Rising Tuition and Supply Constraints: Explaining Canada-U.S. Differences in University Enrollment Rates [*]

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Abstract

This paper exploits differences across the Canadian provinces and U.S. states in the evolution of cohort size, tuition levels and provincial/state appropriations per-college-age person from 1973 to 1999, to investigate cross-country differences in university/4-year college public enrollment rates. For the entire period, the elasticity of enrollment rates with respect to tuition levels is found to be the same in both countries at about -0.15. Provincial/state appropriations per-college-age person are also found to have played a determining role, especially in the 1970s when real tuition plummeted and in the 1990s when these sources of funding flattered.

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1. Introduction

Talks of a New Economy and population aging have fueled concerns about impeding short-ages of high skilled workers. While the 1980s have seen dramatic increases in enrollment rates at higher education institutions in both Canada and the United States, in the 1990s enrollment rates leveled off in Canada. Total enrollment at Canadian universities increased at an annual rate of 4.1 percent between 1973 and 1990, but registered almost no growth in the 1990s.[1] In the United States, total enrollment at all universities and 4-year colleges (private and public) increased at an annual rate of 1.8 percent between 1973 and 1990, and continued to increase at an annual 0.8 percent rate during the 1990s.[2] The annual rate of increase of 1.7 percent at U.S. 4-year public institutions was initially similar, but in the 1990s, the annual rate of increase of 0.2 percent was comparable to Canada's rate.[3]

The past twenty-five years have also seen spectacular increases in tuition levels at institutions of higher education in both countries. In 1973, the average real Canadian tuition (in 1999 $CAN) was around $2,300, in 1999 it had climbed to $3,100.[4] In the United States, over the same period, average real tuition (in 1999 $US) at public institutions went from $2,100 to $3,700.[5] Can these significant rises in tuition levels be implicated in the slow-down of enrollment rates? Or alternatively, can this slow-down be traced back to the dramatic changes in cohort size and direct government funding over that period? This paper addresses this puzzle by evaluating the impact of demographic changes and higher education policies on enrollment rates. The analysis is set at the provincial/state level where policy makers determine the level of higher education funding, as well as tuition and

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[1]According to Statistics Canada numbers obtained from the Association of Universities and Colleges of Canada (AUCC), total enrollment went from 495,000 in 1973 to 841,000 in 1990, but finished off at 843,000 in 1999. Total enrollment is the simple sum of full-time and part-time Fall enrollment.

[2]Total Fall enrollment at all 4-year institutions of higher education went from 6,590,000 in 1973 to 8,580,000 in 1990, and ended up at 9,200,000 in 1999. These numbers are extracted from table 197 of National Center for Education Statistics (2003).

[3]Total enrollment at 4-year public institutions of higher education went from 4,530,000 in 1973 to 5,850,000 in 1990, and totaled 5,970,000 in 1999.

[4]These figures from Corak, Lipps and Zhao (2003) are for Arts program.

[5]Average tuition levels are derived using data from Raudenbush (2002). See the appendix for details.

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capacity levels at public universities and colleges.

In Canada, constitutional responsibility with education rests with the provinces and provincial funding is the main source of general operating support for post secondary institutions. In 1973, provincial funding constituted 72 percent of educational expenditures of universities; in 1999 it was down to 57 percent.[6] The provinces rely on federal transfers to provide that funding and the steep decline in provincial support in the 1990s can be, in part, traced back to the federal deficit fighting over that period (Cameron (2004)). As shown below, there are nevertheless substantial differences across provinces in the growth of provincial funding per-college-age person. Direct federal incursions into this area of provincial jurisdiction take the form of research grants and student aid. Excluding student aid, direct federal funding has been the subject of substantially less fluctuations over time. These federal expenditures amounted to 15 percent of educational expenditures in 1973 and 12 percent in 1999, noting that the impact of more recent federal initiatives such as the Canada Foundation for Innovation and the Canada Research Chairs mostly fall after the period of study (see Snowdon (2004)).[7]

In the United States, states and local governments have also historically invested heavily in university/college education through direct and indirect subsidies, but that support has been eroded with each recession, especially with the recession of the early 1990s. The state appropriations constituted about 59 percent of general education revenues of public higher education institutions in 1973; by 1999 however, state appropriations were down to roughly 46 percent.[8] The share of federal appropriations, grants and contracts in the general education revenues of post-secondary public institutions is also sizeable, but like in

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[6]To enhance comparability with U.S. data, educational expenditures of universities are computed as total expenditures [CANSIM II series V1992346] minus capital expenditures [series V1992357]. See the data appendix and appendix table A1.

[7]See appendix table A1.

[8]These numbers are for all public institutions of higher education, including 2-year colleges but excluding vocational and trade colleges. Note however that the share of educational expenditures going to universities and 4-year colleges has been remarkably constant at 79 percent of the expenditures of all public institutions over the entire period. The percentage distribution of general education revenues of higher education per FTE student are reported separately for universities, 4-year colleges and 2-year colleges in table 39-1 of National Center for Education Statistics (1999a).

Canada it has been more stable over time. It went from 16 percent in 1981 to 14 percent in 1999.

Empirical studies of the political economy of public education across jurisdictions have found that higher public spending on post-secondary education are related to equal opportunities objectives, such wealth or income level and distribution (Humphreys (2000)), social homogeneity (Quigley and Rubinfeld (1993), Poterba (1996) for K-12 education) and lower support for private higher education (Goldin and Katz (1999)). In the United States, the levels of state appropriations have also been found to be determined by legislative choices (Koshal and Koshal (2000)) and by the lobbying activities of public institutions and their governing bodies (Lowry (2001b), Hearn, Griswold and Marine (1996)). Other factors, such as the importance of research-intensive industries (Goldin and Katz (1999) for 1929), were also found to be significant. Here, provincial/state appropriations are taken to be a reduced form estimate of these factors.

Faced with dwindling government support, higher education institutions had to increase their tuition revenues.[9] In Canada, the share of educational expenditures coming from tuition and fees went from a low of 10 percent in 1980 to a high of 21 percent in 1999. In the United Stated, tuition fees as a share of general education expenditures were also at a low of 16 percent in 1980, and but up to 24 percent in 1999. However as shown below, the size and timing of the increases in tuition did vary considerably across provinces and states. The combination of often times abruptly varying provincial/state tuition levels and provincial/state funding thus creates a potentially attractive source of the identification of the impact of these policies.

A primary finding of the paper is an estimated elasticity of student demand with respect to tuition fees of -0.15, which is surprisingly similar in Canada and the United States. When controlling for supply factors such as provincial/state funding, provincial/state trends, and demographics, the elasticity of enrollment rates with respect to tuition ranges from -0.09 to

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[9]Lowry (2001a) who uses NCES data from individual campuses for 1994-95 finds that higher tuition revenues are associated with lower state government funding, but are higher in states where public universities have more financial autonomy. Fortin (2004) finds a similar negative relationship between tuition and state appropriations using pooled cross-sections of states from 1973 to 1993.

-0.14, over the 1973-1999 period. Thus at worst, the near doubling (a 100 percent increase) of tuition fees between 1989/90 and 1990/91 experienced by Quebec students (Corak et al. (2003)) would have reduced the enrollment rate from 23.3 to 20.3 percent, in the absence of the countervailing effects of increases in provincial funding and decreases in college-age population. It actually increased to 24.8 percent.

Another major finding is the substantial role played by the supply of university/college seats in determining enrollment rates, in particular in 1970s when real tuition plummeted and in the 1990s when provincial/state appropriations per-college-age person flattered. Over the entire period, the elasticity of student supply with respect to provincial/state funding is generally larger in Canada (0.33) than in the United States (0.11). When controlling for changes in tuition fees and demographics, the elasticity of enrollment rates with respect to provincial/state funding is somewhat reduced, ranging from 0.29 to 0.07 over the 1973-1999 period. That is, the 13 percent decline in provincial funding, from 1992 to 1996 in Canada, would have led to a 0.8 percentage point in the decline in enrollment rates in the absence of other countervailing trends.[10] Enrollment rates actually went from 23.8 to 23.5 percent, thus the negative impact of the decline in provincial funding substantially wiped out the secular upward trends in enrollment rates.

The remainder of the paper is organized as follows. The next section sets out the economic framework of enrollment supply and demand used to analyze the potential impact of higher education polices on enrollment rates. Section 3 presents the broad aggregate and provincial/state trends in the key variables of interest. The empirical results are presented in section 4. A policy analysis of the findings concludes.

2.   Enrollments in a Supply and Demand Framework

In a higher education economic framework, the observed enrollment rates can be seen as outcomes of a supply and demand model, where prospective students demand university/college seats and public institutions supply those seats with tuition fees serving as the intermediating price. Enrollment supply is positively related to tuition fees, which have the

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[10]This calculation uses the more precise estimate 0f 0.25 of column (5), table 1.

potential to increase the revenues of higher educations institutions. Enrollment demand is negatively related to tuition fees, which increase the cost of attending university or college. However, as pointed by Clotfelter (1999), a singular feature of the higher education market is the presence of non-price rationing: excess demand for college seats is a necessary condition for selectivity in admissions. In turn, selectivity in admissions is the mechanism used by institutions to set a lower bound on the quality of applicants. Institutions can thus in theory use a combination of these two instruments—price and grades—to equilibrate supply and demand.

In practice, different countries have favoured more or less rigid institutional framework. In France, admission in the elite "Grandes Écoles" is restricted to very high aptitude students on the basis of an admission test that often requires attendance in preparatory schools, but tuition is very low (380€). There is virtually universal and free access (on average 200€ at LaSorbonne) to universities thought to be of lower quality.[11] The United States enjoys a mixed system of private and public institutions. Admission to the American elite private institutions is restricted by very high tuition (20,015$US in 2003-04) and/or very high grades.[12] Public institutions use a combination of price and grades with public research universities requiring moderate tuition (4,793$US in 2003-04) and restricting access on the basis of aptitude, while public community and technical colleges have very low tuition (2,142$US) and unrestricted admission.[13]

As often thought, the Canadian higher education system can be placed at some intermediate point between the French and American systems: it attempts to emphasize wider access while being somewhat preoccupied with quality. Skolnik and Jones (1992) argue that Canadian universities are not hierarchically differentiated. Yet, while they are no elite private institutions in Canada, the three best public research universities (University

[11]In the academic ranking of world universities (url: ed.sjtu.edu.cn/ranking.htm), the highest ranking French university, Université Paris VI is ranked 65fth, while the top ranking Canadian university, the University of Toronto, is ranked 23rd.

[12]At some elite universities/4-year colleges, as much as 40 percent of students are admitted on a needs-blind basis with an average of 18,000$US in scholarships. Yet because of its high cost, needs-blind admission for high aptitude students at elite universities has been curtailed following the 1991 law suit (Salop and White (1991).

[13]Card and Krueger (2003) report admission rates of 40 percent at UC-Berkeley and 85 percent at UC-Santa Cruz.

of Toronto, UBC and McGill) rank 18th, 28th and 50th in North-America, respectively.[14] Like in the United States, Canadian public institutions have less latitude in setting tuition fees than private institutions. Until the mid-1990s tuition was set at the provincial level with institutions having very few options to ask for differential tuition.[15] In the mid-1990s, however institutions in Ontario began asking close to market price for professional programs.

In theory, institutions can compete for the best students by using combinations of price and grades—or price discrimination—almost on a per student basis with "merit" based scholarships. In Canada, institutional outlays to student support went from 7.5 percent in 1980 to 10.4 in 1999. Meanwhile in the United States, public institutional outlays to student scholarships and fellowships increased from 3 percent to 6 percent. Yet much of the competition among institutions may take other forms, including the influential Canadian *MacLeans's* and *U.S. News and World Report* rankings of universities and colleges (Mueller and Rockerbie (2002), Monks and Ehrenberg (1999)).

Governments on the other hand are concerned with equality of opportunity objectives. In the 1970s in particular, many jurisdictions kept hikes in tuition fees well below the inflation rate. At times, they have even frozen nominal tuition fees. Governments also offer means-tested scholarships and loans making the net cost of attending universities less than posted tuition for many students. While Clotfelter (1999) finds some evidence of increasing inequality in the link between socio-economic status and college attendance, this troublesome trend is sharpest among private universities. In Canada, Corak et al. (2003) find no evidence of an increase in the link between parental income and participation in post-secondary education.[16] Recent research (Kane (2003)) has also focused on financial aid as way to alleviate the potential inequality increasing effect of rising tuition.

Here, the intricacies of asking "who" gets a university education are pushed into the

[14]The few Canadian private institutions (such as Alberta's King's College) are religiously-based, not-for-profit, and focused on undergraduate education. These rankings (url: ed.sjtu.edu.cn/ranking.htm) emphasize health and science.

[15]Corak et al. (2003) report specific differences by institutions and fields of study in differential tuition increases.

[16]The importance of that link is also evaluated in Christofides, Cirello and Hoy (2001), Knighton and Mirza (2002), Coelli (2004) among others.

background. Rather I ask "how many" can get a university education given jurisdiction-specific higher education policies and underlying demographics, thus abstracting from the issue of non-price rationing. While this is clearly a step back from the current American research in higher education (Hoxby (2004)) where the issues of college choices are paramount, it is more appropriate for the Canadian context and may actually be very relevant to American public institutions that are still attended by the majority of post-secondary students.

In economics, the post-secondary enrollment decisions of high school graduates are seen as solutions to a simplified version of the human capital investment model. After completing high school, individuals are faced with the decision of whether or not to get a university degree by maximizing the discounted present value of lifetime earnings, net of education costs.[17] Assuming that the marginal cost of attending university rises faster than the marginal benefit, the discounted lifetime earnings function is concave and the solution to this maximization problem equates the marginal costs of a university education to the marginal benefits. Individual heterogeneity in the decision to attend university or not will arise from differences in the marginal benefits of obtaining a university degree or differences in the marginal costs obtaining a university degree. Aggregating across individuals in any given jurisdiction will imply that jurisdictional differences in educational attainment will arise from differences in the returns to a university/college education and in the marginal costs of that education. Thus enrollment rates should be higher in jurisdiction with higher returns to a university degree and lower net costs of attendance, and conversely.

Yet precise information about the marginal benefits and the marginal costs of a university education may not be precisely known or correctly estimated by prospective students. In evaluating the marginal benefits, do prospective students use the national university/college premium or rather the provinces/state specific values? Do they use a contemporaneous, past, or discounted expected present value of that premium? In evaluating the marginal costs, prospective students may not be fully aware of the parameters of the

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[17]This formulation is appropriate if people can borrow and lend at a fixed interest rate, and if they are indifferent between attending school and working. More generally, differences in aptitudes and tastes for schooling relative to work may lead to differences in the optimal level of schooling across individuals.

financial assistance available to them and may make irrational decisions (Avery and Hoxby (2004)). Because of these informational difficulties, it is reasonable to believe that the very concrete level of tuition fees may have an unduly important effect on those decisions.

On the enrollment supply side, the ability of public institutions of higher education to supply university/college seats greatly depends on the level of provincial/state funding, which constitute their most important single revenue source. There are many quasi-fixed costs associated with the expansion of college seats. At the extensive margin, increasing the number of college seats by increasing the number of institutions entails expansions in physical buildings which are not easily scaled down.[18] Card and Lemieux (2001) argue that the partial adjustment of the higher education system to the temporary bulge in enrollment caused by the baby boom may have been a rational response. At the intensive margin, increasing the number of seats at existing institutions may imply the hiring of tenured or tenured-track faculty whose numbers are also not easily brought down. Bound and Turner (2002) argue that institutions face a quality-quantity tradeoff in expanding the number of college seats. When financial resources do not fully adjust to changes in the college-age population, limiting the expansion of college seats preserves institutional quality. Either arguments have become known as the "cohort crowding" hypothesis, which implies a negative impact of cohort size on enrollment rates. However, the 1980s onwards were characterized by the baby bust cohort becoming of college-age, thus one should expect enrollment rates going up as a "cohort hollowing" effect. Thus the more important determinants of enrollment supply will be the logarithm of the number of college persons and the logarithm of provincial/state appropriations per-college-age person, since the appropriate per capita basis in this context is per-college-age person.

Given the above considerations, it is reasonable to think that tuition levels seldom play the equilibrating role that prices ought to play in supply and demand system. Thus the higher education system is often in a state of dis-equilibrium, where the enrollment rate is determined by the short side of the market. If tuition is too low, the short side of the

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[18]The option of leasing regular office space is one that maintains higher flexibility, yet some physical demands (labs, amphitheater, etc.) of instruction rarely make this choice a long term one.

market will be the supply side and the provincial/state appropriations will determine the enrollment rates. If tuition is too high, the short side of the market will be the demand side and the tuition levels will determine the enrollment rates. Another complication arises from the fact that at times, tuition levels are exogenously determined by policy makers, when tuition levels are frozen in nominal terms for example (as in Quebec in the early 1980s). At other times, tuition levels and provincial/state funding are negatively correlated. It is thus also possible for tuitions to be high while low provincial/state funding determines enrollment rates. A reduced form equation of enrollment rates that focuses on higher education policies will be of the form[19]

$$E_{jt} = \beta_0 + \beta_1 Tui_{jt} + \beta_2 App_{jt} + \beta_3 Col_{jt} + \epsilon_{jt} \tag{1}$$

where E_{jt} represents the logarithm of the ratio of FTE Fall enrollments in public universities and 4-year colleges divided the number of persons aged 18 to 24 in jurisdiction j at time t, Tui_{jt} represents the logarithm of average tuition, App_{jt} represents the logarithm of per-college-age person provincial/state appropriations, Col_{jt} the logarithm of the number of persons aged 18 to 24. The jurisdiction-time specific errors are further modeled as $\epsilon_{jt} = \beta_j J_j + \beta_t P_t + \varepsilon_{jt}$, where J_j are jurisdiction-specific dummies, and P_t time period dummies.

Other authors (Quigley and Rubinfeld (1993), Berger and Kostal (2002) among others) have attempted to estimate separate more structural models of enrollment demand and enrollment supply. The difficulties there are of finding appropriate instruments to identify either curve. Quigley and Rubinfeld (1993) for example acknowledge that the negative sign on tuition in their legislative supply equation may be the result of an identification problem. My goal here is a more modest assessment of the relative role of demographics, government cut-backs and tuition on enrollment rates.

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[19]There are substantial difficulties in estimating formal dis-equilibrium models with controlled prices, such as establishing which regime prevails in each jurisdiction at each time period. The approach here is closer in spirit to the one suggested by Hendry and Spanos (1980) which concentrates on market pressures.

3. Canada–U.S. Differences in Higher Education and Population Trends

The most important changes of the later part of the twentieth century with respect to potential determinants of educational attainment have been demographic changes. Both Canada and the United States experienced sizeable baby booms in the 1950s and 1960s, so that twenty years or so after, the college age population as a fraction of the total population was at an all times high in the early 1980s. Figure 1 presents a dramatic illustration of the changes in the college-age population (individuals aged 18 to 24) and in university/college enrollment per college-age person.[20] The baby boom and the baby bust are clearly shown in panel A. In 1980, the college-age population represented at least 13 percent of the total population, by 1999 that percentage was less than 10 percent.[21] Panel A also shows that the decline of the college-age population was more pronounced in Canada than in the United States. Basically, the baby bust created an opportunity that I will argue is modulated by higher education policies, for enrollment rates to climb up as more college seats per college-age person became available.

Panel B focuses on Fall FTE enrollment at Canadian universities and at American universities and 4-year colleges per college-age person.[22] For the United States, the enrollment rates computed at the ratio of FTE enrollment to the college-age population are given for both private and public institutions, and for public institutions alone. The cross-country comparison shows differences in the magnitude and the timing of the rise in enrollment

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[20]It is typical in education research to think of individuals aged 18 to 24 as representative of the college-age population. According to National Center for Education Statistics (1999c) (table 13) 18 to 22 year olds constituted only 54 percent of all undergraduate enrollments in the Fall 1997. By including the 22 to 24 years, 70 percent of potential enrollees are captured. In Canada, it is somewhat inaccurate to include 18 year olds from Ontario in the college-age population since in period under study, high school included grade 13th. However, according to Statistics Canada (2003), 18 to 24 year olds constituted 80 percent of university enrollees in 2001, down from 82 percent in 1991. See the data appendix for more detail.

[21]If the average life span was 70 years and the population was uniformly distributed across age groups, there would be 10 percent of individuals in each 7-years age group.

[22]Full-Time Equivalent (FTE) enrollment is either provided by the institutions in the United States or computed as the sum of full-time Fall enrollment plus one-third of part-time Fall enrollment.

rates in response to roughly similar population trends. In the United States, enrollment rates very roughly stagnant at around 20 percent from the early 1970s to the early 1980s. But starting in 1984, U.S. enrollment rates at both public and private institutions began climbing up to reach a high of 30 percent in 1999. The climb at public institutions alone is a lot less pronounced going from 14 percent in 1984 to 19 percent in 1999.[23] Canadian enrollment rates began to climb earlier and more abruptly, going from 14 percent in 1981 to 24 percent in 1992, but remained around that number for the rest of the 1990s.

Figure 2 displays similar numbers as per-college-age person growth indexes (1980=100). The indexes of enrollment rates at Canadian universities and U.S. public 4-year institutions are coupled with corresponding indexes for real financial and higher education policy variables. In panel A, the dramatic cross-country differences in the growth of public enrollment curiously contrast similar trends in the growth of expenditures. In the 1980s, the per-college-age person real educational expenditures of public institutions experienced sizeable annual growth rates in both countries. However, in the 1990s that growth stalled in Canada, and so did the growth in enrollment rate. In the 1980s, while in Canada the growth of public expenditures per-college-age person roughly matched the growth of enrollment rates, in the United States it seriously outpaced that of enrollment rates. It is beyond the scope of this paper to fully explain these differences. Ehrenberg (2004) cites as a key factor in the stupendous growth in U.S. higher education expenditures the increasing institutional costs of scientific research, fueled by major advances in genomics, advanced material, and information technology among others. Another clue is the relatively constant or even declining students/faculty ratio in the United States versus an increasing ratio in Canada in the 1990s. In Canada, the FTE-students to FTE-faculty ratio went from 16.6 in 1991 to 19.4 in 1999, while over the same period, the American ratio went from 17.6 to 15.8.[24]

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[23]The difference in total and public enrollment rates in the United States reflects the fact that about one third of university and 4-year college students are enrolled at private institutions.

[24]The Canadian numbers are from Canadian Association of University Teachers (2003), they may not be fully comparable to the U.S numbers since the CAUT considers that 3.5 part-time students is equivalent to 1 full-time student. The U.S. numbers are from table 223 of National Center for Education Statistics (2003) and include all public institutions.

Panel B of figure 2 plots the growth indexes of the two main revenue sources of public institutions of higher education: tuition fees and provincial/state funding. In the 1970s in both countries, tuition increases did not match the inflation rates of the period, so the growth in real average tuition exhibits a negative trend. In Canada that negative trend is particularly severe: real average tuition declined by more than 60 percent from 1973 to 1982. In the United States, that negative trend in real tuition levels halted with the recession of the early 1980s. By contrast, during the 1970s, provincial/state funding generally kept up with inflation.

After the recession of the early 1980s, they were startling changes in these trends. In the United States, the downward trend in real average tuition was reversed and replaced by steady increases in real tuition of averaging 5.6 percent a year. In Canada, the downward trend also stopped but the following increases in real tuition averaged less than 1 percent a year. In the 1980s, there were quite impressive annual increases in per-college-age person provincial/state funding of 3.2 and 4.2 percent in Canada and the United States, respectively, about 1 percent of which came from the decrease in college-age population.[25] In terms of increases in the revenues of higher education institutions, the 1980s was certainly the most favorable decade in the period under study.

The 1990s signaled yet another turn of events in higher education policies. As pointed out by Humphreys (2000), U.S. state appropriations are cyclical, and they began another downturn with the recession of the early 1990s. Given that tuition revenues and state appropriations are the two most important sources of revenues of American higher education institutions, whenever the growth of public educational expenditures is non-negative, a decline in either revenue sources has eventually to be compensated by an increase in the other. In many U.S states, there is thus a negative relationship between tuition levels and state appropriations, as pointed out by many authors (Berger and Kostal (2002), Lowry (2001a), Koshal and Koshal (2000), Fortin (2004)). Thus not surprisingly, the pace of increases in real tuition fees in the United States also picked up, increasing at a rate of 8 percent a year.

[25]For the period 1983 to 1992, the annual rate of increase of provincial funding is similar to that of the U.S. for the 1980s.

In Canada, the link between these two revenue sources is not as strong perhaps because provinces have the ability to run budget deficits and because tuition revenues made up a relatively smaller share of educational revenues until 1995 when they became more important than federal appropriations.[26] Nevertheless after years of near stagnation, real tuition began to rise in the 1990s in Canada at the accelerated pace of 11 percent per year, almost getting close to U.S. levels in 2000. Thus to the extent that the hypothesized negative role of tuition on enrollment demand and positive role of government funding on enrollment supply are supported empirically, which I will verify in the next section, the 1990s would appear to be the decade least favorable to increases in enrollment rates in both countries, but in Canada in particular.

The broad aggregate cross-country trends in demographics and higher education variables depicted in figures 1 and 2 mask important jurisdictional differences which will prove sufficient to allow the identification of the effects sought. I now turn to a brief description of some of these jurisdictional differences in college-age population and enrollment rates depicted in figures 3a, b and c and in higher education policies displayed in figures 4a, b and c.

Figure 3a shows the growth indexes (1980=100) of college-age population and FTE enrollment rates for each of the ten Canadian provinces. As could be inferred from figure 1, there are many provinces (about 7) which experienced spectacular growth in university enrollment rates in the 1980s in particular. But there are also some provinces (Ontario, Manitoba and British Columbia) where the baby bust of the 1990s was less pronounced and where increases in enrollment rates were less spectacular, actually closer to American enrollment rates.

Figure 3b and 3c displays the growth indexes (1980=100) of college-age population and FTE enrollment rates at public universities and 4-year colleges for the 50 U.S. states.[27] Again there is a lot of diversity across the U.S. states in patterns of college-age population growth. In the 1990s, college-age population actually increased in Arizona, Nevada and

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[26]See appendix table A1.

[27]Note for graphical illustration, the growth indexes are caped at 275. This explains the flat line in the 1990s for enrollment rates in Alaska.

Utah, was stable in many other states (such as Alabama, Arkansas, California, Florida, Georgia, Texas) but declined in most other states. The figures also show different growth patterns in public enrollment rates across the states. While most states experienced growth in public enrollment rates in the 1990s, there are some states where there was very little growth such as Arizona, California, Hawaii, and Washington.

Figures 3 highlight the potential impact of cohort size on enrollment rates. Clearly in jurisdictions where the baby bust was compensated by the in-migration of college-age persons, the growth in enrollment rates was stunned. In a state like Wyoming where there are no private institutions, the growth of enrollment rates seems to mirror the growth of the college-age population signaling substantial "cohort crowding", where increases (decreases) in the college-age population entail decreases (increases) in the enrollment rate. The country-specific magnitude of this effect will actually be evaluated below.

Figure 4a, b and c display the growth paths of average tuition and provincial/state appropriations per-college-age person by jurisdictions.[28] Figure 4a displays these growth rates for the Canadian provinces. The general pattern of average real tuition growth for Canada (figure 2) was U-shaped with average tuition beginning to show significant increases only in the 1990s, while the U.S. pattern was more V-shaped with significant increases beginning in the 1980s. The "by province" graph shows that two provinces depart from the general Canadian pattern: Quebec where real average tuition continued to decline until 1990 and British Columbia which saw some sizeable increases in the mid-1980s.

There are also important inter-provincial differences in the timing and growth of provincial funding per-college-age person. Some provinces (PEI, Quebec, Saskatchewan, Alberta, and BC) show spurts of growth in provincial funding in the mid 1980s and/or in the early 1990s, while others do not. Despite the 1996 reductions in federal block grants through the combination of health care and education transfers into the Canada Health and Social Transfer (CHST), there were substantial differences in the decline in provincial appropriations in the late 1990s, with some provinces (NFLD, NB, Manitoba, BC) showing less

[28]Note that for the purpose of graphical exposition the tuition growth indexes are caped at 275.

cut-backs than others.[29]

Similarly for the United States, the aggregate pattern of growth of real average tuition and state appropriations per-college-age person mask important differences across states shown in figure 4b and 4c. In most states, the 1970s were a period of declining real tuition which arrested in the early 1980s. The tuition readjustments varied considerably by states. Some states (such as California, Hawaii and West Virginia) imposed sharp tuition increases right away to bring tuition up to the real mid-1970s levels. Some states imposed gradual and moderate increases, while others saw steeply increasing tuition levels. New York, North Carolina, Nevada and Wyoming are states which exhibit patterns of tuition increases similar to the Canadian pattern where increases in tuition are delayed until the 1990s.

The patterns of growth in state appropriations per-college-age person also show substantial differentiation across states. There are some states where state appropriations per-college-age person show a roughly steady growth (Arizona, Delaware, New Mexico, and Utah) or stagnation (West Virginia, Wisconsin). But for most states, there are many spurts of growth in state appropriations per-college-age person as well as discontinuous declines. There are thus sufficient variations across jurisdictions to allow for the identification of the effects of tuition levels and provincial/state funding on enrollment rates.

4.   The Impact of Demographics and Higher Education Policies on Enrollment Rates

I now turn to the formal analysis of the impact of demographics and higher education policies on enrollment rates. The estimated coefficients from equation 1, along with the robust standard errors (in parentheses), are reported in table 1, panel A for Canada and panel B the United States. The logarithm of the jurisdiction specific ratio of FTE 4-year enrollment divided by college-age population is the dependent variable and the regressions are estimated by weighted least squares, where the weights are the provincial/state total

[29]Prior to 1996, the federal government provided funding for education in terms of cash transfers and tax points to the provinces through its Established Programs Financing transfer (EPF).

population estimates. Year and jurisdiction dummies are included in all regressions to control for time and jurisdiction specific effects. In columns (5) and (6), jurisdictional linear trends and quadratic trends are also included, these may capture jurisdiction-specific labour market trends, for example. The results are generally found to be robust to the introduction of these trends.

Column (1) shows the dramatic negative impact of log college-age population on log enrollment rates. In Canada, the estimated effect of -1.04 (0.10) indicates perfect crowding: a 1 percent increase (decrease) in the college-age population entails a 1 percent decrease (increase) in the enrollment rate. While 11 out of the 93 universities associated with the AUCC were founded after 1973, these were generally smaller institutions. Thus virtually all increases in college seats had to come at the intensive margin, that is at the expense of quality, as the increase in faculty-student ratio reported previously indicates.[30] In the United States, increases in the number of public 4-year degree-granting institutions were comparable going from 537 to 613 institutions from 1975 to 1999.[31] But the capacity of the higher education system was substantially aided by the presence of 1,730 private 4-year institutions in 1999.[32] It is thus not surprising that for the United States, the estimated effect of log college-age population is substantially lower at -0.52 (0.04). This estimate is very close to results of about -0.41 (0.04) found in Bound and Turner (2002), who present results using the logarithm of total FTE enrollment as dependent variable for the 1967-1997 period.

In column (2), the logarithm of real average tuition is added to the explanatory variables. This yields an elasticity of -0.15 (0.3-0.2) of enrollment rates with respect to tuition, that amazingly identical in both countries. The impact of tuition on college enrollment rates is most often reported in terms of the impact of a $1000 change in direct costs on student demand. Leslie and Brinkman (1987) perform a meta-analysis of twenty-five U.S.

[30]In facts, most Canadian universities (58) were founded before 1960. There is no formal university accreditation system in Canada. But membership in the AUCC coupled with provincial government charters is generally deemed equivalent. Note that there are 129 universities listed on www.schoolfinder.com.

[31]See table 245 of National Center for Education Statistics (2001).

[32]As noted earlier, about one third of students attending 4-year institutions are enrolled in private institutions.

student demand studies who seek to evaluate the impact of student responses to tuition using 1960s and 1970s data. The meta-analysis attempts to harmonize the results of studies using national, state, individual, district and institutional samples that are based on experiments, hypothetical situations, cross-sectional and time-series designs, etc. The results of most studies are found to lie in the very close range of -0.03 to -0.05 percentage point decline in the participation rates among 18-24 year olds to a $1000 tuition increase.[33] Kane (2003) brings this meta-analysis up-to-date by including the results of more recent studies which use state-time differences in public tuition levels or evaluate the impact of changes in financial aid. As with the previous studies, the latter ones assume that the supply of college seats is perfectly elastic and find similar estimates of -0.04 (0.01). Given an average tuition of $4,000 in 2001, a $1000 increase corresponds to a 25% increase. With an elasticity of -0.15, this increase would lead to -0.0375 (-0.15*0.25) decline in enrollment rates consistent with the more recent U.S. findings. It is thus interesting that despite substantial differences in the financing of higher education institutions in Canada and in the United States, the negative impact of tuition on enrollment rates in Canada is similar to that of the United States.

The estimates of the tuition effects are very robust to the introduction of supply effects (government funding), jurisdiction-specific linear and quadratic trends in the United States, less so in Canada, but the number of observations there is five times smaller. In Canada, the estimates of column (5) that control for supply effects and provincial linear trends are the more precisely estimated. Both Kane (1994) and Card and Lemieux (2001) had difficulty of finding significant negative tuition effects in the presence of state fixed effects using Current Population Survey data. As pointed by Kane (2003), one problem there, as with Canadian labour force survey data, is that many students are assigned to the state or province of residence of their parents rather than to their jurisdiction of college attendance.

In column (3), the logarithm of real state appropriations per-college-age person replaces tuition and yields an estimated elasticity of enrollment supply with respect to provin-

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[33]The results are reported as a 0.5 to 0.8 percentage point decline in the participation among 18-14 year olds to a $100 tuition increase in 1982-83$ when tuition averaged $3,420. The conversion above uses a 177.1 value for the CPI in 2001.

cial/state funding ranging from 0.114 (0.022) to 0.334 (0.039) for the United States and Canada, respectively. Given that the share of provincial funding out of the educational expenditures of higher education institutions is somewhat larger that the share of U.S. state appropriations, this result is not surprising. These results indicate that in Canada the positive impact of provincial appropriations is more important than the negative impact of tuition over the entire period.

This inference is further confirmed in column (4) which includes both log average tuition and log provincial/state appropriations per-college-age person as regressors. Whereas introducing the main determinant of enrollment demand—tuition—substantially weakens the positive impact of state appropriations per-college-age person on enrollment rates in the United States, this reducing effect is much smaller in Canada. This is consistent with a larger impact of provincial funding in Canada. Using the more precise Canadian estimates (column (5)), the elasticity of enrollment rates with respect to tuition fees of about -0.13 to -0.14 is found to be similar in both countries. For the United States, it is remarkably robust to the introduction of state linear and quadratic trends.

As pointed out in the descriptive analysis of the previous section, the three decades of the 1970s, 1980s and 1990s can be characterized as different regimes in terms of trends in higher education policies. Columns (7), (8) and (9) report estimates for the three decades separately. For Canada, the 1970s were characterized by steep declines in tuition and slow increases in provincial funding; the 1980s were characterized by relatively stable tuition levels and moderately rising provincial funding; the 1990s saw tuition escalate very steeply while provincial funding barely increased. The analysis shows that both tuition and provincial appropriations had significant impacts on enrollment rates in the 1970s and in the 1980s. In the 1990s, college-age population stabilized and there were severe provincial funding cut-backs, then only provincial funding is significant consistent with the enrollment supply side of the market becoming binding. The wrong sign of tuition is investigated below in the context of rising institutional student support and direct federal funding.

In the United States, real tuition also declined in the 1970s but not as steeply as in Canada, state appropriations showed slow increases. The 1980s were characterized by

rising tuition and substantial growth in state appropriations; in the 1990s, tuition escalated even more rapidly while increases in state funding slowed. The results from columns (7), (8) and (9) for the United States show that in the 1970s only state appropriations have a significant impact on enrollment, in the 1980s only tuition has a significant impact and in the 1990s both appropriations and tuition have significant effects.

The non-significance of either tuition or jurisdictional funding can be attributed either to insufficient inter-jurisdiction variations to allow identification or to enrollments being determined by the short side of the market. Since there is actually more variation in state appropriations in the 1980s than in the 1970s, the first hypothesis can be ruled out. Rather the results are consistent with enrollment supply being the short side of the market in the 1970s when college-age population was increasing and enrollment demand becoming the short side of the market in the 1980s when college-age population was decreasing. In the 1990s, there was a more substantial echo of the baby boom generation becoming of college-age in the Unites States than in Canada, thus the more significant role of cohort size is not surprising. Some "wrong" signs on tuition levels (column 7, panel B, column 9, panel A) and on state appropriations (column 8, panel B) could signal some endogeneity problems, but these effects are never significant.

A response of governments and institutions to the skyrocketing tuitions of the 1990 has been a substantial increase in student aid. One way for institutions to increase tuition while mitigating its adverse impact on lower income students is to give back some portion (as much as one third) of the increase in tuition revenues to students in the form of scholarships. As indicated earlier, these outlays as a share of the expenditures of higher education institutions have indeed been increasing over time in Canada and the United States.[34] One obvious problem with this strategy is that it also mitigates the impact of rising tuition on the ability of institutions to supply more college seats.

Table 2 assesses the impact of institutional outlays going to student support and of direct federal funding on enrollment rates in Canada.[35] Column (1) shows that for the

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[34]See appendix table A.1

[35]A more complete analysis of the impact of student aid would include the impact of loans and grants from the Canada Student Loans and Canada Study Grants programs, as well as from the various provincial programs, the Newfoundland Labrador Provincial Student Loan Program,

entire period, student support has a positive and significant impact on enrollment rates equal to more than half the negative effect of tuition. However, comparing the estimates of column (1), table 2 to those of column (4), panel A, table 1 shows that adding student support reduces the positive effect of provincial funding on enrollment rates but leaves the negative effect of tuition basically unchanged. Column (2) adds the logarithm of direct federal funding as another explanatory variables.[36] The effect of direct federal funding is positive and significant, and of about the same order of magnitude as the effect of tuition. Interestingly it does not seem to crowd out the total effect of provincial funding and institutional student support.

Column (3), (4) and (5) investigate differential impacts across the three decades under study. The inference for the 1970s and 1980s is similar to that of table 1. For the 1990s, the effect of student support and federal funding turns negative, although it is not significant. This signals an endogeneity problem coming from the link between rising tuition and rising student support that can be corrected with an instrumental strategy reported in column (6). The effect of tuition then becomes negative and is of the same order of magnitude as in column (1)-(2). It remains insignificant confirming that enrollment supply is the short side of the market over the 1990s. However, it shows some possible crowding out of institutional student support and federal funding, these sources of funding seem to merely compensate the increases in tuition rather than help generate new college seats.

Overall, the analysis shows that the impact of higher education policies on enrollment rates has to be understood in the context of underlying demographics. Similarly, the impact of rising tuition has to be understood in the context of the overall funding of higher education institutions and their ability to increase the number of college seats while maintaining the quality of instruction. The impact of financial aid on enrollment rates need

the Prince Edward Island Student Loan Program, the Nova Scotia Student Assistance Program, the New Brunswick Financial Loans, the Quebec Student Assistance Program (Aide financière aux études), the Ontario Student Assistance Program (OSAP), the Manitoba Student Financial Assistance Program (MSFAP), the Saskatchewan Student Loans Program, the Alberta Student Loan Program, and the British Columbia Student Assistance Program (BCSAP). Some of the provincial programs do include grants. Yet, the analysis of the impact of loans requires the use of an intertemporal framework and is beyond the scope of the present study.

[36]See appendix table A.1

to be assessed bearing in mind the possibility that it could be offset by other government cut-backs.

5. Conclusion

This paper studies the impact of jurisdiction-specific higher education policies on enrollment rates in Canada and in the United States over the last three decades of the twentieth century. Looking back at the mistakes of the past may enable us to formulate more adequate policies for the future. In that context, the present study reveals that the declining real tuitions of the 1970s were probably unfortunate for institutions of higher education. In the 1970s, the college-age population was increasing so that increases in the number of college seats were necessary to augment enrollment rates. Instead, declining real tuition seriously impaired the ability of higher education systems in both countries to expand and enrollment rates were largely stagnant.[37] Issues associated with money illusion (Shafir, Diamond and Tversky (1997)) may explain why policy makers and their constituents fail to realize that, in the presence of double digit inflation, stable nominal tuition levels meant steeply declining real tuition. Allan W. Ostar, the executive director of the American Association of State Colleges and Universities in the 1970s is cited (Russell (1998)) as saying: "Low tuition higher education [...] is the envy and wonder of the world [...] It has contributed enormously to our progress and well-being as a nation."

In the 1980s, college-age population was declining and higher education expenditures began to rise sharply.[38] The response of many U.S. states was a substantial rise in tuition levels, which had been eroded by the high inflation of the late 1970s. By contrast, most Canadian provinces refrained from imposing tuition hikes until the 1990s, despite some calls to the contrary (Gerson (1985)). As a consequence, the Canadian enrollment rate rose

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[37]Quebec is one jurisdiction which expanded its higher education system by the introducing the Université du Québec system in 1969-70 despite declining real tuition. There the enrollment rates increased over the 1970s.

[38]Cited factors (Russell (1998)) responsible for the increase were the doubling of the purchase regularly utilized by campuses, including energy costs. In the United States, the negative trend in the growth of real average salary of faculty (Froomkin (1990)) has been credited for the relative flat growth in public educational expenditures until 1984.

sharply and early in the 1980s, while increases in American public enrollment rates were delayed and more modest. Given the downward trend in demographics, it can be argued that tuition increases were detrimental to increases in enrollment rates. Yet Canada may have done too much of a good thing.

At the beginning of the 1990s, the comparatively low Canadian tuition levels were no longer sustainable. As provincial appropriations began to plummet, very sharp increases in tuition followed. Since the 1990s witnessed the bottom of the baby bust becoming of college-age, the increases in tuition, that were partly compensated by increases in institutional financial aid, did not have as detrimental an impact on enrollment rates as did government cut-backs. The results above show that in the 1990s enrollment (institutional) supply was constraining enrollment rates in Canada. Only 3 universities were founded in the 1990s and the student-faculty ratio increased substantially in most provinces.[39] By contrast in the United States, state appropriations began to pick up in the mid-1990s. Over the 1990s, 216 four-year higher education degree-granting institutions were added (admittedly only 14 public) and student-faculty ratio declined.[40]

Table 3 shows the impact on university enrollments of some alternative higher education policies for Canada as a whole, and for its three largest provinces: Québec, Ontario and British Columbia. In the first panel, the table reports descriptive statistics on the number of FTE university enrollees, the size of the college-age population, the resulting university enrollment rates, the average provincial tuition for Arts program and the provincial funding per college-age person. The provincial funding per college-age person is presented as the appropriate per-capita measure of the potential impact of funding, that is the correct way to control for the different sizes of the provinces.[41] Average annual growth rates are indicated in parentheses below the numbers. For example, for Canada as a whole, the number of university enrollees increased by 3.7 percent a year from 1980 to 1990, and by

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[39] These institutions (University of Northern British Columbia, Royal Roads University and Nipissing College) were of small size. Student-faculty ratio was more stable in NLD, PEI, NS and MA (Canadian Association of University Teachers (2003)).

[40] See table 245, National Center for Education Statistics (2001).

[41] Provincial funding per-capita would be the correct measure for an analysis of the willingness to pay, while the per-college-age person measure is more appropriate to the ability to consume.

just 0.5 percent from 1990 to 1999.

In the second panel of table 3, simulated university enrollments are computed under alternative policies using the estimated elasticities of column (5) table 1, which are the most precisely estimated. There an increase of 1 percent in tuition yields a 0.14 percent decrease in enrollment rates and a decrease of 1 percent in provincial funding yields a 0.25 percent decrease in enrollment rates. The fact that the negative impact of decreasing provincial funding is almost twice as large as the negative impact of rising tuition has to be understood in the context of the excess demand for university seats.[42] Policy A cuts by half the yearly Canadian average increase in tuition over the 1990s, policy B reduces it to a fourth. Policy C doubles the yearly Canadian average increase in provincial funding over the 1990s, policy D increases it fourfold. Policy E is essentially the British Columbian policy: it includes yearly increases of 2 percent in both tuition and provincial funding. The simulation shows that, for Canada as a whole, this latter policy would have resulted in 75,000 more university students in 1999 and raised the university enrollment rate from 23 to 26 percent.

At the dawn of the 21st century, there is much worry about the future of higher education in both countries (Ehrenberg (2004), Laidler (2002)). Population projections of the Canadian college-age population show increases up to around 2012 (Statistics Canada (2003)). The modest but sustained growth, coupled with a higher propensity to attend university as a result of parents' higher educational attainment, signals a continued excess demand for college seats. Thus, enrollment demand should not be expected to become the constraining side of the market until 2025. Tuition increases are thus unlikely to be the factor adversely affecting the supply of skills, although they could undermine equality of opportunities objectives. Note that these objectives are also undermined when a restricted supply of university/college seats implies that institutions increasingly ration seats using grades, themselves linked to socio-economic status.

Arguments that support continued tuition increases point out to the persistently favourable labour market outcomes of university/college graduates. In the United States, increases

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[42]The estimates of column (6) table 2 indicate a 2:1 ratio for the 1990s per se, but are less precisely estimated.

in the college/high school wage premium had slowed down in the 1990s. In Fortin (2004), I links this deceleration to the increase in enrollment rates associated with the relatively favourable higher education policies of the 1980s.[43] These increases in enrollment rates translated into increases in the relative supply of college graduates in the 1990s, which exerted downward pressure on the premium. A similar inference likely holds for Canada where the near stagnant university/high school premium of the 1990s (Burbidge, Magee and Robb (2002)) was replaced by a climbing premium in the 2000s (Boudarbat, Lemieux and Riddell (2003)). As pointed out by Freeman and Needels (1993), the steeply increasing enrollments of the 1980s, which here are traced back to the relatively flat increases in tuition over that period, suppressed the growth of the university premium in the 1990s. By contrast, the skyrocketing tuition fees and severe government cut-backs implied stagnant enrollment rates over the 1990s. Thus the relatively stable university premium of the 1990s gave way to a rising premium in the 2000s.

Even if Canadian tuition fees reach American levels, the ability of Canadian universities/colleges to supply college seats will become the key issue and issues of direct funding will rise to the top of the agenda. Yet it is difficult to see how the fiscal position of the provinces (and of the states, for that matter) could allow them to restore funding (as say a share of total educational expenditures) to the level of the 1980s. Federal incursions in higher education have continued to favour research infrastructure grants (Canadian Foundation for Innovation) and student financial aid (Millennium Scholarships), but also included funds towards the indirect costs of research and the hiring of faculty (Canada Research Chairs). Much future research is needed to assess the impact of these recent funding initiatives on enrollment rates in a supply and demand framework.[44] The fungibility of diverse sources of funding and the extent to which the impact of financial aid is mitigated when that aid crowds out other forms of funding are not well understood.

However it is difficult to see how these sources of funding could lead to an expansion in the number of institutions, which requires basic infrastructure funding. Private sources

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[43] I study the college/high school wage premium among young workers that are ten years away from entering college.

[44] Most of the research on the recent innovations focuses on enrollment demand rather than on enrollment supply (e.g. Junor and Usher (2002)).

of funding, while is a subject of concern, are another inescapable avenue to consider. Another controversial idea calls for increases in the hierarchical differentiation of Canadian institutions as a way to preserve quality at least in some parts of the higher education system. In the United States where hierarchical differentiation is a desired outcome, a sizeable share of college seats is supplied by private institutions so that overall institutional supply is less constrained. Rather skyrocketing tuition levels and financial aid are the subject of much research in higher education.

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Data Appendix

1.   Canadian Data

1.1.   Education Data

Most educational data series used in the paper are extracted from the CANSIM II database which compiles data from Statistics Canada's "Survey of Federal Government Expenditures in Support of Education" (Statistics Canada (2002)). The expenditures data are extracted from the CANSIM II, Table 4780008 – Total Expenditures on University Education by Type of Expenditures. The table provides data for Canada as a whole and separately by provinces and territories. To enhance comparability with U.S. data, educational expenditures of Canadian universities are computed as total expenditures minus capital expenditures. The Canadian educational expenditures thus comprise expenditures on instruction, libraries, administration, plant maintenance, student services, sponsored research, student support, departmental and others expenditures.

The sources of funding are extracted from Table 4780001 – Total Expenditures on Education, by Direct Source of Funds and Type of Education. For example for Canada as a whole, direct federal funds are from series V1996809, provincial funds are from series V1996815, student fees from series V1996833.

The full-time and part-time enrollment figures were made available by the Association of Universities and Colleges of Canada (AUCC). Full-Time Equivalent enrollment (FTE) is computed as the sum of full-time Fall enrollment plus one-third of part-time Fall enrollment for comparability with the U.S. data. In Canada, the ratio of 3.5 part-time students for 1 full-time student has also been used.

The source for the tuition data is Statistics Canada's "Tuition Fees and Living Accommodations at Canadian Universities Survey". From 1979 to 2002, detailed information on tuition fees are available from this source for a host of disciplines for each degree granting institution in Canada.

The Consumer Price Index used comes from CANSIM II Table 3260002, series V737344 (CPI, Canada, All-items). Note the related provincial price indexes are for time-series use and not appropriate for inter-provincial comparisons: they are all equal to 100 in 1992.

1.2.   Population Data

The population data is extracted from the CANSIM II Table 051-0001 – Estimates of population, by group and sex, Canada, provinces and territories, annual. Preliminary, updated and final postcensal estimates are based on the most recent census adjusted for net census under coverage and estimates of the components of demographic change since the last census. Intercensal estimates are based on postcensal estimates and data from the most recent census counts adjusted for net undercount preceding and following the year in question.

2. American Data

2.1. Education Data

The information on enrollment and expenditures is drawn from various reports, as indicated in the text, of the National Center for Education Statistics. A number of state level tabulations are performed by the NCES and are available through on-line publications at url:nces.ed.gov.

The enrollment data used is the full-time equivalent fall enrollment in 4-year institutions of higher education in a given state from tables 58 and 60 of National Center for Education Statistics (1998b), updated to 1999 with table 201 of National Center for Education Statistics (2003). The enrollment data is available separately for public and private institutions.

The U.S. expenditures data are restricted to educational and general expenditures. They comprise expenditures on administration and general expense, instruction and departmental research, organized research, plant operation and maintenance, organized activities related to instructional departments, extension and public service, scholarships and fellowships, and others. But they exclude expenditures by university hospitals, dormitories, food service operations, bookstores, and other independent operations. The expenditures information is extracted from tables 350 and 351 of National Center for Education Statistics (2003) with earlier data from table 88 of National Center for Education Statistics (1999b).

Detailed state appropriations data is available in a series of "Appropriations of State Tax Funds for Operating Expenses" reports by M.M. Chambers, sometimes called the "Chambers Reports" available from 1961 onwards. The reports are posted on the Grapevine web site: www.coe.ilstu.edu/grapevine/Welcome.htm. Details of the amounts included in the appropriations for each of the 50 states are available in those reports. However, I use the state summary tables that should be viewed as approximations of the amounts that are destined to 4-year public institutions of higher education.

Prior to 1986, tuition data is not available from the NCES. However, the Washington State Higher Education Coordination Board [Raudenbush (2002)] has compiled historically consistent data, from 1972-73 onwards, on tuition and fee rates at public institutions using surveys of state agencies or individual institutions. The data are available separately for resident and non-resident and for universities, colleges and state universities and community colleges. Where applicable, an average of the tuition at universities and at colleges and state universities is constructed for residents and non-residents separately. Then a weighted average of the tuition for residents and non-residents is constructed using the 1996 proportion of residents vs. non-residents tuition available from the table 7 of National Center for Education Statistics (1998a)].

2.2. Population Data

The national estimates of the United States resident population were downloaded from the web site of U.S. Census Bureau: www.census.gov/population/www/estimates. The estimates include persons resident in the 50 States. The criteria for residence defines a

resident of a specified area as a person "usually resident" in that area. College students living away from home while attending college are counted where they are living at college. College students living at their parental home while attending college are counted at their parental home. Details on the sources and methods for obtaining the postcensal estimates are available from the web site.

The population estimates by states were downloaded from the web site of U.S. Census Bureau: www.census.gov/population/www/estimates/statepop.html. The Population Estimates Program produces estimates of the total resident population, as well as estimates by age and sex for states for each year (as of July 1). The data used were compiled from the "Single Years of age by sex" for the 1990s and 1980s, and from the "Selected Age groups" for the 1970s.

Table 1
Impact of Higher Education Policies on University/4-year College Enrollment Rates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Time Period :				1973-1999			1973-1980	1981-1990	1991-1999
A: CANADA									
Dependent Variable:				Provincial Log Enrollment Rates					
Log College Age Population	-1.037 (0.105)	-0.929 (0.090)	-0.743 (0.064)	-0.767 (0.070)	-0.909 (0.070)	-0.783 (0.066)	-0.843 (0.077)	-1.034 (0.110)	-0.255 (0.104)
Log Average Provincial Tuition		-0.148 (0.029)		-0.087 (0.019)	-0.141 (0.018)	-0.067 (0.034)	-0.336 (0.051)	-0.057 (0.029)	0.043 (0.047)
Log Provincial Funding per College-Age Person			0.334 (0.039)	0.293 (0.035)	0.253 (0.028)	0.205 (0.034)	0.292 (0.054)	0.132 (0.059)	0.199 (0.056)
R-squared	0.96	0.97	0.97	0.98	0.99	0.99	0.99	0.98	0.98
No. Observations	270	270	270	270	270	270	80	100	90
B: UNITED STATES									
Dependent Variable:				State 4-yr Public Log Enrollment Rates					
Log College Age Population	-0.522 (0.037)	-0.541 (0.031)	-0.488 (0.038)	-0.517 (0.034)	-0.525 (0.035)	-0.526 (0.036)	-0.672 (0.096)	-0.752 (0.067)	-0.650 (0.052)
Log Average Public Tuition[b]		-0.152 (0.018)		-0.134 (0.019)	-0.132 (0.020)	-0.132 (0.022)	0.063 (0.037)	-0.127 (0.023)	-0.076 (0.021)
Log State Appropriation per College-Age Person			0.114 (0.022)	0.073 (0.022)	0.081 (0.024)	0.080 (0.024)	0.166 (0.029)	-0.004 (0.032)	0.137 (0.021)
R-squared	0.95	0.95	0.95	0.95	0.96	0.96	0.98	0.98	0.99
No. Observations	1350	1350	1350	1350	1350	1350	400	500	450
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prov/State Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prov/State Trends	No	No	No	No	Yes	Yes	No	No	No
Prov/State Quadratic Trends	No	No	No	No	No	Yes	No	No	No

Note: Robust standard errors are in parentheses. Models are estimated by weighted least squares, where the weights are the provincial/state population estimates.

Table 2
Impact of Institutional Student Support and Federal Funding
on University Enrollment Rates in Canada

	(1)	(2)	(3)	(4)	(5)	(6)
Time Period :	1973-1999		1973-1980	1981-1990	1991-1999	
Econometric Specification:	OLS	OLS	OLS	OLS	OLS	IV
Dependent Variable:	Provincial Log Enrollment Rates					
Log College Age	-0.706	-0.581	-0.746	-0.890	-0.427	-0.369
Population	(0.063)	(0.070)	(0.090)	(0.110)	(0.116)	(0.134)
Log Average	-0.094	-0.109	-0.316	-0.089	0.087	-0.108
Provincial Tuition	(0.018)	(0.017)	(0.055)	(0.027)	(0.049)	(0.078)
Log Provincial Funding	0.253	0.277	0.271	0.007	0.164	0.213
per College-Age Person	(0.041)	(0.039)	(0.053)	(0.072)	(0.052)	(0.062)
Log Direct Federal Funding		0.089	0.044	0.053	-0.085	
per College-Age Person		(0.029)	(0.027)	(0.030)	(0.041)	
Log Institutional Outlays	0.039	0.022	0.045	0.057	-0.031	
on Student Support	(0.019)	(0.019)	(0.027)	(0.024)	(0.027)	
per College-Age Person						
R-squared	0.98	0.98	0.99	0.99	0.98	0.98
No. Observations	270	270	80	100	90	90
First-Stage Estimates of the Instruments:						
Determinants of Log Average Tuition						
Log Direct Federal Funding						0.428
per College-Age Person						(0.140)
Log Institutional Outlays						0.166
on Student Support						(0.077)
per College-Age Person						
Overid Test (p-value)						0.941
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Provincial Dummies	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors are in parentheses. Models are estimated by weighted least squares, where the weights are the provincial population estimates.

Table 3

Simulated Impacts of Changes in Higher Education Policies on University Enrollment in Canada

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Canada		Quebec		Ontario		BC	
Academic Years Ending:	1990	1999	1990	1999	1990	1999	1990	1999
FTE University Enrollees (in 1000s)	635 (3.7)	674 (0.5)	165 (3.4)	168 (0.2)	252 (3.3)	262 (0.4)	49 (3.3)	62 (2.5)
College-Age Population (in 1000s)	2,928 (-1.4)	2,876 (-0.2)	708 (-2.4)	702 (-0.1)	1,122 (-0.4)	1,055 (-0.5)	326 (-1.1)	368 (1.2)
University Enrollment Rates	21.7 (6.0)	23.4 (0.7)	23.3 (7.7)	24.0 (0.2)	22.4 (3.9)	24.9 (1.0)	14.9 (4.9)	16.9 (1.2)
Average Provincial Tuition (in 1999 $CAN)	1,600 (0.7)	3,100 (8.4)	600 (-4.0)	1,700 (16.5)	1,900 (2.7)	3,600 (8.1)	2,000 (6.7)	2,500 (2.3)
Provincial Funding per College-Age Person (in 1999 $CAN)	2,592 (3.5)	2,719 (0.5)	3,108 (13.2)	2,834 (-0.8)	2,289 (2.0)	2,733 (1.7)	2,212 (3.4)	2,760 (2.2)

Simulated Enrollments under Alternative Higher Education Policies

Annual Average Real Change over the 1990s								
A: Tuition Increase at 4%/yr	710		195		276		61	
B: Tuition Increase at 2%/yr	727		199		282		62	
C: Provincial Funding Increase at 1%/yr	681		175		258		61	
D: Provincial Funding Increase at 2%/yr	696		179		264		62	
E: Tuition Increase at 2%/yr and Provincial Funding Increase at 2%/yr	751		209		283		62	

Note: Average yearly growth rates over the previous ten years are shown in parentheses. The simulated enrollment uses elasticities of enrollment rates with respect to tuition of -0.14 and with respect to provincial funding of 0.25, as estimated in column (5) of table 1.

Table A1
Educational Expenditures (in millions of current $CAN) of Canadian Universities
by Source of Funds and Purpose

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Academic Year ending	Total	Federal Funds	% of Total	Provincial Funds	% of Total	Student Fees	% of Total	Student Support	% of Total
1973	1,866	275	14.7	1,346	72.1	238	12.8	184	9.9
1974	2,184	305	14.0	1,583	72.5	253	11.6	198	9.0
1975	2,551	332	13.0	1,931	75.7	273	10.7	231	9.1
1976	2,832	360	12.7	2,148	75.9	291	10.3	233	8.2
1977	3,175	395	12.4	2,417	76.1	328	10.3	255	8.0
1978	3,402	416	12.2	2,612	76.8	340	10.0	271	8.0
1979	3,700	429	11.6	2,826	76.4	358	9.7	278	7.5
1980	4,145	491	11.8	3,111	75.1	401	9.7	315	7.6
1981	4,676	618	13.2	3,431	73.4	469	10.0	351	7.5
1982	5,312	735	13.8	3,885	73.1	561	10.6	394	7.4
1983	5,641	856	15.2	4,067	72.1	623	11.1	434	7.7
1984	6,149	944	15.4	4,296	69.9	678	11.0	527	8.6
1985	6,561	1,035	15.8	4,509	68.7	730	11.1	560	8.5
1986	6,818	1,039	15.2	4,856	71.2	767	11.2	605	8.9
1987	7,424	1,156	15.6	5,206	70.1	830	11.2	707	9.5
1988	8,093	1,367	16.9	5,649	69.8	911	11.3	806	10.0
1989	8,783	1,480	16.8	5,986	68.2	1,012	11.5	843	9.6
1990	9,695	1,685	17.4	6,407	66.1	1,179	12.2	957	9.9
1991	10,503	1,716	16.3	6,843	65.2	1,381	13.1	949	9.0
1992	10,900	1,764	16.2	6,943	63.7	1,563	14.3	1,221	11.2
1993	10,972	1,799	16.4	6,741	61.4	1,699	15.5	1,124	10.2
1994	11,059	1,875	17.0	6,674	60.3	1,825	16.5	1,099	9.9
1995	11,001	1,677	15.2	6,589	59.9	1,942	17.7	1,071	9.7
1996	10,891	1,500	13.8	6,297	57.8	2,127	19.5	1,067	9.8
1997	11,527	1,441	12.5	6,694	58.1	2,353	20.4	1,329	11.5
1998	12,092	1,639	13.6	6,931	57.3	2,562	21.2	1,263	10.4
1999	13,718	1,960	14.3	7,818	57.0	2,874	21.0	1,433	10.4

Note: Numbers are from Statistics Data's "Survey of Federal Government Expenditures in Support of Education" are extracted from the CANSIM II Table 4780001 – Total Expenditures on Education, by Direct Source of Funds and Type of Education and Table 4780008 Total Expenditures on University Education by Type of Expenditures. Column (1) is Total expenditures [series V1992346] minus capital expenditures [series V1992357]. Direct federal funds in column (2) are from series V1996809, provincial funds are from series V1996815, student fees from series V1996833 and expenditures on student support are from V1992358.
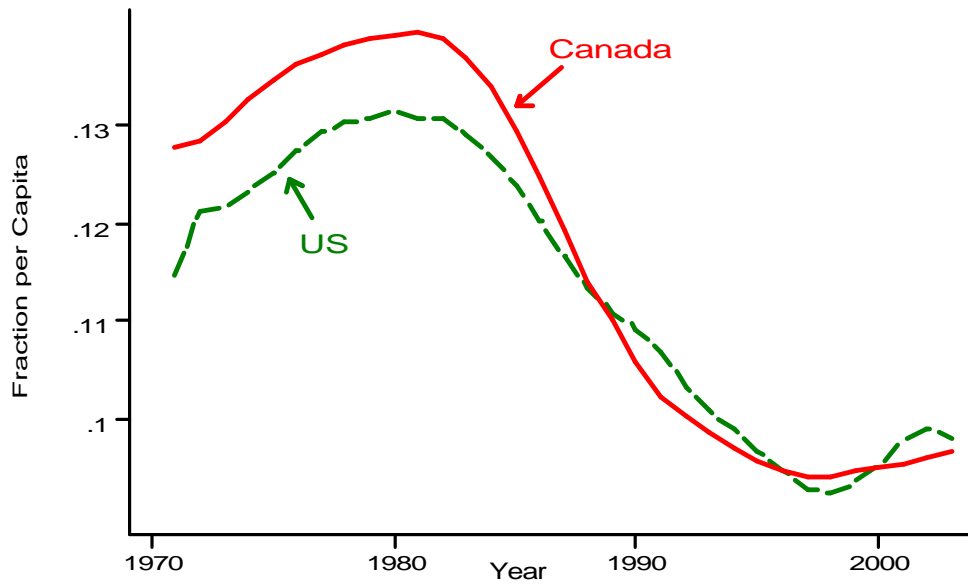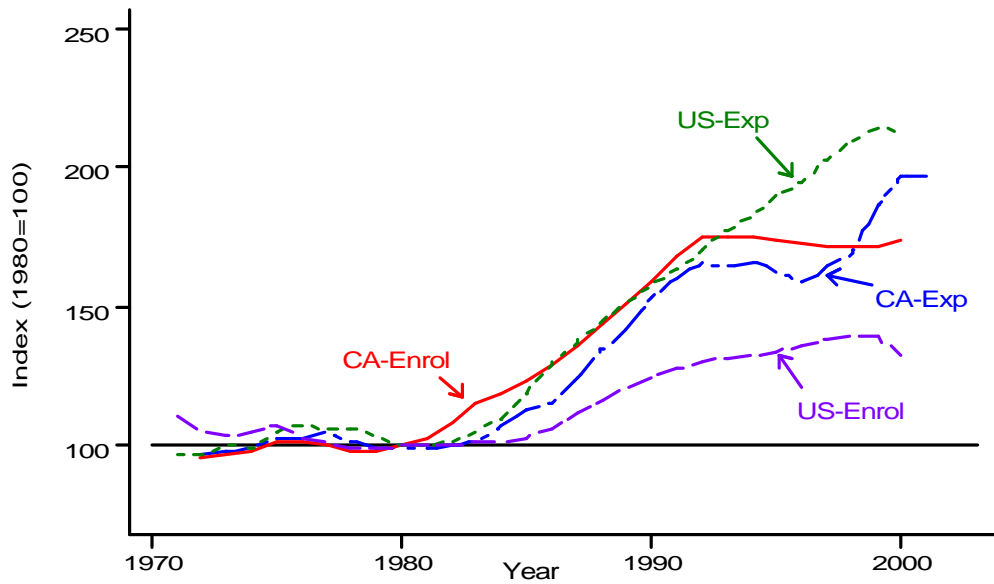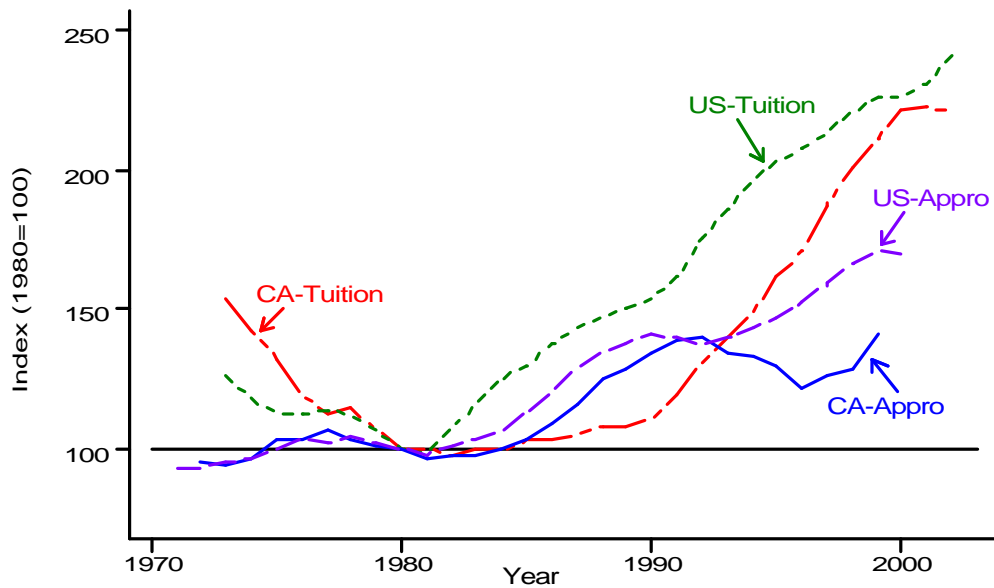
A. College Age Population
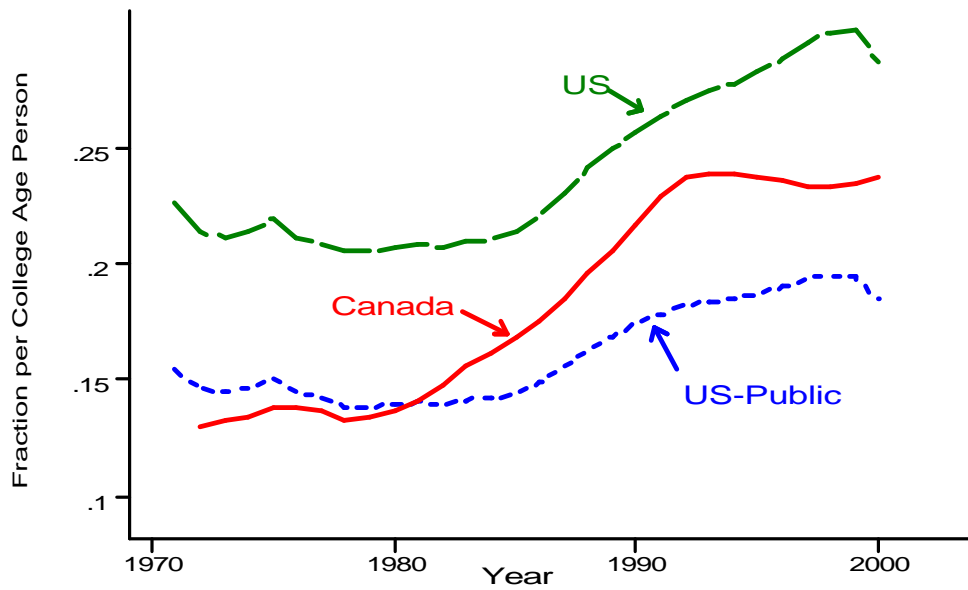
B. FTE 4-year Enrollment

Figure 1. Trends in College Population
and University Enrollment

A. FTE-4yr Enrollment and Expenditures

B. Average Tuition and Prov/State Appropriations

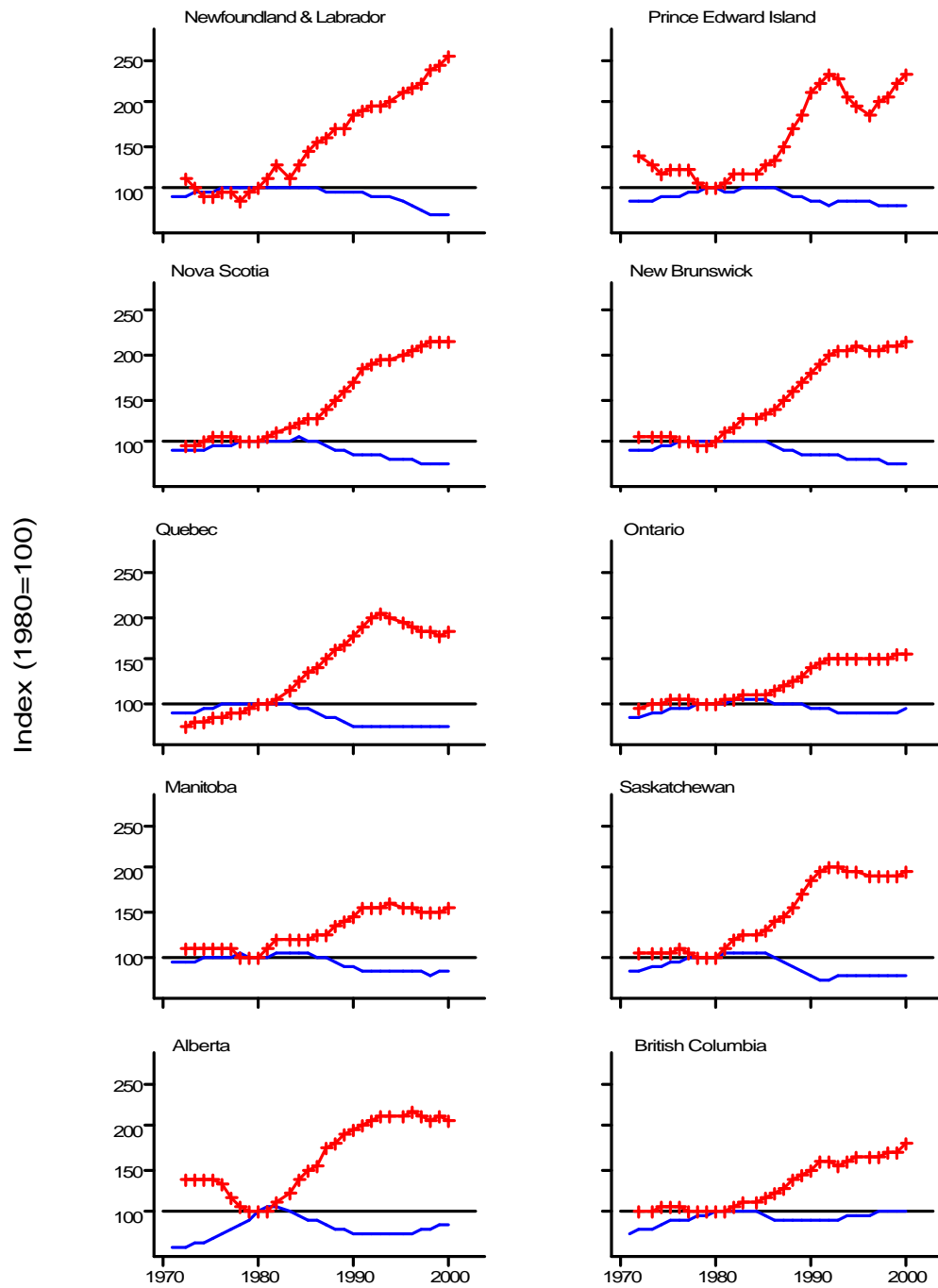**Figure 2. Per-college-age Person Growth Indexes**

Newfoundland & Labrador

Prince Edward Island

Nova Scotia

New Brunswick

Quebec

Ontario

Manitoba

Saskatchewan

Alberta

British Columbia

Index (1980=100)

Figure 3a. College-Age Population (solid line)

and Enrollment Rates (plus line)
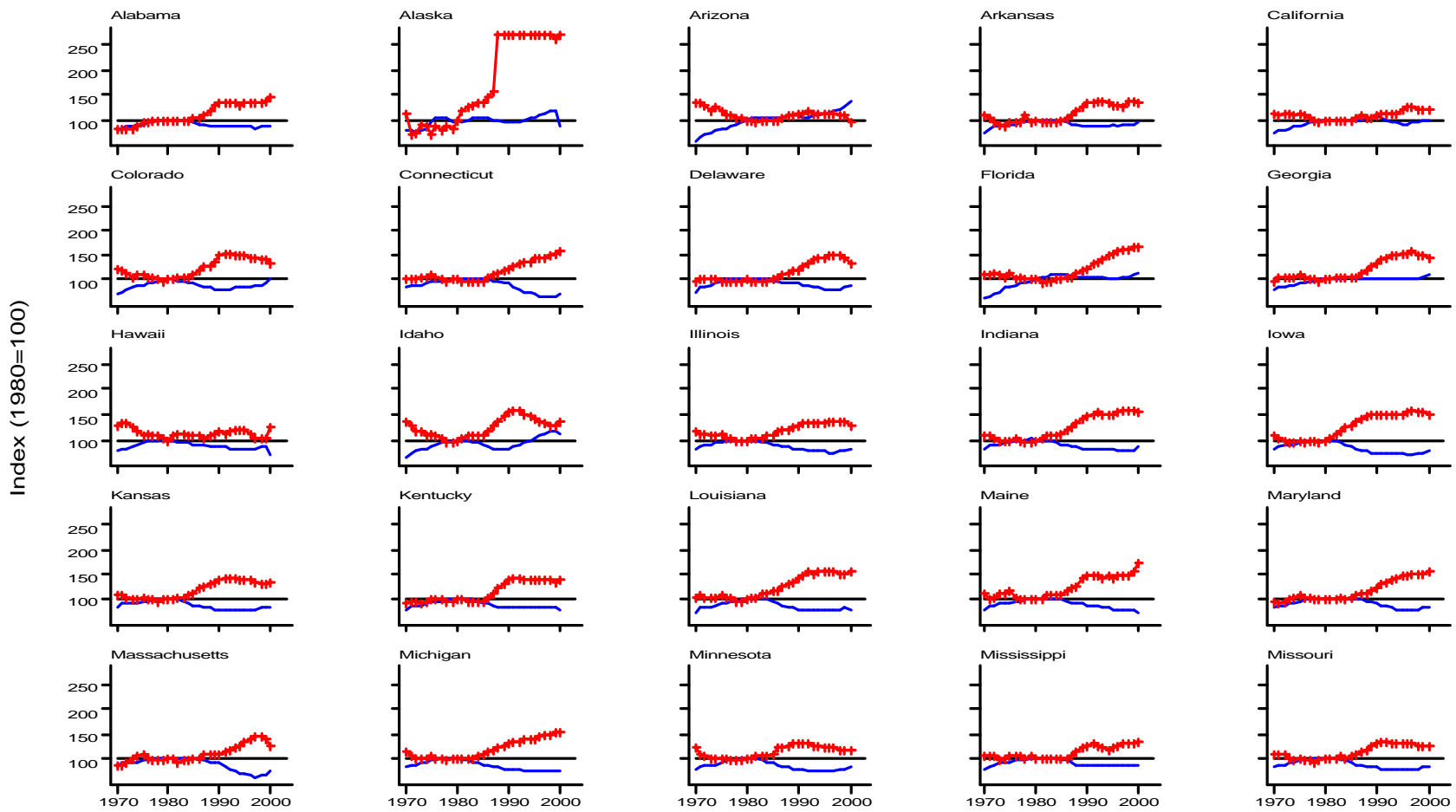
Figure 3b. College-Age Population (solid line) and
Public Enrollment Rates (plus line)
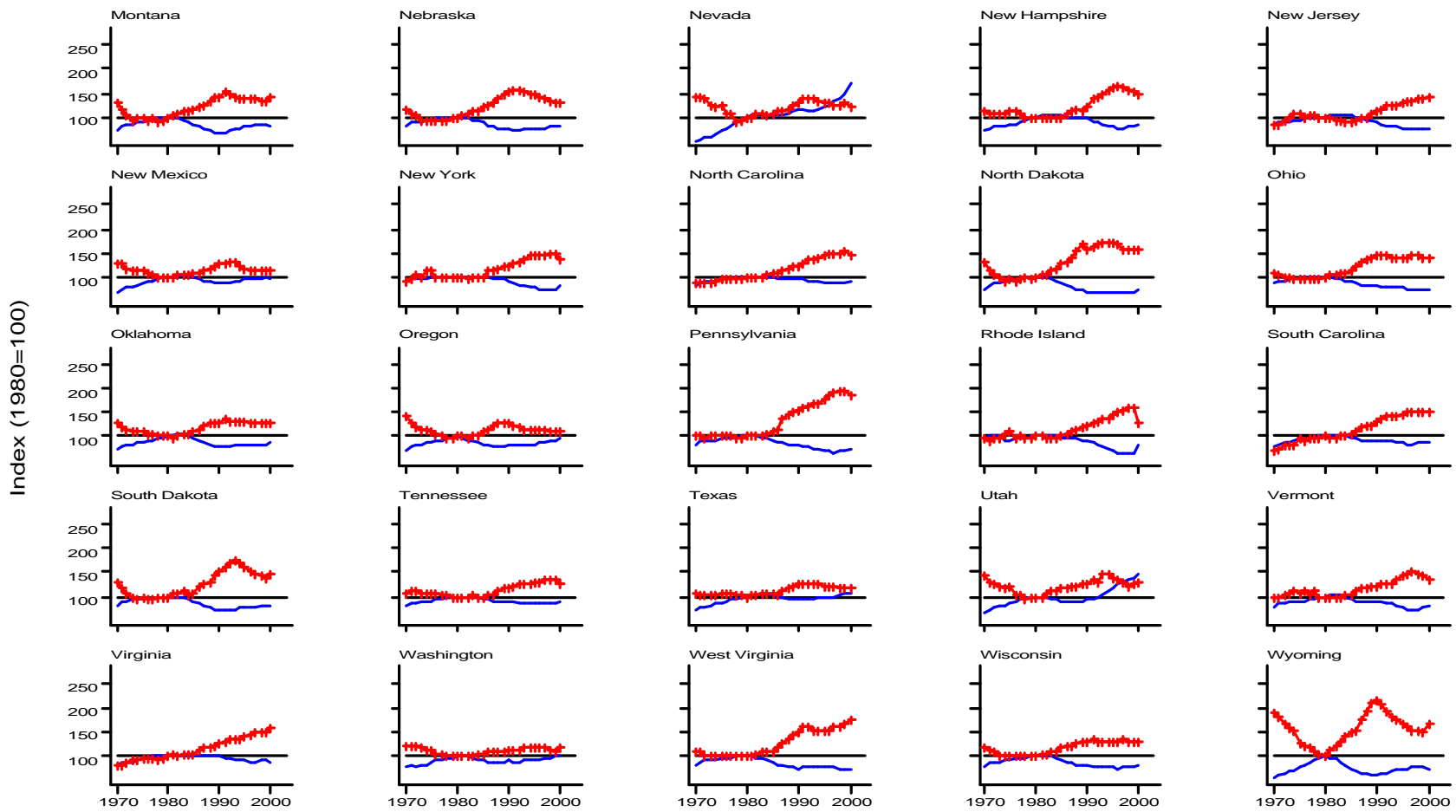
Figure 3c. College-Age Population (solid line) and
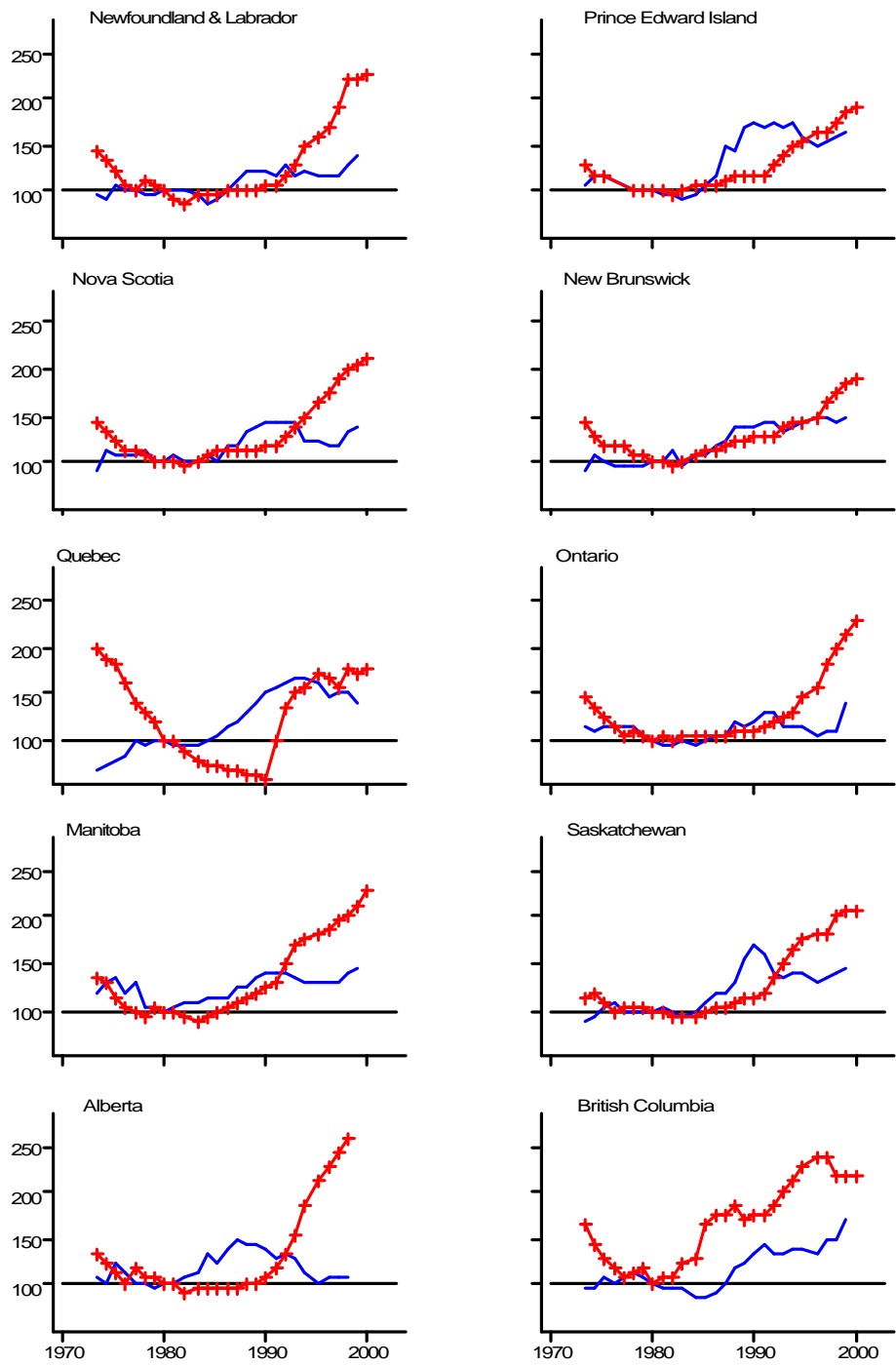Public Enrollment Rates (plus line)

Figure 4a. Provincial Funding per-college-age Person (solid line)
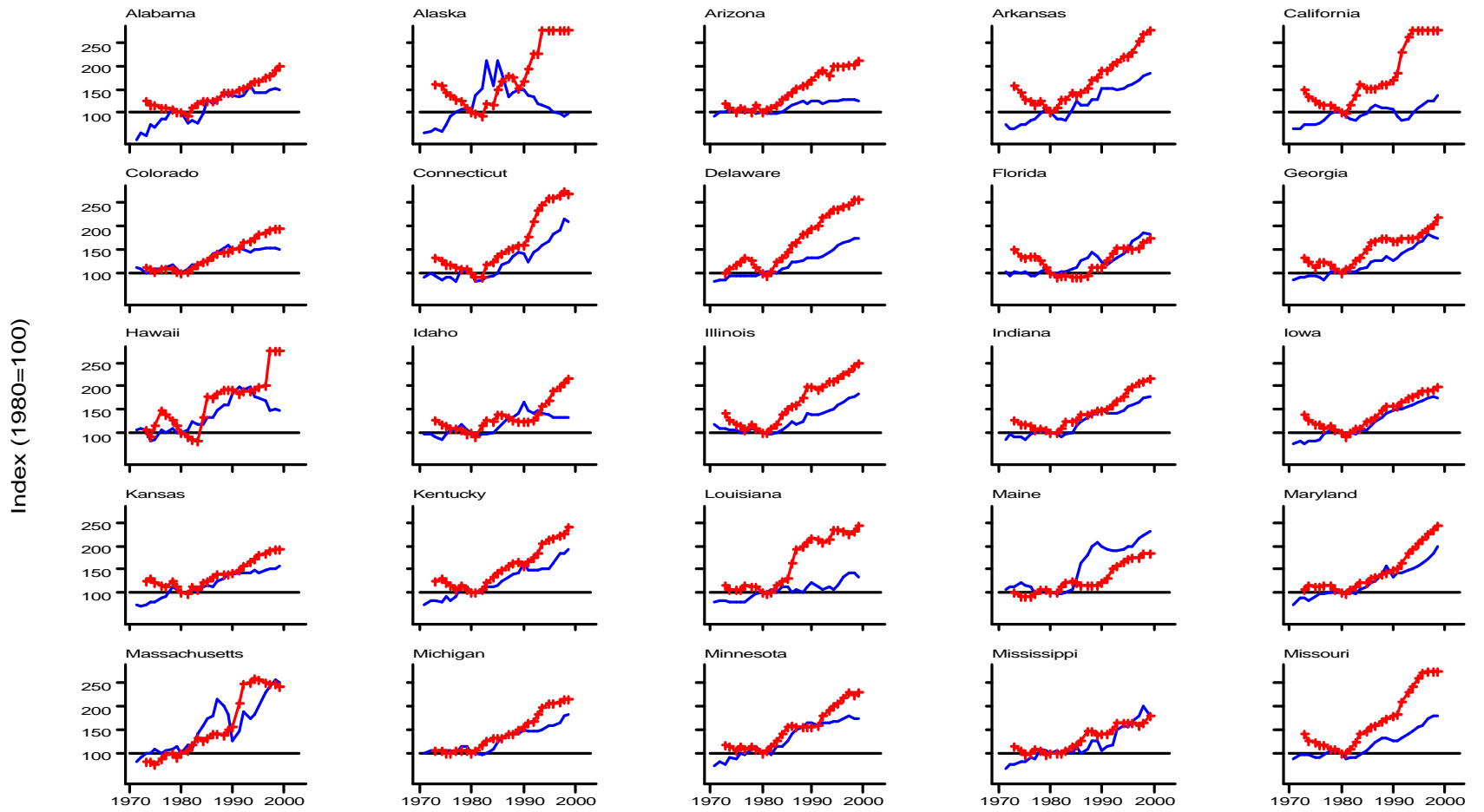
and Average Tuition (plus line)

Figure 4b. State Appropriations per-college-age Person (solid line)
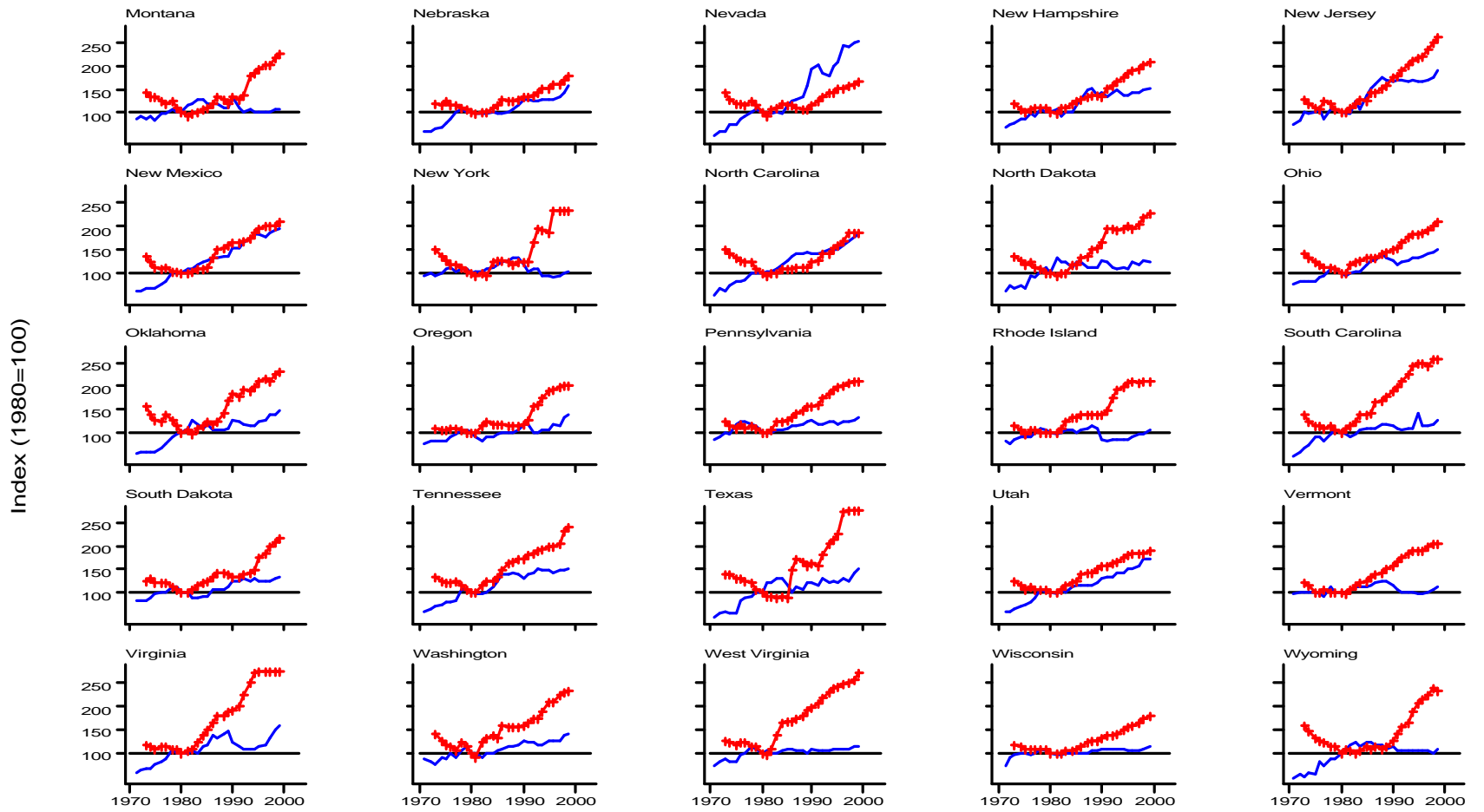and Average Tuition (plus line)

Figure 4c. State Appropriations per-college-age Person (solid line)
and Average Tuition (plus line)