial support for students has a number of sources, some at the institutional level and some at provincial or national levels. Ontario students can apply to a single source, the Ontario Student Assistance Program (OSAP), for provincial and federal grants and loans. Students are awarded financial support based on costs, past student savings, student earnings and parental income. Loans are interest-free while the recipient is a student and repayable only after graduation or discontinuation of study. Awards are portable between universities and programs though a cost of living allowance is added for students at schools more than 40 kilometers from home. There are also portable entry scholarships and bursaries provided by private donors.

Over our data period, Ontario universities substantially increased financial aid and new undergraduate scholarship support has often been in the form of guaranteed merit based scholarships. The federal and Ontario governments have also expanded the amounts of repayable and non-repayable (grants, bursaries and scholarships) aid available to university students. Ontario universities want to make sure that their merit aid programs truly lower the cost of attendance. Hence, both the universities and OSAP take strong steps to ensure that financial aid from these two sources supplement rather than replace each other. This is especially true in the case of non-repayable forms of aid. To this end, the formula used to determine

the amount of repayable and non-repayable aid to which a student is entitled incorporates substantial exemptions for merit based entry awards. In almost all cases, a merit-based entry scholarship will not reduce the amount of non-repayable aid available from government sources.[4]

We have collected individual university scholarship data from a variety of sources including the annual INFO publication of the Ontario Universities Application Centre, the Maclean's Magazine Annual Report on Universities, individual university web sites, and personal communications with university administrators. The proportion of university budgets devoted to scholarships and bursaries increased from 3.1% on average in 1994 to 5.2% in 1999 and to 10.7% in 2005. Some of this increase was due to a requirement of the funding Ministry that tuition increases be accompanied by increased student support. The Ministry placed few restrictions, however, on the manner in which additional funds for scholarships were to be allocated.

As indicated in the Introduction, the number of universities that offer merit-based entry awards for students with a GPA of 80 to 90 rose from 2 in 1994 to 13 (out of a total of 19) in 2005 and the number with an award for students with a GPA of 90 to 100 rose from 10 to 16. At all institutions, the value of merit entry awards is the same across programs. There are considerable differences over time and across institutions in the dollar value of awards and in the grade categories for which these awards are made. Some institutions have had as many as five different categories of awards for GPAs between 80 and 100. As a means of condensing this information, we have calculated the expected value (2001 dollars) of a guaranteed entry scholarship for a student in the grade range of 80 to 90 and in the range of 90 to 100 at each university including those that offer no guaranteed merit aid.[5] This expected value takes into account both the award offered at each grade level (80, 81, 82 etc.) and the distribution in that range of the GPA's of students who

[4] The principal exception would be a student who receives both a merit based entry scholarship from the university and a scholarship from some other non-governmental source. The current values of the exemptions for merit scholarships are $4400 for the federal and $3500 for provincial aid.

[5] Universities differ in their cutoff points. For some institutions, 90 means 90.0 or better whereas for others this 90 means 89.5 or better. We have followed each university's policies in our calculations but, for simplicity, use the terms 80-90 and 90-100 in our text.

actually register in the university. (For the editor and referees, Table A-2 in the Appendix contains these values.) For the 80-90 grade range, the median scholarship (over all the universities) increased from $0 to $571 over our data period and the inter-quartile range grew from $216 to $954. In the 90-100 grade range, the median almost doubled from $1156 to $2023 but the inter-quartile range actually decreased from $1734 to $1067.[6]

The key price variable that we use in our multivariate analysis is "net cost" of a program/university which we have defined as tuition and mandatory fees minus the expected value of a guaranteed entry scholarship for a student in each of our two grade ranges. Figure 2a provides the maximum, minimum and 25th, 50th and 75th percentiles of net cost for students with a GPA of from 80 to 90 in the Arts and Sciences. (For the editor and referees, table A-3 in the Appendix is the basis for these figures.) Median net cost rose by about one-third. The inter-quartile range increased from $398 to $1102 whereas the same difference for tuition and fees only rose from $188 to $265. The range in net cost was little changed at about $1800. Figure 2b provides the same information for Commerce and Engineering.[7] In this case, the inter-quartile range increased by almost $1700 from $336 to $2035 and the range by almost $3000 from $2401 to $5331. Figures 2c and 2d show the distribution of expected net costs for students in the 90 to 100 grade range. For Arts and Sciences, the inter-quartile range actually decreased slightly by about $300 from $1661 to $1364 but the range increased by over $1100 from $2292 to $3446. In the case of Commerce and Engineering, the inter-quartile range increased by almost $700 from $1596 to $2287 and the range increased by $3833 from $3119 to $6952. In summary, differences among universities in tuition and fees remained modest in Arts and Sciences programs but grew significantly in the cases of Commerce and Engineering. In all programs,

[6] In two different specifications, we regressed the proportion of university budgets devoted to scholarships and bursaries on the expected scholarship value in the 80-90 grade range and, in a separate regression, on the expected scholarship value in the 90-100 grade range along with university fixed effect and year fixed effects. The coefficients for the expected scholarship value in the 80-90 grade range were significantly positive but small in value. The coefficients for the expected scholarship value in the 90-100 grade range were not significantly different from zero.

[7] As in Figure 1b, we have combined the distributions for Commerce and Engineering because the individual distributions are so similar.

however, there were substantial increases in the differences among universities in the net cost for academically strong entering students.

4.2 Ontario University Application Data

All applicants to Ontario universities from Ontario high schools submit a common form to the Ontario Universities Application Centre in which they rank their choices of programs. Both mature Ontario applicants and non-Ontario applicants follow a different application procedure, are relatively small in number, and come from very heterogeneous academic backgrounds. The application information and marks (provided directly by Ontario high schools) are forwarded by OUAC to each program and institution of choice, and OUAC later receives confirmation from the university, if any, at which the student has registered. Our OUAC data file contains information about applications and registrations at Ontario universities, high school grades, and the student's postal code at the time of application.

Our full OUAC data set contains the records of all Ontario high school students who applied for admission to start in the fall of 1994 through the fall of 2005.[8] For this paper, we have chosen the subset of applicants who registered at an Ontario university during that time period. We have also restricted our sample to those registrants who were students in high schools that offered the standard academic curriculum and who registered initially in a full-time degree program. These two restrictions eliminated only 3.1% of registrants leaving a sample of 537,801. The restriction to schools with the standard academic curriculum means that we exclude students from such heterogeneous educational backgrounds as adult education centers, treatment schools, night schools, and special education schools. Our sample includes students from the public school system, the publicly-funded separate (Roman Catholic) school system and the small

[8] Merit aid is not limited to students from in province but, given the closed nature of the system, the main purpose of the scholarships is to attract a larger share of the academically strong students from Ontario to the individual institution.

number of privately-funded high schools. The purpose of our restriction to registrants in full-time degree programs was to focus on students with relatively homogeneous educational aspirations.

Our data period witnessed a major secondary curriculum change that shortened the number of years of high school for university bound students from five years to four for the majority of students. This resulted in two cohorts of high school students having a normal graduation date in June of 2003 (commonly known as the "double cohort" year). Under the pre-2003 system, students would normally progress to university after 13 years of schooling, but outstanding students could proceed after 12 years and some students would take 14 years. After the curriculum change, it became very difficult to graduate before the normal time of 12 years but it was still possible and not uncommon to take an extra year.

Table 1 provides summary statistics on our OUAC sample. Column 2 indicates that the number of registrants was relatively stable in the 1990's but started to increase markedly in 2002 both in absolute terms and as a percent of 19 year olds (see column 3) with what appears to be the arrival of an unusually large number of students who completed an academic high school degree in only four years under the old system to avoid the "double cohort" year. The number of registrants declines after 2003 but remains substantially above the levels at the turn of the century. The number of registrants in 2004 (relative to 2001 or even to 2002) likely reflects some students who postponed registration for a year in order to avoid the big entry cohort of 2003. The effect of the double cohort is also shown in Column 3 where the ratio of registrants to 19 year-olds grew from about 26% to 30%. One feature of our data that changed little over our sample period was the fraction of applicants who register (not shown in Table 1) which stayed constant at about 70% with much higher percentages (85 to 86%) for students with averages of 80 and over.

Columns 4 and 5 of Table 1 demonstrate the increasing proportions of students being awarded high school grade averages of 80% or better and 90% or better.[9] This suggests some grade inflation given that the same or an increasing fraction of the relevant age group registers each year (except for the 2003 to 2004 drop

[9] Grade averages (GPAs) are calculated from grades submitted by the high schools to the Application Centre. These are calculated as the average of the best 6 courses needed for university admission in Ontario.

after the double cohort year). The noticeably improved grades in the double cohort year of 2003 likely reflect both increased selectivity as universities make offers to the better applicants and some additional grade inflation. That the higher marks seem concentrated in the 80-90 range and not in the 90-100 range suggests that it is mainly selection.[10]

4.3 Neighbourhood Income Data

Two of the three questions that we are considering in this paper require information about the socioeconomic background of students. The OUAC data do not contain family income information but they do contain the postal code that can be linked to the 2001 Census Dissemination Area (DA) in which the family resides. The DA is a small, relatively stable geographic unit with a population of 400 to 700 persons and is the smallest standard geographic area for which all Canadian census data are disseminated. We use the characteristics of the residents of a DA to represent the characteristics of the applicant's family.

In order to consider socioeconomic differences among OUAC applicants and registrants, we first calculated the equivalent average household income in each DA.[11] We then determined the 33rd ($53,500) and 67th ($77,000) percentiles of the distribution of all postal codes in Ontario when ranked by the equivalent average household income of the 2001 Census Dissemination Area with which the postal code is most strongly associated.[12] The resulting terciles are labeled as low, middle and high-income. To keep the

[10] If teachers were giving better grades to 'help' students in the double cohort year one might have expected the increases to have been throughout the distribution.

[11] Equivalent average household income is equal to average household income divided by the square root of the average number of persons per household in the DA. This is analogous to a common measure of equivalent household income, that is, household income divided by the square root of the number of persons in the household.

[12] Some postal codes cross DA boundaries but our data identify that DA which contains the largest proportion of the population of the postal code. The approximate 10th, 25th, 50th, 75th and 90th percentiles of the distribution of average DA family incomes in 2001 dollars are as follows: $39,000, $49,000, $64,500, $84,500, and $109,000.

ranking of the postal codes constant over the data period, we rely on the average income data as provided in the 2001 Census.[13]

We use these income terciles to answer the third of the three questions that we pose in this paper which concerns the distribution of the benefits of merit aid across students from different socioeconomic backgrounds. The top row of Table 2 shows that 40% of all Ontarians age 15-24 lived in low-income DA's and 35% in high-income DA's in 2001. The second panel of Table 2 shows that only 22% of registrants in our data set in 2001 came from low-income DA's and 45% came from high-income DA's. This pattern was typical of other years in our data set.

The forgoing demonstrates the unsurprising finding that university registrants do indeed come disproportionately from higher income neighbourhoods. But what of access to merit aid given university registration? Are the affluent more favoured among the population of university students? The third and fourth panels of Table 2 reveal that the distributions by neighbourhood income of either students with grade averages of 90 to 100 or of students with grade averages from 80 to 90 are very similar to the distribution of all registrants in the second panel above. Registrants with the highest grades (90-100) are only slightly more likely (1 to 4 percentage points) to come from high income neighbourhoods than are all registrants. Furthermore this difference appears to be diminishing over time. The sharpest difference by far in Table 2 is between university registrants and all persons age 15-24. Merit aid does favour more economically privileged students in Ontario but only because such students are more likely to attend university. Conditional upon registration, the differences in the proportions of students from low-income and high-income areas that would qualify for a merit-based entry scholarship at a given university are small. (The same is true of applicants.) A different picture might be painted, of course, by a data set with information on other forms of financial aid and/or individual family income.

[13] This might have raised concerns if the tercile ranking changed significantly over time but it does not as we found by comparing the 2001 terciles with terciles based on the 1996 census. Rankings were very similar.

4.4 Empirical Model

The principal goal of merit aid is to attract more academically strong registrants from the available pool of current graduates from Ontario high schools. Hence, the dependent variable in our regressions is the proportion of such individuals that enrol at given university. We estimated separate regressions for registrants in Arts, Science, Commerce and Engineering for the following reasons. First, many academically strong students commonly apply to more than one university but our data show that less than 20% apply to more than one of the foregoing programs . In other words, competition for these accomplished students takes place primarily within these four program categories. Second, Figures 1 and 2 demonstrate that these four programs differ substantially in terms of tuition, fees and net cost. The programs also differ in terms of entering grade distributions. For example, engineering programs have both the highest net costs and the registrants with the highest grades. For this reason alone, a regression with all programs combined might spuriously indicate that high net cost attracts more strong students. Our results demonstrate that disaggregation by program does make a difference in at least one instance.

Arts, Science, Commerce and Engineering are by far the largest categories in the classification system for academic programs recognized by OUAC. However, there are other categories such as Architecture, Nursing, Education and Agriculture. In the regressions reported below, we have assigned all registrants in our sample to one of our four basic programs. For example, Nursing and Agriculture registrants were reassigned to Science and Architecture registrants were reassigned to Engineering. We have also estimated the same regressions using only those registrants whose initial classification was one of Arts, Science, Commerce and Engineering. These more narrowly defined samples yielded very similar regression estimates to those reported below.

We also estimate separate regressions for the grade categories 80-90 and 90-100. The value of the merit awards is typically larger, up to three times as large, for students in the higher grade range. Even more importantly, the relationship between grades and merit aid awards differs noticeably across universities.

Hence, one gets a more accurate measure of the relative size of offers being made to students by different institutions by disaggregating the data into the above two grade ranges. [14]

Table 3 illustrates the distribution of our dependent variable (the proportion of students who enrol at given university in each of four programs) for 1994 and 2005. The data for other years show a similar pattern. The mean share for Arts, Sciences and Commerce is 5.3% (which is one divided by the number of universities or 19). The mean share for Engineering is either 7.7% or 7.1% because five universities do not have this program and one initiated its first Engineering program in 2001. The most noticeable difference by program is that Engineering students are more concentrated than students in other programs even when one accounts for the fact that there are fewer Engineering programs. Another result not shown in Table 3 is that there are frequent changes across years in the ordering of the universities by share of students including which university lies in first place.[15] A final characteristic of the dependent variable demonstrated by Table 3 is that the absolute value of these shares of students varies considerably across universities and, hence, we use the natural logarithm of this proportion as the dependent variable in our regressions.

There are two types of independent variables in our regressions. The first type is made up of variables reflecting institutional characteristics. One of these variables is net cost which varies by university, year, faculty and grade level (see Figure 2). The other two variables of this type are the proportion of the operating budget that the university spends on scholarships and bursaries and the proportion of the operating budget that the university spends on student services. The values of these last two measures, which vary only by university and year, were taken from the annual Maclean's issue on Canadian universities. Over our

[14] We have considered estimating separate regression for clusters of universities. We looked for such clusters by tabulating the second and third place choices among all students whose first choice was a given university. For no university, does the most common second choice account for more than 40% of the second choices. For only two universities, does the most common second choice account for more than 30% of the second choices. For only one university, do the three most common second choices account for more than 60% of the second choices. Furthermore, these tabulations often reveal asymmetry, that is, university X is clearly most common second choice among students who put university Y in first place but university Y is a far less common second choice among students who chose university X first. In sum, the data do not indicate that the applications generally break down into well defined clusters of competing universities.

[15] We remind the reader that our data sharing agreement prohibits the identification of individual universities.

sample period, the mean values increased from 3.1% to 10.7% for scholarships and from 4.5% to 6.3% for student services.[16]

Independent variables of the second type are based on the individual student level characteristics. One of these characteristics is the average income tercile (high, middle, low) of the student's neighbourhood. The second is a dummy variable indicating whether or not the student lives within 40 kilometres of the university at which she registers as measured by the centroids for the postal code of the student's permanent residence.[17]

We model the impact of these last two variables by further partitioning our data set by neighbourhood income tercile and distance from the student's university (near or far). We then calculate the dependent variable as follows. For each combination of year, program, grade range, income tercile, and distance category, we calculate the proportion of registrants at the university in question. These data are then used to estimate the following regression equation for each of two grade ranges (80-90 and 90-100) and four academic programs (Arts, Science, Commerce and Engineering):

(1) $\text{Ln (Prop)}_{ijkt} = \beta_0 + \beta_1 \text{ Ln Relative Net Cost}_{it} + \beta_2 \text{ Ln Relative Net Cost}_{it}\text{*Low Income} + \beta_3 \text{ Ln Relative Net Cost}_{it}\text{*High Income} + \beta_4 \text{ Low Income} + \beta_5 \text{ High Income} + \beta_6 \text{ Distant} + \beta_7 \text{ Ln Prop Scholarships}_{it} + \beta_8 \text{ Ln Prop Student Services}_{it} + \beta_9 U_i + \varepsilon_{ijkt}$ where

[16] As noted in Section 2, three previous papers have used the rankings of universities by Maclean's magazine in their analyses. We do not do so for three reasons. First, the Maclean's rankings are within three categories: Medical/Doctoral, Comprehensive and Primarily Undergraduate. There is no ranking of universities across the categories. That is why two of the papers cited in Section 2 used rankings within categories and the third analysed the impact of changes in rank. We do not believe that either strategy is appropriate for our analysis. Our data reveal that students very commonly apply to universities from two or all three of the Maclean's categories. In addition, we focus on the cost of attending different institutions. Students are concerned with the level of such costs and not recent changes therein. Second, the Maclean's rankings are quite stable over our data period. We wish to include a university fixed effect in our regressions to control for unobserved and unchanging institutional characteristics. These fixed effects and the Maclean's rankings are quite collinear. Third, we have divided the University of Toronto into its three separate campuses for our analysis. We believe that this approach is clearly justified indicated by the separate admissions procedures and differences among entering students at these campuses. Maclean's, however, does not provide separate rankings for these three campuses.

[17] Forty kilometres is the distance that the Ontario Student Assistance Program uses to qualify a student for a living allowance in its aid formula. Fifty-two percent of students in our sample have permanent residences 40 kilometres or more from their university and this changed little over our sample period.

$Prop_{ijkt} = Reg_{ijkt} / (\Sigma_{ijk} Reg_{ijkt})$ where Reg stands for the number of registrants or less formally,

$Prop_{ijkt}$ = proportion of the annual total of registrants in the t^{th} year who are at the i^{th} university, in the j^{th} neighbourhood income category (high, middle, low), and in the k^{th} distance-to-university category (more than 40 kilometeres or not).

Relative Net $Cost_{it}$ = net cost (tuition plus mandatory fees minus expected[18] value of a guaranteed entry scholarship) at the i^{th} university in the t^{th} year relative to the provincial average net cost for the same year (and program and grade range).

Low Income = dummy variable equal to 1 for low neighbourhood-income categories and equal to 0 otherwise

High Income = dummy variable equal to 1 for high neighbourhood-income categories and equal to 0 otherwise

Distant = dummy variable equal to 1 for the "live 40 kilometres or more away" category and equal to 0 otherwise

Prop Scholarship $_{it}$ = proportion of the operating budget spent on scholarships and bursaries at the i^{th} university in the t^{th} year

Prop Student $Services_{it}$ = proportion of the operating budget spent on student services at the i^{th} university in the t^{th} year

U_i = vector of dummy variables for each university (save that in omitted case), the estimates for which are not reported in this paper due to the nature of our data sharing agreement.

ε_{ijkt} = error term

The interactions between net cost and neighbourhood income reflect our expectation that students from low-income areas would be more sensitive to price than would students from high-income areas. The absence of year dummies is due to the nature of our dependent variable which is the share of registrants within a given year. These shares always add to 100% in any year and, hence, the average value cannot rise or fall over time. In each year and grade range, there are 114 observations (19 universities, 2 distance categories and 3 income categories) for Arts, Science and Commerce. Engineering has 78 observations (13 universities) prior to 2001 and 84 observations (14 universities) thereafter.

[18] See the earlier discussion in Section 4.1 for the meaning of 'expected' in this context.

For summary statistics on these variables, please see Table 3 (dependent variable), Figure 2 (net cost), and Table 2 (neighourhood income). The remaining sample means are as follows: Distant (52%), Prop Scholarship (7.1%) and Prop Student Services (5.4%).

Before proceeding to the regression results, it is appropriate to discuss several limitations of our analysis. As stressed in Section 3, universities compete vigorously for academically strong students in many ways only one of which is merit aid. Alternative competitive strategies include other types of scholarships and bursaries, the quality and diversity of academic programs, co-op programs, and many non-academic features of university life such as preferred access to student housing, athletic and social facilities, exchange programs, etc. All such lures are costly and a decision to spend more on entry scholarships must, at least in the short run, lead to tradeoffs with other costs or services. As indicated above, our expectation is that entry scholarships would be more effective in attracting students from lower income backgrounds. The corollary of this expectation is that students from higher income backgrounds will give relatively greater weight to the other features of university life listed above. Hence, merit aid may change the mix of students that register at an institution.

One shortcoming of our analysis is that we do not have good measures for many of the factors other than entry scholarships that likely influence the enrolment decisions of academically strong students. For example, we do not have controls for the average awards of other types made to students at different grade levels. All we know are the value of the guaranteed (and hence clearly advertised) merit awards and the proportion of the university's operating budget that is allocated to scholarships and bursaries. One concern is that those universities with no merit aid (or awards with relatively low value) may be compensating by making relatively large non-guaranteed awards to strong applicants. If true, then the estimated impact of guaranteed merit awards should be weaker or harder to discern.

A second shortcoming of our analysis is that of possible endogeneity, that is, a university may decide to initiate or enrich entry scholarships as a consequence of a declining share of academically strong students. In constructing our data set we have been careful to match the timing of the variables so as to minimize this

problem, i.e., the net cost variable is based on the tuition, fees and scholarships that students would have observed at the time of application. Both of these problems, incomplete measures of university characteristics other than merit aid and endogeneity, also characterize the Canadian papers discussed in Section 2 and the U.S. literature on merit aid.

The era of growing "sticker price" competition among Ontario universities was initiated by the partial deregulation of university tuition and fees in Ontario. This policy change, however, preceded the period for which data are available and is therefore of limited use in identifying our parameter estimates. We also considered the use of a regression discontinuity estimation strategy. As explained in section 4.1, however, there are considerable differences over time and across institutions in the dollar value of awards and in the grade categories for which these awards are made. Some institutions have had as many as five different categories of awards for GPA's between 80 and 100. Hence, this strategy was not applicable.

5. Regression Estimates

We report the regression results for registrants in Arts and Sciences programs in Table 4 and for registrants in Commerce and Engineering in Table 5. Our pattern of reporting is the same across all four programs. In the first two columns we report the results for the registrants with a high school average in the 80-90 range and in the last two columns we report the results for the registrants with a high school average in the 90-100 range. For each grade range, we report the results from two specifications. The first specification assumes that net cost has a similar effect across all groups of students. The second specification allows the net cost to have a different effect across the three income groupings (low, middle, and high). We have measured both the dependent variable and the continuous independent variables in natural logarithms and, hence, can interpret the coefficients as elasticities, that is, the relative proportionate changes in the dependent and independent variables. In the text, we shall refer to estimates with a p-value of 0.10 or less as "significant" (though in the tables we identify as well the 0.05 and 0.01 p-values as well).

The coefficients for the non-cost variables in Tables 4 and 5 are, in most instances, quite similar. Hence, we will comment on them before moving on to consider the net cost coefficients. The first non-cost variable is an indicator of the type of neighborhood from which a registrant has come (low, middle or high income). We use the middle income neighborhood as the omitted category. Across all specifications and programs, the sign of the coefficients are similar. The coefficients for the low-income dummy variable are always significantly negative and imply that registrants from these neighborhoods, other things equal, constitute a proportion of students in this grade range that is from 50% to 80% smaller than that of the students from middle-income neighborhoods.[19] In contrast, the high-income neighborhood coefficients are usually close to zero in value and not significantly different from the omitted category (middle income). The one exception is in the case of Science students for whom the high-income neighborhood coefficients are significantly negative but still small in absolute value.

We also include a measure based on the students' home residences being within 40 kilometers of the university. For the Arts programs, students whose home residence is more than 40 kilometres from their university constitute a significantly greater share of registrants in both grade ranges than do students who live closer to campus. For other programs, however, the distance coefficient is not significant for the 80-90 grade range and is significantly negative for the 90-100 grade range. Hence, there is no consistent pattern for this variable. The coefficients for the proportion of operating budgets spent on scholarships and the proportion spent on student services are usually positive, as expected, but small and not significant. The only exceptions are the (positive) coefficients for the proportion of operating budgets spent on scholarships on the share of Science students in the 90-100 grade range and the proportion spent on student services on the share of Commerce students in 90-100 grade ranges.

We now turn to the cost coefficients and begin with the specification that assumes that net cost has a similar effect across all groups of students in the 80-90 range (column 1 for each of the programs). For each program in 80-90 grade range, this net cost coefficient is positive but not significantly different from zero.

[19] These refer to proportionate changes in a number that is expressed in percentage points.

In contrast, the coefficient on the net cost measure for the students in the 90-100 range (column 3), is negative and statistically significant. For Arts, Science, and Commerce, however, the cost elasticity is quite small ranging from -0.085 to -0.129. Only the cost elasticity estimate for Engineering in the 90-100 grade range is both statistically significant and large in absolute value (-0.86). Hence, the answer to the first of the three questions that we are considering in this paper is that, with one exception, merit scholarships have at most a small effect on the ability of an individual university to increase its share of academically strong students.

When we allow the effect of the net cost to vary across the income groupings by including the interaction effects in equation (1), important differences in the cost elasticities are revealed. The coefficient on net cost (row 1) reflects the effect of change in the net cost for registrants from middle income neighborhoods. The additional effect for low income neighborhoods is reported as the interaction effect in row 7 while the additional effect for high income neighborhoods is reported in row 9. For ease of interpretation, we report in rows 8 and 10 respectively the total effect (row 1 plus either row 7 or row 9) of a change in net cost for these income groups. In row 11, we report the difference between the high and low income interaction coefficients (row 9 minus row 7) which reflects the impact of net cost on the relative proportions of students coming from the most affluent and the least affluent neighbourhoods.

For Arts students in the 80-90 grade range, the net cost effect for the middle income is not significant. For the low income group, both the interaction coefficient and the total net cost effect are negative and significant with an elasticity of -0.54 when the two terms are combined. For the high-income group, the interaction coefficient and the total cost effect are positive and significant with a combined elasticity of 1.57. The difference between the interaction coefficients for the high-income and low-income neighbourhoods is positive which implies that an increase in net cost at a university will lead to an increase in the ratio of the share of students from high-income neighborhoods to the share of students from low-income neighborhoods.

These estimates confirm our expectation that a high sticker price would have a negative effect on students from low-income areas. Table 4 also shows that, for Arts students in the 80-90 grade range, a higher net cost is associated with an increased proportion of students from high-income areas. As discussed in Section 2, this finding suggests that universities with lower merit aid awards might be channeling funds towards services that high-income students value more greatly, e.g., smaller classes, better facilities, etc. Note that we do include the Maclean's measures of the proportions of the operating budget devoted to scholarships and student services but these likely miss many important aspects of student life.[20]

For Arts students in the 90-100 grade range, both interaction coefficients and total cost effects are negative though only the interaction term for the low-income students and the total net cost effect for high-income students are significant. This is the only instance in Table 4 in which the difference between the interaction coefficients is not significant and, hence, do not indicate that an increase in net cost will lead to an increase in the ratio of the share of students from high-income neighborhoods to the share of students from low-income neighborhoods.

The estimates for Science students in the 80-90 grade range are very similar to those for Arts students in the same grade range, that is, the net cost effect for the middle income is not significant, both the interaction term and the total net cost effect are negative (positive) for the low (high) income group, and higher net cost is associated with an increase in the ratio of the share of students from high-income neighborhoods to the share of students from low-income neighborhoods. For Science students in the 90-100 grade range, the total net cost effect for students from both middle and low income neighbourhoods is significantly negative. The interaction coefficient for the high income group is positive and significantly different from zero but the total cost effect for this group is not. An increase in net cost is associated with an increase in the ratio of the share of students from high-income neighborhoods to the share of students from low-income neighborhoods but the size of the effect is much smaller than for the 80-90 grade range.

[20] Maclean's does have measures of class size but, unfortunately, these measures are not consistent over our data period.

The net cost estimates for Commerce students in the 80-90 grade range in Table 5 are also similar to those for Arts and Science students in the same grade range. For the low income group, the interaction coefficient is negative and almost significant by our standard (p-value = 0.11) but the total net cost effect is not significant. For the high income group, both the interaction term and the total net cost effect are positive and significant. These results suggest the familiar effect of an increase in net cost on the mix of students from high-income and low-income neighborhoods. The results for Commerce students in the 90-100 grade range are similar to those for such students in the 80-90 grade range. The key difference is that, for the 90-100 group, the total cost effects for middle and low income groups are significant though the total cost effect for the high income group is not.

For Engineering registrants in the 80-90 grade range (Table 5), the total net cost effect is not significant for any income group. For the 90-100 students, the total net cost effects are negative and significant for the middle- and low-income groups but not significant for the high-income category. For Engineering students in both grade ranges, an increase in net cost will raise the share of students from high-income neighborhoods relative to those from low-income areas

In summary, with regard to the second of the three questions considered in this paper, the effect of net costs by income group, the estimates in Tables 4 and 5 commonly indicate that higher net cost is associated with a decrease in a university's share of students from low-income areas and an increase in the share from high-income areas. Our most robust finding is that a higher net cost is associated with an increase in the proportion of students from high-income areas relative to the proportion from low-income areas. Furthermore, the size of this effect is always substantially larger for the 80-90 grade range than for the 90-100 range. One possible reason for this is that universities differ less in net cost for the top grade group once non-guaranteed entry scholarships are taken into account. That is to say, many students in the 90-100 range anticipate and receive substantial scholarships whether guaranteed or not.

We undertook two sensitivity tests of the models in Tables 4 and 5. In the first, we estimated models in which the distance dummy variable was interacted with net cost and the low-income and high-income

variables. This specification increases substantially the number of parameters to be estimated and does not offer any systematic additional insights. In the second, we estimated our models using data restricted to the years prior to the (high school) graduation of the "double cohort", that is, 1994 through 2002. The estimates of both coefficients and standard errors were very similar to those in Tables 4 and 5.

6. Summary and Conclusion

The past decade witnessed steady increases in the real cost of tuition and fees at Ontario universities especially in professional programs such as Commerce and Engineering. These cost hikes were accompanied by large increases in financial aid often in the form of merit-based entry scholarships. This form of financial aid was not the norm at Ontario universities in the mid-1990's but now is offered by most of these institutions. Over this period there have been increases not only in the average value of such scholarships but in the variation among universities in the value of such merit aid. Virtually all Ontario universities are publicly funded and the system is quite self-contained. The main purpose of these scholarships is to attract academically strong students to the individual institution by lowering the net cost of attendance. This "sticker price" strategy may be especially appealing to lower income students but will also divert expenditures from other institutional features (class size, program diversity, etc.) that may hold more appeal for higher income students. Hence, we hypothesized that this strategy may end up altering the mix of students who register at a university.

We use data from the Ontario Universities Application Centre on student registrations from 1994 through 2005 to examine three questions. Does a lower net cost enable an Ontario university to attract a greater share of academically strong high school students? Does the impact of net cost on attendance vary by the socioeconomic background of the student? Is merit aid of disproportionate benefit to students from more privileged socioeconomic backgrounds?

Our regression estimates indicate no significant relationship between the net cost (tuition minus merit aid) of attending a given university relative to its competitors and the overall share of high school applicants with a high school grade average in the 80-90 range that the university is able to attract. For students in the 90-100 grade range, however, we find a significant and modest-sized cost elasticity of about -0.10 in value for students in Arts, Science, and Commerce. For the Engineering students in this top grade range, however, the cost elasticity is -0.86. Hence the answer to our first question is that, with one exception, merit scholarships have at most a small effect on the ability of a university to increase its share of academically strong students.

To answer our second question, we also estimated our regressions with interactions between net cost and the average income level of the neighbourhood in which the student's family resides. In the majority of cases, we find higher net cost is associated with a decrease in a university's share of students from low-income areas and an increase in the share from high-income areas. Our interpretation of the positive effect of higher costs on students from high-income neighbourhoods is that guaranteed entry scholarships channel funds away from other services that high-income students value more greatly, e.g., smaller classes, better facilities, etc. Our most robust finding is that a higher net cost is associated with an increase in the proportion of students from high-income areas relative to the proportion from low-income areas. In other words, merit aid influences not so much the number as the type of academically strong students that a university can attract.

To answer our final question, the data reveal that university registrants do indeed come disproportionately from higher income neighbourhoods. Conditional upon university registration, however, the differences in the proportions of students from low-income and high-income neighbourhoods that qualify for a merit-based entry scholarship at a given university is only one or two percentage points. Hence, among those students who make it to university, merit aid does not appear to be of disproportionate benefit to those from more economically advantaged backgrounds.

Further research on this topic is well warranted. Our findings would clearly be enhanced by

additional controls for the characteristics of both universities and the characteristics of students and their families. It would also be very helpful to have data beyond registration that permitted one to assess the impact of merit aid on student progress once in university.

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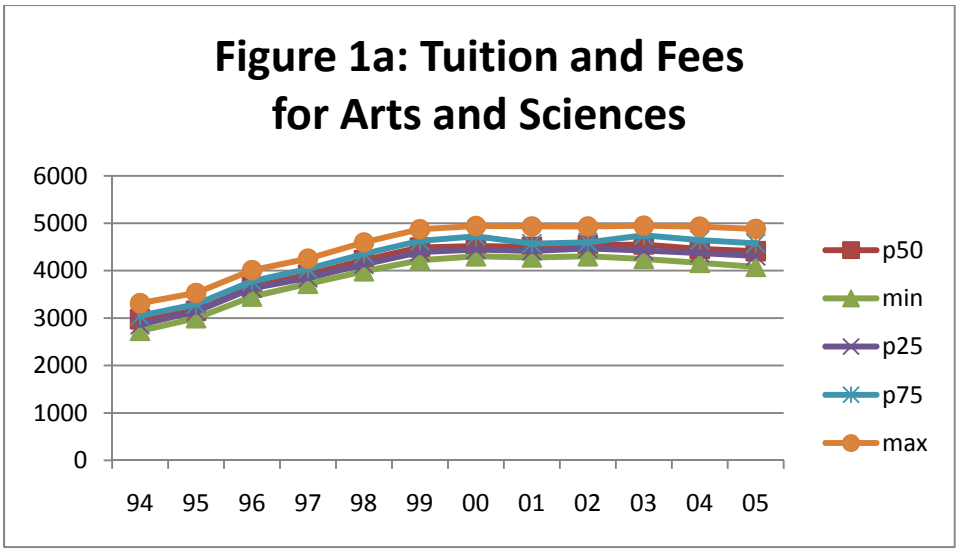
Figure 1a: Tuition and Fees for Arts and Sciences
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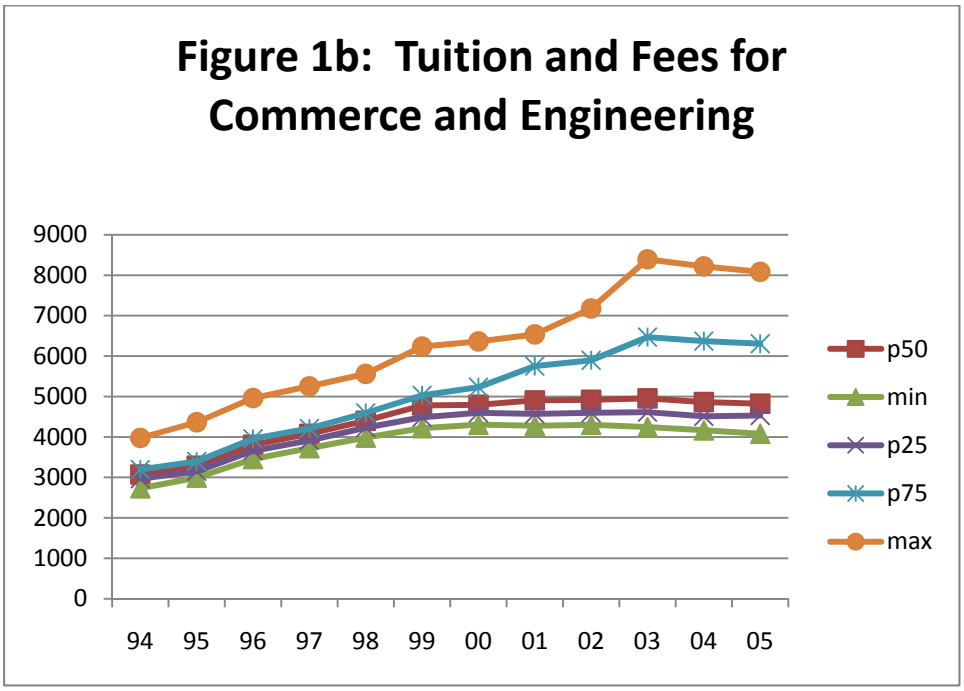
Figure 1b: Tuition and Fees for Commerce and Engineering
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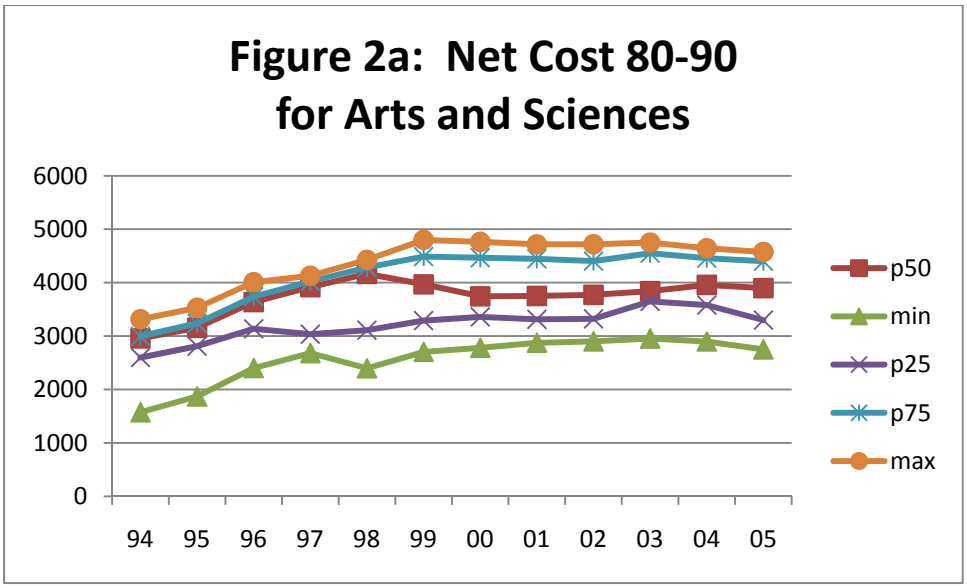
Figure 2a: Net Cost 80-90 for Arts and Sciences
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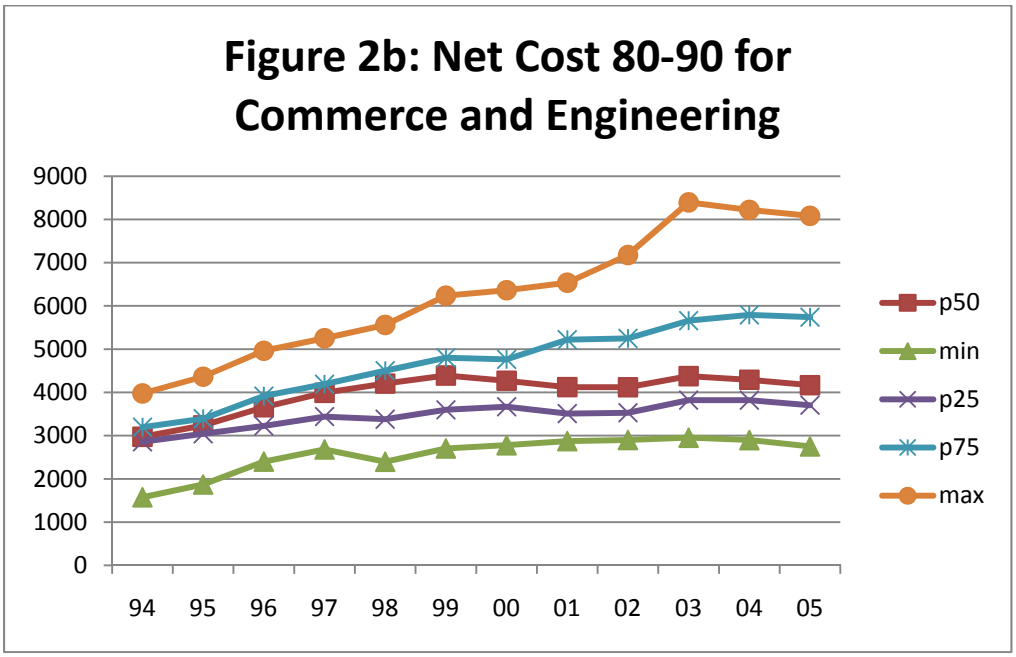
Figure 2b: Net Cost 80-90 for Commerce and Engineering
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Figure 2c: Net Cost 90-100 for Arts and Sciences

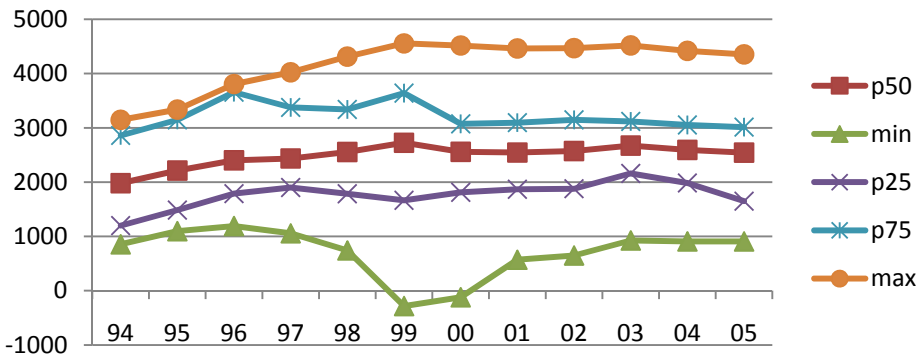

Figure 2d: Net Cost 90-100 for Commerce and Engineering

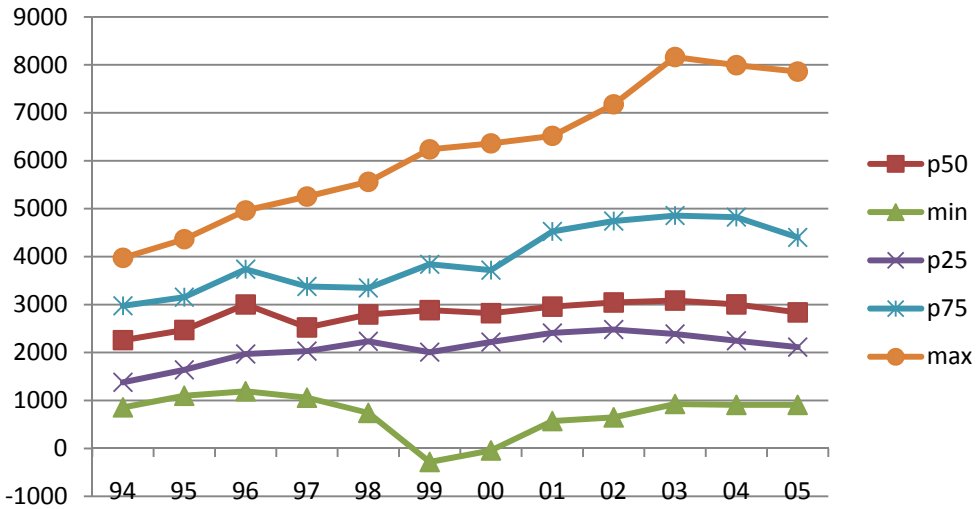

Table 1				
Year One Registrants at Ontario Universities				
(1)	(2)	(3)	(4)	(5)
Year	Number of Registrants	Registrants / 19 year olds*	% Registrants with GPA 80+	% Registrants with GPA 90+
1994	38972	27%	50%	9%
1995	38199	26%	52%	9%
1996	38933	27%	53%	10%
1997	38386	27%	55%	11%
1998	38928	26%	55%	11%
1999	41138	27%	55%	12%
2000	40250	26%	57%	13%
2001	42101	26%	57%	13%
2002	49168	30%	59%	14%
2003	68958	41%	66%	15%
2004	50552	30%	62%	13%
2005	52216	31%	62%	14%

*Number 19 year olds is from Statistics Canada Intercensal Projections.

Table 2			
Distribution of Registrants by Neighbourhood Average Income:			
Overall and by Grade Category			
(1)	(2)	(3)	(4)
Year	**Low Income***	**Middle Income***	**High Income***
All Persons Age 15-24 in 2001 Census			
	40%	25%	35%
Year	**All Registrants**		
1994	24%	35%	42%
1995	23%	34%	42%
1996	23%	35%	42%
1997	23%	34%	43%
1998	22%	34%	44%
1999	22%	34%	45%
2000	22%	34%	44%
2001	22%	34%	45%
2002	21%	34%	46%
2003	20%	33%	47%
2004	21%	33%	47%
2005	20%	33%	47%
Year	**Registrants with GPA 90+**		
1994	21%	33%	46%
1995	20%	34%	46%
1996	21%	34%	45%
1997	21%	32%	47%
1998	21%	32%	47%
1999	20%	32%	48%
2000	19%	33%	48%
2001	19%	33%	48%
2002	19%	32%	49%
2003	19%	32%	49%
2004	19%	33%	48%
2005	20%	32%	48%
Year	**Registrants with GPA 80-90**		
1994	23%	34%	43%
1995	22%	34%	44%
1996	22%	34%	44%
1997	22%	33%	45%
1998	21%	33%	45%
1999	21%	33%	46%
2000	20%	34%	46%
2001	21%	33%	46%
2002	20%	33%	47%
2003	19%	33%	48%
2004	20%	33%	47%
2005	20%	33%	47%

*High, Middle and Low are defined by the 33rd and 67th percentililes of the distribution of postal codes by the equivalent average income of the Census Dissemination Area with which the postal code is associated.

Table 3											
Distribution of Student Shares by Grade Level, Program and Year											
		Percentiles						Percentiles			
	Min	25th	50th	75th	Max		Min	25th	50th	75th	Max
	Arts 80-90						Arts 90+				
1994	0.6%	2.2%	4.2%	6.2%	17.3%		0.0%	9.9%	4.3%	7.1%	15.6%
2005	1.0%	2.2%	5.4%	6.6%	13.7%		1.1%	13.6%	3.6%	7.9%	14.9%
	Science 80-90						Science 90+				
1994	0.2%	1.4%	3.4%	11.6%	14.8%		0.1%	0.9%	2.2%	9.9%	22.3%
2005	0.4%	1.7%	3.7%	8.6%	14.8%		0.4%	1.0%	2.6%	9.0%	19.1%
	Commerce 80-90						Commerce 90+				
1994	0.1%	2.0%	4.4%	8.4%	17.1%		0.0%	0.7%	2.3%	12.2%	22.3%
2005	0.4%	1.6%	4.9%	8.9%	11.7%		0.0%	0.6%	1.8%	9.3%	19.1%
	Engineering 80-90						Engineering 90+				
1994	0.5%	4.6%	7.1%	10.3%	20.0%		0.2%	1.8%	3.5%	7.2%	34.1%
2005	0.2%	2.0%	5.7%	9.6%	26.1%		0.2%	0.8%	2.3%	8.0%	36.7%

Table 4

Regressions for Impact of Net Cost on the Share of Registrants: Arts and Science

		(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
	Faculty	**Arts**					**Science**			
	Grade Range	**80-90**		**90-100**			**80-90**		**90-100**	
(1)	(Natural Log of) Net Cost	0.34	0.01	-0.12*	-0.05		0.28	0.30	-0.13***	-0.18***
	Relative to Provincial Average	(0.35)	(0.99)	(0.10)	(0.53)		(0.60)	(0.63)	(0.00)	(0.00)
(2)	Low Income Census Dissemination Area	-0.50***	-0.51***	-0.81***	-0.84***		-0.41***	-0.42***	-0.50***	-0.50***
		(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)
(3)	High Income Census Dissemination Area	-0.026	-0.01	-0.09	-0.11		-0.11***	-0.09***	-0.15**	-0.13*
		(0.48)	(0.84)	(0.29)	(0.27)		(0.01)	(0.01)	(0.03)	(0.06)
(4)	Lives at least 40 kilometers from campus	0.32***	0.32***	0.48***	0.48***		0.07	0.07	-0.38***	-0.38***
		(0.00)	(0.00)	(0.00)	(0.00)		(0.18)	(0.18)	(0.00)	(0.00)
(5)	(Natural Log of) Proportion of Operating	0.13	0.13	0.15	0.15		0.17	0.17	0.60***	0.60***
	Budget Spent on Scholarships	(0.14)	(0.14)	(0.51)	(0.51)		(0.31)	(0.32)	(0.00)	(0.00)
(6)	(Natural Log of) Proportion of Operating	0.04	0.04	0.27	0.27		-0.07	-0.07	0.20	0.20
	Budget Spent on Student Services	(0.60)	(0.60)	(0.22)	(0.22)		(0.75)	(0.75)	(0.24)	(0.25)
(7)	Interaction of Net Cost with Low Income		-0.55***		-0.11**			-1.17**		0.03
	Dissemination Area		(0.00)		(0.03)			(0.02)		(0.64)
(8)	Net Cost plus Low Income Interaction		-0.54*		-0.16			-0.87*		-0.15***
	(1) + (7)		(0.10)		(0.14)			(0.10)		(0.00)
(9)	Interaction of Net Cost with HIgh Income		1.56***		-0.09			1.10*		0.12*
	Dissemination Area		(0.00)		(0.29)			(0.06)		(0.06)
(10)	Net Cost plus High Income Interaction		1.57**		-0.14**			1.40*		-0.05
	(1) + (9)		(0.02)		(0.04)			(0.07)		(0.24)
(11)	High Income Interaction minus Low		2.11***		0.03			2.27***		0.10**
	Income Interaction (9) - (7)		(0.00)		(0.83)			(0.00)		(0.02)
	Number of observations	1386	1386	1386	1386		1386	1386	1386	1386
	p-values in parentheses	*p<0.10, **p<0.05, ***p<0.01								

Table 5

Regressions for Impact of Net Cost on the Share of Registrants: Commerce and Engineering

		(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
	Faculty	**Commerce**					**Engineering**			
	Grade Range	**80-90**		**90-100**			**80-90**		**90-100**	
(1)	(Natural Log of) Net Cost	0.52	0.45	-0.08**	-0.09**		0.09	0.08	-0.86**	-0.84**
	Relative to Provincial Average	(0.22)	(0.34)	(0.02)	(0.04)		(0.91)	(0.93)	(0.02)	(0.02)
(2)	Low Income Census Dissemination Area	-0.51***	-0.53***	-0.55***	-0.58***		-0.36***	-0.39***	-0.75***	-0.78***
		(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)
(3)	High Income Census Dissemination Area	0.01	0.03	-0.11	-0.09		0.06	0.09*	0.07	0.09
		(0.88)	(0.65)	(0.43)	(0.53)		(0.18)	(0.05)	(0.40)	(0.29)
(4)	Lives at least 40 kilometers from campus	-0.01	-0.01	-0.45***	-0.45***		-0.02	-0.02	-0.33***	-0.33***
		(0.87)	(0.87)	(0.00)	(0.00)		(0.75)	(0.75)	(0.00)	(0.00)
(5)	(Natural Log of) Proportion of Operating	0.24	0.24	-0.15	-0.15		-0.04	-0.04	-0.06	-0.06
	Budget Spent on Scholarships	(0.27)	(0.28)	(0.34)	(0.34)		(0.89)	(0.89)	(0.79)	(0.79)
(6)	(Natural Log of) Proportion of Operating	0.27	0.27	0.80**	0.80**		0.21	0.21	0.22	0.22
	Budget Spent on Student Services	(0.29)	(0.29)	(0.02)	(0.02)		(0.28)	(0.28)	(0.42)	(0.42)
(7)	Interaction of Net Cost with Low Income		-0.61		-0.13*			-0.77		-0.26
	Dissemination Area		(0.11)		(0.06)			(0.14)		(0.29)
(8)	Net Cost plus Low Income Interaction		-0.16		-0.22*			-0.69		-1.09**
	(12) + (18)		(0.77)		(0.00)			(0.34)		(0.02)
(9)	Interaction of Net Cost with HIgh Income		0.83**		0.13*			0.79*		0.19
	Dissemination Area		(0.02)		(0.10)			(0.06)		(0.49)
(10)	Net Cost plus High Income Interaction		1.28		0.05			0.87		-0.65
	(12) + (20)		(0.01)		(0.49)			(0.20)		(0.11)
(11)	High Income Interaction minus Low		1.44**		0.27**			1.55**		0.44*
	Income Interaction (20) - (18)		(0.01)		(0.01)			(0.00)		(0.10)
	Number of observations	1386	1386	1386	1386		966	966	966	966
	p-values in parentheses	*p<0.10, **p<0.05, ***p<0.01								

Table A-1a (background for editor and referees)

Tuition and Fees for Arts and Sciences (CDN$2001)

	mean	p50	min	p25	p75	max	p75-p25	max-min
94	2982	2975	2730	2860	3048	3315	188	585
95	3194	3154	2997	3140	3290	3530	150	532
96	3690	3658	3453	3630	3779	4010	149	557
97	3962	3915	3724	3849	4037	4253	188	529
98	4247	4224	3985	4132	4354	4595	223	611
99	4521	4487	4220	4393	4626	4873	233	653
00	4562	4520	4304	4444	4724	4941	280	637
01	4526	4504	4278	4416	4570	4933	154	655
02	4543	4539	4303	4467	4597	4930	130	627
03	4569	4551	4245	4424	4746	4949	322	704
04	4499	4459	4165	4372	4644	4928	272	763
05	4444	4411	4080	4311	4576	4882	265	801

Table A-1b

Tuition and Fees for Commerce and Engingeering (CDN$2001)

	mean	p50	min	p25	p75	max	p75-p25	max-min
94	3107	3071	2730	2968	3196	3975	228	1245
95	3321	3290	2997	3152	3395	4363	244	1366
96	3833	3806	3453	3658	3955	4962	297	1509
97	4117	4078	3724	3915	4211	5253	296	1530
98	4440	4399	3985	4231	4595	5559	364	1574
99	4878	4781	4220	4487	5030	6237	543	2017
00	4971	4795	4304	4598	5231	6362	633	2058
01	5146	4904	4278	4570	5753	6537	1183	2259
02	5272	4920	4303	4597	5896	7176	1299	2873
03	5580	4954	4245	4613	6469	8393	1857	4148
04	5491	4864	4165	4511	6371	8219	1860	4054
05	5414	4823	4080	4530	6307	8082	1777	4002

Table A-2a (background for editor and referees)								
Expected Scholarship 80-90 for All Programs (CDN$2001)								
	mean	p50	min	p25	p75	max	p75-p25	max-min
1994	171	0	0	0	216	1156	216	1156
1995	166	0	0	0	211	1128	211	1128
1996	257	0	0	0	561	1111	561	1111
1997	313	0	0	0	770	1091	770	1091
1998	472	209	0	0	1021	1598	1021	1598
1999	615	700	0	0	1060	1567	1060	1567
2000	726	879	0	212	1093	1524	881	1524
2001	721	858	0	144	1182	1478	1038	1478
2002	715	841	0	141	1158	1448	1018	1448
2003	609	631	0	137	955	1291	818	1291
2004	566	582	0	135	916	1448	782	1448
2005	632	571	0	132	1086	1467	954	1467
Table A-2b								
Expected Scholarship 90-100 for All Programs (CDN$2001)								
	mean	p50	min	p25	p75	max	p75-p25	max-min
1994	956	1156	0	0	1734	2139	1734	2139
1995	933	1128	0	0	1692	2087	1692	2087
1996	1049	1111	0	0	1906	2446	1906	2446
1997	1416	1500	0	660	2182	2728	1522	2728
1998	1676	1730	0	865	2354	3243	1490	3243
1999	1977	1818	0	961	2807	4770	1846	4770
2000	2047	2062	0	1547	2730	4640	1184	4640
2001	1873	2000	0	1500	2645	4000	1145	4000
2002	1836	1960	0	1470	2593	3920	1123	3920
2003	1802	1910	0	1433	2346	3820	914	3820
2004	1801	1954	0	1406	2343	3748	937	3748
2005	1921	2023	223	1379	2446	3676	1067	3453

Table A-3a (background for editor and referees)								
Net Cost 80-90 for Arts and Sciences (CDN$2001)								
	mean	p50	min	p25	p75	max	p75-p25	max-min
94	2811	2957	1574	2597	2995	3315	398	1741
95	3027	3154	1870	2812	3238	3530	426	1659
96	3433	3638	2402	3136	3738	4010	602	1608
97	3649	3915	2682	3035	4024	4128	989	1446
98	3775	4165	2396	3111	4284	4427	1173	2030
99	3906	3969	2704	3290	4487	4801	1197	2096
00	3836	3744	2780	3359	4466	4764	1107	1984
01	3806	3751	2875	3313	4446	4717	1133	1842
02	3828	3771	2901	3323	4403	4719	1080	1818
03	3959	3841	2954	3649	4551	4750	902	1796
04	3933	3957	2898	3581	4459	4644	878	1746
05	3812	3897	2751	3298	4401	4576	1102	1825
Table A-3b								
Net Cost 80-90 for Commerce and Engineering (CDN$2001)								
	mean	p50	min	p25	p75	max	p75-p25	max-min
94	2958	2975	1574	2860	3196	3975	336	2401
95	3175	3238	1870	3043	3391	4363	348	2493
96	3603	3658	2402	3225	3916	4962	690	2560
97	3832	3992	2682	3441	4189	5253	748	2572
98	4000	4204	2396	3381	4503	5559	1121	3162
99	4282	4389	2704	3598	4801	6237	1203	3532
00	4285	4270	2780	3669	4764	6362	1095	3582
01	4468	4122	2875	3510	5219	6537	1709	3662
02	4597	4119	2901	3530	5248	7176	1718	4275
03	5012	4376	2954	3820	5661	8393	1841	5440
04	4957	4292	2898	3820	5792	8219	1972	5321
05	4808	4167	2751	3704	5740	8082	2035	5331

Table A-3c (background for editor and referees)								
Net Cost 90-100 for Arts and Sciences (CDN$2001)								
	mean	p50	min	p25	p75	max	p75-p25	max-min
94	2026	1981	856	1199	2860	3148	1661	2292
95	2261	2213	1097	1486	3148	3335	1663	2238
96	2641	2402	1191	1788	3658	3806	1870	2615
97	2547	2435	1057	1901	3376	4023	1475	2965
98	2571	2554	742	1785	3339	4311	1554	3570
99	2544	2725	-283	1665	3639	4555	1974	4838
00	2515	2558	-120	1812	3074	4516	1262	4636
01	2653	2545	570	1868	3096	4463	1228	3893
02	2707	2574	649	1878	3148	4467	1269	3819
03	2766	2674	926	2160	3118	4518	959	3593
04	2698	2593	908	1985	3053	4417	1068	3509
05	2523	2544	908	1649	3014	4353	1364	3446
Table A-3d								
Net Cost 90-100 for Commerce and Engineering (CDN$2001)								
	mean	p50	min	p25	p75	max	p75-p25	max-min
94	2197	2257	856	1379	2975	3975	1596	3119
95	2432	2469	1097	1639	3154	4363	1515	3266
96	2847	3002	1191	1970	3739	4962	1769	3771
97	2705	2524	1057	2029	3376	5253	1347	4196
98	2806	2793	742	2233	3347	5559	1114	4817
00	3013	2820	-42	2218	3717	6362	1499	6404
01	3337	2957	570	2409	4525	6519	2116	5949
02	3499	3043	649	2480	4743	7176	2264	6527
03	3846	3084	926	2387	4857	8162	2470	7236
04	3741	3005	908	2245	4824	7992	2579	7083
05	3526	2837	908	2113	4401	7859	2287	6952