S E D A P

SOCIAL AND ECONOMIC DIMENSIONS OF AN AGING POPULATION

Student Enrolment and Faculty
Recruitment in Ontario:
The Double Cohort, the Baby Boom Echo,
and the Aging of University Faculty

Byron G. Spencer

SEDAP Research Paper No. 75

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Abstract

The recent restructuring of the Ontario secondary school system means that two graduating classes – the so-called "double cohort" – will compete for admission to the universities in the fall of 2003. Unless admission standards are raised to restrict enrolment, the sheer numbers involved will place extraordinary demands on the system for half a decade. The demands will be difficult to accommodate, not least because more than half of current faculty are over the age of 50, and most will retire in this decade. Working with the latest available numbers, this paper provides projections to show the impact that the double cohort will have on student numbers, faculty requirements, and the need to recruit new faculty.

Student Enrolment and Faculty Recruitment in Ontario:

The Double Cohort, the Baby Boom Echo, and the Aging of University Faculty[1]

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1. Introduction

Two demographic events will have significant effects on the Ontario university system this decade. The first is the growth in the population of student age, which will *increase the demand* on the system. That increase is associated with the baby boom echo, but it will be exacerbated by the so-called "double cohort" (which will see two classes of secondary school graduates enter university in the same year) and by the trend towards higher enrolment rates. The second event will *reduce the*

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supply of services that the university system can provide. That is the retirement of the large fraction of the faculty that was hired in the late 1960s and the 1970s to meet the demands associated with the baby boom itself.

The purpose of this paper is to attach some numbers to these two events and, in particular, to project both the number of students who will be seeking places at universities and the need to recruit new faculty. Some have suggested that recruitment needs are of crisis proportions. Indeed, the projections below indicate that the minimum need for net recruitment of faculty by the end of this decade is equal to almost half of the current complement, and it is likely to be considerably more. Whether the universities will be able to hire enough new faculty in the next few years will determine whether they can honour the commitment entered into with the Ontario Ministry of Training, Colleges and Universities, namely:

> *The universities and the government are committed to the principle that, regardless*
>
> *of their program of studies, or when they entered high school, students' chances of*
>
> *gaining admission to university will be the same.* (Council of Ontario Universities,
>
> 2002)

The Council of Ontario Universities (COU) and the Ontario Confederation of University Faculty Associations (OCUFA) have already drawn attention to the impending shortage of faculty. The COU commissioned a study, "Will there be room for me?" (PriceWaterhouseCoopers, 1999), that focussed attention especially on the prospective growth in student demand in its report. A year later another COU-commissioned study, "Will there be enough excellent profs?" (Smith, 2000),

focussed attention on the massive retirement of university faculty in the present decade and on the opportunities that that provides for renewal, and emphasised the importance of maintaining or improving the quality of faculty in the process. A third COU study reviewed the situation as of the year 2000, and compared what happened in the 1990s with its own earlier projections (COU, 2000). Finally, in 2001 OCUFA published its report, "Less Isn't More: Ontario's Faculty Crisis" (OCUFA, 2001). These studies are in broad agreement that Ontario universities face significant problems in this decade.

This study differs from earlier work in that it develops and articulates a model in which emphasis is given to demographic factors. On the demand side, attention is paid to enrolment by level of study, and the associated requirements for faculty are derived. On the supply side attention is given to the retention in the system of the current complement of full-time faculty, and the instructional requirements that they will be able to meet over the rest of this decade. Finally, comparisons of these demand and supply components are made to determine the implied requirements for recruitment. Thus attention is focussed on demographic issues. Important matters relating to the continuing uncertain fiscal environment are not addressed.

The paper proceeds as follows. The next two sections are concerned with student enrolment: section 2 sketches the model that is used; section 3 provides projections of enrolment over the rest of the decade. Section 4 considers the current complement of university faculty. Section 5 provides projections of future faculty requirements and section 6 discusses the consequent need for recruitment. Section 7 summarizes the discussion, and concludes.

2. Projection of Enrolment: A Sketch of the Approach

A model is developed to provide enrolment projections for the Ontario university system as a whole. A brief summary description follows; the full model is described in detail in Appendix A. At the undergraduate level, enrolment in first-year full-time studies is related to the projected population of 18- to 21-year-olds, and is calculated as the projected population at each age multiplied by the corresponding age-specific enrolment rates. Those rates, in turn, vary over the projection period for two reasons: (1) to reflect the anticipated reduction in the typical age at which new students enter university, as the double cohort is phased in; and (2) to reflect a possible increase in the proportion of the age group that will attend university. Undergraduate enrolment beyond the first year is related to first-year enrolment in the previous three years, with allowance for attrition. At the graduate level full-time enrolment is related to earlier enrolment at the undergraduate level, with allowance for trends. Hence the system allows for lagged responses to first-year enrolment that last for many years. Finally, part-time enrolment is much smaller than full-time enrolment, when expressed in terms of full-time equivalent students, and is somewhat erratic from year to year; in the projections it is dealt with separately at the undergraduate and graduate levels.

3. Projected Enrolment

Almost all university students are drawn from the population in the age range 18 to 24. That population is shown in Figure 1, for the period from 1988 through to 2010. From the late 1980s through to 1996 there was a decline of about 100,000 in this age group. Since then the number has risen steadily and further increases are projected for the rest of this decade. The increase between

2001 and 2010 is projected to be about 140,000, or 13 percent[2]. It is associated with the baby boom echo, in large part[3].

Figure 2 shows year 1 full-time enrolment over the same period, with actual figures up to and including 1999-2000 and projected ones thereafter[4]. Consider, first, enrolment during the period 1988-89 to 1999-2000. While the population 18-24 *decreased* until the latter part of that period, first-year full-time enrolment was relatively flat and, in fact, even *increased* somewhat, from 54,000 in 1988-89 to 61,000 in 1999-2000, reflecting notably higher enrolment rates. That leads immediately to the question of what enrolment rates will do in the near-term future. The answer will not be determined by considerations of demand alone. In particular, whether the universities are able to accommodate large increases in numbers (by making adjustments on the side of *supply*) will be important also[5]. However, the approach adopted here is to investigate what enrolment would look like under two alternative assumptions: (1) that the proportion of the age group entering universities

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[2] The "standard" population projection based on the McMaster MEDS system is used. (For a general description of MEDS, see Denton, Feaver, and Spencer, 1994; the version of MEDS that provides provincial demographic projections is known as PMEDS-D, and is described in Denton, Feaver, and Spencer, 1997.) The projection is quite insensitive to changes in underlying assumptions. For example, by 2010 higher or lower rates of fertility have no impact on the population in this age group and alternative assumptions about mortality have only a negligible impact. Immigration matters more. Annual immigration to Canada averaged about 190,000 in the three years 1998, 1999, 2000. An immediate increase of 60,000 (which would be consistent with recently reported intentions of the federal government; see *National Post Online*, September 6, 2001) would result in an increase of about 15 percent in the Ontario 18-24-year-old population.

[3] Appendix C provides tabulations of the historical and projected series for enrolment (Tables C1 and C2) and population (Table C6).

[4] Writing in March of 2002, it is regrettable that the latest comparable enrolment figures relate to the academic year 1999-00.

[5] The analysis of Denton, Feaver, and Spencer (1998) is relevant in this regard.

remains constant ("low"); and (2) that it continues to increase in accordance with recent trends ("high"). Beyond that there is the need to consider how the double cohort will be phased in. The general idea is that, with recent school reforms in Ontario, students will enter university after four instead of five years of secondary school. More specifically, the class that entered grade 9 in the fall of 1998 will be the last to complete secondary school in five years and the one that entered in the fall of 1999 will be the first to complete in four. Hence both classes will feed new students into the university system at the same time – in the fall of 2003. That creates obvious concerns about how to accommodate a very large increase in enrolment in a single year.

If students from both classes did enter the university system in full force in the fall of 2003, first-year enrolment would approximately double for that year, and then decrease in subsequent years to roughly the earlier level. In practice, such a response seems unlikely. Some students who are ahead of the double cohort will anticipate crowded conditions at the universities and opt to complete their secondary school studies in four years instead of five, while some who are in the double cohort or later will (for the same reasons), postpone their entry into the university system[6]. That would result in some smoothing, which is incorporated in the projections.

The particular smoothing or phasing-in pattern assumed here is shown in the following table.

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[6] A recent press report states that "Thousands of Ontario high school students are rushing to graduate a year early ... to beat the looming crunch ..." and that "the number of fast-trackers has unexpectedly doubled this year..." *Globe and Mail,* February 25, 2002.

Weights associated with phasing in of double cohort

Year	Age at entry -- 18	19	20	21	Sum of Weights year	cohort
99/00	0.111	0.704	0.106	0.079	1.000	–
00/01	0.120	0.700	0.100	0.080	1.000	–
01/02	*0.190*	0.700	0.100	0.080	1.070	–
02/03	0.250	*0.650*	0.100	0.080	1.080	1.000
03/04	0.550	0.600	*0.090*	0.080	1.320	1.000
04/05	0.640	0.300	0.090	*0.070*	1.100	*1.000*
05/06	0.680	0.210	0.090	0.060	1.040	1.000
06/07	0.680	0.170	0.090	0.060	1.000	1.000
07/08	0.680	0.170	0.090	0.060	1.000	1.000
08/09	0.680	0.170	0.090	0.060	1.000	1.000
09/10	0.680	0.170	0.090	0.060	1.000	1.000
10/11	0.680	0.170	0.090	0.060	1.000	1.000

The table shows the age-specific weights[7] that are assumed to apply in each year, and also (looking diagonally) those associated with enrolment for each successive cohort. The weights necessarily sum to 1.000 for each cohort, but their sum will exceed 1.000 in each year as the double cohort is being phased in. (Since almost all full-time enrolment at the first-year level is drawn from the population of 18- through 21-year-olds, only those ages are shown.)

Consider the academic year 1999-00, for example. The highest weight (0.704) is for 19-year-olds, with much lower weights for 18-year-olds (0.111) and 20- and 21-year-olds (0.106 and 0.079, respectively). With the new policy, the weights will change: the younger age of secondary school completion means that the highest weight will come to be associated with 18-year-olds and, in consequence, lower weights with those older. The bold figures show what is assumed for the cohort

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[7] The proportions for the first two years are based on unpublished information from the Ontario Universities Application Centre as it relates to the age distribution of year one "registered applicants" in full-time study; I am grateful to Wilfred Ward of McMaster University for making the numbers available.

of age 18 in 2001-02. The 18-year-olds in that cohort are two years ahead of the first class officially in the four-year program, but with the new policy coming into effect, it is assumed that a somewhat higher proportion of this group (about 8 percentage points more; the weight is 0.190 rather than 0.111) will opt to complete secondary school sooner, and enter university at age 18 rather than 19. That trend accelerates in the next two years, and by 2005-06 it is assumed to be complete. At the beginning of the projection about 70 percent of those who continued on to university did so at age 19, but by 2005-06 a similar proportion is assumed to be doing so at age 18. During the transition the sum of the weights in each year exceed 1.000. The sum is greatest in 2003-04, at 1.32. The implication is that the demand for first-year university enrolment is 32 percent greater in that year than it would have been without the phasing-in of the double cohort. That result is achieved because the assumed weight for 18-year-olds increases only to 0.550 (instead of 0.680) and that for 19-year-olds decreases only to 0.600 (instead of 0.170), reflecting delays in making the transition to the new system. The 32 percent increase is a long way from the doubling of first-year enrolment that would take place if, in fact, the double cohort were to enrol in the universities all in one year. Even so, the effect is large, as shown below. It is notable that the assumed phase-in effect alone would account for a 7 percent increase in first year enrolment in 2001-02. It would also account for an additional eight percent in the following year, 2002-03. That growth is almost entirely the result of the simple change in the age distribution of incoming students. The phase-in is assumed to be completed in 2005-06.

The weighting pattern just described is applied to the overall projected enrolment rate. In 1999-2000, the latest year for which detailed data are available, full-time first-year enrolment was equivalent to 41 percent of the 19-year-old population. Of course, not all who enrolled were age 19,

but the ratio can be interpreted to indicate that, as a close approximation, 41 percent of the cohort would enrol at some age (most at age 19, but some at 18, others at 20, 21, and so on). We lock on to that idea, and provide two sets of projections, as displayed in Figure 2. The "low" projection assumes that the overall ratio remains at 41 percent; that is, 41 percent of each cohort will eventually have enrolled in first-year studies but the age distribution changes over time, as shown above. In the "high" projection the same change in the age distribution takes place, but the overall ratio rises by 3 percentage points to 44 percent by 2010-11, the end of the projection period. The increase takes place in equal annual increments[8].

As is evident from Figure 2, both the "low" and "high" projections are dominated by the arrival of the double cohort. Even the "low" projection sees an increase in year-one enrolment from 61,000 in 1999-2000 to 86,000 in 2003-04, when the double cohort has its greatest impact. The "high" projection is only about 2,300 more at its peak, but the difference between the two projections grows with time as the assumed continued increase in the enrolment rate comes to play a larger role. Even so, depending on the underlying assumptions, the peak associated with the double cohort clearly dominates, in that projected first-year enrolment is about 19 thousand higher in 2003-04 than in 2006-07 ("low" projection). In subsequent years enrolment is projected to increase, but to remain well below the earlier peak.

The sharply higher first-year enrolment is reflected, with appropriate lags, in second, third, and fourth-year undergraduate studies. Figure 3 shows the implications for the total number of

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[8] As an indication of the extent of recent change, the enrolment proportion in 1989-90 was only 36 percent.

undergraduates, measured in terms of full-time equivalent students[9]. The enrolment peak is much less pronounced for this broader group. Whereas the projected increase from 1999-2000 to the "low" peak is 41 percent after four years for first-year enrolment, it is 31 percent after five years for all undergraduates. The subsequent declines are 22 percent and 12 percent, respectively, both over three years. Similar comments apply to the "high" enrolment case.

As Figure 3 makes clear, the impact of the double cohort on undergraduate enrolment at all levels will extend over a number of years, and be of considerable magnitude. However, the increase is most heavily concentrated in the three academic years 2003-04, 2004-05, and 2005-06: full-time equivalent undergraduate enrolment in those three years averages some 34 to 35 thousand (or about 14 percent) more per year with the double cohort than it would have been without it[10]. By the end of the decade, once the double cohort has worked its way through the system, enrolment is again influenced only by the underlying changes in the population and enrolment rates.

With a further lag, the double cohort also affects graduate enrolment, as shown in Figure 4. The increase is much more gradual at this level, but still strong, and there is a clear peak. The peak at the masters' level (see Appendix C, Tables C1, C2) comes two years after the undergraduate peak, and that at the doctoral level comes another two years after that. In total, full-time equivalent

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[9] In all calculations, in keeping with accepted practice, 3.5 part-time students are deemed equivalent to one full-time student.

[10] For the years 2000-01 and 2001-02 limited comparisons can be made of enrolment as projected by the model with preliminary total enrolment figures that are available from the Ontario Ministry of Training, Colleges and Universities. For the two years taken together, the model produces an average projected increase in full-time equivalent enrolment at the undergraduate level of between 3.23 percent (low projection) and 3.53 percent (high projection) per year; the average actual increase as reported by the Ministry was 3.51 percent. I am grateful to Veronica Daniel of the Ministry for providing recent enrolment figures.

enrolment at the graduate level in the four-year period 2005-06 to 2008-09 is about 10 thousand greater with the double cohort, or about 2,500 per year.

Overall enrolment at all levels, in terms of full-time equivalents, is shown in Figure 5. The projections certainly suggest much higher enrolment figures for the rest of this decade. The projections indicate that even without the double cohort, enrolment would have increased by about 10 percent by 2004-05, whereas with the double cohort the projected increase is a *further 19 percent* in that year. Thus, in the middle of the decade the double cohort clearly will take enrolment (temporarily) to much higher levels than would otherwise be the case – with additional increases of between 30 or 50 thousand per year – provided, of course, that the university system can cope with the numbers, and that the acceptance rate for applications does not (or is not allowed) to decline sharply.

4. The Faculty: Current and Prospective Availability

We turn now from considerations of *demand* (the annual flow of students who would like to gain access to the university system) to considerations of supply. Attention in this section is focussed on the current complement of full-time faculty, and projections of how many of them will be available over the remainder of the decade.

Figure 6 shows the age distribution of full-time faculty in 1999-2000, the latest year for which figures are available[11]. The major and obvious point here is that the current complement of faculty is predominantly in the age groups near the traditional age of retirement. While the male faculty are, on average, much older than female faculty, about *one-third* of all faculty are over the

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[11] Unpublished numbers were obtained from Statistics Canada in five-year age groups, and were converted to single years of age using Sprague multipliers, a demographic technique designed for this purpose.

age of 55 and *more than half* are over the age of 50. The modal age is 56. It is obvious that there will be much retirement over the next five to ten years.

Figure 7 shows the number of full-time faculty from 1988-89 through to 1999-2000 and shows also, for those employed in 1999-2000, three projections of how many will still be full-time faculty through the rest of this decade. The near-constancy of faculty numbers in the first five years, 1988-89 to 1993-94, contrasts sharply with the marked growth in student numbers (see Figure 5). The subsequent substantial *reduction* in faculty numbers – of the order of 10 percent between 1993-94 and 1999-2000 – coincided with a much smaller reduction in student enrolment – of the order of 1 percent. As one indicator of the change over the decade, in 1988-89 there were 17.0 full time equivalent students per full-time faculty member. By 1993-94 that ratio had increased to 18.9, and by 1999-2000 to 20.9.

Let us turn now to the projections of the number who will remain full-time faculty. One projection, "continued early retirement" in Figure 7, shows what would happen if faculty continue to leave the system at ages before 65 at the same rate as they did in the last five years for which we have data. A second projection shows what would happen if no one were to retire before age 65[12]. These two cases presumably place outer bounds on what will happen. On the one hand, it is unlikely that the universities will provide more encouragement to faculty to take early retirement packages than they did in recent years, particularly in view of the prospective difficulties in hiring replacements. On the other, unless mandatory retirement at age 65 is eliminated, everyone will be

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[12] As explained in Appendix A, the term "retirement" is used here to include all departures or exits from full-time faculty status. Hence it includes moves to university appointments outside the province, moves to non-university appointments anywhere, and deaths, as well as regular retirements. However, almost all departures would be retirements in the usual sense.

required to retire at that age. In either case, the extent of attrition is evident. The first projection shows that even if no one retires before age 65, about 4,100 of the current 12,255 will be lost through retirement. With continued early retirement about 6,700 will be lost.

Elimination of Mandatory Retirement

The third projection shows what might happen if retirement were no longer mandatory. This is a case of considerable interest since support for the elimination of mandatory retirement in Canada appears to be building. (It has long since been eliminated in the US.) For example, in 1999 the federal Minister of Justice appointed a panel to review the Canadian Human Rights Act. Among other things, the panel was asked to give attention to the exceptions to the scope of the Act, one of which is mandatory retirement. In its Final Report, which was released in 2000, the Canadian Human Rights Act Review Panel stated that in its view "mandatory retirement is age discrimination", that there should be "no blanket defences for mandatory retirement" (Chapter 18, recommendation 132), and that "a thorough review of the issue of mandatory retirement" should be undertaken (recommendation 131). The Ontario Human Rights Commission also drew attention to this matter by launching a "consultation on age" [13]. Its final report "emphasizes that mandatory retirement is discriminatory. It recommends that the Ontario Human Rights Code be amended to eliminate the defence of mandatory retirement at age 65 and to provide protections against age discrimination to workers over 65."[14] [15]

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[13] The issues are discussed in Gillin and Klassen (2000), Ontario Human Rights Commission (2000), and Canadian Human Rights Act Review Panel (2000, Chapter 18).

[14] Ontario Human Rights Commission (2001, Executive Summary)

[15] Of related interest, Denton and Spencer (1999, 2000) argue that with continuing reductions in rates of mortality and morbidity, and the associated strong increases in life

The projection shown here draws on US experience. Mandatory retirement in postsecondary institutions in the US has been prohibited since the beginning of 1994. (Before that a 1986 amendment to the US Age Discrimination in Employment Act allowed postsecondary institutions to enforce mandatory retirement for faculty who reached the age of 70. However, that exemption was temporary and, after review, the US Congress allowed it to expire on January 1, 1994.) In the projection we assume that the retirement rates of Ontario faculty come to resemble the 1994-96 observed rates in postsecondary institutions in the US[16]. More specifically, it is assumed that there is a transition from the current Ontario retirement pattern to the US pattern that is complete by 2003-04. What difference would that make?

It is evident from Figure 7 that the attrition would be greatly reduced. By 2004-05 there would be 14 percent more faculty with the US retirement pattern than with continued early retirement. By the end of the projection period there would be 29 percent more.

5. Projected Requirements for Faculty

In common with the projection of student enrolment, the projection of faculty requirements is based on some relatively simple assumptions. Full details are provided in the Appendix A, but the approach can be summarized as follows. Faculty requirements are assumed to be related to student

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expectancy, the marker for "old age" should increase also.

[16] The US age-specific exit rates are drawn from Ashenfelter and Card (2001, Figure 4). Ashenfelter and Card (2001, p. 32) concluded that the recent elimination of mandatory retirement in the US will lead to a significant rise in the fraction of older faculty: "We estimate that about 40 percent of 60-year-old faculty at private research universities will remain employed until age 70, compared with about 25 percent at private research universities and just under 25 percent at doctoral granting, comprehensive, and liberal arts institutions."

enrolment, and to depend on the level of study and whether it is on a full- or part-time basis. The ratios used in the projections that start from 1999-2000 are shown in the table below. The overall student-faculty ratio was 20.9 in that year. Among full-time students, the ratio was estimated to be highest for first-year students, somewhat lower for other full-time undergraduates and masters level students, and lowest for doctoral students.

Assumed Ratios of Students per Full-Time Faculty Member, 1999-2000

Undergraduate Studies, Full-Time	
- year 1	25.5
- years 2+	21.6
- other	20.7
Undergraduate Studies, Part-Time	
- degree studies	22.9
- other	21.4
Graduate Studies, Full-Time	
- Masters level	22.6
- PhD level	8.0
- other	12.6
Graduate Studies, Part-Time	
- Masters level	16.5
- PhD level	20.3
- other	14.7
Overall	20.9

Source: The ratios are based on unpublished numbers provided by
Statistics Canada and OCUFA.

Faculty/student ratios are applied to enrolment, as projected, to derive faculty requirements. As shown in Figure 8, the projections are made under two sets of "standards". One refers to the latest available student-faculty ratios, namely 1999-2000, while the other refers to the ratios of 1990-91, when faculty numbers were at their highest level in the decade. By showing calculations relating to these two standards, we are able to distinguish between the faculty requirements necessary to

maintain more or less current student-faculty ratios and requirements that would be necessary to regain the standards (in terms of those ratios) that were in place before the major reduction in the size of the faculty. To avoid clutter, Figure 8 shows faculty requirements from 1999-2000 for only the "low" enrolment projection (i.e., constant enrolment ratio at the first-year level), and from 1991-92 based on both the "high" (i.e., increasing first-year enrolment ratio) and "low" enrolment projections.

Faculty requirements are generally trending upwards, in consequence of the projected increases in enrolment over the longer term, but it is evident from the figure that the double cohort will result in a very sharp temporary increase that is especially large for the four academic years 2003-04 and 2006-07. In order to maintain current standards, 2,500 more faculty would be needed by the end of the decade than in 1999-2000. But a further 900 will be needed before that, in mid-decade, to accommodate the double cohort when its demands are greatest.

If instead the target were to return to the standards of 1990-91, then by 1999-2000 the system was already short by 2,565 faculty, and the gap is projected to grow. By 2004-05, when the faculty requirements are greatest, the gap between the two "low" projections is about 3,380; "high" enrolment implies the needs for an additional 330 to 400 faculty in that year.

6. Projected Shortfall of Faculty: Implications for Recruitment

While Figure 8 indicates that faculty requirements will increase by at least 20 percent between 1999-2000 and 2010-11 if the target is just to maintain current standards, Figure 7 indicates that the current complement of faculty will decrease by at least 33 percent over that same period. Those two figures alone suggest that the need for net recruitment is equivalent to more than 50 percent of the current faculty complement.

Table 1 provides further calculations relating to the two targets (maintain current standards; return to earlier standards), the two enrolment projections ("low"; "high"), and three assumptions about faculty retirement (early; only at age 65; US pattern). With the combination of current standards, low enrolment, and early retirement taken as the reference case, the implication is that (in round numbers) an additional 7,000 full-time faculty would be needed by mid-decade and 9,000 by the end of the decade. As compared to the current complement of about 12,000, that represents an enormous recruitment challenge.

It is evident that possible changes in retirement practices would make a big difference. For example, with a transition to US patterns the need for faculty recruitment would be reduced by more than 1,200 at the middle of the decade and more than 1,600 at the end -- or by roughly one-sixth. That would be more than enough to offset the additional faculty needs associated with higher enrolment which, even by the end of the decade, would increase requirements by only one-eighth. With all retirement at age 65 recruitment needs would be reduced by even more -- by about 2,600. That would be more than enough to offset the additional recruitment (about 3,200) that would be necessary for a return to earlier standards (as shown in the lower panel of Table 1).

Should one be concerned that a successful recruitment effort in the next few years would leave the universities with a surplus of faculty once the double cohort has graduated and left the system? The calculated shortfall is shown for each year in Figure 9 and Table 1. With "continued early retirement" and "1999-00 standards", perhaps the most likely case, the projected shortfall is 7,133 faculty by 2004-05. That means that if the Ontario universities actually hired 7,133 faculty in the five years ending in 2004-05 – or somewhat over 1,400 faculty per year, on average – the result would be a *small* surplus in 2005-06. Without further recruitment even that surplus would have

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disappeared by the following year[17].

7. Conclusions

The recent restructuring of the Ontario secondary school system means that two graduating classes – the so-called "double cohort" – will compete for admission to the universities in the fall of 2003. Unless admission standards are raised to restrict enrolment, the sheer numbers involved will place extraordinary demands on the system for half a decade. The demands will be difficult to accommodate, not least because more than half of current faculty are over the age of 50, and most will retire in this decade.

This paper is concerned with the likely impact that the double cohort will have on the university system in terms of student numbers, faculty requirements, and the need to recruit new faculty.

In terms of student numbers, the major conclusions are:

1. The effects of the double cohort on the demand for places in Ontario universities will peak in 2004/05, but will dominate the middle five years of this decade;

2. First-year undergraduate enrolment will be more than 40 percent (or 26,000 students) greater in 2003-04 than it was in 1999-00, if the university system is able to accommodate the increase in demand; four-fifths of that increase will be the direct result of the double cohort; and

3. Total undergraduate enrolment will be almost one-third (about 70,000 full-time equivalent

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[17] However, it seems unlikely that any surplus will be realized. Preliminary figures indicate that recruitment was well below projected increases in requirements for the 2000-01 academic year.

students) greater at its peak in 2004-05 than five years earlier, again, if the system can accommodate the increased demand; about two-thirds of that increase will be the direct result of the double cohort.

The major conclusions as they relate to faculty requirements and the need for recruitment are:

4. Recruitment of new faculty in unprecedented numbers – about 7,000 by 2004 and another 2,000 by 2010, as compared to the current total size of just over 12,000 – will be essential if the university system at the end of this decade is to have standards even close to those now in place;

5. The ability of the university system as a whole to cope with the increase in enrolment will be importantly affected by the rate at which faculty take early retirement or opt to stay on; and

6. Eliminating mandatory retirement could reduce the need for recruitment by about one-sixth.

1. Population 18-24 ('000)
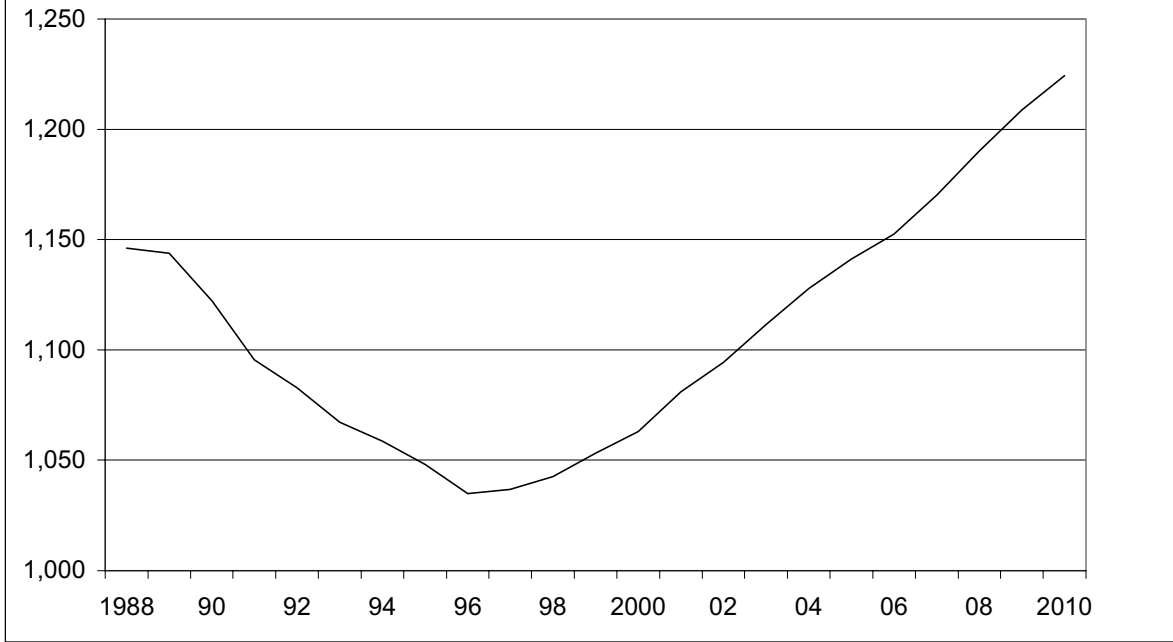
Source: Figures for 1988 to 1996 from Statistics Canada; figures for 1997 to 2010 from McMaster MEDS projection
system (standard projection).

2. Year 1 Full-time Enrolment
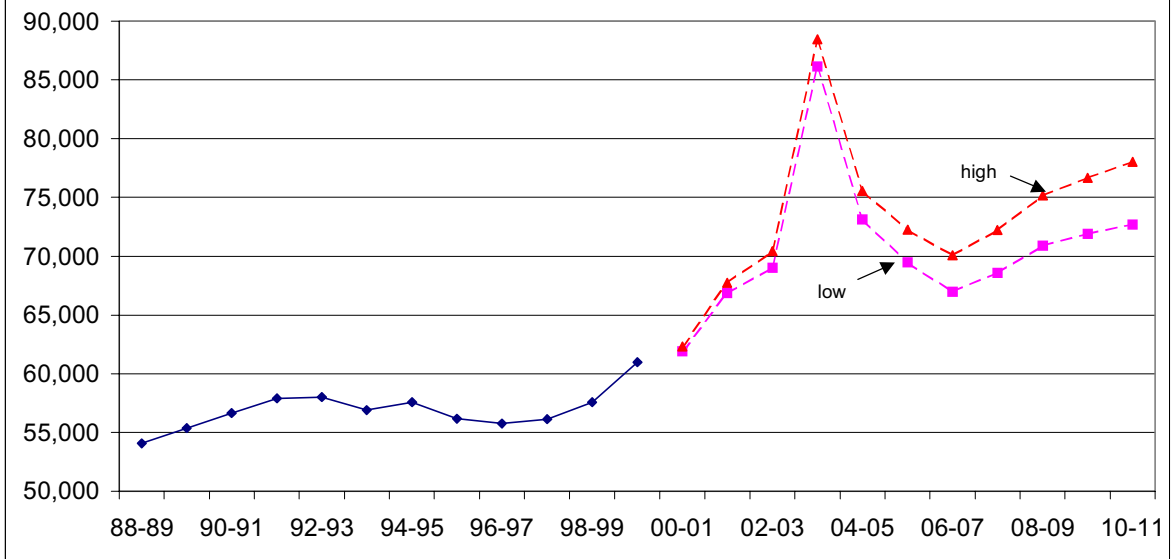
Source: Calculations for 1988-89 to 1999-00 based on special tabulations from Statistics Canada; projections based on
model of enrolment.

Note: The fraction of the population that enrols is centred on 19- (and then 18-) year-olds; the double cohort is phased in
between 2001-02 and 2005-06. In the "low" projection that fraction is held constant; in the "high" projection,
it increases by three percentage points.

3. FTE Undergraduate Enrolment
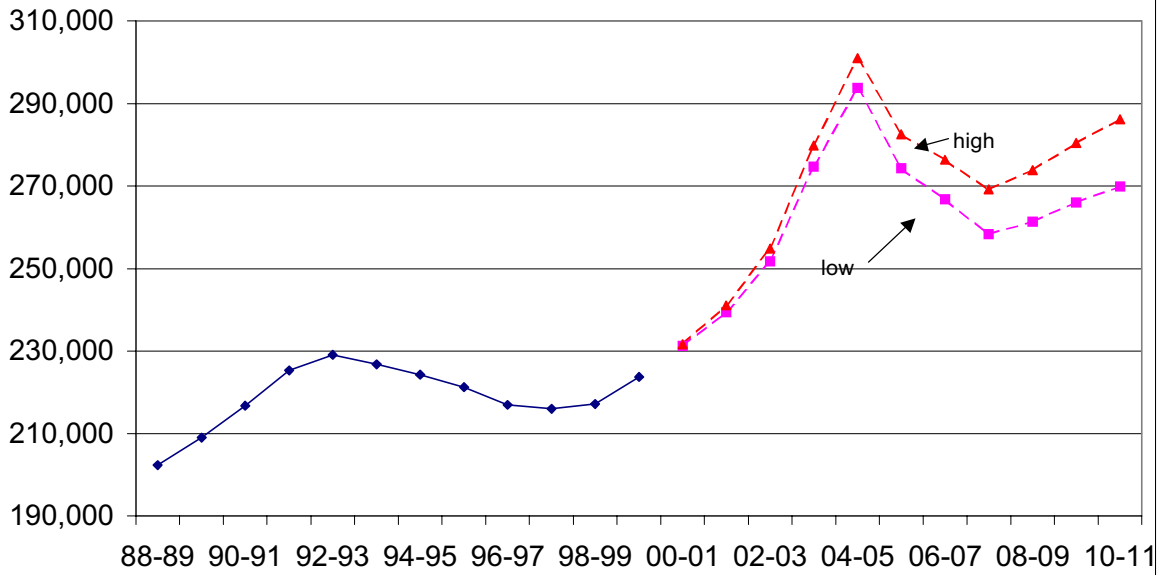
Source: See Figure 2.

4. FTE Graduate Enrolment
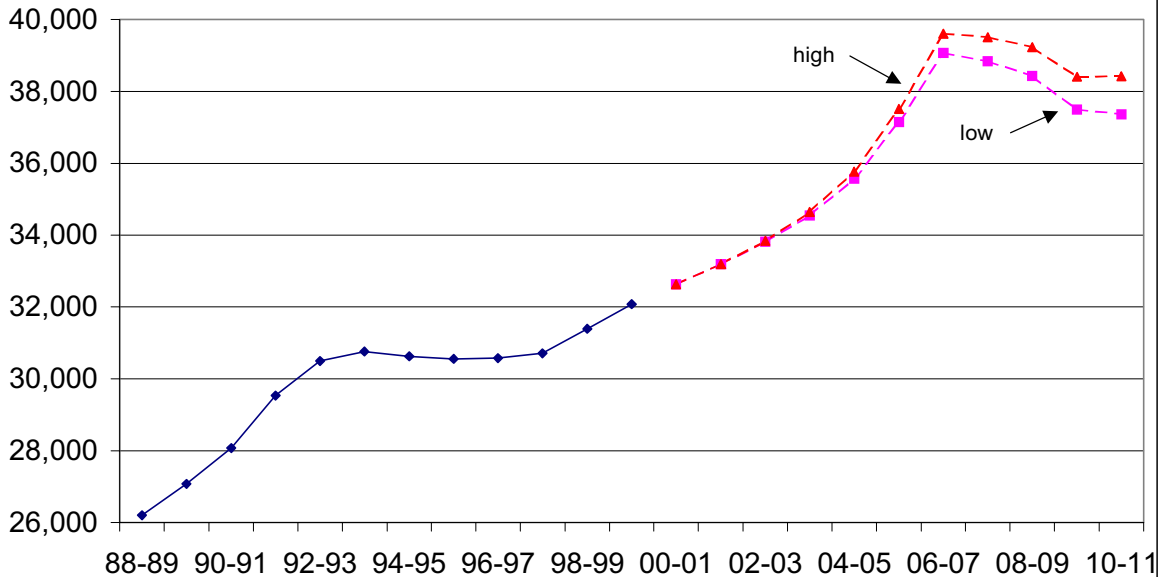
Source: See Figure 2.

5. FTE University Enrolment
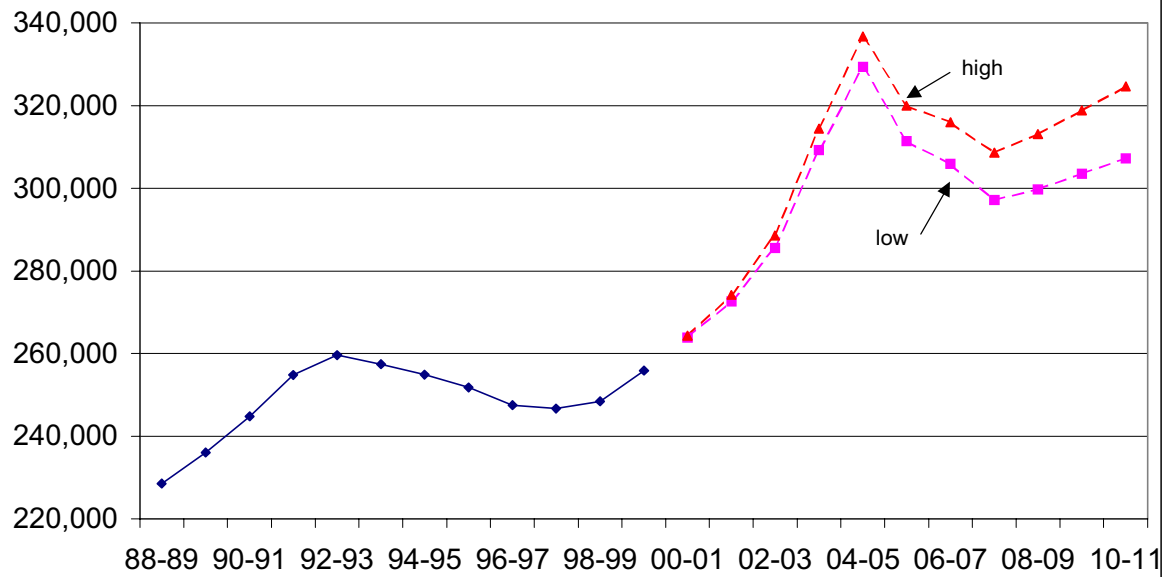
Source: See Figure 2.

6. Age Distribution of Full-time Faculty, 1999-2000
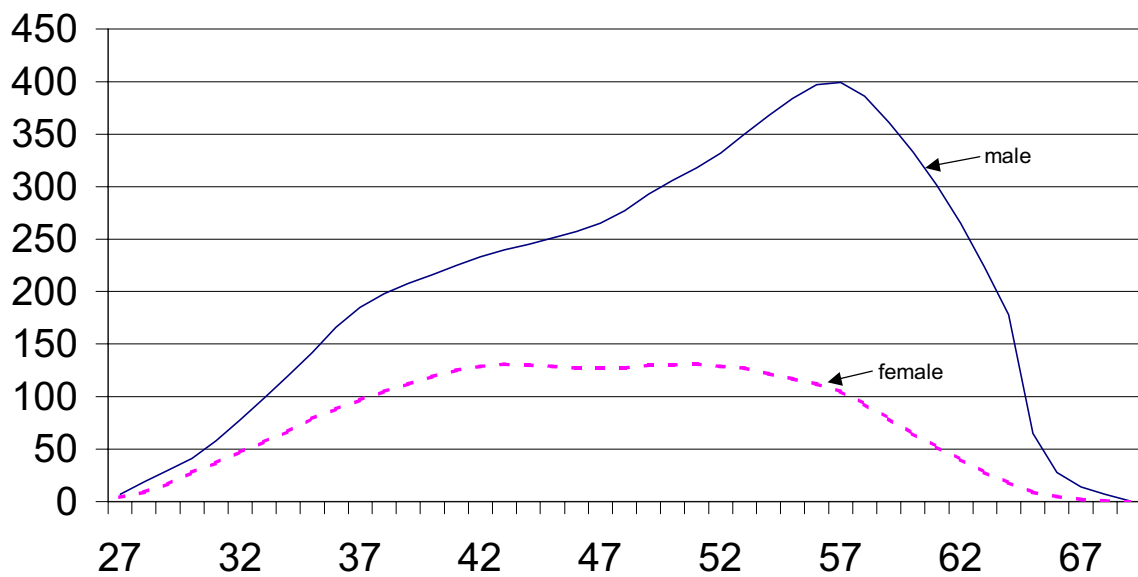
Source: Based on special tabulation from Statistics Canada.

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7. Full-time University Faculty

retirement at age 65

continued early retirement

US retirement pattern
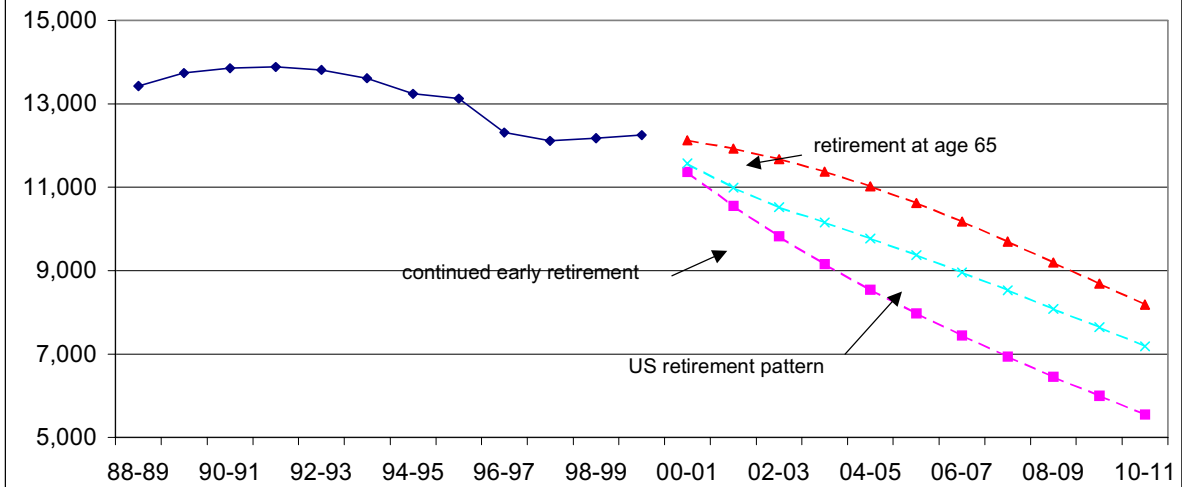
Source: Figures for 1988 to 1999 based on special tabulation from Statistics Canada; figures for 2000 to 2010 based on a model of retirement. "Continued early retirement" assumes that age-specific retirement rates observed during the 1994-99 period apply thereafter; "retirement at age 65" assumes that no one retires before age 65; "US retirement pattern" assumes a phase-in of US retirement rates by 2003-04.

8. Requirements for University Faculty

high

low

1990-91 standards

Actual

1999-00 standards, low

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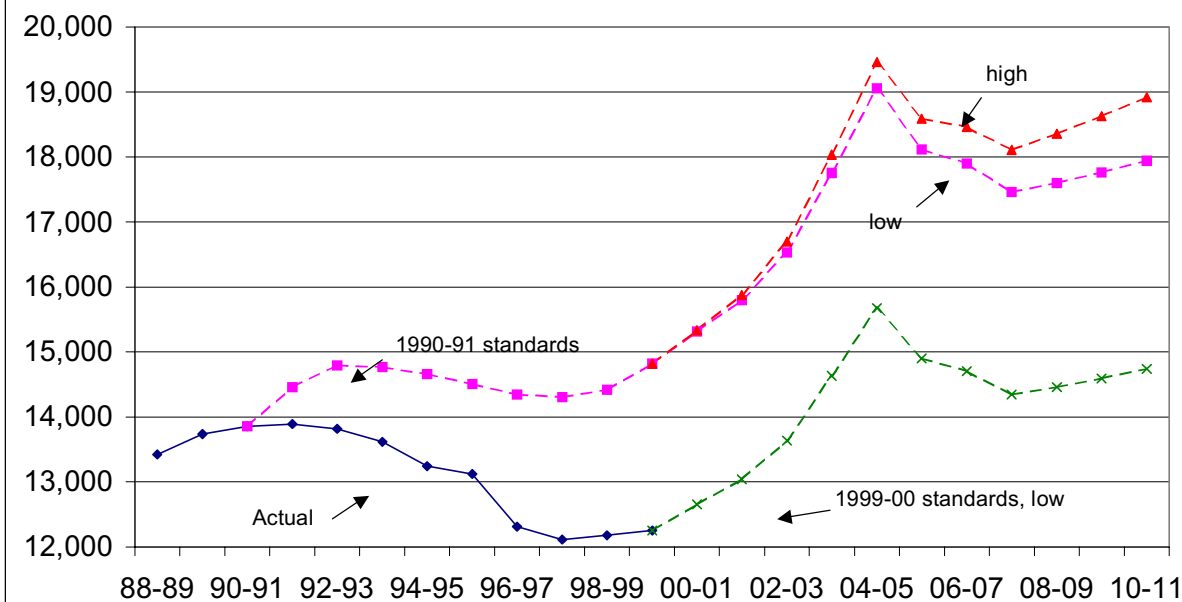
9. Shortfall of Full-time University Faculty, 1999-00 Standards and "Low" Student Enrolment
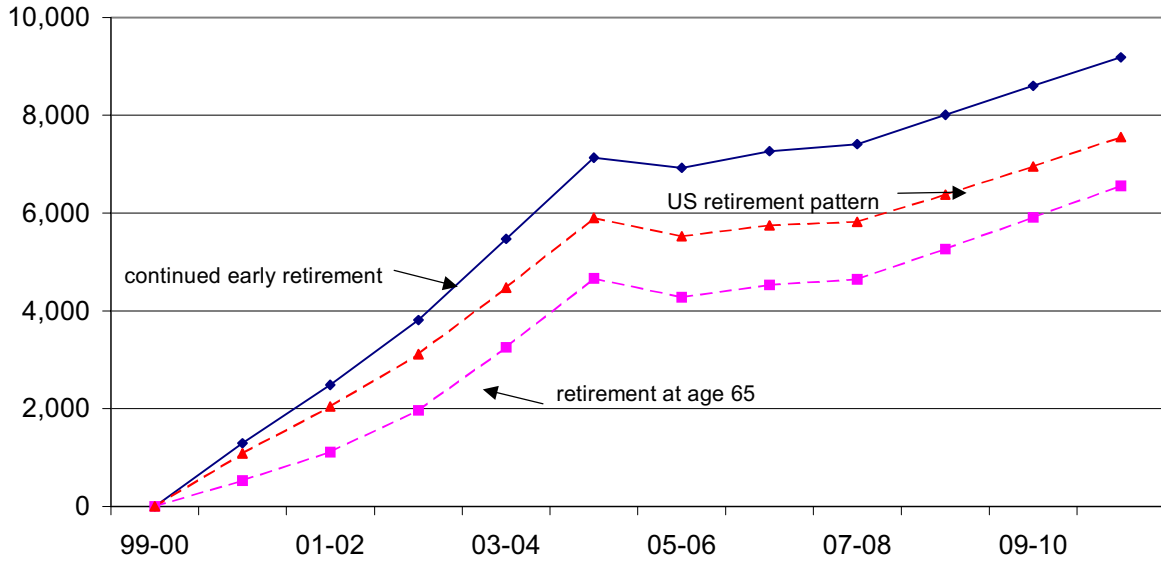
10. Shortfall of Full-time University Faculty, 1999-00 Standards and "High" Student Enrolment
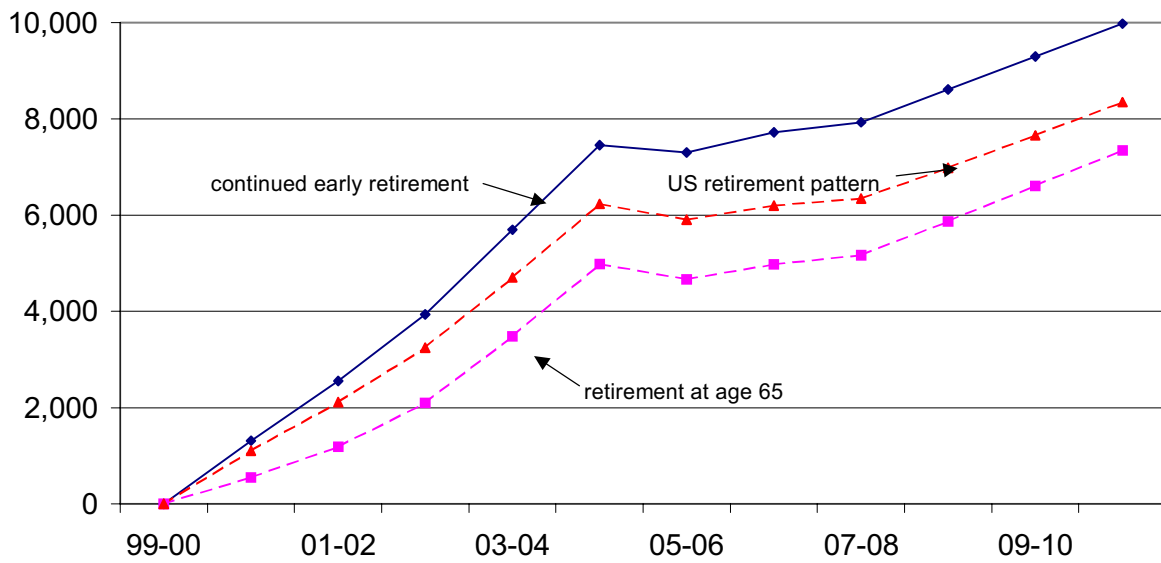
Table 1: Shortfall of Ontario Full-time University Faculty, 1999/00 to 2010/11

Enrolment	Retirement	Shortfall of Faculty		
		1999-00	2004-05	2010-11
	Target is to maintain 1999-00 standards			
"low"	Early retirement	--	7,133	9,186
	US retirement pattern		5,904	7,553
	Retirement only at age 65	--	4,660	6,556
"high"	Early retirement	--	7,460	9,980
	US retirement pattern		6,231	8,346
	Retirement only at age 65	--	4,987	7,349
	Target is to return to 1990-91 standards			
"low"	Early retirement	2,565	10,513	12,382
	US retirement pattern	2,565	9,284	10,749
	Retirement only at age 65	2,565	8,040	9,752
"high"	Early retirement	2,565	10,915	13,364
	US retirement pattern	2,565	9,687	11,730
	Retirement only at age 65	2,565	8,443	10,733

Appendix A: Description of the Projection Model of Student Enrolment and Faculty Aging

 Student Enrolment:

Enrolment is modelled separately at the undergraduate and graduate levels, and for both full-time and part-time studies. In the case of full-time undergraduate studies, first year is distinguished from other years. A category "all other" (which includes diploma and certificate programs, non-university programs at universities, and other) is included for both full-time and part-time studies. At the graduate level, masters and doctoral studies are treated separately, as is a third category, "all other" (which includes certificate, diploma, and other programs). The enrolment counts include *all* enrolment in *all* universities in Ontario that receive financial support from the provincial government. (In particular, the counts here include those enrolled in professional schools; schools of medicine and dentistry, among others, are often omitted in such counts. The institutions included are listed in Appendix B; the university-level institutions in the province that are not included are the Royal Military College, Redeemer University College, Tyndale College, and Tyndale Seminary.)

A description of the projection system follows. Some equations of the system have been estimated, based on data relating to the twelve academic years 1988-89 to 1999-2000. (Historical as well as projected enrolment series are reported in Appendix C.)

Undergraduate Level

First-year full-time enrolment is projected by the equation

(1) $UF1(t) = e(UF1,t)*[w(18,t)*N(18,t) + ... + w(21,t)*N(21,t)]$ $(t = 00/01, ..., 10/11)$

where: UF1   indicates full-time first-year enrolment

e   indicates the enrolment ratio (the ratio of first-year enrolment to the population of 19-year-olds)

w   is an age-specific weight (the assumed weights are shown in the text)

N   is the age-specific population

t   is the academic year (00/01, 01/02, etc.)

Full-time enrolment in the second year and beyond (UF2) is related to first-year enrolment in the preceding three years. The year weights are constrained to sum to 1.0, and their relative values are determined by a grid search using ordinary least squares. The estimated equation (with the standard error in brackets) that is used in the projections is

(2) $UF2(t) = 2.426 * (5/7*UF1(t-1) + 1/7*UF1(t-2) + 1/7*UF1(t-3))$ (t = 00/01, ..., 10/11)
        (0.006)
    R-bar squared = 0.605

The estimated residual for 1999-2000 is included in projected values of UF2.

Enrolment in "other" full-time undergraduate programs (UFO) was 5,684 in 1988-89, declined to 4,753 two years later and has fluctuated subsequently within a fairly narrow range. In the projections it is held constant at its latest (1999-2000) level.

(3) $UFO(t) = 4,355$ (t = 00/01, ..., 10/11)

Part-time enrolment in standard degree programs (UP12) increased by almost 9,000 between 1988-89 and 1992-93 before decreasing fairly steadily by more than 20,000 to a level of just under 42,000 by 1998-99. There was an increase of about 1,800 in the latest year. In the projections it is assumed that the latest level is maintained.

(4) $UP12(t) = 43,529$ $(t = 00/01, ..., 10/11)$

Other part-time enrolment (UPO) declined from 35,000 in 1988-89 to 20,000 eleven years later. However, the decline has been relatively slow in recent years. In the projection it is assumed that that the latest level is maintained.

(5) $UPO(t) = 20,215$ $(t = 00/01, ..., 10/11)$

Graduate Level

Full-time enrolment at the masters level (GFM) increased fairly steadily from less than 12,200 in 1988-89 to almost 16,500 eleven years later. Regression analysis suggests that enrolment in such programs has been equal to (a weighted average of) 10.9 percent of full-time undergraduate enrolment beyond the first year level in the previous two years. The projections draw on that ratio, but also allow for students coming from out of province and for continued growth beyond that experienced in undergraduate studies. Firm figures are not available, but an educated guess suggests that about two-thirds of Ontario graduate students are drawn from undergraduate programs in

Ontario universities[18]. In the projections a weight of two-thirds is assigned to undergraduate enrolment in the previous two years and a weight of one-third to other sources of enrolment, with an allowance for continued growth in the latter component of 1 percent per year. (The weights in the estimated relationship with lagged undergraduate enrolment are constrained to sum to 1.0 and their relative values are determined by a grid search using ordinary least squares.)

(6) $GFM(t) = 0.109 * 2/3 * (1/3 * UF2(t-1) + 2/3 * UF2(t-2)) + 1/3 * GFM(98/99) * 1.01^{t-99/00}$
            (0.002) $(t = 00/01, ..., 10/11)$
        R-bar squared = 0.504

The estimated residual for 1999-2000 is included in projected values of GFM.

Full-time enrolment at the PhD level (GFD) is related to enrolment at the Masters level in the previous two years. The estimated relationship is shown in equation (7). The weights are constrained to sum to 1.0 and their relative values are determined by a grid search using ordinary least squares.

(7) $GFD(t) = 0.641 * (½ * GFM(t-1) + ½ * GFM(t-2))$ $(t = 00/01, ..., 10/11)$
            (0.007)
        R-bar squared = 0.504

The estimated residual for 1999-2000 is included in projected values of GFD.

Full-time enrolment in other graduate programs (GFO) has changed little over the last decade. In the projections it is assumed to remain constant at its latest level.

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[18] I am grateful to John A. Scime, Graduate Registrar and Secretary of the School of Graduate Studies, McMaster University, for discussions on this matter.

(8)   GFO(t) = 3,600   (t = 00/01, ..., 10/11)

Enrolment in part-time Masters programs (GPM) increased slightly before 1991-92, but has declined fairly steadily since then, not only in absolute numbers but also relative to full-time enrolment at this level. In the projections that ratio is assumed to continue to decline by 2.134 percent per year. That is half the observed rate of decline over the data period, and results in the ratio declining from 0.4647 in 1999-2000 to 0.366 in 2009-10. Specifically,

(9) $GPM(t) = 0.4647 * GFM(99/00) * 0.97866^{t-99/00}$ (t = 00/01, ..., 10/11)

Enrolment in part-time PhD programs (GPD) has also declined, both in absolute numbers and relative to full-time programs. In the projections the ratio of part-time to full-time doctoral students is assumed to decline by 2.977 percent per year. That is half the observed average rate of decline over the data period, and results in the ratio declining from 0.0931 in 1999-2000 to 0.0670 in 2010-11.

(10) $GPD(t) = 0.0931 * GFD(99/00) * 0.97023^{t-99/00}$ (t = 00/01, ..., 10/11)

All other enrolment in graduate studies (GPO) is related to full-time Masters enrolment. The ratio is assumed to decline at 3.675 percent per year. That is half the observed average rate of decline over the data period, and results in the ratio declining from 0.0460 in 1999-2000 to 0.0300 in 2009-10.

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(11)   GPO(t) = 0.0460 * GFM(99/00) * 0.96325 $^{t-99/00}$ (t = 00/01, ..., 10/11)

Faculty Demand

The demand for faculty (or "faculty requirements") at the aggregate level is related to student enrolment by equation (12).

(12)   FD(t) = SUM(i) (w(i) * E(i,t))   (t = 00/01, ..., 10/11)

where FD   indicates faculty demand

       w   indicates an enrolment-group-specific weight

       i   indicates the enrolment group (UF1, UF2, etc.)

       E   indicates enrolment level

The weights, w(i), are the ratio of full-time faculty associated with the ith enrolment group, F(i), to enrolment at that level, E(i). That ratio is not directly observable, but it can be re-written as

(13)   w(i) = F(i)/E(i) = (F/E(i)) * (F(i)/F)   (t = 00/01, ..., 10/11)

The first part, F/E(i), is the ratio of all full-time faculty to enrolment in the ith group, and is directly observable from the data. The second part, F(i)/F, is the fraction of faculty teaching resources devoted to the ith enrolment group. That portion is not directly observable, but can be approximated by the fraction of total faculty teaching time allocated to each group, and that is what is done. More

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specifically, OCUFA provided estimates of how faculty teaching time is allocated across the various

groups[19], and those estimates were adjusted slightly to reflect the groups identified in the projections

shown here. The allocations are shown below; some of the implied student-faculty ratios are reported

in the text.

Enrolment Group	OCUFA-specified Fraction of Faculty Instructional Time (base period)	Adjusted Allocation
UF1	0.1954	0.1954
UF2	0.5473	0.5301
UFO		0.0172
UP12	0.0663	0.0443
UP0		0.0220
GFM	0.0685	0.0595
GFD	0.1095	0.0951
GFO		0.0234
GPM		0.0108
GPD	0.0130	0.0010
GPO		0.0012
Total	1.0000	1.0000

Projection of Continuing Supply

Statistics Canada provided unpublished counts of the number of full-time faculty in Ontario

by age group (under 30, 30-34, 35-39, ..., 60-64, and 65 and older), separately for each sex, for each

academic year from 1988-89 to 1999-2000. The faculty counts relate to the same set of institutions

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[19] I am grateful to Henry Jacek for providing these estimates.

as do the student enrolment counts.

Estimates of faculty numbers by single years of age, separately for each sex, were derived by the application of Sprague multipliers to the grouped data. The resulting numbers for the latest year are displayed in Figure 6.

Retention ratios were derived for those age 50 and older by taking the ratio of those age $x+5$ in 1999-2000 to those five years younger (age x) five years earlier, and expressing the result on an annualized basis. In this age range the ratio would show the proportion surviving (and in full-time employment) at each age. (Some would have retired and others would have died. Such ratios could exceed 1.0 if gains through recruitment exceeded losses through attrition, but none did.

Equation (14) is then used to project the count of continuing full-time faculty (FS) at each age.

(14)   FS(a+1,t+1) = FS(a,t) * r(a+1)   (a = 50, ..., 68; t = 00/01, ..., 10/11)

where   r   is the annual retention rate

In the case of "retirement at age 65", as shown in Figure 7, the retention ratio is set to 1.0 at ages below 65.

B: Institutions Included in the Counts of Student Enrolment and Full-time Faculty

Algoma College

Brock University

Carleton University

University of Guelph

Collège de Hearst

Collège Dominicain

Lakehead University

Laurentian University

McMaster University

Nipissing University

University of Ottawa

Queen's University

Ryerson Polytechnic University

University of Toronto

Trent University

University of Waterloo

The University of Western Ontario

Wilfrid Laurier University

The University of Windsor

York University

Note: All colleges and seminaries associated with the above institutions are included in the

counts.

Appendix C: Historical and Projected Enrolment and Full-time Faculty Numbers

Table C1: Undergraduate and Graduate Enrolment, Ontario University System, 1988-89 to 2010-11, Alternative Projections

Year	Undergraduate Programs						Graduate Programs					
	Full-time			Part-time			Full-time			Part-time		
	Year 1	Years 2+	Other	Degree	Other		Masters	PhD	Other	Masters	PhD	Other
1988-89	54,063	117,105	5,684	54,213	34,914		12,147	6,923	3,753	9,155	1,315	1,377
1989-90	55,379	122,979	5,013	56,077	33,564		12,430	7,390	3,696	9,410	1,360	1,685
1990-91	56,664	129,038	4,753	58,011	34,121		12,797	7,934	3,701	9,464	1,469	1,795
1991-92	57,879	135,192	4,809	61,446	34,343		13,734	8,492	3,704	9,478	1,466	1,674
1992-93	58,017	139,035	4,821	63,125	32,121		14,332	8,932	3,739	9,254	1,399	1,580
1993-94	56,911	139,967	5,083	57,149	29,490		14,505	9,220	3,681	8,999	1,349	1,390
1994-95	57,564	138,609	4,684	54,514	27,529		14,547	9,317	3,625	8,452	1,431	1,112
1995-96	56,179	137,778	4,540	51,342	28,249		14,501	9,329	3,647	8,377	1,327	1,050
1996-97	55,761	137,026	4,421	45,991	22,940		14,642	9,361	3,772	7,828	1,065	901
1997-98	56,122	136,631	4,521	44,530	21,033		15,158	9,171	3,652	7,731	941	865
1998-99	57,552	137,111	4,599	41,732	20,711		15,979	9,190	3,579	7,635	797	838
1999-00	60,993	140,200	4,355	43,529	20,215		16,479	9,345	3,600	7,657	870	758
Low Projection												
2000-01	61,883	146,785	4,355	43,529	20,215		16,632	9,768	3,600	7,564	882	737
2001-02	66,863	150,015	4,355	43,529	20,215		16,998	9,977	3,600	7,566	874	726
2002-03	69,038	160,146	4,355	43,529	20,215		17,453	10,143	3,600	7,602	862	718
2003-04	86,160	165,949	4,355	43,529	20,215		17,913	10,406	3,600	7,636	858	709
2004-05	73,127	198,100	4,355	43,529	20,215		18,604	10,699	3,600	7,762	856	710
2005-06	69,472	182,203	4,355	43,529	20,215		19,726	11,068	3,600	8,054	860	725
2006-07	66,960	177,287	4,355	43,529	20,215		20,962	11,649	3,600	8,376	878	742
2007-08	68,585	167,149	4,355	43,529	20,215		20,128	12,404	3,600	7,871	907	686
2008-09	70,906	167,828	4,355	43,529	20,215		19,702	12,532	3,600	7,540	889	647
2009-10	71,902	171,543	4,355	43,529	20,215		19,285	12,129	3,600	7,223	835	610
2010-11	72,696	174,637	4,355	43,529	20,215		19,469	11,859	3,600	7,136	792	593

Table C1: concluded

Year	Undergraduate Programs						Graduate Programs					
	Full-time			Part-time			Full-time			Part-time		
	Year 1	Years 2+	Other	Degree	Other		Masters	PhD	Other	Masters	PhD	Other
High Projection												
2000-01	62,294	146,785	4,355	43,529	20,215		16,632	9,768	3,600	7,564	882	737
2001-02	67,752	150,727	4,355	43,529	20,215		16,998	9,977	3,600	7,566	874	726
2002-03	70,414	161,829	4,355	43,529	20,215		17,470	10,143	3,600	7,610	862	718
2003-04	88,450	168,785	4,355	43,529	20,215		17,989	10,412	3,600	7,668	859	712
2004-05	75,556	202,854	4,355	43,529	20,215		18,755	10,729	3,600	7,824	859	715
2005-06	72,242	187,684	4,355	43,529	20,215		19,980	11,140	3,600	8,157	865	734
2006-07	70,074	183,722	4,355	43,529	20,215		21,326	11,778	3,600	8,521	887	755
2007-08	72,230	174,348	4,355	43,529	20,215		20,551	12,602	3,600	8,036	921	701
2008-09	75,146	176,185	4,355	43,529	20,215		20,190	12,785	3,600	7,727	907	663
2009-10	76,680	181,234	4,355	43,529	20,215		19,839	12,421	3,600	7,430	855	628
2010-11	78,010	185,650	4,355	43,529	20,215		20,111	12,192	3,600	7,372	814	613

Note 1: See Appendix B for institutions covered.
Note 2: The "low" and "high" projections are described in the text.
Source: Figures for 1988-89 to 1998-99 are from Statistics Canada, CTCES (Culture, Tourism,and the Centre
for Education Statistics); projections by the author.
Definitions: Undergraduate programs--"other" refers to diploma and certificate, non-university programs at
university and other.
Graduate programs--"other" refers to certificate, diploma and other.

Table C2: Full-time Equivalent Undergraduate and Graduate Enrolment, Ontario University System, 1988-89 to 2010-11, Alternative Projections

Year	Undergraduate Programs						Graduate Programs							Total
	Full-time			Part-time		Total	Full-time			Part-time			Total	
	Year 1	Years 2+	Other	Degree	Other		Masters	PhD	Other	Masters	PhD	Other		
1988-89	54,063	117,105	5,684	15,489	9,975	202,317	12,147	6,923	3,753	2,616	376	393	26,208	228,525
1989-90	55,379	122,979	5,013	16,022	9,590	208,983	12,430	7,390	3,696	2,689	389	481	27,075	236,057
1990-91	56,664	129,038	4,753	16,575	9,749	216,778	12,797	7,934	3,701	2,704	420	513	28,069	244,847
1991-92	57,879	135,192	4,809	17,556	9,812	225,248	13,734	8,492	3,704	2,708	419	478	29,535	254,783
1992-93	58,017	139,035	4,821	18,036	9,177	229,086	14,332	8,932	3,739	2,644	400	451	30,498	259,584
1993-94	56,911	139,967	5,083	16,328	8,426	226,715	14,505	9,220	3,681	2,571	385	397	30,760	257,475
1994-95	57,564	138,609	4,684	15,575	7,865	224,298	14,547	9,317	3,625	2,415	409	318	30,630	254,928
1995-96	56,179	137,778	4,540	14,669	8,071	221,237	14,501	9,329	3,647	2,393	379	300	30,550	251,787
1996-97	55,761	137,026	4,421	13,140	6,554	216,903	14,642	9,361	3,772	2,237	304	257	30,573	247,476
1997-98	56,122	136,631	4,521	12,723	6,009	216,006	15,158	9,171	3,652	2,209	269	247	30,706	246,712
1998-99	57,552	137,111	4,599	11,923	5,917	217,103	15,979	9,190	3,579	2,181	228	239	31,397	248,499
1999-00	60,993	140,200	4,355	12,437	5,776	223,761	16,479	9,345	3,600	2,188	249	217	32,077	255,837
Low Projection														
2000-01	61,883	146,785	4,355	12,437	5,776	231,235	16,632	9,768	3,600	2,161	252	211	32,624	263,859
2001-02	66,863	150,015	4,355	12,437	5,776	239,446	16,998	9,977	3,600	2,162	250	207	33,194	272,640
2002-03	69,038	160,146	4,355	12,437	5,776	251,752	17,453	10,143	3,600	2,172	246	205	33,820	285,572
2003-04	86,160	165,949	4,355	12,437	5,776	274,677	17,913	10,406	3,600	2,182	245	203	34,549	309,226
2004-05	73,127	198,100	4,355	12,437	5,776	293,795	18,604	10,699	3,600	2,218	245	203	35,569	329,363
2005-06	69,472	182,203	4,355	12,437	5,776	274,243	19,726	11,068	3,600	2,301	246	207	37,148	311,391
2006-07	66,960	177,287	4,355	12,437	5,776	266,814	20,962	11,649	3,600	2,393	251	212	39,066	305,881
2007-08	68,585	167,149	4,355	12,437	5,776	258,302	20,128	12,404	3,600	2,249	259	196	38,836	297,137
2008-09	70,906	167,828	4,355	12,437	5,776	261,301	19,702	12,532	3,600	2,154	254	185	38,427	299,728
2009-10	71,902	171,543	4,355	12,437	5,776	266,013	19,285	12,129	3,600	2,064	238	174	37,490	303,503
2010-11	72,696	174,637	4,355	12,437	5,776	269,901	19,469	11,859	3,600	2,039	226	169	37,363	307,264

Table C2: concluded

Year	Undergraduate Programs						Graduate Programs							Total
	Full-time			Part-time		Total	Full-time			Part-time			Total	
	Year 1	Years 2+	Other	Degree	Other		Masters	PhD	Other	Masters	PhD	Other		

High Projection

2000-01	62,294	146,785	4,355	12,437	5,776	231,646	16,632	9,768	3,600	2,161	252	211	32,624	264,270
2001-02	67,752	150,727	4,355	12,437	5,776	241,047	16,998	9,977	3,600	2,162	250	207	33,194	274,241
2002-03	70,414	161,829	4,355	12,437	5,776	254,810	17,470	10,143	3,600	2,174	246	205	33,840	288,650
2003-04	88,450	168,785	4,355	12,437	5,776	279,802	17,989	10,412	3,600	2,191	245	204	34,640	314,443
2004-05	75,556	202,854	4,355	12,437	5,776	300,978	18,755	10,729	3,600	2,236	245	204	35,769	336,747
2005-06	72,242	187,684	4,355	12,437	5,776	282,493	19,980	11,140	3,600	2,331	247	210	37,508	320,001
2006-07	70,074	183,722	4,355	12,437	5,776	276,364	21,326	11,778	3,600	2,435	254	216	39,609	315,972
2007-08	72,230	174,348	4,355	12,437	5,776	269,146	20,551	12,602	3,600	2,296	263	200	39,512	308,659
2008-09	75,146	176,185	4,355	12,437	5,776	273,899	20,190	12,785	3,600	2,208	259	189	39,231	313,129
2009-10	76,680	181,234	4,355	12,437	5,776	280,481	19,839	12,421	3,600	2,123	244	179	38,406	318,887
2010-11	78,010	185,650	4,355	12,437	5,776	286,227	20,111	12,192	3,600	2,106	233	175	38,418	324,645

Note: See notes to Table 1. The conversion to full-time equivalence is based on the following ratio:
    3.5 part-time students are equivalent to one full-time student.

Table C3: Full-time Equivalent Undergraduate and Graduate Enrolment, Ontario University System, 1988-89 to 2010-11, Alternative Projections Without Double Cohort Effect

Year	Undergraduate Programs						Graduate Programs							Total
	Full-time			Part-time		Total	Full-time			Part-time			Total	
	Year 1	Years 2+	Other	Degree	Other		Masters	PhD	Other	Masters	PhD	Other		
Low Projection														
2000-01	61,883	146,785	4,355	12,437	5,776	231,235	16,632	9,768	3,600	2,161	252	211	32,624	263,859
2001-02	62,444	150,015	4,355	12,437	5,776	235,027	16,998	9,977	3,600	2,162	250	207	33,194	268,221
2002-03	63,883	152,489	4,355	12,437	5,776	238,939	17,453	10,143	3,600	2,172	246	205	33,820	272,759
2003-04	64,956	155,484	4,355	12,437	5,776	243,007	17,727	10,406	3,600	2,159	245	201	34,338	277,345
2004-05	66,486	158,036	4,355	12,437	5,776	247,090	17,977	10,640	3,600	2,143	243	196	34,799	281,889
2005-06	67,163	161,558	4,355	12,437	5,776	251,289	18,243	10,807	3,600	2,128	240	192	35,210	286,499
2006-07	67,336	163,634	4,355	12,437	5,776	253,538	18,511	10,973	3,600	2,113	236	187	35,620	289,158
2007-08	67,683	164,699	4,355	12,437	5,776	254,950	18,792	11,144	3,600	2,100	233	183	36,051	291,001
2008-09	69,658	165,596	4,355	12,437	5,776	257,821	18,978	11,319	3,600	2,075	229	178	36,380	294,201
2009-10	71,925	169,198	4,355	12,437	5,776	263,690	19,112	11,469	3,600	2,045	226	173	36,624	300,314
2010-11	72,734	173,931	4,355	12,437	5,776	269,233	19,304	11,571	3,600	2,022	221	168	36,885	306,119
High Projection														
2000-01	62,294	146,785	4,355	12,437	5,776	231,646	16,632	9,768	3,600	2,161	252	211	32,624	264,270
2001-02	63,274	150,727	4,355	12,437	5,776	236,569	16,998	9,977	3,600	2,162	250	207	33,194	269,763
2002-03	65,156	154,069	4,355	12,437	5,776	241,793	17,470	10,143	3,600	2,174	246	205	33,840	275,632
2003-04	66,682	158,121	4,355	12,437	5,776	247,371	17,800	10,412	3,600	2,168	245	201	34,427	281,797
2004-05	68,695	161,757	4,355	12,437	5,776	253,019	18,118	10,669	3,600	2,160	244	197	34,988	288,007
2005-06	69,841	166,426	4,355	12,437	5,776	258,834	18,462	10,876	3,600	2,154	241	194	35,526	294,360
2006-07	70,468	169,638	4,355	12,437	5,776	262,674	18,810	11,088	3,600	2,147	239	190	36,075	298,749
2007-08	71,281	171,821	4,355	12,437	5,776	265,669	19,174	11,310	3,600	2,142	236	187	36,649	302,319
2008-09	73,823	173,844	4,355	12,437	5,776	270,235	19,443	11,538	3,600	2,126	234	182	37,123	307,359
2009-10	76,704	178,749	4,355	12,437	5,776	278,020	19,659	11,741	3,600	2,104	231	178	37,511	315,532
2010-11	78,051	184,904	4,355	12,437	5,776	285,522	19,937	11,896	3,600	2,088	227	174	37,921	323,443

Table C4: Full-time Equivalent Undergraduate and Graduate Enrolment, Ontario University System, 1988-89 to 2010-11, Percentage Difference with Double Cohort Effect

Year	Undergraduate Programs						Graduate Programs							Total
	Full-time			Part-time		Total	Full-time			Part-time			Total	
	Year 1	Years 2+	Other	Degree	Other		Masters	PhD	Other	Masters	PhD	Other		
Low Projection														
2000-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001-02	7.1	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6
2002-03	8.1	5.0	0.0	0.0	0.0	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7
2003-04	32.6	6.7	0.0	0.0	0.0	13.0	1.1	0.0	0.0	1.1	0.0	1.1	0.6	11.5
2004-05	10.0	25.4	0.0	0.0	0.0	18.9	3.5	0.6	0.0	3.5	0.6	3.5	2.2	16.8
2005-06	3.4	12.8	0.0	0.0	0.0	9.1	8.1	2.4	0.0	8.1	2.4	8.1	5.5	8.7
2006-07	-0.6	8.3	0.0	0.0	0.0	5.2	13.2	6.2	0.0	13.2	6.2	13.2	9.7	5.8
2007-08	1.3	1.5	0.0	0.0	0.0	1.3	7.1	11.3	0.0	7.1	11.3	7.1	7.7	2.1
2008-09	1.8	1.3	0.0	0.0	0.0	1.3	3.8	10.7	0.0	3.8	10.7	3.8	5.6	1.9
2009-10	0.0	1.4	0.0	0.0	0.0	0.9	0.9	5.8	0.0	0.9	5.8	0.9	2.4	1.1
2010-11	-0.1	0.4	0.0	0.0	0.0	0.2	0.9	2.5	0.0	0.9	2.5	0.9	1.3	0.4
High Projection														
2000-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001-02	7.1	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7
2002-03	8.1	5.0	0.0	0.0	0.0	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7
2003-04	32.6	6.7	0.0	0.0	0.0	13.1	1.1	0.0	0.0	1.1	0.0	1.1	0.6	11.6
2004-05	10.0	25.4	0.0	0.0	0.0	19.0	3.5	0.6	0.0	3.5	0.6	3.5	2.2	16.9
2005-06	3.4	12.8	0.0	0.0	0.0	9.1	8.2	2.4	0.0	8.2	2.4	8.2	5.6	8.7
2006-07	-0.6	8.3	0.0	0.0	0.0	5.2	13.4	6.2	0.0	13.4	6.2	13.4	9.8	5.8
2007-08	1.3	1.5	0.0	0.0	0.0	1.3	7.2	11.4	0.0	7.2	11.4	7.2	7.8	2.1
2008-09	1.8	1.3	0.0	0.0	0.0	1.4	3.8	10.8	0.0	3.8	10.8	3.8	5.7	1.9
2009-10	0.0	1.4	0.0	0.0	0.0	0.9	0.9	5.8	0.0	0.9	5.8	0.9	2.4	1.1
2010-11	-0.1	0.4	0.0	0.0	0.0	0.2	0.9	2.5	0.0	0.9	2.5	0.9	1.3	0.4

Table C5: Full-time Faculty in the Ontario University System, 1998-99 and Alternative Projections of
          Continuing Faculty

Year	Age–									
	<30	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+	total
Male Faculty										
1999-00	56	396	899	1,159	1,343	1,674	1,927	1,300	115	8,869
Continuing faculty if all retirement at age 65										
2000-01	26	306	811	1,122	1,295	1,599	1,934	1,483	178	8,754
2001-02	7	226	712	1,080	1,258	1,526	1,898	1,646	223	8,576
2002-03	0	155	605	1,032	1,226	1,459	1,831	1,780	265	8,353
2003-04	0	97	497	973	1,194	1,398	1,752	1,876	301	8,088
2004-05	0	56	396	899	1,159	1,343	1,674	1,927	333	7,787
2005-06	0	26	306	811	1,122	1,295	1,599	1,934	361	7,454
2006-07	0	7	226	712	1,080	1,258	1,526	1,898	386	7,093
2007-08	0	0	155	605	1,032	1,226	1,459	1,831	399	6,707
2008-09	0	0	97	497	973	1,194	1,398	1,752	397	6,308
2009-10	0	0	56	396	899	1,159	1,343	1,674	384	5,911
2010-11	0	0	26	306	811	1,122	1,295	1,599	368	5,527
Continuing faculty with sustained early retirement										
2000-01	26	306	811	1,123	1,290	1,566	1,797	1,034	153	8,106
2001-02	7	226	712	1,081	1,250	1,469	1,658	885	142	7,431
2002-03	0	155	605	1,033	1,216	1,386	1,522	798	116	6,832
2003-04	0	97	497	974	1,184	1,316	1,404	736	88	6,296
2004-05	0	56	396	900	1,150	1,259	1,308	680	64	5,812
2005-06	0	26	306	812	1,114	1,210	1,225	628	54	5,375
2006-07	0	7	226	713	1,072	1,172	1,150	580	51	4,970
2007-08	0	0	155	606	1,025	1,141	1,085	535	48	4,594
2008-09	0	0	97	498	966	1,110	1,031	496	44	4,242
2009-10	0	0	56	397	892	1,078	987	463	40	3,913
2010-11	0	0	26	306	805	1,044	950	436	37	3,603

Table C5: continued

Year	Age--									
	<30	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+	total

Male Faculty

Continuing faculty with US retirement pattern

Year	<30	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+	total
2000-01	26	306	811	1,123	1,290	1,566	1,797	1,175	196	8,289
2001-02	7	226	712	1,081	1,250	1,469	1,658	1,149	258	7,809
2002-03	0	155	605	1,033	1,216	1,386	1,522	1,181	325	7,423
2003-04	0	97	497	974	1,184	1,316	1,404	1,248	413	7,133
2004-05	0	56	396	900	1,150	1,259	1,308	1,269	495	6,832
2005-06	0	26	306	812	1,114	1,210	1,225	1,232	599	6,523
2006-07	0	7	226	713	1,072	1,172	1,150	1,153	707	6,200
2007-08	0	0	155	606	1,025	1,141	1,085	1,058	799	5,868
2008-09	0	0	97	498	966	1,110	1,031	975	853	5,531
2009-10	0	0	56	397	892	1,078	987	909	875	5,194
2010-11	0	0	26	306	805	1,044	950	851	874	4,856

Table C5: continued

Year	Age--										Total male
	<30	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+	total	and female
Female Faculty											
1999-00	30	236	481	634	640	639	506	203	17	3,386	12,255
Continuing faculty if all retirement at age 65											
2000-01	13	186	436	616	640	647	549	264	18	3,369	12,123
2001-02	4	138	388	590	644	647	583	329	28	3,351	11,927
2002-03	0	95	338	558	646	645	607	394	40	3,323	11,676
2003-04	0	58	287	521	644	641	626	454	52	3,283	11,371
2004-05	0	30	236	481	634	640	639	506	65	3,231	11,018
2005-06	0	13	186	436	616	640	647	549	79	3,166	10,620
2006-07	0	4	138	388	590	644	647	583	93	3,087	10,180
2007-08	0	0	95	338	558	646	645	607	105	2,994	9,701
2008-09	0	0	58	287	521	644	641	626	112	2,889	9,197
2009-10	0	0	30	236	481	634	640	639	117	2,777	8,688
2010-11	0	0	13	186	436	616	640	647	122	2,660	8,187
Continuing faculty with sustained early retirement											
2000-01	13	186	436	616	640	640	512	190	21	3,254	11,360
2001-02	4	138	388	590	644	634	516	188	22	3,124	10,555
2002-03	0	95	338	558	646	628	516	191	22	2,994	9,826
2003-04	0	58	287	521	644	623	518	193	20	2,863	9,159
2004-05	0	30	236	481	634	622	520	193	18	2,733	8,545
2005-06	0	13	186	436	616	622	520	194	17	2,603	7,978
2006-07	0	4	138	388	590	626	515	196	17	2,473	7,444
2007-08	0	0	95	338	558	628	510	197	17	2,343	6,937
2008-09	0	0	58	287	521	626	506	198	17	2,213	6,455
2009-10	0	0	30	236	481	616	506	197	17	2,083	5,996
2010-11	0	0	13	186	436	598	506	196	17	1,953	5,556

Table C5: concluded

Year	Age–										Total male
	<30	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+	total	and female

Female Faculty

Continuing faculty with US retirement pattern

Year	<30	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+	total	Total male and female
2000-01	13	186	436	616	640	640	512	213	25	3,281	11,570
2001-02	4	138	388	590	644	634	516	236	35	3,184	10,994
2002-03	0	95	338	558	646	628	516	269	47	3,097	10,521
2003-04	0	58	287	521	644	623	518	308	65	3,022	10,155
2004-05	0	30	236	481	634	622	520	335	83	2,941	9,774
2005-06	0	13	186	436	616	622	520	351	110	2,854	9,377
2006-07	0	4	138	388	590	626	515	357	143	2,761	8,960
2007-08	0	0	95	338	558	628	510	357	175	2,661	8,529
2008-09	0	0	58	287	521	626	506	359	200	2,556	8,087
2009-10	0	0	30	236	481	616	506	360	219	2,447	7,642
2010-11	0	0	13	186	436	598	506	360	235	2,334	7,190

Source: Figures for 1999-00 from Statistics Canada, CTCES; projections by the author.

Note 1: The series relate to all Ontario universities; see Note 1 to Table 1.

Note 2: The alternative projections are described in the text.

Table C6: Ontario Population Ages 18-24:
Historical and Projected

	(thousands)
1988	1,146
1989	1,144
1990	1,122
1991	1,095
1992	1,083
1993	1,067
1994	1,059
1995	1,048
1996	1,035
1997	1,037
1998	1,043
1999	1,053
2000	1,063
2001	1,081
2002	1,094
2003	1,112
2004	1,128
2005	1,141
2006	1,153
2007	1,170
2008	1,190
2009	1,209
2010	1,224

Source: Figures for 1988 to 1996 are from Statistics
Canada; figures for 1997 to 2010 are from
McMaster MEDS projection system
(standard projection).

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