DEPARTMENT OF ECONOMICS
UNIVERSITY OF CYPRUS

THE GENDER IMBALANCE IN PARTICIPATION IN CANADIAN UNIVERSITIES (1977-2005)

Louis N. Christofides, Michael Hoy and Ling Yang

Discussion Paper 2008-05

P.O. Box 20537, 1678 Nicosia, CYPRUS Tel.: ++357-2-892430, Fax: ++357-2-892432
Web site: http://www.econ.ucy.ac.cy

The Determinants of University Participation in Canada (1977-2003)[1]

Louis N. Christofides
Department of Economics, Universities of Cyprus and Guelph
Kallipoleos 75, P.O.Box 20537, 1678 Nicosia, CYPRUS
louis.christofides@ucy.ac.cy

Michael Hoy
Department of Economics, University of Guelph
Guelph, Ontario, N1G 2W1, CANADA
mhoy@uoguelph.ca

Ling Yang
Department of Economics, Wilfrid Laurier University
Waterloo, Ontario, N2L 3C5, CANADA
lyang@wlu.ca

February 18, 2008

[1] Earlier versions of this paper were presented at the Authors' Workshop *Exploring New Realities of Gender in Canadian Society* and the *Socioeconomic Annual Conference*, both run by Statistics Canada and at Ben Gurion University, Israel. We thank all participants, especially Miles Corak, Leif Danziger, David Johnson and Christine Neill for helpful comments. We also thank the SSHRC and CLLRNet for financial support. The statistical work for this paper was carried out using Statistics Canada Master Files at the Toronto and Waterloo Data Resource Centres and the results have been approved for release. While the research and analysis are based on data from Statistics Canada, the opinions expressed do not represent the views of Statistics Canada.

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ABSTRACT

The decision to attend university is influenced by the balance of the expected returns and costs of attending university, by liquidity constraints and capital market imperfections that may modify these calculations and, hence, by the family income of prospective students. Family circumstances also play a role. We examine the secular increase in the propensity of children from Canadian families, evident in annual surveys spanning two and a half decades, to attend university. We quantify the importance of these factors taking account of the greater propensity by young women than men to attend university and controlling for secular trends in socioeconomic norms that impinge on these decisions.

1. Introduction

It is generally accepted that governments' involvement with post-secondary education financing reflects both equity and efficiency concerns. Since the children of families with higher income tend to use the post-secondary education system with greater frequency, shifting the cost of post-secondary education from tuition fees to government subsidization is often thought to be a regressive policy. On the other hand, high tuition fees may restrict access especially for children from low-income families. Imperfect credit markets would accentuate this effect and possibly lead to (overall) inefficiently low levels of post-secondary school attendance. Any positive externalities flowing from post-secondary education would exacerbate this effect, as would concern for intergenerational equity (see Currie and Moretti, 2003). Thus, determining the factors that influence individual decisions to obtain post-secondary education is an important input into the public policy discussions that shape the extent and manner in which governments should finance higher learning. Besides ascertaining the overall level of support that governments should provide to post-secondary institutions, such studies can also help to target aid to specific socio-economic groups. In this paper we shed light on such issues by considering various factors that have influenced university attendance in Canada over the period 1977 to 2003.

Many of the forces that impinge on decisions to acquire post-secondary education (such as increases in family real income, parental education, the additional earnings and indirect costs involved from further education, and increases in tuition fees) unfold gradually and may exert their effects more clearly over long periods of time because only then do modest but persistent changes of variables in the same direction cumulate to large enough effects for them to be clearly discerned. It is, therefore, necessary to study the long run if such effects are to be identified. Two studies that adopt this approach are those of Christofides, Cirello, and Hoy (2001), or CCH, and Johnson and Rahman (2005), or JR. While these papers are strongly complementary[2], room for much further work remains. In the words of JR, p. 107, "It seems sensible to use different data … and … models to improve our understanding of the university participation decision".

[2] The former uses data from the Survey of Consumer Finances (SCF) and the Survey of Labour Income Dynamics (SLID), while the latter draws upon the Labour Force Survey (LFS) and somewhat different periods are studied. The public use surveys in CCH provide information on important family characteristics but do not identify the gender of the children, nor do they distinguish between college and university attendance. By contrast, the LFS surveys provide personal details such as the child's gender and choice of college or university but do not report important family characteristics such as family income or parental education. Other complementarities between this study and JR are noted below. Neill (2005) also uses LFS data with a focus on obtaining personal characteristics for a sub-sample and on instrumenting tuition.

To that end, we have used the Master Files of the SCF and the SLID at the Statistics Canada Data Resource Centres in Waterloo and Toronto, thus gaining access to additional information not available to CCH or JR. Because we work with the SCF and SLID, we continue to have full access for the entire sample to family income and parental education but, in addition, we now know the gender of the children in the family and whether they attend college or university. Moreover, parental income is available on the, more appropriate, after-tax basis. We are also able to remove the seam between the SCF and SLID as far as the definition of the family Head is concerned, adopting the SCF definition throughout the study - see footnote 11 below. Finally, we are able to reduce the age of children under study from 18 to 17, thus including in the sample children who might gain access to university at an earlier age.

In this paper, we focus on university rather than post-secondary (as in CCH) or college attendance. There are several reasons for doing this. First, the ability to take into account the gender of a family's children allows us to explore the increasing university gender participation gap. In the SCF and SLID data, there is no noteworthy college participation gap: in recent years, the college participation rate for both genders has been around 20%. Second, family income is a more important determinant of university rather than college attendance and the overall costs and benefits are generally higher for a university than for a college education.[3] In other words, the stakes are higher when considering how to finance university education, both from an equity and an efficiency perspective. Third, university tuition fees are generally higher but they have also increased more for universities than for colleges. The average tuition fee for a Bachelor of Arts program in Canada (expressed in 2001 dollars) rose from $1,866 in 1990/91 to $3,456 in 1999/2000 (see Corak, *et al*., 2003). Using the long data set that we have put together, we consider whether the recent increase in tuition fees has restricted accessibility to universities. Finally and as just noted in footnote 3, the relative returns to university and college education are different. The university premium, so usefully considered in Bar-Or *et al* (1995) and Burbidge *et al* (2002) and used in JR, has attracted a good deal of recent attention in the US literature of Jacob (2002) and Goldin *et al* (2006); it bears further scrutiny. We follow a suggestion in Bar-Or *et al* (1995) and focus on the returns to university education (relative to high school education only) in the years immediately after one's education was completed. This is a credible, alternative, definition of the university premium which is not based on the experience of all individuals to the

[3] To see that parental income has been a much stronger determinant of who goes to university than to college, see Corak*, et al*. (2003), Figures 9 and 10 (pp. 33, 34). Higher costs and relative returns to university than to college are evident from Vaillancourt (1995), Table 3 on p. 544 and Table 5 on p. 548.

age of retirement but focuses, instead, on the five years immediately after the completion of schooling. This may well be the period of greatest interest to individuals making human capital acquisition decisions and may better predict the future gains to a university education.

The substantial convergence across income groups, noted in CCH, in the relative likelihood of attending post-secondary education in general occurred for university attendance specifically as well and continued until the end of our sample in 2003. The relative likelihood (i.e. the proportion in the fifth income quintile divided by that in the first quintile) fell continually from 4.00 in 1977, to 2.88 in 1985, 2.15 in 1993, 2.07 in 2000 and 2.0 by 2003 - see Table 1. This appears to imply that family income has become less important as a factor in determining university participation. However, it may just reflect a natural tendency when participation rates for all income groups are rising strongly, given that the rates for the highest income groups are closest to their natural limit of unity. Since the period leading up to 2003 was, for most provinces, a time of significant increases in university tuition fees, it is natural to wonder whether the cost of university education has had any impact on participation rates. Of course, this may still be the case if increases in real after-tax income, the university premium, and other variables have stronger positive impacts on university participation rates than negative, albeit smaller, impacts emanating from tuition fee increases.

Evidence on the impact of tuition fees, in Canada, has been mixed. Rivard and Raymond (2004), using the Youth in Transition Survey for 1997-1999 and all provinces but Quebec and Ontario, found no evidence of an effect of tuition fees on post-secondary attendance. CCH covered a period that extended only to 1993, thus excluding consideration of more recent periods when increases in tuition fees have been substantial, and found no effects from tuition fees on post-secondary attendance. JR found some negative tuition effects on the younger of the two groups (17, 18 and 19 year olds) that they studied. Believing that tuition fees are endogenous, Neill (2005) used data from the Master Files of the LFS for the period 1979 to 2001 and estimated demand for university places by instrumenting tuition fees with the political party in power for the relevant province. She found some negative effects of tuition on the demand for university places. Coelli (2005a) used data from the first two panels (1993 to 1998 and 1996 to 2001) of SLID but found negative tuition effects only for children from low income families.[4] Fortin (2005) exploited

[4] Coelli (2005b) also finds that "unanticipated" negative shocks to family income reduce the likelihood of further education of children. Quirke and Davies (2002) consider the importance of tuition fees and family background for students attending the University of Guelph while Mueller and Rockerbie (2005) look at factors determining demand for university education in Ontario.

differences across Canadian provinces and US States for the period 1973 to 1999, finding some negative effects. In general, these Canadian results are quite mixed. Junor and Usher (2004, p. 104) claim that "The evidence to support the notion that price – that is, tuition and forgone income – is a barrier to access is, in an aggregate sense, slim to non-existent."[5] We consider at length the impact of increases in real tuition fees on the demand for university attendance.

Studying university participation in Canada is important but it is also useful to keep in mind the findings of studies from countries that may differ in the way that governments charge tuition fees and support post-secondary education through direct subsidies and loans to students. In the UK it has been noted (Machin and Vignole, 2005, p. 71) that " … even during the last fifteen years, participation in H(igher) E(ducation) has largely been the preserve of the higher socio-economic groups in the UK. Furthermore, there is evidence that the gap in HE participation between richer and poorer students actually widened, at least in the mid- and late 1990s." The trend noted for the late 1990s in the UK does not square with the secular trend for greater relative participation by lower income groups in Canada. Substantial research has been conducted on the effect of tuition fees on enrolments in post-secondary education in the US. Surveys of these studies indicate that there is indeed a negative impact from tuition increases on rates of enrolment (see Heller, 1997 and Leslie and Brinkman, 1987). However, Canton and de Jong (2005) find no effect from tuition in their study of post-secondary attendance in the Netherlands. Thus, the idea that higher tuition fees should necessarily have a negative impact on university participation rates is not a forgone conclusion.

Increases in real income relieve liquidity constraints and are likely to increase participation rates. We explore the role of cross-sectional differences in real after-tax family income, as well as secular increases in such income, in shaping university participation decisions. This important point cannot be pursued using the LFS data in JR and Neill (2005).

Another variable that is not available for the full LFS sample is parental education. We include this in all our specifications and explore not only its static influence on university participation but its dynamic effects. We are able to consider how, over time, the growth in parental education feeds upon itself: A random increase in university participation will, once children become

[5] Admittedly, this quotation preceded the results in the important recent literature just surveyed. See JR for a more comprehensive review of Canadian studies regarding the determinants of university attendance.

parents, encourage further increases in university participation as parents influence their children to attend university.

The university premium is also an important force and our specification differs substantially from that in JR, thus providing a useful sensitivity analysis.

While improved information through the Master Files is one major thrust of this paper, we also follow JR's second admonition (to use different models) in paragraph two above by estimating not only Linear Probability but also Poisson and Probit models in our statistical work. These provide useful additional checks and a sensitivity analysis. We also explore and report briefly on the issue of the possible endogeneity of tuition fees. Finally, we consider these models from a regional perspective, relaxing earlier constraints about the homogeneity of slope coefficients across regions. It turns out that these, more flexible, specifications are statistically more appropriate and shed new light on these processes.

We find that tuition fees, family real income and parental educational attainment as well as the university premium all have significant roles to play in shaping university attendance. We evaluate the contribution of each of these (and other) variables to the increase in university attendance that occurred over the sample period, having checked for the possible endogeneity of tuition fees.

In section 2 we provide an overview of the trends in university participation. In section 3 we discuss our data and sources, while in section 4 we present the econometric models used and the results obtained. Concluding comments appear in section 5.

2. Overall trends in postsecondary education attendance

For each family that we examine over the period 1977 to 2003, we consider the propensity of its children aged 17 to 24 [6] to attend university. We study the raw number of children at university (CAU) and CAU as a proportion to the total number of children in this age group in the family (PROPU). More information on our variables and definitions appears in section 3.

Table 2 presents PROPU for selected years by after-tax[7] income group. For each year in the Table, a very powerful cross-sectional association with real family income is observed. In 1977, for instance, the value of PROPU for families with real income between $20,000-30,000 was 0.07 while its value for families with income between $80,000-90,000 was 0.29 - see section 3 on the definition of real income. Thus, higher income groups have a much higher propensity to have children at university. Generally speaking, an upward trend for PROPU is observed for every income group, particularly the low-income ones. For example, PROPU for families with income between $20,000-30,000 increased from 0.07 in 1977 to 0.16 in 2003 while PROPU for families with incomes between $80,000-90,000 increased from 0.29 to 0.34 between 1977 and 2003. It is patterns of increase such as these that underlie the convergence referred to in the introduction and in Table 1.

Table 3 presents more detail on these patterns for all the years that we are able to analyze - see section 3 below. Column 2 shows average real family income, columns 3 and 4 the year averages of the ingredients of PROPU (i.e. CAU and Children, the number of children in the family), column 5 shows PROPU, while columns 6 and 7 show the value of PROPU for families with only male and only female children respectively. These last two columns highlight a pattern, shown also in Figure 1, namely the tendency for all-girl families to send more children to university than all-boy families. This is an issue that deserves further attention and to which we return below.

The Appendix Tables A1 and A2 illustrate the tremendous increase in nominal and real tuition fees that have occurred over the period 1977-2003. In most provinces, real tuition fees (for Bachelor of Arts programmes) in the largest provincial university more than doubled. Exceptions are Newfoundland, New Brunswick, and Quebec, with Newfoundland implementing the lowest percentage increase over the period 1977 to 2003. But, even in Newfoundland, an 83.3% increase in real tuition fees can be discerned over this period.

In the next section, the data and the variables used for quantitative analysis are explained in detail.

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[6] The age group of children attending university is expanded, relative to the norm, to include relatively young high school graduates. Thus, we consider individuals between 17 and 24 by making use of information in the master files of the SCF and the SLID. Only families with children in this age group are included in our data.

[7] After-tax income is available in the master files of SCF and SLID but was not available to CCH who relied on the public files. After-tax income gives a more accurate measurement of the disposable income for each family.

3. Data Sources and Variable Definitions

In this paper, we use data from the SCF covering the years 1977 to 1997 for which comparable surveys were available and the SLID covering the years 1998 to 2003; in both cases, the master file versions of these Statistics Canada surveys were relied on. Due to restrictions imposed in the master files of SCF, 1975 could not be used and 1977 became the starting point for the current research. Data for 1976, 1978, 1980 and 1983 were not used either as these were small-sample years of the SCF. We focus on economic families, which are defined in these data sets as units of persons residing together and related by blood, marriage or adoption. For the purpose of investigating possible factors influencing attendance at university, we use only the sub-sample of economic families with children between 17 and 24 in the corresponding survey year. No selection issues are involved in the determination of the samples analyzed. We have taken care to set up variable definitions so as to ensure as seamless a transition from the SCF to the SLID as possible. As an extra precaution and in order to mop up any remaining differences in the means of variables of interest we include the dummy variable SLID which takes the value of 1 for all observations from that survey and is equal to zero otherwise. The sampling weights provided by each survey are used throughout.

Three variables measuring university participation are defined and used as dependent variables in our econometric analysis. PROPU (CAU/Children) is used as the dependent variable in Linear Probability Models based on Ordinary Least Squares (OLS). It measures the proportion of children between 17 and 24 at university for each family. CAU measures the absolute number of children between 17 and 24 attending university in each family and constitutes the dependent variable in a Poisson Count model. Finally, PROBU is assigned the value of unity if a family has at least one child between 17 and 24 attending university and it is otherwise equal to zero; PROBU is the regressand in Probit regressions of the probability of attending university. The three variables PROPU, CAU and PROBU are related to a number of independent variables which we now describe.

Explanatory variables include the real tuition fee (Tuition) in the province where the economic family resides in a given year; nominal tuition fees are deflated by the All Items CPI (1992=100) for the largest city in the relevant province. Burbidge and Finnie (2000) note that over 90% of university students choose to attend university in their home province, so this way of assigning tuition fees is justified. At the margin, an increase in this variable is expected to reduce university attendance. As suggested by Table 2, real after-tax family income (Income) and its powers may

be another important force influencing (by relaxing liquidity constraints and helping to overcome capital market imperfections) the decision to attend university. Income is defined as the sum of parental income and it is converted into real terms using the All Items CPI (1992=100) for the largest city in the province in which the family resides. Regardless of the choice of dependent variable, we condition on the number of children in the family (Children) and the second power of this variable.[8]

When considering the cost of attending postsecondary education, transportation and rental expenditures are other important elements, beyond tuition fees, that each family must consider.[9] If a family lives in a rural area, far from a university, it will be more costly to send a child to university than if living in a city. At the other extreme, families living in large cities will have a choice of universities for their children to attend. The dummy variable Urban1 is equal to 1 if the family lives in an urban area of 29,001-99,000 inhabitants; otherwise it is equal to 0. The dummy variable Urban2 is equal to 1 if the family lives in an urban area of more than 99,000 inhabitants; otherwise it is equal to 0. We would expect both variables to be associated with greater propensity to attend university and the coefficient on Urban2 to be greater than that on Urban1.[10] This differentiation of urban areas by size was not possible in CCH.

The education level of the head of the family is commonly used to explain university attendance.[11] The following dummy variables are used for this purpose: NonGrad equals 1 if the family head has not finished high school and it equals 0 otherwise; this is the omitted category. Grad equals 1 if the family head has graduated from high school without further education and it equals 0 otherwise. Some Post equals 1 if the family head has received some postsecondary education without receiving any certificate, diploma or degree and it equals 0 otherwise. Post equals 1 if the family head has received some postsecondary education and received some form of certificate (but no degree) and it equals 0 otherwise. Degree equals 1 if the family head has

[8] In the case of Tuition, Income, Children and the time trend we experimented with various powers of these variables in order to capture important non-linearities. We report the statistically most successful implementation of this general-to-particular strategy but the qualitative nature of our o results does not depend on this choice.
[9] Card (1995) makes use of this idea.
[10] Frenette (2006) uses postal code information to determine distance to the nearest university. He finds that children whose family home is " … out of commuting distance …" are significantly less likely to attend university and this effect is especially important for lower-income families.
[11] It should be noted that the SCF defines the husband as the head of the family, while the SLID selects the major earner. In our empirical work, we have used the detailed information available in the Master Files to extend the SCF convention into the period covered by SLID, selecting the husband as the head where this was not the case. In this way, we maintain consistency in this variable.

received a university degree and it equals 0 otherwise. An interesting possibility is that the secular increase in university attendance may, through the variable Degree, exert a further upward pressure to attend university. We evaluate and quantify this dynamic effect.

In view of the secular increase in university attendance evident in Tables 2 and 3 and in Figure 1, it is important to explore long run forces that may account for this, despite the trend increase in tuition fees. A reasonable hypothesis is that the increased interest in university education is due to the rewards that can be expected from holding a degree. In order to investigate this possibility, the variable (Premium) capturing the earnings premium expected from holding a university degree was constructed. Taking the sample of full-time full-year paid employees for each year of our surveys[12], we define the university premium as the ratio of the average earnings of individuals with a degree and up to five years experience to the average earnings of individuals with 11-13 years of schooling only and up to five years experience. Thus, for those with a university degree we use individuals aged 25-29, while for those with 11-13 years of schooling only we use individuals aged 19-23.[13] The Premium is calculated for men, women and for all individuals together. When a family has only boys, the male value of Premium ($Premium_m$) is assigned to that family; when it has only girls, the female value of Premium ($Premium_f$) is assigned to that family; when it has boys and girls, the general value of Premium is assigned to the family. Earnings were calculated on both a provincial and a national basis and the results obtained were similar; for brevity's sake, we do not report results based on the national definition of Premium. It should be noted that Burbidge and Finnie (2000) find that over 85% of graduates are still in the province in which they lived and attended university; thus, the provincial definition of the Premium is justified. The provincially based variable, averaged by year for all observations in that year, appears in Figure 2. It (like the Bar Or *et al*, 1995, Figure 6, for 1-5 years of experience) has a clear upward trend for both the general and the gender-conditioned variants. Note that, over time, $Premium_f$ rises faster than $Premium_m$. Figure 2 contrasts sharply with the university premium proxy in Figure 1 of JR. There, the female premium is higher than that for males and it

[12] Robb, Magee and Burbidge (2003) examined SLID and the LFS in their role as successors to SCF. They conclude that, for the purposes of studying the education premium, it is reasonable to merge data from the SCF and SLID.

[13] Bar-Or *et al* (1995) discuss the relation between the criterion of 11-13 years of schooling and high school graduation. They also explore (see their Figure 6) the difference between definitions using limited (e.g. 5 - years) experience, as we have, and those using a much broader (e.g. up to 40 years of experience as would be implied by use of the age group 25-64 years) concept. In their work, defining the premium using the broad experience concept (instead of 1-5 years of experience) results in a time series for the university premium which is very flat over time. By contrast, their Figure 6 for 1-5 years of experience has a clear

is roughly constant, while that for males is lower but increases through time; thus, in JR, the premium differential between women and men narrows, while that in our Figure 2 widens. The possibility that the secular increase in Premium generally, and the relatively faster increase in $Premium_f$ may account for salient features in university attendance[14] is something that we consider.

Figure 1 has already suggested that all-girl families are more likely to send children to university. In this economic family-based study of university participation, we consider the distinction between all-girl and all-boy families to be a proxy for what the US literature has identified as the gender gap, i.e. the increasing propensity for more girls than boys to attend university. To explore such effects, three mutually exclusive and exhaustive dummy variables were generated. Only Male Children Family equals 1 if there are only male children in the family and it equals 0 otherwise. Only Female Children Family equals 1 if there are only female children in the family and it equals 0 otherwise. Both Gender Child Family equals 1 if there are male and female children in the family and it equals 0 otherwise; this constitutes the omitted category. Clearly, the inclusion of the Only Male and Only Female Children dummy variables in addition to the University Premium provides (given that, in Figure 2, $Premium_f$ lies uniformly above $Premium_m$, though not by a constant amount) a major challenge to the earnings-based explanation of the higher participation by women. We would expect University Premium to be weakened or rendered insignificant when the gender dummy variables are added as well. It is worth noting that JR, p. 120, argue that "It is impossible to distinguish the effect of being female in Canada from the effect of having a higher payoff to university attendance". This is an issue we explore at length in this paper.

A trend variable was also included in all equations: For observations in 1977, the variable Trend equals 1, for 1979 it equals 3, for 1981 it equals 5, for 1982 it equals 6, and so on. This variable captures many socioeconomic changes (e.g. the tendency for later marriage and family formation) that occurred over time and which can be neither measured nor separately identified. Goldin *et al* (2006) provide a careful discussion of these. It is important to include Trend because it controls

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upward trend. We would argue that the decision to attend university is more likely to be based on the relative earnings of young adults, rather than those who finished their education a long time ago.

[14] While the increase in Premium through time may account for the increasing propensity to attend university, the relatively higher and faster-growing values of $Premium_f$ may explain the relatively higher and increasing propensity of girls to attend university.

for pure time trends, allowing the time-varying regressors in the model to exert their independent influence.

In addition to Canada-wide regressions regional sub-sample specifications are also investigated. These are important because exploring regional effects using intercept differences alone may not capture the diversity of behaviour that may be found in a country as large and as diverse in its treatment of education as Canada.

Regression results are reported in the following section.

4. Empirical Results

To quantify the relationships discussed above, various statistical models are adopted. The most straightforward specification is the Linear Probability Model applied to PROPU. The application of OLS, including the use of hypothesis tests in finite samples, is based on specific assumptions about the residual term (i.e. normality) which, in this particular context, are not appropriate. On the other hand, OLS is often robust against certain misspecifications and so the Linear Probability Model is generally viewed as a useful first step. As noted in section 3, CAU and PROBU are two alternative variables that can be used to examine university participation. Since CAU is an integer, Count Models are a natural way to proceed. The Poisson regression model assumes that the $E(CAU_i| X_i) = \lambda_i$, where

$$\ln \lambda_i = \sum_{j=1}^{q} \beta_j X_{i,j} ,$$

q is the number of j covariates X, i refers to a particular family's observations and β_j are constant population parameters to be estimated. The marginal effect of an increase in a particular covariate j is equal to β_j times λ evaluated appropriately. The variable PROBU takes on the values of 0 or 1 and so a natural way to proceed is by using Logit or Probit – we use the latter. In the Probit model, the probability that the ith family will have at least one child attending university and PROBU will assume the value of unity is given by

$$\Pr\left(PROBU_i = 1 \mid X_i\right) = \Phi\left(\sum_{j=1}^{q} \beta_j X_{i,j}\right)$$

where Φ is the standard normal cumulative distribution function.[15] In the Probit model, the marginal effect of an increase in a particular covariate j is equal to $\phi\left(\sum_{j=1}^{q}\beta_j X_{i,j}\right)\beta_j$, where ϕ is the standard normal probability density function.

Results from the three models are presented in Table 4. These include the estimated coefficients, the ratios of the estimated coefficients to their standard errors, and the marginal effects for the Count and Probit models. In the case of continuous variables including Trend, the marginal effects are calculated in the usual fashion for continuous variables (but setting dummy variables equal to zero). In the case of dummy variables, marginal effects are calculated by switching each dummy variable in turn on and evaluating its impact on the predicted probability while holding all other dummy variables at zero.

In Table 4, we report the results of OLS regressions of PROPU on Tuition, University Premium, Income and its second and third powers, Children and its square, Only Male and Only Female Children Family, Urban1 and Urban2, the four dummy variables indicating the Head's educational attainment, as well as province effects, a trend, a constant and the dummy variable SLID. The results obtained are generally consistent with those from the more statistically appropriate Poisson and Probit specifications that will be discussed in greater detail below. Suffice it to say that, with the exception of Tuition, all variables have the expected impact on PROPU and are statistically significant. Important province effects are also in evidence. The upward trend in PROPU and the greater propensity of girls to attend university, shown in Figure 1, are captured in the OLS results. The dummy variable SLID has a positive coefficient, suggesting a *ceteris paribus* higher propensity to attend university in the SLID data but this effect is not significant at the 5% level. Tuition has the expected negative coefficient (-9.76E-07) but it is not significantly different from zero at the 5% level.

The Count and Probit results are similar to the Linear Probability Model results mentioned above. The variable Children has a positive, diminishing, effect on CAU and PROBU. The polynomial suggests (based on the marginal effects) an increasing impact until 3.82 children in the Count model and 3.60 children in the Probit model. These complex effects of Income and Children can

[15] For a discussion of Limited Dependent Variable Models and Count Models in particular, see Greene (2002).

arise in a number of theoretical ways and we do not, in this reduced form context, attempt to discriminate among competing theoretical models.

The results from both models suggest unequivocally that families with boys only will have lower values for CAU and PROBU than families with girls only – families with boys as well as girls being the standard of comparison. The marginal effects in the Probit model for example, suggest that there will be a constant (through time) 2.41(=0.0134742+0.0106258) percentage point difference between PROBU for all-girl and all-boy families.[16] In Figure 1, the difference between $PROP_f$ and $PROP_m$ is close to zero at the beginning of the sample but grows to approximately 10 percentage points by the end of the sample. Thus, our estimates produce a reasonable effect over the period as a whole.

Urban families send more children to university as compared with rural families. In fact, in the Probit results, larger urban areas are associated with a 4.63 percentage point and smaller urban areas a 1.97 percentage point additional probability of families having at least one child at university.

The education level of the family head is also an important factor in decisions affecting university attendance. Indeed, the higher the educational attainment the higher will be the probability of having at least one child at university. These effects range (in the Probit model) from 3.4 percentage points in the case of Grad to 16.6 percentage points in the case of Degree.

The provincial effects suggest that there are significant differences between all provinces and British Columbia, the omitted province. These effects range (in the Probit model) from 0.73633 percentage points[17] in the case of Alberta to 10.29225 percentage points in the case of Prince Edward Island. These effects may, in fact, indicate only the tip of the iceberg in that provincial differences in the forces that shape university attendance may not be confined to differences in intercepts. This is an issue we explore at length below.

The secular increase in the propensity to attend university, measured by PROPU, CAU and PROBU, cannot be explained by the above variables and we now turn to variables with important

[16] In this comparison, continuous variables are held at their means while all but the relevant dummy variables are set at zero.
[17] This is the marginal effect of switching this dummy variable on.

variation over time. Tuition has the expected negative coefficient in both models and, in the Count model, it is significantly different from zero at the 10% level. As Tuition in British Columbia, for example, increases from its lowest to its highest value in Appendix Table A2 (an increase of 2199-972=1227 real dollars), the impact on CAU in the Count model is 0.00454 (=1227×0.00000370). To this effect one may wish to add the 0.0001234 marginal effect for SLID, given that (unlike the minimum) the maximum tuition value is drawn from the 2003 SLID observations. Nevertheless, this effect is quantitatively small which is as well given that what we must explain is an increase in the secular propensity to attend university.

Income, Income squared and Income cubed are all significant. The estimated polynomial suggests that as real after-tax family income increases, more children attend university and the probability that a family will have at least one child at university rises until Income equals $252,155 in the Count model and $344,050 in the Probit model. These levels are effectively outside the income values in our sample. Thus, Income is an important cross-sectional force on the propensity to attend university and its effect continues to be positive throughout the sample for all intents and purposes. However, its capacity to explain the secular growth in university attendance is limited: Between 1977 and 2003 average real income increased from $40,557 to $50,207. The change of $9,650 implies an increase in CAU and PROBU of 0.00626 and 0.00877 respectively. These increases fall considerably short of the actual increases in CAU and PROBU from 0.17 and 0.11 to 0.31 and 0.22 respectively – for the values of variables, see Table 3. Thus, it is necessary to look elsewhere for an explanation of the secular increase in university attendance during the period 1977-2003**.**

The increased interest in securing a university education may reflect trends in the additional earnings to be expected from holding a university degree. Despite the fact that the Only Female and Only Male Children dummy variables mop up significant differences in the propensity to attend university between families with all girls and all boys, a substantial role remains for University Premium. It is positive and statistically significant in all equations. In the Probit model, for example, as this variable increases from its lowest value of 1.6324 for men and 1.84 for women to its highest value of 2.4487 for men and 3.0417 for women PROBU increases by 0.00899 (=0.8163×0.011019) points for men and 0.0132 (=1.2017×0.011019) points for women.

Relative to the maximal tuition effect using the Probit model of 0.0032 (=1227×0.00000261), these effects are over three times as large for men and five times as large for women.[18]

To the extent that no genuine gender effect, beyond that embodied in the University Premium, should be present, the results in Appendix Table A3 should apply. Here, the Only Male and Only Female dummy variables have been excluded and, though some differences in all coefficients can be discerned, the coefficients and marginal effects on University Premium are more than double those in Table 4. In the Probit equation, for example, the marginal effect increases from 0.011019 to 0.0247319 when the gender dummies are excluded as in Appendix Table A3. The effect of an increase in the value of University Premium from its lowest to its highest value is now 0.0202 for men and 0.030 for women.

It is important to note that these effects hold in a specification which already accounts for a pure trend. The linear time trend is significantly different from zero at the 5% level in all three specifications in Table 4 and in Table A3.

It is noteworthy that the dummy variable SLID is never significant in Table 4 but it is positive and significant when the gender effects are excluded. This suggests that the increased participation by women, most evident in the last years of our sample, is to some extent picked up by the SLID dummy variable.

The provincial intercept effects in Table 4 may be an indication of more fundamental differences between the provinces. To explore this possibility, we estimated the equations in Table 4 along the following regional lines. The Atlantic region (Newfoundland, Prince Edward Island, Nova Scotia and New Brunswick), Quebec, Ontario, the Prairie region (Manitoba and Saskatchewan), and the Western region (Alberta and British Columbia) are distinguished. When provinces are aggregated into regions, provincial effects are allowed for within the region. Our groupings reflect geography, some provincial peculiarities such as the CEGEP program in Quebec, and the fact that Ontario has the largest population and the most universities in Canada. Structural homogeneity tests reject the aggregation of regions into the Canada-wide equations of Table 4. We do not report the full results in table form. The broad pattern of results in Table 4 continues to hold. Income and Children have the same effects. The education of the head of family generally

[18] Minimum and maximum values were taken from Figure 2, where for each year provincial averages by gender are plotted.

impacts on university participation in much the same way as at the national level. In the case of the Atlantic provinces, children in Prince Edward Island always have higher propensities to attend university and this effect is also significant in the case of New Brunswick when the gender dummies are excluded. In the case of the Western region, Alberta carries a significant, positive, coefficient in all specifications, suggesting that its children are more likely to attend university than those of British Columbia.

The regional results indicate noteworthy differences from the national results in Table 4 with respect to Tuition and its coefficients. Tuition in Table 5 has a negative and statistically significant coefficient in almost all regions and specifications; exceptions are all equations for Quebec and the OLS and Probit results for the Atlantic region. This pattern holds, regardless of whether the gender effects are included. These results are the strongest and most robust indication yet that Tuition has a role to play in the decision to attend university.[19] Repeating the calculation done earlier for British Columbia, as Tuition increases from its lowest to its highest value the impact on CAU in the Count model is now 0.014724 (=0.000012×1227) instead of 0.00454 as in the Canada-wide results of Table 4. While this effect is larger, the maximal increase in Tuition in that province decreases the number of a family's children at university by less than one fiftieth of a child.

In Table 5, the University Premium is always positive and statistically significant, regardless of region, when the gender effects are excluded. It is clear, however, that the Only Male and Only Female Children Family dummy variables are, in the case of Quebec, Ontario and the West, sufficient to capture the gender differences, leaving no significant further role at the 5% level to the time series variation in University Premium - in the case of the West, the University Premium is significant at the 10% level for the OLS and Count models. Naturally, the gender dummies do not preclude an economic explanation based on roughly constant gender differences in the University Premium. But neither can we be certain that this is, in fact, the correct reason why the dummy variables in Table 5 so consistently suggest that all-female (all-male) children families have a greater (smaller) propensity to send children to university than families with children of both genders. That gender differences in earnings are important is beyond doubt in the remaining regional equations. The gender dummies reduce but do not eliminate the role of the University Premium in the Atlantic and Prairie regions. In the regional context and when gender is excluded,

[19] We have interacted Income with Tuition in order to see if the tuition effects are stronger form low-income groups but the resulting coefficients were generally not significantly different from zero.

the Probit marginal effect of the University Premium ranges from 0.02008 in Quebec to 0.031102 in Ontario, as compared to the effect of 0.011019 reported for Canada as a whole in Table 4.

In order to obtain a clearer view of the relative importance of these variables and in order to better evaluate the potential cumulative effect of more heads of family having tertiary qualifications (Degree, Post) for explaining the secular trend in university attendance, we computed the predicted impact due to the changes in explanatory variables between the years 1977 and 2003. The detailed results of this exercise are provided in Table 6. The calculations involved setting each of the stated explanatory variables at its average level for the years 1977 and 2003 and then applying the estimated regression coefficients to generate the predicted change in the dependent variable between these two years. This predicted change is decomposed into the different parts noted in Table 6.

As one might expect, changes in population proportions by province explain little of the increasing trend in university attendance over this long time period. We could expect the provincial dummies to contribute significantly to this effect only if there were very large changes in population proportions among these province between the years 1977 and 2003. For similar reasons, explanatory variables such as Urban1, Urban 2 and Children (this includes the role of Children and Children2) also contribute little to the explanation of the change in university attendance over time.

Our two variables that explicitly take into account time (i.e. Time Trend variable and SLID) are very strong especially in the Poisson and Probit regressions; in the OLS regression, the SLID effect is relatively stronger. The time trend variable captures a number of effects that we cannot assign to our particular explanatory variables due to the impossibility of finding or modeling the effect of relevant variables such as the socioeconomic forces discussed in Goldin *et al* (2006), relative access to student loans and private sector borrowing. So it is not surprising that these "time" variables are very important factors. The university premium, which increases (albeit not uniformly) over this time period, also explains a large percentage of the variation in the average rate of attendance between 1977 and 2003 (19.43% to 24.25% of the total predicted change across the various regression equations).

Perhaps of most interest, however, is the effect of the increasing education levels of the head of household on this trend. The combined effect of changes in the proportion of the head having a

university degree (Degree) or post-secondary education experience leading to a qualification (Post) over this time period accounts for a very large proportion of the total variation in university attendance (from 31% of the total variation in the Poisson regression to 42% in the OLS regression). Thus, increases in university attendance over time are self-reinforcing. This is an interesting new result that could not be established on the basis of LFS data.

Average income over this period grew from (approx.) $40,600 to $50,200 and the role of this change (taking the combined effect of Income, Income2 and Income3) in explaining the overall growth in post-secondary education attendance ranges from 5.9% (Poisson regression) to 10.82% (OLS regression), Table 6. Although the tuition level has a negative and statistically significant effect in most cases, the size of this effect is modest, holding back growth in post-secondary attendance by amounts ranging from 1.26% in the OLS regression to 7.93% in the Poisson regression, Table 6.

It should be noted, however, that the variation of incomes across families within a given year is far more significant than the variation in average incomes over time. This is clear from looking, in Table 7, at the average incomes of the top and bottom deciles of the populations both in 1977 and 2003. The ratio of income for the highest decile to the lowest decile is 10.4 in 1977 and 9.6 in 2003. The cross-sectional effect of income differences in explaining the differences in the likelihood of children from different family backgrounds attending university in a given year is very strong as seen in Table 8. Within a given year, the difference in the dependent variable between families from the top to the bottom decile ranges from approximately 0.09 (Poisson regression, 1977) to 0.16 (Probit regression, 2003). Given that the average levels of these dependent variables are 0.17 and 0.22, respectively, in these years, the effect of family income is an important consideration when considering cross-sectional variation in the relative likelihood of children from different family backgrounds attending post-secondary education.

Judging by the frequent insignificance of the dummy variable SLID in the regional results[20] underlying Table 5 and the fact that further interactions we tried were typically insignificant, it does not appear that combining SCF and SLID data is grossly inappropriate. Nevertheless, it seemed useful to estimate the regional equations using only SCF data to 1997. The results, in Appendix Table A4, are generally similar to those in Table 5 with the following noteworthy

[20] In the equations where the gender dummy variables were included, SLID was not significant in eight of the fifteen specifications.

differences. In Table A4, Tuition has a stronger negative influence on university participation in the Atlantic provinces but a considerably weaker one in the West. This is probably because, in British Columbia, Tuition did not continue to rise as the SLID period unfolded. The University Premium variable, which was positive and significant in Quebec when gender was excluded, is considerably weaker in Table A4. This may be because the University Premium for men and women in Quebec followed a rather different path than in the rest of Canada. Generally speaking the premium pattern for Quebec is flatter, especially for the SCF period. Also the male, female and general premiums are very close as compared to other provinces. Finally, although the gender dummies have the same coefficient pattern as in Table 5, they are generally not as well-defined as in the larger sample. In general, one would expect smaller samples to produce less clear-cut results and this appears to be the case in the SCF only, as opposed to the SCF plus SLID, sample.

Another sensitivity analysis that is called for involves assessing the possible impact on the results so far of treating Tuition as endogenous. The argument for doing so is that the error terms in an endogenous tuition equation and in the participation equations that we have actually estimated may be related. That is, unusually large participation rates are likely to go hand in hand with unusually large tuition fees - presumably as provincial governments try to choke back demand by increasing tuition levels. This argument is not very powerful when it is realized that the dependent variable in our participation equations is micro based referring, as it does, to individual families. Nevertheless, we have instrumented Tuition, thus breaking the possible contemporaneous relation between the error terms in the two equations. Real tuition levels for the previous three years (constructed in the same manner as the data in Appendix Table A2) were used to that end. The results of instrumenting in this fashion are practically identical to those in Tables 4, 5 and A3. For instance, the coefficients on Tuition in the OLS, Poisson and Probit equations change from those in the first row of Table 4 to -4.43E-06, -0.00005 and -0.0000385 respectively. The comparable instrumented estimates for Table A3 are -2.48E-06, -0.00004 and -0.0000294 respectively. The results in the instrumented version of Table 5 are also very similar to what appears in this paper. These are changes after several decimal points with no real statistical or quantitative importance relative to the main results above. The other variables are affected to an even smaller extent. In light of this, other calculations that appear in Tables 6 and 8 are not affected. Thus, we do not pursue this matter further.

5. Conclusion

Master Files from the SCF (1977 to 1997) and SLID (1998 to 2003) are used to examine the factors that shape university attendance. The examination of this issue over an extremely long time horizon is useful in that it is possible to investigate with greater clarity the impact of secular increases in the real incomes of families of potential students, real tuition fees and the additional earnings accruing to those holding university degrees on the proclivity to attend university. An additional dynamic that can be evaluated in the context of a very long time horizon is the possibility that, since more educated parents are more likely to send their children to university, the growth over time in the fraction of parents with high levels of education may also contribute to growth in university participation. This is an interesting dynamic that had not been quantified in the literature.

Use of the Master Files also allows the separation of university attendance from other post-secondary participation, thereby giving cleaner results. In addition, it is possible to establish the gender of children attending university, allowing us to examine whether and why girls are more likely to attend university than boys.

Data from the Master Files offer four other important advantages. First, they make it possible to calculate and assign a gender-conditioned university premium to families depending on the gender of their children. Second, they allow us to impose on SLID data the conventions defining Headship in the SCF, thereby avoiding one possible seam problem. Third, they allow consideration of 17-year olds. Finally, they allow us to examine the importance of living in urban areas of different size as opposed to living in rural areas. National and regional samples are investigated. Our results illuminate changes in the distributional aspects of university participation which are important in developing higher education policies.

Our results shed light on many of these issues. To begin with, a strong case can be made for examining the university participation issue at the regional, rather than the national, level. Structural homogeneity tests support doing so and substantial differences from region to region can be discerned. Increases in tuition fees exert a downward influence on university participation in all areas except Quebec. This effect is statistically robust but modest in size (Table 6) and the substantial increase in real tuition fees, noted in Appendix Table A2, has not held back university enrolments to any substantial extent. Treating Tuition as endogenous and instrumenting using

tuition levels from the previous three years produced results which were, for all intents and purposes, identical.

In light of this, the secular increase in the university premium evident for both genders but particularly so for women (see Figure 2) has had an important role to play. This variable enters the national equations with significant positive coefficients even when gender dummies pick up much of the higher propensity by the children of all-girl families to attend university. In the regional results, this effect is much better established when gender dummies identifying families with just girls or just boys (as opposed to families with children of both genders) are not included in the equations. In this case, the university premium which is higher for girls than boys is called upon to provide the economic explanation of the higher and rising participation by women. When the gender dummies are included in the participation equations, they capture the higher interest in university education by women and, in some regions and provinces, they leave a further role for the time series variation in the university premium. However, in Quebec, Ontario and (to some extent) the West no additional role for the time series aspect of the university premium remains. All these results are well-established in the context of equations that include a time trend.

Another important variable with a time series dimension is family real income. This variable has an important cross-sectional role but it cannot explain the secular increase in university participation.

Other variables of importance in a cross-sectional sense are whether the family resides in an urban or rural area, since in the former proximity to universities reduces the cost of attendance. We find that not only are urban areas associated with a higher propensity to attend university but that this is more true of larger urban areas, where more universities are to be found. Also, the Head's educational background and total number of children have important roles to play. The long run dynamic of more educated parents being more likely to send their children to university is an important determinant of the secular increase in university participation.

Using the combined SCF and SLID samples and the extended period that this entails suggests that benefits can be reaped because of the larger sample and the greater variation that is involved in variables such as tuition fees and the university premium. At the same time, efforts to explore the significance of the seam suggest that the results are not substantially affected quantitatively nor do our qualitative conclusions change.

Although our principal aim in this paper is to explain the determinants that affect the decision of young people in economic families to attend university, some policy relevant considerations naturally follow. Two types of policy considerations are informed by our work; namely those concerned with understanding and influencing (i) the trend in average university attendance over time and (ii) the cross-sectional variation in attendance according to family background. Our results suggest that individuals respond at least in some significant measure as rational economic agents to variations in economic incentives to attend university. The increasing wage premium associated with a university education leads to a significant increase in participation over time while the increase in tuition fees has had a modest negative impact on participation. This latter effect makes sense from a rational economic calculation perspective since the added cost of tuition is modest in comparison to the full cost of attending university as well as the lifetime discounted benefits of a university education. Of course, this does not mean that the vast majority of people or that individuals from all social backgrounds have full information about the costs and benefits of higher education, but at least one can expect that any increase in the labour market demand for university educated workers will generate some significant response from the supply side.

From our results we see that the increase in average family income over time played only a small role in explaining the increase in average attendance at university over time. However, from a cross-sectional perspective family income represents a strong determining factor in the decision to attend university.[21] This result (as have others) provides a flag for governments concerned with social equity in post-secondary attendance. Conditional on the head's education level, family income does have a strong effect on university attendance. Therefore, governments should be aware that policies that appear not to significantly restrict access to university at an aggregate level may have important effects on children from lower income families, a concern that is also highlighted in Frenette's (2006) study that demonstrates the importance of the cost of attending university especially for lower income families.

Finally, our result that the education level of the head of the family explains a significant percentage of the variation in children's university attendance has important ramifications for both "trend" and "cross-sectional" policy concerns. Introducing at some point in time policies that increase university attendance will have compounding future effects as those who obtain a

university degree will much more likely have children who also attend university. Therefore, if a government wishes to create a more highly educated workforce, measuring the benefits of such expansion from a current set of programs should include the effect that having more highly educated parents will enhance the likelihood of university attendance for individuals in future generations. There are also cross-sectional policy considerations from this finding; namely that, from an intergenerational perspective, upward social mobility through higher educational attainment can be promoted with lasting effects through policies that encourage children from lower income families to attend university.[22]

Of course, well-designed government policy for higher (and all levels of) education requires more intensive study along several fronts. In particular, results such as ours concerning the strong effect of family educational background on individuals' decisions to attend university begs the question as to why this effect is so strong. Moreover, for a government concerned with social equity, the fact that this effect is reinforced by a relatively strong cross-sectional and independent income effect enhances the importance of higher education both as a source of concern and as a possible tool for lessening intergenerational inequity.

[21] See also Finnie, Lascelles and Sweetman (2005).
[22] For more explicit treatment of the link between education and intergenerational mobility, see Blandon, Goodman, Gregg and Machin (2004), Solon (2004), and Corak (2005).

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Figure 1
Proportion (PROPU) of University Participation by Gender

Figure 2
University Premium by Gender

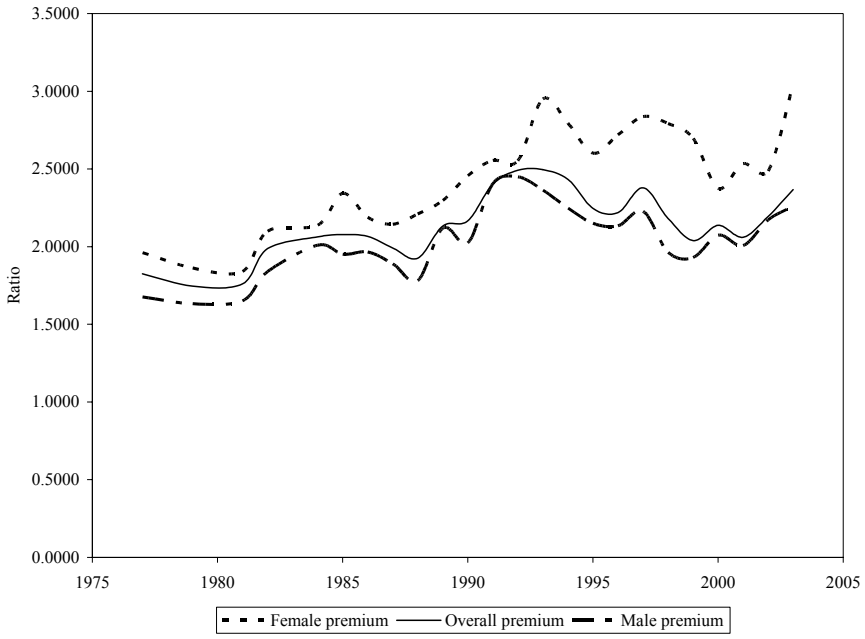

Table 1
The Relative Likelihood of University Attendance

Year	(Fifth Quintile/First Quintile)
1977	4.00
1982	2.14
1985	2.88
1989	2.78
1993	2.15
1997	2.08
2000	2.07
2003	2.00

Note: A number such as 4.00 for 1977 is the ratio of PROPU for the fifth quintile relative to its value for the first quintile.

Table 2
Proportion of Children (PROPU) at University by Income Group (1992 constant dollars)

Income	Year							
Range ($)	1977	1982	1985	1989	1993	1997	2000	2003
0-10,000	0.08	0.06	0.11	0.09	0.13	0.12	0.20	0.20
10,001-20,000	0.04	0.07	0.07	0.08	0.13	0.14	0.11	0.18
20,001-30,000	0.07	0.10	0.09	0.12	0.13	0.12	0.15	0.16
30,001-40,000	0.09	0.13	0.11	0.12	0.15	0.17	0.18	0.18
40,001-50,000	0.12	0.13	0.13	0.18	0.18	0.16	0.17	0.19
50,001-60,000	0.12	0.16	0.15	0.19	0.21	0.16	0.20	0.22
60,001-70,000	0.17	0.16	0.20	0.22	0.25	0.23	0.23	0.27
70,001-80,000	0.20	0.16	0.25	0.21	0.33	0.27	0.26	0.31
80,001-90,000	0.29	0.15	0.31	0.23	0.26	0.29	0.28	0.34
90,001-100,000	0.36	0.10	0.37	0.53	0.39	0.17	0.34	0.37
100,000+	0.27	0.15	0.36	0.32	0.35	0.33	0.39	0.36

Source: Master Files of Survey of Consumer Finance and Survey of Labour and Income Dynamics, various years.
PROPU is the proportion of Children At University (CAU) to the total number of Children (Children) in the economic family.

Table 3
Descriptive Statistics

	Mean Values					
Year	Real Income	CAU	Children	PROPU	$PROPU_m$	$PROPU_f$
1977	40,557.00	0.17	1.47	0.11	0.11	0.12
1979	41,053.65	0.15	1.46	0.10	0.10	0.11
1981	42,048.75	0.18	1.47	0.12	0.11	0.13
1982	41,258.74	0.18	1.48	0.12	0.11	0.13
1984	40,170.71	0.18	1.42	0.12	0.11	0.13
1985	41,105.25	0.19	1.37	0.13	0.12	0.15
1986	41,537.31	0.19	1.38	0.13	0.12	0.16
1987	40,494.71	0.21	1.36	0.14	0.14	0.17
1988	41,862.17	0.21	1.34	0.15	0.15	0.17
1989	43,018.26	0.22	1.30	0.16	0.14	0.20
1990	42,318.66	0.23	1.34	0.16	0.15	0.20
1991	41,708.59	0.25	1.31	0.18	0.16	0.21
1992	42,283.50	0.26	1.33	0.18	0.17	0.21
1993	42,035.06	0.26	1.33	0.18	0.16	0.22
1994	42,574.98	0.25	1.33	0.18	0.15	0.22
1995	41,842.00	0.23	1.32	0.16	0.15	0.19
1996	43,086.98	0.23	1.32	0.16	0.15	0.20
1997	41,665.95	0.24	1.33	0.17	0.15	0.20
1998	45,746.45	0.29	1.35	0.20	0.19	0.23
1999	47,604.90	0.29	1.33	0.21	0.18	0.26
2000	50,936.97	0.28	1.34	0.20	0.16	0.25
2001	51,376.77	0.28	1.33	0.20	0.17	0.25
2003	50,206.84	0.31	1.32	0.22	0.17	0.26

Source: Master files of Survey of Consumer Finance and Survey of Labour and Income Dynamics, various years.
The variable Children is the total number of children aged 17-24 in the family: a number such as 1.47 represents the average number of such children in the families of our sample in 1977. The variables CAU and PROPU are defined in Table 2. $PROPU_m$ is the value of PROPU for families with just boys and $PROPU_f$ is the value of PROPU for families with just girls.

Table 4
Propensity to Attend University in Canada (1977-2003)

	OLS		Poisson Count Model			Probit Model		
Variable	Coefficient	Coeff./St. Error	Coefficient	Coeff./St. Error	Marginal Effect	Coefficient	Coeff./St. Error	Marginal Effect
Tuition	-9.76E-07	-0.2	-0.0000478	-1.7	-3.70E-06	-0.0000206	-0.95	-2.61E-06
University Premium	0.0200815	4.53	0.1169306	4.78	0.0090397	0.0870908	4.52	0.011019
Income	1.34E-06	12.3	8.39E-06	12.9	6.49E-07	7.19E-06	12.48	9.09E-07
Income2	-1.48E-12	-2.56	-2.04E-11	-6.65	-1.58E-12	-1.69E-11	-4.5	-2.14E-12
Income3	4.57E-19	1.31	9.95E-18	5.67	7.69E-19	1.25E-17	2.83	1.58E-18
Children	0.0823616	9.64	1.469045	24.37	0.1135698	0.9243336	20.91	0.1169499
Children2	-0.0147385	-7.78	-0.1925232	-13.14	-0.0148837	-0.1285023	-12.1	-0.0162586
Male-Children Family	-0.0166945	-3.5	-0.1323573	-5.04	-0.0095841	-0.116417	-5.35	-0.0134742
Female-Children Family	0.0241104	4.64	0.1469228	5.46	0.0122352	0.0791329	3.43	0.0106258
Urban1	0.0258393	6.37	0.1948807	6.95	0.0166342	0.1400499	6.88	0.0196727
Urban2	0.0600161	22.32	0.3761974	20.07	0.0353095	0.2951404	22.39	0.0463406
Head Education								
Grad	0.0360811	10.62	0.3784437	12.78	0.0355628	0.2296671	12.25	0.0344272
Some Postsecondary	0.0516081	8.55	0.476361	12.03	0.047174	0.3107493	11.14	0.049326
Postsecondary	0.0528712	13.22	0.4972773	16.45	0.0498052	0.311866	15.67	0.0495418
Degree	0.1959766	32.94	1.028848	33.5	0.1389886	0.7782857	34.56	0.1656709
Province								
Newfoundland	0.0780648	10	0.4270728	9.01	0.0411873	0.3505806	9.79	0.057202
Prince Edward Island	0.1179078	14.69	0.7196866	15.8	0.081467	0.552393	15.68	0.1029225
Nova Scotia	0.0659402	9.38	0.4188967	9.26	0.0402224	0.3058485	9.12	0.0483826
New Brunswick	0.0912791	14.03	0.5698569	14.08	0.0593741	0.4253204	14	0.0729929
Quebec	0.0271411	4.45	0.1445329	3.78	0.0120215	0.1450225	5.14	0.0204457
Ontario	0.0243062	4.54	0.1763593	4.98	0.0149102	0.1330486	5.14	0.0185933
Manitoba	0.0667018	10.05	0.3786016	9.74	0.0355806	0.2870591	9.71	0.0448171
Saskatchewan	0.0650348	10.57	0.4038165	10.48	0.0384633	0.2947474	10.28	0.0462662
Alberta	0.0134757	2.28	0.0952476	2.44	0.0077255	0.0558008	1.97	0.0073633
Time Trend	0.0016317	4.22	0.0188785	7.33	0.0014595	0.0102814	5.45	0.0013008
SLID	0.0104533	1.68	0.0015955	0.05	0.0001234	0.0175445	0.66	0.0022495
Constant	-0.1636775	-11.77	-4.896785	-56.83		-3.065744	-45.24	
R Squared	0.0807							
Log Likelihood					-18934594			-52646.203

Table 5
Selected Results from Regional Equations on Propensity to Attend University (1977-2003)

	OLS				Poisson Count Model						Probit Model					
	With Gender		Without Gender		With Gender			Without Gender			With Gender			Without Gender		
	Coeff.	Coeff./ St.Error	Coeff.	Coeff./ StError	Coeff.	Coeff./ St.Error	Marginal Effect	Coeff.	Coeff./ St.Error	Marginal Effect	Coeff.	Coeff./ St.Error	Marginal Effect	Coeff.	Coeff./ St.Error	Marginal Effect
Atlantic																
Tuition	-3.13E-06	-0.29	7.25E-07	0.07	-0.00013	-2.46	-0.000014	-0.00011	-2.02	-0.000011	-0.000062	-1.37	-0.000013	-4.3E-05	-0.96	-7.78E-06
Premium	0.011793	2.26	0.035885	7.55	0.05680	2.49	0.006271	0.17659	8.56	0.017844	0.047561	2.34	0.009771	0.148701	8.15	0.026772
Male	-0.02927	-3.83			-0.19920	-4.94	-0.019941				-0.203880	-5.59	-0.037089			
Female	0.035111	4.16			0.17137	4.3	0.020638				0.085630	2.25	0.018466			
Quebec																
Tuition	7.43E-06	0.88	0.000004	0.47	0.00002	0.47	0.000002	6.06E-06	0.12	4.97E-07	0.000011	0.28	0.000002	-3.88E-06	-0.1	-5.41E-07
Premium	-0.00711	-0.61	0.025822	2.44	-0.05006	-0.68	-0.004144	0.171968	2.52	0.014114	-0.020070	-0.37	-0.002851	0.14423	2.89	0.02008
Male	-0.01466	-1.55			-0.13862	-2.39	-0.010714				-0.105204	-2.25	-0.013843			
Female	0.035817	3.41			0.22921	3.85	0.021324				0.154195	3.06	0.024415			
Ontario																
Tuition	-0.00005	-3.67	-0.000060	-4.19	-0.00044	-5.19	-0.000043	-0.00046	-5.47	-0.000042	-0.000274	-4.32	-0.000044	-0.00030	-4.79	-4.32E-05
Premium	0.001464	0.11	0.046156	4.37	0.06641	0.96	0.006440	0.30687	5.36	0.027900	0.027739	0.51	0.004437	0.21718	4.89	0.031102
Male	-0.024545	-2.84			-0.15598	-3.45	-0.014006				-0.147467	-3.95	-0.021309			
Female	0.019910	2.1			0.12455	2.66	0.012864				0.052371	1.3	0.008676			
Prairie																
Tuition	-0.000028	-2.15	-0.000030	-2.24	-0.00022	-3.22	-0.000022	-0.00023	-3.33	-0.000023	-0.000132	-2.3	-0.000021	-0.00014	-2.42	-2.27E-05
Premium	0.026521	2.5	0.038527	4.15	0.12126	2.6	0.011916	0.18500	4.67	0.018387	0.108510	2.73	0.017544	0.16361	4.76	0.026929
Male	0.000599	0.05			-0.03029	-0.55	-0.002931				-0.018155	-0.37	-0.002900			
Female	0.020504	1.62			0.09092	1.57	0.009353				0.078989	1.49	0.013459			
West																
Tuition	-0.000027	-2.79	-0.000020	-2.14	-0.00018	-3.22	-0.000012	-0.00015	-2.65	-0.000010	-0.000153	-3.65	-0.000017	-0.00013	-3	-1.45E-05
Premium	0.020753	1.77	0.043507	4	0.12950	1.77	0.008812	0.27625	4	0.019170	0.075117	1.39	0.008521	0.18039	3.61	0.020739
Male	-0.004495	-0.43			-0.07938	-1.31	-0.005193				-0.059275	-1.2	-0.006414			
Female	0.032641	2.85			0.19398	3.1	0.014568				0.121796	2.32	0.015201			

Table 6
Growth in University Attendance Between 1977 and 2003: Role of Variables

	OLS		Poisson		Probit	
Variable	Absolute Change	Percentage Change	Absolute Change	Percentage Change	Absolute Change	Percentage Change
Total change	0.1033	n/a	0.1135	n/a	0.1120	n/a
Tuition	-0.0013	-1.26%	-0.0090	-7.93%	-0.0065	-5.78%
Premium	0.0245	23.68%	0.0221	19.43%	0.0272	24.25%
Income (incl. 2,3)	0.0112	10.82%	0.0067	5.90%	0.0101	8.99%
Children (incl.Sq)	-0.0027	-2.63%	-0.0113	-9.96%	-0.0115	-10.31%
Urban1	0.0001	0.07%	0.0001	0.06%	0.0001	0.07%
Urban2	0.0013	1.22%	0.0009	0.79%	0.0012	1.10%
Head Education						
Grad	-0.0087	-8.46%	-0.0099	-8.76%	-0.0107	-9.53%
Some Post	0.0016	1.57%	0.0016	1.38%	0.0018	1.63%
Post	0.0150	14.52%	0.0160	14.12%	0.0176	15.73%
Degree	0.0283	27.37%	0.0196	17.28%	0.0251	22.43%
Province						
Newfoundland	-0.0002	-0.16%	-0.0001	-0.10%	-0.0002	-0.15%
Prince Ed. Island	0.0000	0.01%	0.0000	0.00%	0.0000	0.01%
Nova Scotia	-0.0001	-0.11%	-0.0001	-0.09%	-0.0001	-0.11%
New Brunswick	-0.0001	-0.06%	-0.0001	-0.05%	-0.0001	-0.06%
Quebec	-0.0013	-1.23%	-0.0010	-0.85%	-0.0017	-1.49%
Ontario	0.0003	0.30%	0.0004	0.31%	0.0004	0.40%
Manitoba	-0.0005	-0.46%	-0.0004	-0.34%	-0.0005	-0.43%
Saskatchewan	-0.0004	-0.41%	-0.0004	-0.33%	-0.0005	-0.41%
Alberta	0.0005	0.48%	0.0005	0.44%	0.0005	0.45%
Time Trend	0.0148	14.31%	0.0662	58.37%	0.0414	36.99%
SLID	0.0211	20.43%	0.0117	10.33%	0.0182	16.23%

Table 7
Average Real Income for Low and High Income Families

Year	Upper 10% Income Families	Lower 10% Income Families	Ratio (Upper 10% / Lower 10%)
1977	84640.612	8090.5308	10.4
2003	120762.52	12573.659	9.6

Table 8
Cross-Sectional Analysis of Role of Income

	OLS		Poisson		Probit	
Year	Higher Income Group	Lower Income Group	Higher Income Group	Lower Income Group	Higher Income Group	Lower Income Group
1977	0.21134887	0.11801878	0.22948014	0.1379403	0.24147547	0.12679035
2003	0.24948131	0.12397095	0.27028412	0.14303138	0.28990605	0.13334445

Appendix Table A1
Nominal Tuition Fees for Full-time Students at Canadian Universities (BA Programmes)

Year	Memorial (NF)	U of PEI (PEI)	Dalhousie (NS)	U of NB (NB)	U of Quebec (QC)	U of T (ON)	U of Man. (MB)	U of Sask (SK)	U of Alberta (AB)	UBC (BC)
1977	500	640	720	740	500	575	450	520	500	428
1979	630	750	765	740	500	700	540	625	550	536
1981	630	865	915	850	500	835	615	690	605	590
1982	690	950	1025	950	500	915	670	740	606	660
1984	892	1200	1320	1250	500	1105	705	870	770	901
1985	936	1270	1410	1325	500	1160	776	940	828	1271
1986	1006	1350	1466	1400	500	1215	822	1015	852	1403
1987	1056	1480	1525	1575	500	1265	888	1075	878	1452
1988	1108	1560	1585	1675	500	1350	975	1185	966	1518
1989	1164	1640	1650	1775	500	1410	1210	1280	995	1601
1990	1280	1720	1710	1875	500	1520	1332	1344	1069	1766
1991	1344	1840	1770	1975	850	1640	1467	1478	1229	1848
1992	1544	2120	2195	2100	1320	1770	1756	1830	1413	2046
1993	1700	2280	2415	2350	1416	1894	2055	2484	1610	2046
1994	2000	2490	2655	2470	1528	2025	2156	2280	2038	2040
1995	2150	2620	2920	2470	1665	2228	2264	2430	2279	2197
1996	2312	2820	3095	2610	1665	2451	2361	2550	2529	2295
1997	2670	2920	3395	2840	1665	2941	2499	2670	2789	2295
1998	3150	3150	3655	3140	2265	3196	2574	2832	3056	2333
1999	3150	3310	4368	3290	2415	3516	2687	3405	3328	2295
2000	3300	3480	4050	3430	2553	3835	3005	3470	3551	2295
2001	3300	3480	4685	3635	2688	3951	2807	3768	3770	2295
2002	2970	3690	4815	3945	2763	4029	2818	3793	3890	2181
2003	2670	3870	5265	4265	2841	4107	2700	4128	4032	2661

Source: Statistics Canada

Appendix Table A2
Real Tuition Fees for Full-time Students at Canadian Universities (BA Programmes; 1992 Dollars)

Year	Memorial (NF)	U of PEI (PEI)	Dalhousie (NS)	U of NB (NB)	U of Quebec (QC)	U of T (ON)	U of Man. (MB)	U of Sask (SK)	U of Alberta (AB)	UBC (BC)
1977	1208	1517	1739	1800	1276	1474	1082	1229	1193	1024
1979	1283	1515	1574	1526	1078	1515	1095	1260	1107	1103
1981	1013	1393	1520	1410	868	1457	1022	1127	982	972
1982	1009	1397	1555	1439	779	1434	1023	1109	889	984
1984	1169	1611	1801	1687	708	1561	974	1184	1039	1223
1985	1177	1645	1841	1716	678	1576	1029	1235	1084	1672
1986	1228	1713	1851	1752	647	1576	1043	1282	1078	1787
1987	1254	1814	1860	1911	619	1554	1082	1294	1067	2017
1988	1285	1844	1863	1966	596	1579	1140	1364	1142	1812
1989	1303	1868	1852	1990	571	1551	1350	1417	1127	1830
1990	1373	1863	1827	2012	547	1597	1422	1425	1149	1913
1991	1358	1855	1786	1989	866	1655	1489	1490	1252	1903
1992	1544	2120	2195	2100	1320	1770	1756	1830	1413	2046
1993	1672	2237	2391	2318	1396	1864	2001	2416	1597	1975
1994	1942	2448	2600	2426	1530	1991	2071	2182	1990	1930
1995	2059	2536	2824	2389	1637	2138	2116	2280	2181	2027
1996	2181	2683	2945	2488	1610	2312	2162	2350	2368	2102
1997	2470	2744	3170	2662	1589	2726	2241	2434	2566	2090
1998	2903	2966	3387	2929	2127	2932	2278	2544	2788	2113
1999	2858	3082	3978	3018	2232	3162	2330	3003	2966	2060
2000	2915	3124	3578	3049	2306	3349	2544	2984	3064	2015
2001	2882	3047	4056	3175	2370	3345	2310	3148	3184	1978
2002	2532	3151	4046	3338	2388	3341	2285	3081	3191	1839
2003	2214	3201	4284	3490	2399	3307	2151	3281	3140	2199

Source: Statistics Canada

Appendix Table A3
Propensity to Attend University in Canada Without Gender Dummy Variables (1977-2003)

	OLS		Poisson Count Model			Probit Model		
Variable	Coefficient	Coeff./ St. Error	Coefficient	Coeff./ St. Error	Marginal Effect	Coefficient	Coeff./ St. Error	Marginal Effect
Tuition	-8.23E-07	-0.17	-0.0000466	-1.66	-3.63E-06	-0.0000201	-0.93	-2.50E-06
University Premium	0.0445843	11.05	0.2652048	12.17	0.020671	0.1989804	11.51	0.0247319
Income	1.36E-06	12.4	8.51E-06	12.85	6.64E-07	7.27E-06	12.6	9.03E-07
Income2	-1.56E-12	-2.65	-2.10E-11	-6.64	-1.64E-12	-1.75E-11	-4.61	-2.17E-12
Income3	4.97E-19	1.4	1.03E-17	5.67	8.01E-19	1.30E-17	2.9	1.61E-18
Children	0.0806389	10.35	1.46608	25.95	0.1142716	0.9411632	23.1	0.1169799
Children2	-0.0144403	-7.82	-0.1917157	-13.35	-0.014943	-0.1303567	-12.57	-0.0162024
Urban1	0.0265949	6.54	0.1989426	7.08	0.0171563	0.1421505	6.99	0.0196629
Urban2	0.0608475	22.6	0.3812947	20.32	0.0361798	0.2970517	22.57	0.0459649
Head Education								
Grad	0.0371344	10.92	0.3853642	12.99	0.0366452	0.23364	12.48	0.0345529
Some Postsecondary	0.0525659	8.68	0.4832542	12.16	0.0484296	0.3150122	11.29	0.0493644
Postsecondary	0.0535295	13.37	0.5011576	16.54	0.0507125	0.3139674	15.8	0.0491646
Degree	0.1969919	33.07	1.035869	33.61	0.1416668	0.7811513	34.73	0.1644627
Province								
Newfoundland	0.0523215	6.89	0.2598964	5.58	0.0231333	0.2285038	6.59	0.0336683
Prince Edward Island	0.10968	13.66	0.668345	14.58	0.0741248	0.514293	14.62	0.0921962
Nova Scotia	0.05503	7.87	0.3553695	7.89	0.0332592	0.2561212	7.71	0.0384945
New Brunswick	0.0809919	12.5	0.5080688	12.57	0.0516048	0.3791272	12.57	0.0621133
Quebec	0.0224644	3.69	0.1203943	3.17	0.0099722	0.1249974	4.47	0.0170716
Ontario	0.015693	2.95	0.1265724	3.59	0.0105171	0.0948875	3.7	0.0126715
Manitoba	0.0631287	9.51	0.3618773	9.32	0.0339852	0.2713161	9.23	0.0412232
Saskatchewan	0.0608888	9.91	0.3779984	9.8	0.0358042	0.2746115	9.62	0.0418219
Alberta	0.0142029	2.4	0.1020028	2.61	0.0083701	0.061293	2.16	0.0079811
Time Trend	0.0005682	1.5	0.0123697	4.94	0.0009641	0.0054128	2.95	0.0006728
SLID	0.0211002	3.42	0.0694641	2.11	0.0056068	0.0673063	2.58	0.008804
Constant	-0.1961047	-17.12	-5.111811	-67.96		-3.265547	-56.81	
R Squared	0.0783							
Log Likelihood					-18980249			-52807.683

Table A4
Trend of Children Attending University in Canada (SCF Only: 1977-1997)

	OLS				Poisson Count Model						Probit Model					
	With Gender		Without Gender		With Gender			Without Gender			With Gender			Without Gender		
	Coeff.	Coeff./ St.Error	Coeff.	Coeff./ St.Error	Coeff.	Coeff./ St.Error	Marginal Effect	Coeff.	Coeff./ St.Error	Marginal Effect	Coeff.	Coeff./ St. Error	Marginal Effect	Coeff.	Coeff./ St.Error	Marginal Effect
Atlantic																
Tuition	-0.0000159	-1.3	-1E-05	-1.01	-0.0003869	-4.79	-0.000033	-0.000364	-4.52	-0.0000278	-0.0001716	-2.83	-0.0000277	-0.0001523	-2.53	-0.0000214
Premium	0.0127584	2.26	0.029	5.66	0.0828558	3.03	0.0070596	0.172901	6.95	0.0131819	0.0653385	2.79	0.0105421	0.1377435	6.48	0.0193437
Male	-0.0301183	-3.94			-0.2247452	-4.79	-0.0171498				-0.1854812	-4.71	-0.0263426			
Female	0.0142866	1.67			0.0775526	1.62	0.0068708				0.0320008	0.77	0.0052751			
Quebec																
Tuition	9.30E-06	0.97	3.80E-06	0.4	0.0000467	0.76	4.09E-06	1.11E-05	0.18	9.62E-07	0.0000167	0.36	2.58E-06	-9.90E-06	-0.21	-1.46E-06
Premium	-0.0128564	-0.93	0.0151	1.18	-0.1276135	-1.39	-0.0111625	0.074324	0.87	0.0064281	-0.0533981	-0.8	-0.0082751	0.0880192	1.42	0.0129789
Male	-0.0187781	-1.86			-0.1703363	-2.64	-0.0136997				-0.1454364	-2.85	-0.0203592			
Female	0.0277005	2.46			0.2014117	3.05	0.0195173				0.1007426	1.84	0.0167159			
Ontario																
Tuition	-0.0000465	-3.16	-5E-05	-3.59	-0.0003839	-4.42	-0.0000358	-0.000404	-4.59	-0.0000377	-0.0002491	-3.82	-0.00004	-0.0002749	-4.22	-0.0000423
Premium	0.009359	0.68	0.0461	4.11	0.0485379	0.6	0.0045245	0.29417	4.51	0.0274698	0.0490456	0.8	0.0078814	0.2193988	4.51	0.0337923
Male	-0.0159796	-1.72			-0.1157637	-2.19	-0.0101899				-0.1130951	-2.69	-0.0168213			
Female	0.0197565	1.95			0.1565668	2.81	0.0157992				0.0612646	1.35	0.0102565			
Prairie																
Tuition	-0.0000521	-3.45	-5E-05	-3.51	-0.0005583	-5.61	-0.000047	-0.000562	-5.67	-0.0000502	-0.000284	-3.96	-0.0000401	-0.0002886	-4.04	-0.0000437
Premium	0.0451854	3.88	0.0525	5.04	0.2596274	4.85	0.0218699	0.298236	6.32	0.0266678	0.1994926	4.51	0.0281486	0.2384955	6.06	0.0361268
Male	0.0066976	0.54			0.0381595	0.58	0.0032765				0.028976	0.52	0.0041746			
Female	0.0195431	1.46			0.1158028	1.7	0.010342				0.1031729	1.74	0.0156674			
West																
Tuition	-9.87E-06	-0.77	-6.9E-06	-0.54	-0.0001424	-1.56	-8.84E-06	-0.000121	-1.32	-7.24E-06	-0.0000997	-1.55	-0.0000108	-0.000086	-1.34	-8.92E-06
Premium	0.0226196	1.88	0.0343	3.1	0.1185851	1.44	0.0073566	0.210662	2.79	0.0126502	0.0948973	1.59	0.0102934	0.1542569	2.85	0.016
Male	-0.0104858	-0.98			-0.1042599	-1.57	-0.0061421				-0.0717418	-1.33	-0.007342			
Female	0.0082754	0.71			0.0657545	0.92	0.0042163				0.0278631	0.49	0.0030909			