A LOOK IN TO THE RELATIONSHIP BETWEEN AVERAGE PROVINCIAL UNIVERSITY ATTRIBUTES AND THE EARNINGS OF YOUNG GADUATES: PANEL DATA EVIDENCE FROM THREE CANADIAN CYCLES

by

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Abstract

This essay examines the relationship between university quality and future bachelor degree graduate earnings. It uses three main quality measures including student-professor ratio, median professor salaries (full, associate, and assistant), and tuition fees. These measures are provincial averages taken over relevant years. For this study the National Graduate Survey data from Statistics Canada was used and merged with other Statistics Canada data on universities. Some of the results found differed slightly from other studies in this area and warrant further study.

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1. Introduction

The purpose of this study is to examine the influence of post-secondary education on the earnings of young graduates using data from the National Graduate Survey (NGS). The university quality measurements used are student-professor ratio, tuition fees, and professor salary. Based on the data available through the NGS the three quality measures are provincial averages taken over relevant years. This paper will follow a similar methodology and process conducted by Betts at al. (2013) using more recent data cycles, with the main difference being that Betts et al. used quality measures at the university level, not at the provincial level.

How universities affect a recent graduate's success in their early, professional careers is a concern for not only the graduates but public organizations as well. This paper seeks to add to the answers of pressing questions like; will higher costs of tuition allow for higher earnings down the road? Does the student to teacher ratio still have a relevant influence in a post-secondary environment? Can we attribute higher professor salaries to higher recent graduate earnings in the labour market?

For the examination of graduate earnings we will be using NGS data from 1995, 2000, and 2005 (which have been produced by Statistics Canada). These are 5 year follow up surveys of young professionals who graduated in 1990, 1995, and 2000. This data gives information on how the attainment of a bachelor's degree has affected earnings through information pertaining to personal background, field of study, and prior education level. Through a merging of this data and publicly available university data from Statistics Canada, at the provincial level, a dataset is created which allows for an analysis to be conducted on the effects of average provincial university quality on future graduate earnings.

This paper is organized as follows. A review of the literature and a look into the differences between Canada and other countries in this research area. This is followed by a discussion of the methodology used for the analysis. After this the data and variables used will be reviewed. There is a results section in which the findings are considered and a brief discussion on limitations follows. The last section is a conclusion of the paper.

2. Literature Review

Due to availability of data there has been many papers published in the United States. Recently more studies have been published in countries like Finland, China, and the U.K. but there has not been many studies completed using Canadian data. This section reviews some of the key literature in this area followed by a review of some of the recent studies conducted.

An excellent discussion of the American literature compared to the Canadian literature is given in Betts et al. (2013), the main paper that this study draws upon. Betts et al. (2013) use a university fixed effects approach in comparing the effects of university qualities on future earnings of bachelor degree graduates. The paper merges three NGS datasets (1982, 1986, and 1990) with Statistics Canada data, on 43 Canadian universities, to create the sample for the fixed effects model. This study finds that there is evidence that changes in university resources, which affect university quality, do have a significant impact on future graduate earnings but that these effects are smaller than expected. In the results section of this paper we determine whether our findings support the conclusions of Betts et al. (2013).

A very influential paper on the returns to college education was written by James et al. (1989) and sets the ground work for studies analyzing the effects of post-secondary institution quality and human capital returns. This paper implements a linear regression model with

weighted least squares. The data that this paper uses is gathered from the National Longitudinal Study of the High School Class of 1972 which is merged with data from the Higher education General Information Survey and the Post-Secondary Education Transcript Study. The study concludes that the choice of college does not appear to be as important as the choice of field of study and what is accomplished while attending the institution. It is also discussed that college expenditure on students did not have a significant social impact.

Ferrer & Riddell (2002) conducted a study on the impact of education (both secondary and post-secondary) in the Canadian labour market. The study constructs a linear human capital earnings regression model with dummy variables for credentials (achieved education). The data used in this study was gathered from the 1996 Canadian Census. Ferrer & Riddell conclude that including both years of education and degree earned are important in determining effects on graduate earnings. Similar to James et al. (1989), it is found that there are significant effects of degree field choice on earnings.

A study on U.K. university qualities and their effects on the labour market was directed by McGuinness (2003). The paper implements a basic labour market outcome OLS regression model in which selectivity bias is corrected using a level score variable. After analysis of the basic model, the study constructs a probit model to account for faculty interactions. McGuinness (2003) uses a 1999 follow-up survey for a cohort of Northern Irish students who graduated 1994 and 1996. The results found in this study support some of the results of James et al. (1989) and Ferrer & Riddell (2002) regarding the importance of degree field choice of particular institution choice.

An American data study was recently conducted by Tamborini et al. (2015) which examined lifetime earnings based on level of education. The paper focuses on estimating 50 year lifetime earnings based on data from the 1980s until 2008. Tamborini et al. (2015) use a multivariate regression technique to estimate the effects of post-secondary education on lifetime earnings. The data used is from the U.S. Survey of Income and Program Participation which is then matched with respondent's earnings based on tax information from the Social Security Administration. The study concludes that higher education does have a positive real effect on lifetime earnings and they also find that men tend to have higher returns, on average, than women. While Tambourini et al. (2015) look only at level education and not specific educational institution attended we can still compare their results at the bachelor level to results we find on the effect of prior education level. We expect to find similar results in our study, that there is an increasing positive effect as education level increases.

A study done by Tuomo Suhonen in 2013 examined the relationship between early career earnings of young graduates and quality of post-secondary institution using administrative data from Finland. The method and data used for this study follows similarly to the data and method of Suhonen. The data used in this study is gathered from the KOTA Ministry of Education Finish database which is merged with a Statistics Finland Administrative dataset. He uses three measures of university quality; student teacher ratio, the number of publications per researcher, and the number of applicants per admitted student, which are similar measures to the ones used by Betts et al. (2013). Suhonen also allows for differences in student programs or fields of study. To analyze the data he implements a log linear regression model. The results that he finds suggest a weak overall effect between institute quality and early career earnings but that there

may be larger effects between specific measures and programs. We will compare and discuss his results in more detail in the results section of this paper.

The effect of education on the earning distribution in urban China is an area researched by Wang (2013). The method of this study is similar to the one discussed in Tambornini et al. (2015) with the main difference being Wang focuses on years of education instead of level attained. Wang (2013) uses data obtained from the China Household Income Project. The paper uses instrumental variable quantile regression to account for the endogeneity problem when considering a distributional framework. The results found, although not pertinent to this study, are interesting and somewhat contradictory to results concluded in many developed country reports. It is concluded that, contrary to previous studies, women have a higher return than men for more years of education attained. This opens up a new area of consideration in the Canadian context, which is the effect of postsecondary quality on earnings of graduates of a low income background versus a high income background. With the availability of more data this would be an interesting area for future study.

Broecke (2012) reviews the effect of university selectivity based on UK data. He hypothesizes that there is a link between expected earnings and university choice. He uses techniques implemented by Behrman, Rosenzweig, and Taubman (1996) as well as instrumental variables to account for the non-random selection process used by universities. This study uses data from the second Longitudinal Destinations of Leavers from Higher Education survey merged with university data from the Higher Education Statistics Agency. Broecke does find a positive relationship between earnings and university selection in the UK.

3. Methodology

Similar to the paper by Betts et al. (2013) we aim to model the effects of average provincial university quality on recent graduate earnings. Unfortunately the data for university attended was not available for this study and so we will only be able to examine province level effects instead of direct university fixed effects as done in Betts et al. (2013). In doing so we set the ground work for later studies that are able to attain the information on attended university of the respondents.

We are able to test whether there appears to be significant differences in university quality by province based on future graduate earnings because of certain attributes of the NGS datasets. These attributes include a large amount of graduates in each province for each cohort over three cohorts. This is done by testing for provincial fixed effects. Another benefit to using the NGS data is that it provides the ability to more easily identify the marginal effect of average provincial quality measures on the 5 year future earnings. By using 3 cohorts we are better able to control for the unobserved, or imperfectly observed, provincial characteristics that are fixed over the time periods of the study.

We employ a recent earnings function for graduates similar to Betts et al.:

$$\ln(E_{ipt}) = \sum_{j=1}^{P} \delta_j + \beta X_{ipt} + \gamma U_{pt} + \varepsilon_{ipt} \qquad (1)$$

where *i* indexes the respondents (graduates), *p* indexes the provinces up to *P*, and the final subscript *t* indexes the time period or cohort. The left hand side of the equation, $\ln(E_{ipt})$, represents the respondents log earnings. The δ_j terms represent a set of province fixed effects, the *X* vector corresponds to the set of personal and background traits, and the *U* vector corresponds to the set of provincial university attributes. The main coefficients of interest are the γ's, representing the provincial university trait effects, however we also consider the β

coefficients as well, which give the effects of personal background traits. We assume that $E(e_{ipt}|p,t) = 0$. Due to serial correlation the standard errors of our model may be underestimated and so we alleviate this problem by using robust standard errors, clustered by province.

There are 5 measures of provincial university traits included in our dataset over three periods and are established from data gathered between 1986 and 2000. Each period relates to one of the three NGS cohorts. These variables are discussed in more detail in the data section. Based on this data we are able to estimate the province fixed effects while keeping γ identified in model (1). Unfortunately, our model cannot fully control for unobserved characteristics of each province that change over time but we believe that this is better than an OLS model approach. Our study conducts and discusses an OLS model in the second part of the results section.

The main weakness of our data and model is that we are unable to view the specific university attended and therefore are unable to construct a model of university fixed effects as in Betts et al. (2013). This gives results that may not seem to be interesting as there are certain aspects that we cannot completely control for such as being able to control for strong or weak labour markets in the area surrounding each university. This study provides a first overview for the cohorts reviewed and the results will allow for future studies, which can access specific university information, a better idea of which measures should be focused on more heavily.

We hypothesize that higher quality provinces will offer lower student-professor ratios and pay higher professor salaries. We also hypothesize that a higher tuition fee is an indicator that the university can offer more to its students and therefore give a higher quality education. We expect to see a positive relation between recent earnings and median salaries and tuition fees.

The way we measured student to professor ratios we would expect to see a negative relation with earnings, i.e. the lower the ratio the more time a professor can spend on each student.

4. Data

The primary source of data for this paper is the National Graduate Survey (NGS) produced by Statistics Canada. This is a survey that is conducted every 4 or 5 years and the samples consist of recent graduates of Canadian post-secondary institutions. The datasets used in this study are follow-up surveys from 1995, 2000, and 2005 which gathered information on respondents who graduated in 1990, 1995, and 2000, respectively. This study uses information on family background and educational background. The variables used in the model include respondent age, dummy variables for prior post-secondary education (college diploma, some university education, bachelor's degree, and master's degree), marital status, father's highest achieved education, mother's highest achieved education, number of dependent children, prior full time work experience, aggregate degree field, and earnings 5 years after graduating.

The respondents are divided into male and female sections to view the role that gender plays in these reported earnings. An alternative approach is to include a gender dummy variable, however, based on the results of Betts et al. (2013) there is evidence that certain quality measures will affect the earnings of men and women differently. For example, it is possible that lower student-professor ratios will have a significant impact on men but not on women, or higher tuition fees will significantly affect women but not men. These results would not be picked up in a gender dummy variable approach. There are, however, benefits to each model type. The original model, with datasets divided into male and female, gives benefits to potential students trying to decide on which university will maximize their potential future earnings (in our study it

is the optimal province). The gender dummy model provides more benefit to the universities, who accept students of both gender and therefore are not conditioning their choice of tuition fee or enrolment on accepting only men or only women. Having an increased sample size is the other benefit to a gender dummy model. This alternative model is constructed and reviewed briefly in the third part of the results section.

Table 1 gives the mean and standard deviation for the variables used in the regression models for the combined cohorts. Statistics on individual cohorts is given in Appendix 1. The quality measures used to indicate university expenditure, at the provincial level, show large standard deviations, these being the professor salaries and tuition fees. The variable for marital status shows the average respondent to be married but there is a large standard error showing that there is a substantial amount of variation. Due to the variation in questions asked and information gathered between surveys we were not able to gather complete information on the education received prior to the completion of the bachelor's degree. Therefore we include dummy variables as indicators for any prior post-secondary education. Our values show some similarities to what is found by Betts et al. (2013). We find that close to 15% of men had completed a bachelor's degree before completing the degree in question but only about 10% of women had a prior bachelor's degree. An interesting variable to consider is the prior university indicator; the surveys were unclear as to what this variable entails. Does it consider part of a degree taken at a different university, or if a student had switched degree fields, or if a student had taken time off and come back to finish their degree?

Table 1: Descriptive Statistics for Regression Samples

Variable	*Women (N=7300)*		*Men (N=5824)*	
	Mean	*Std. Dev.*	*Mean*	*Std. Dev.*
University				
Student to Professor Ratio	13.55	2.23	13.39	2.22
Tuition Fees	2153.92	907.34	2077.25	898.65
Full Professor Salary	82862.31	9468.10	81981.31	9689.88
Associate Professor Salary	66734.50	7675.41	65963.69	7869.54
Assistant Professor Salary	50541.22	5608.24	49989.65	5769.29
Graduate Background				
Age	26.36	5.21	26.55	4.72
Work Experience	1.54	0.78	1.42	0.69
Father's Education Level	7.17	13.72	7.12	11.42
Mother's Education Level	5.68	9.56	5.98	9.41
Marital Status	3.03	7.01	2.79	4.18
Dependent Children	0.16	0.57	0.14	0.50
College Diploma	0.22	0.41	0.23	0.42
Some University	0.04	0.19	0.03	0.17
Bachelor's Degree	0.13	0.34	0.09	0.29
Master's Degree	0.00	0.06	0.00	0.06
Field of Study				
Education	0.21	0.41	0.11	0.32
Arts	0.04	0.19	0.03	0.17
Humanities	0.14	0.34	0.10	0.30
Social Sciences	0.26	0.44	0.21	0.41
Commerce	0.13	0.33	0.19	0.39
Agriculture	0.04	0.20	0.05	0.21
Engineering	0.02	0.14	0.16	0.37
Engineering Technologies	0.01	0.12	0.06	0.24
Health Related	0.09	0.28	0.02	0.15
Mathematics	0.02	0.15	0.07	0.26
No Specialization	0.02	0.15	0.02	0.14

Note: Std. Dev.=standard deviation
Source: Author's calculations

Our table shows that only an average of 5% of graduates had some previous university education which may imply that it shows students who had switched universities as well as degrees.

For information on average university quality, at the provincial level, the public databases of Statistics Canada are used. The three main databases are "University and College Academic

Staff System.", "Tuition and Living Accommodation Costs.", and "Postsecondary Student Information System.". From this data variables for student-professor ratios, median salaries of professors, and tuition fees for full-time students are produced. For each NGS cohort we found data for the 4 years prior to graduation, so data from 1986-87 to 1989-90 for the 1990 graduation cohort and so on. We then took the average of these years to get an overall picture for the time that the respondent was enrolled in a bachelor's program. The table below gives a summary of the average measures used in each cohort.

Table 2: Average Canadian University Quality Measures by Cohort

Provincial Quality Measure	1990 Cohort	1995 Cohort	2000 Cohort
Student-Professor Ratio	11.54032	12.41676	13.85062
Tuition Fees	1317.375	2123.775	3078.325
Median Full Professor Salary	66702.5	81575.625	86338.125
Median Associate Professor Salary	52796.25	65150.625	67511.875
Median Assistant Professor Salary	40576.875	49438.75	52521.875

Note: Tuition fees and salaries are measured in Canadian dollars indexed to 2002 prices. These values are averages for all of Canada.
Source: Author's calculations

Table 2 shows the average values for the provincial university quality measures used in the regression models. Information at the provincial level for each cohort is given in Appendix 1. The most noticeable change is shown in the professor salary measures between the 1990 and 1995 cohorts. Over these 5 years the average salaries have increased by 10,000 to 15,000 dollars. What we would expect to see is tuition fees following a similar pattern to account for some of this rise in salary but the change is not as large, an increase of approximately 8,000 dollars. Between the 1995 and 2000 cohort we see this tuition values increase again by close to 9,000

dollars. This could mean that the cost of rise in salary between 1990 and 1995 had to be covered by a longer period of increased tuition fees as fees continued to rise between 1995 and 2000 but professor salaries did not see as great an increase.

For the student-professor ratios we include multiple different ratios with respect to professor rank (full, associate, and assistant). To measure this we took the amount of full-time, undergraduate students divided by the number of full-time professors, by rank, to find the amount of students per one professor. We decided to incorporate the professor salary and tuition fees to get an idea of average provincial university expenditure and its relation with recent graduate earnings. In total we include five quality measures; student-professor ratio, tuition, full professor salary, associate professor salary, and assistant professor salary.

The regression sample consists of respondents who graduated with a bachelor's degree in the years of 1990, 1995, and 2000. The way we censored our data follows similarly to what was done in Betts et al. (2013). We filtered out those who had missing data for age, work experience, and earnings. We assume that degree fields of medicine and law more closely follow post-graduate education and so we drop graduates of these fields from the study. Each sample is separated into male and female respondents in order to determine how each quality measure affects gender as discussed in the methodology section. To account for outliers we set a maximum for earnings at $150,000, as in Betts et al. (2013). Note that all the financial variables used and reported in this study are expressed in terms of 2002 prices based on the all-items consumer price index from CANSIM. The NGS datasets are then merged with the public university data. The respondents of the survey are matched to the appropriate quality measure variables by the province in which they attended university. There are two sub samples of this sample, one of women and one of men as stated above.

5. Results

This study starts with a province fixed effects model followed by an analysis of a standard OLS model. For the final part of the results section a model with a gender dummy variable is included and discussed. For the analysis of the fixed effects and OLS models we review effects on men and then review the effects for women. Weighted regression is conducted for both the fixed effects models as well as the OLS models.

5.1. Fixed Effects Models

Table 3 shows the estimates of the fixed effects model for men. Column (1) gives the model with all five quality measures and columns (2) to (4) show the basic model with only one quality measure at a time. Note that our study keeps the three professor salary variables together in the analysis. The other variables included in the model consist of prior educational experience and personal traits such as mother and father's highest education achieved, marital status, and prior full time work experience.

The results of table 3 suggest that the future earnings of men are positively correlated with student-professor ratios and tuition fees. Column (2) shows the predicted effect of student-professor ratio to be 0.0621, meaning that an increase in of 1 student is expected to increase a graduates wage by close to 6%. This suggests that increasing class capacity or overall enrolment will have a small, positive impact on male earnings 5 years after graduating. Based on previous literature and the results of Betts et al. (2013) we expected that this quality measure would have a negative link to future earnings. This study does find is that when all the quality measures are estimated together there is a negative relationship; however the result is no longer significant. In column (3) the significant estimate of tuition fee effect is given.

Table 3: Estimates of Log Earning for Fixed Effects Models for Men

VARIABLES	(1)	(2)	(3)	(4)
Student-professor ratio	-0.0316	0.0621***		
	(0.0254)	(0.00753)		
Tuition	1.54e-05		9.82e-05***	
	(5.24e-05)		(2.42e-05)	
Full-professor salary	1.76e-05			1.42e-05
	(1.48e-05)			(1.64e-05)
Associate professor salary	-1.94e-05			-1.36e-05
	(2.20e-05)			(1.15e-05)
Assistant professor salary	1.85e-05			1.20e-05
	(5.54e-05)			(3.59e-05)
Age	0.0472***	0.0363***	0.0354***	0.0465***
	(0.00389)	(0.00477)	(0.00499)	(0.00413)
Age squared	-0.000376***	-0.000281***	-0.000276***	-0.000368***
	(2.98e-05)	(5.26e-05)	(5.48e-05)	(3.30e-05)
Degree field	0.00112**	0.00127*	0.00128*	0.00111*
	(0.000481)	(0.000618)	(0.000630)	(0.000490)
Father education	6.41e-05	0.000202	0.000322	7.70e-05
	(0.000677)	(0.000641)	(0.000658)	(0.000680)
Mother education	-0.00117	-0.00122	-0.00110	-0.00113
	(0.00136)	(0.00152)	(0.00142)	(0.00134)
Marital status	-0.00693	-0.00672*	-0.00699*	-0.00695
	(0.00386)	(0.00341)	(0.00359)	(0.00387)
# of dependent children	0.0850***	0.0893***	0.0895***	0.0849***
	(0.0155)	(0.0179)	(0.0183)	(0.0154)
Prior college	0.0414*	0.0491**	0.0456**	0.0434*
	(0.0210)	(0.0173)	(0.0167)	(0.0217)
Some university	0.0746	0.0775*	0.0789*	0.0744
	(0.0431)	(0.0403)	(0.0423)	(0.0422)
Prior bachelor's	0.0176	0.0402	0.0403	0.0198
	(0.0406)	(0.0514)	(0.0513)	(0.0409)
Prior master's	-0.0307	-0.00697	-0.0101	-0.0275
	(0.142)	(0.136)	(0.136)	(0.142)
Prior work experience	-0.0208	-0.0179*	-0.0155	-0.0202
	(0.0133)	(0.00922)	(0.00946)	(0.0138)
Constant	8.593***	8.661***	9.304***	8.429***
	(0.289)	(0.155)	(0.110)	(0.194)
Observations	5,824	5,824	5,824	5,824
R-squared	0.053	0.049	0.050	0.052

Note: Professor salaries are median salaries. Robust standard errors in are parentheses and *** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations

The results of the model here anticipate that an increase of 100 dollars in average tuition fees will increase men's future earnings by almost 1%. This is a small impact on earnings but does support our hypothesis of a positive relation between tuition fees and graduate earnings. We theorize that higher tuition fees will allow universities a better ability to offer their students higher quality education. These results support the findings of Betts et al. (2013).

Column (1) of table 3 gives a model of all provincial university quality measures at once. There are reductions in magnitude of all of the measures and there is no longer any statistical significance. Due to multicollinearity we should be careful about over interpreting the models in columns (2) to (4), which show only one measure at a time. It should also be noted that the model in column (1) reports the largest R-squared value which suggests that to capture as much of the provincial university to earnings effect a model of all measures should be used.

The two other significant estimates of this model are the number of dependent children as well as the dummy variable for prior college education. We contemplate that the relationship between children and earnings is that having higher earnings give certain graduates the ability to have dependent children. Although only prior college education shows a significant effect on earnings there are studies that provide evidence that combining post-secondary educations together to provide positive impacts on earnings. For a detailed discussion and results see Ferrer & Riddell (2002). Note that this college effect of 0.0414 is weakly significant, only at the 10% level, and has a relatively large standard deviation of 0.021.

Table 4 of this study provides the fixed effects estimates for women. The sign of the coefficients follow the results of the men's results in table 3 however there are more statistically significant effects for women. In column (4) of table 4 there are significant effects for both

Table 4: Estimates of Log Earning for Fixed Effects Models for Women

VARIABLES	(1)	(2)	(3)	(4)
Student-professor ratio	-0.0397	0.0760***		
	(0.0313)	(0.00912)		
Tuition	5.73e-05		0.000132***	
	(6.23e-05)		(1.31e-05)	
Full-professor salary	1.76e-05			1.07e-05
	(1.31e-05)			(1.54e-05)
Associate professor salary	-6.55e-05***			-6.69e-05***
	(1.79e-05)			(8.06e-06)
Assistant professor salary	7.25e-05			8.42e-05***
	(4.76e-05)			(1.89e-05)
Age	0.0411***	0.0495***	0.0488***	0.0403***
	(0.00640)	(0.00800)	(0.00678)	(0.00649)
Age squared	-0.000326***	-0.000423***	-0.000411***	-0.000317***
	(6.66e-05)	(8.31e-05)	(7.30e-05)	(6.82e-05)
Degree field	0.00129***	0.00141***	0.00131***	0.00129***
	(0.000298)	(0.000313)	(0.000247)	(0.000305)
Father education	-0.000530	-0.000724	-0.000689	-0.000507
	(0.000915)	(0.000890)	(0.000913)	(0.000899)
Mother education	0.000429	-0.000312	7.04e-05	0.000459
	(0.000524)	(0.000707)	(0.000656)	(0.000490)
Marital status	-0.00260***	-0.00224***	-0.00243***	-0.00260***
	(0.000339)	(0.000418)	(0.000368)	(0.000327)
# of dependent children	0.0496***	0.0434***	0.0449***	0.0495***
	(0.00897)	(0.00972)	(0.00957)	(0.00893)
Prior college	0.0700***	0.0684***	0.0705***	0.0697***
	(0.0118)	(0.00954)	(0.00864)	(0.0106)
Some university	0.130***	0.127***	0.126***	0.130***
	(0.0248)	(0.0242)	(0.0241)	(0.0249)
Prior bachelor's	0.111***	0.0957**	0.0987***	0.112***
	(0.0242)	(0.0304)	(0.0277)	(0.0244)
Prior master's	0.185***	0.205***	0.186***	0.189***
	(0.0410)	(0.0425)	(0.0370)	(0.0405)
Prior work experience	-0.0420***	-0.0543***	-0.0487***	-0.0420***
	(0.00613)	(0.00692)	(0.00724)	(0.00621)
Constant	8.946***	8.120***	8.867***	8.617***
	(0.289)	(0.223)	(0.131)	(0.175)
Observations	7,300	7,300	7,300	7,300
R-squared	0.098	0.089	0.094	0.097

Note: Professor salaries are median salaries. Robust standard errors in are parentheses and *** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations

associate and assistant professor salaries. What is interesting is that these effects report different signs; there is a negative link between associate professor salary and graduate earnings and a positive link with assistant professor salary. We had predicted that the effects would be positive for all levels of professor salaries. We assume that full professors give the highest quality of education, followed by associate professors, and finally assistant professors. A possible explanation for this result is that increasing the salary of an associate professor will take away or lessen the amount available to increase a full professor's salary and therefore have a negative effect on graduate earnings. The above explanation also assumes that higher salaries provide incentive to give higher quality education and that universities have a fixed budget for salary increases. The weakness in this proposed explanation is that there is a positive correlation between assistant professor salary and graduate earnings in this model. However, when all measures are included as in column (1) the significance of assistant salary drops and only the associate salary effect is significant. This model would support our previous explanation.

The other major difference between the estimates of men and women, for this fixed effects model, is that all the dummy variables for prior educational experience, as well as the variables for marital status, number of dependent children, and prior full-time work experience are highly significant for women in all models but not for men. The estimates of prior education show expected effects on earnings. As the education level increases, the magnitude of the effect increases as well, so that having prior college experience provides the lowest benefit and having a prior master's degree has the highest benefit. It should be noted that table 4 shows having some university experience provides a larger benefit than having a full bachelor's degree but it is only a 2% difference. Note also that the standard deviation on the master's dummy variable is twice as large as the other education dummy variables, reported as 0.041 in table 4. We consider this to

be a result of low observation amounts for prior master's degree. The other interesting estimate to examine here is prior full-time work experience which has a negative link to future earnings. This contradicts the results found in Betts et al. (2013), although those prior experience estimates were not significant. An explanation for this effect is that the type of full-time work done prior to graduation did not have any relevance to the type of work of the current employment of the graduate. Analyzing the specific type and area of prior full-time experience and its effects on earnings would be an interesting area for future study. Lastly, similar to table 3, the R-squared for women is largest in column (1) when all the quality measures are included in the model.

The next part of this fixed effects section constructs a model with specific degree field dummy variables. This is done to compare against conclusions and results by Betts et al. (2013) and James et al. (1989) that support the theory that choice of degree field is more important than the quality of post-secondary institutions. Tables 5 & 6 provide estimates for men and women, respectively.

In table 5 the major change is the decrease in significance of a majority of the coefficients. The student-professor ratio is no longer significant in column (2) and the tuition fee effect drops in significance in column (3). Along with the drop in significance, the tuition fee effect increases in magnitude relative to the previous model, from approximately 1% to almost 1.7% for every 100 dollar increase in average tuition fees. In this model the estimates for personal traits remain similar to the coefficients in table 3. The main focus of this model is too analyze the effect of specific degree fields on earnings, unfortunately the results for men predict that only an arts degree has a significant impact on future earnings. This arts degree effect is similar to the result in Betts et al. (2013). Also, as in the previous models, the R-squared of the model including all quality measures is the largest.

Table 5: Estimates of Log Earning for Fixed Effects Models for Men with Degree Field Dummy Variables

VARIABLES	(1)	(2)	(3)	(4)
Student-professor ratio	-0.00521	0.0494		
	(0.0449)	(0.0475)		
Tuition	5.49e-05		0.000168*	
	(0.000238)		(8.96e-05)	
Full-professor salary	-0.000147			-0.000130
	(0.000121)			(8.38e-05)
Associate professor	-5.12e-05			-5.44e-05
salary	(4.51e-05)			(3.25e-05)
Assistant professor	0.000330			0.000311
salary	(0.000230)			(0.000180)
Age	0.0362***	0.0198***	0.0307***	0.0361***
	(0.00619)	(0.00598)	(0.00582)	(0.00614)
Age squared	-0.000266***	-0.000121**	-0.000216***	-0.000265***
	(3.96e-05)	(4.64e-05)	(3.71e-05)	(3.89e-05)
Education	0.0621	0.0511	0.0656	0.0622
	(0.196)	(0.202)	(0.199)	(0.196)
Arts	-0.482**	-0.485**	-0.476**	-0.482**
	(0.153)	(0.156)	(0.155)	(0.153)
Humanities	-0.243	-0.253	-0.238	-0.243
	(0.267)	(0.275)	(0.272)	(0.267)
Social Sciences	-0.125	-0.137	-0.121	-0.125
	(0.236)	(0.246)	(0.243)	(0.236)
Commerce & business	0.180	0.171	0.187	0.180
	(0.220)	(0.228)	(0.224)	(0.220)
Agricultural	-0.155	-0.160	-0.143	-0.155
	(0.241)	(0.249)	(0.244)	(0.240)
Engineering	0.314	0.305	0.321	0.314
	(0.205)	(0.214)	(0.211)	(0.205)
Engineering technologies	0.0547	0.0498	0.0660	0.0551
	(0.164)	(0.168)	(0.166)	(0.164)
Health related fields	0.330	0.333	0.352	0.330
	(0.206)	(0.212)	(0.207)	(0.206)
Mathematics	0.125	0.118	0.133	0.125
	(0.207)	(0.215)	(0.210)	(0.207)
No Specialization	-0.00542	-0.0157	-0.00229	-0.00426
	(0.263)	(0.275)	(0.276)	(0.262)
Father education	0.00184	0.00216*	0.00200	0.00185
	(0.00121)	(0.00115)	(0.00118)	(0.00121)
Mother education	-0.00183	-0.00182	-0.00175	-0.00183
	(0.00176)	(0.00163)	(0.00167)	(0.00176)
Marital status	-0.00664**	-0.00634**	-0.00645**	-0.00665**
	(0.00255)	(0.00257)	(0.00255)	(0.00258)
# of dependent children	0.0847***	0.0893***	0.0860***	0.0848***
	(0.00914)	(0.00956)	(0.00943)	(0.00910)
Prior education	-0.000121	0.00430	0.000999	-0.000129
	(0.00453)	(0.00526)	(0.00453)	(0.00451)
Prior work experience	-0.0247	-0.0196	-0.0212	-0.0247
	(0.0155)	(0.0157)	(0.0155)	(0.0155)
Constant	8.500***	9.120***	9.266***	8.343***
	(0.922)	(0.919)	(0.475)	(0.434)
Observations	3,641	3,641	3,641	3,641
R-squared	0.147	0.140	0.143	0.147

Note: Professor salaries are median salaries. Robust standard errors in are parentheses and *** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations

There is also a large in increase in the R-squared from the models in table 3 which suggests that including dummy variables for degree field choice captures more of the provincial average university to earnings effect. This supports the theory of James et al. (1989) on degree choice importance even though our results for men only provide one significant degree field effect.

Table 6 provides the estimates for women when degree field dummy variables are added to the fixed effects model. For the provincial university quality measures we notice a decrease in significance of some variables, similar to those in table 5 for men. Both student-professor ratio and tuition fee effects lose significance, as shown in columns (2) and (3) respectively. In column (1) the coefficient for associate professor salary effect has decreased in significance, from the 1% to the 10% level, however there is also an increase in magnitude due to the addition of the new dummy variables. Examining the effects of specific degree choice for women, we observe more significant effects than with the men. Column (1) of table 6 shows that the fields of education, social sciences, commerce & business, engineering, health related fields, and having no specialization all had significant and positive effects on future earnings. The field of engineering had the largest added benefit while not specializing had the lowest benefit. These results are supportive of the results in James et al. (1989) which finds engineering to have the largest effect on future earnings. In this study we observe a gap in predicted earnings, between most beneficial and least beneficial field of study of 55%, which is comparable to the gap reported in Betts et al. (2013) of approximately 60%. As with men, the personal trait effects for women stayed relatively the same as in the model with no degree field dummy variables.

Table 6: Estimates of Log Earning for Fixed Effects Models for Women with Degree Field Dummy Variables

VARIABLES	(1)	(2)	(3)	(4)
Student-professor ratio	-0.00811	-0.0101		
	(0.0429)	(0.00830)		
Tuition	-1.58e-05		4.07e-05	
	(0.000200)		(4.16e-05)	
Full-professor salary	-0.000133			-0.000160**
	(0.000148)			(4.94e-05)
Associate professor salary	-0.000110*			-0.000117***
	(5.12e-05)			(2.52e-05)
Assistant professor salary	0.000385			0.000438***
	(0.000292)			(0.000116)
Age	0.0255***	0.0168***	0.0248***	0.0255***
	(0.00429)	(0.00510)	(0.00393)	(0.00420)
Age squared	-0.000146**	-5.80e-05	-0.000141***	-0.000146**
	(4.76e-05)	(5.29e-05)	(4.32e-05)	(4.66e-05)
Education	0.322***	0.344***	0.337***	0.322***
	(0.0431)	(0.0287)	(0.0280)	(0.0412)
Arts	0.0675	0.0934	0.0839	0.0679
	(0.0957)	(0.0789)	(0.0783)	(0.0938)
Humanities	0.0848	0.107*	0.0991	0.0853
	(0.0720)	(0.0569)	(0.0558)	(0.0701)
Social Sciences	0.155**	0.179***	0.169***	0.156**
	(0.0565)	(0.0422)	(0.0410)	(0.0544)
Commerce & business	0.471***	0.491***	0.487***	0.472***
	(0.0420)	(0.0303)	(0.0304)	(0.0402)
Agricultural	0.143	0.161*	0.158*	0.144
	(0.0953)	(0.0825)	(0.0821)	(0.0943)
Engineering	0.679***	0.702***	0.695***	0.679***
	(0.0650)	(0.0535)	(0.0537)	(0.0642)
Engineering technologies	0.136	0.188	0.176	0.137
	(0.211)	(0.202)	(0.202)	(0.208)
Health related fields	0.557***	0.577***	0.572***	0.557***
	(0.0842)	(0.0694)	(0.0691)	(0.0825)
Mathematics	0.488***	0.507***	0.504***	0.489***
	(0.119)	(0.104)	(0.104)	(0.118)
No Specialization	0.135**	0.152***	0.143***	0.135**
	(0.0448)	(0.0423)	(0.0378)	(0.0462)
Father education	-0.000285	-0.000261	-0.000337	-0.000281
	(0.000364)	(0.000383)	(0.000404)	(0.000370)
Mother education	-5.89e-06	5.45e-05	4.34e-05	-6.60e-06
	(0.000622)	(0.000571)	(0.000565)	(0.000623)
Marital status	-0.00283	-0.00264	-0.00274	-0.00283
	(0.00161)	(0.00164)	(0.00165)	(0.00161)
# of dependent children	0.0786***	0.0796***	0.0776***	0.0786***
	(0.0101)	(0.0103)	(0.00980)	(0.0101)
Prior education	0.00655***	0.00843***	0.00652***	0.00657***
	(0.00149)	(0.00191)	(0.00134)	(0.00142)
Prior work experience	-0.0463***	-0.0450***	-0.0473***	-0.0464***
	(0.00798)	(0.00758)	(0.00817)	(0.00787)
Constant	8.434***	9.492***	9.170***	8.369***
	(0.632)	(0.177)	(0.126)	(0.224)
Observations	4,329	4,329	4,329	4,329
R-squared	0.159	0.156	0.156	0.159

Note: Professor salaries are median salaries. Robust standard errors in are parentheses and *** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations

5.2. OLS Models

This section conducts a short analysis of the OLS model estimates in comparison to the estimates of the fixed effects model. Similar to the fixed effects section, we will discuss the effects for men followed by the effects for women.

Table 7 provides the estimates from a basic OLS model for men where, as before, columns (2) to (4) show models with only one quality measure at a time. Columns (2) and (3) provide similar coefficients to the fixed effects model where the student-professor ratio and tuition fees have a positive link to future earnings. The major difference between the two models, for these quality measures, is the reduction in both magnitude and standard deviation. These OLS models remain similar to the fixed effects models in terms of the R-squared values, which suggest that including all quality measures fits the data better than only having one measure at a time. The R-squared for the OLS models are also relatively smaller than those of the fixed effects model which would advocate for the fixed effects model. A test between the two models is suggested, as done in Betts et al. (2013), we discuss why it is not included in this paper in the Limitations section.

The OLS estimates for women are given in Table 8. The changes in this table follow similarly to the changes in the men's table with a few exceptions. In column (1) there is a change in significance of three of the quality measures. Student-professor ratio and assistant professor salary become positively significant while the effect of associate professor salary loses significance. The student-professor ratio coefficient is conclusive to the previous results however the effect of assistant professor salary does not support the fixed effects results.

Table 7: Estimates of Log Earning for OLS Models for Men

VARIABLES	(1)	(2)	(3)	(4)
Student-professor ratio	0.0171**	0.0374***		
	(0.00827)	(0.00725)		
Tuition	-4.74e-06		8.84e-05***	
	(2.61e-05)		(2.11e-05)	
Full-professor salary	4.39e-06			8.22e-06
	(6.53e-06)			(5.31e-06)
Associate professor salary	-3.20e-06			1.99e-06
	(1.17e-05)			(9.45e-06)
Assistant professor salary	1.14e-05			2.00e-06
	(1.56e-05)			(1.34e-05)
Age	0.0477***	0.0328***	0.0363***	0.0508***
	(0.00895)	(0.00835)	(0.00823)	(0.00885)
Age squared	-0.000380***	-0.000255***	-0.000284***	-0.000408***
	(9.59e-05)	(9.01e-05)	(8.93e-05)	(9.55e-05)
Degree field	0.00111*	0.00149**	0.00134**	0.00110*
	(0.000574)	(0.000697)	(0.000649)	(0.000576)
Father education	4.35e-05	0.000113	0.000404	-0.000107
	(0.00149)	(0.00150)	(0.00147)	(0.00148)
Mother education	-0.00115	-0.00176	-0.00125	-0.00130
	(0.00145)	(0.00149)	(0.00147)	(0.00147)
Marital status	-0.00711*	-0.00612	-0.00686*	-0.00692*
	(0.00408)	(0.00385)	(0.00412)	(0.00406)
# of dependent children	0.0828***	0.0909***	0.0872***	0.0814***
	(0.0160)	(0.0160)	(0.0160)	(0.0160)
Prior college	0.0394	0.0800***	0.0669**	0.0237
	(0.0362)	(0.0269)	(0.0285)	(0.0384)
Some university	0.0693	0.0870	0.0577	0.0584
	(0.0540)	(0.0548)	(0.0554)	(0.0550)
Prior bachelor's	0.0178	0.0492	0.0404	0.00966
	(0.0449)	(0.0435)	(0.0438)	(0.0454)
Prior master's	-0.0239	0.0104	0.0129	-0.0275
	(0.167)	(0.171)	(0.169)	(0.169)
Prior work experience	-0.0207	-0.0225	-0.0127	-0.0233
	(0.0207)	(0.0209)	(0.0205)	(0.0209)
Constant	8.339***	9.057***	9.295***	8.319***
	(0.244)	(0.194)	(0.182)	(0.260)
Observations	5,824	5,824	5,824	5,824
R-squared	0.049	0.043	0.041	0.048

Note: Professor salaries are median salaries. Robust standard errors in are parentheses and *** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations

Table 8: Estimates of Log Earning for OLS Models for Women

VARIABLES	(1)	(2)	(3)	(4)
Student-professor ratio	0.0272***	0.0440***		
	(0.00640)	(0.00570)		
Tuition	1.12e-05		0.000118***	
	(2.19e-05)		(1.67e-05)	
Full-professor salary	2.85e-06			1.06e-05**
	(5.30e-06)			(4.45e-06)
Associate professor salary	-1.55e-05			-1.04e-05
	(9.77e-06)			(7.86e-06)
Assistant professor salary	2.81e-05**			1.69e-05
	(1.26e-05)			(1.10e-05)
Age	0.0571***	0.0456***	0.0501***	0.0628***
	(0.00797)	(0.00716)	(0.00731)	(0.00829)
Age squared	-0.000491***	-0.000394***	-0.000429***	-0.000554***
	(9.60e-05)	(8.69e-05)	(8.88e-05)	(0.000103)
Degree field	0.00116**	0.00177***	0.00136***	0.00119**
	(0.000466)	(0.000530)	(0.000486)	(0.000476)
Father education	-0.000721	-0.000702	-0.000707	-0.000894
	(0.000961)	(0.000982)	(0.000955)	(0.000995)
Mother education	7.08e-05	-0.00111	-4.77e-05	-0.000293
	(0.00131)	(0.00133)	(0.00129)	(0.00134)
Marital status	-0.00240	-0.00192	-0.00210	-0.00221
	(0.00218)	(0.00219)	(0.00212)	(0.00227)
# of dependent children	0.0406***	0.0427***	0.0415***	0.0386***
	(0.0148)	(0.0148)	(0.0147)	(0.0149)
Prior college	0.0572*	0.0891***	0.0884***	0.0201
	(0.0310)	(0.0240)	(0.0262)	(0.0310)
Some university	0.115***	0.124***	0.106***	0.102**
	(0.0400)	(0.0393)	(0.0407)	(0.0399)
Prior bachelor's	0.0894**	0.104***	0.104***	0.0797**
	(0.0388)	(0.0384)	(0.0383)	(0.0389)
Prior master's	0.185**	0.235***	0.224***	0.191**
	(0.0780)	(0.0741)	(0.0752)	(0.0789)
Prior work experience	-0.0491***	-0.0572***	-0.0453***	-0.0552***
	(0.0154)	(0.0154)	(0.0153)	(0.0156)
Constant	7.986***	8.628***	8.866***	7.881***
	(0.203)	(0.156)	(0.148)	(0.218)
Observations	7,300	7,300	7,300	7,300
R-squared	0.086	0.078	0.078	0.082

Note: Professor salaries are median salaries. Robust standard errors in are parentheses and *** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations

It does support the original hypothesis on professor salary effect that there would be a positive relation between professor salary and future earnings. As with the men, we find larger R-squared values for the fixed effects model.

This part of the paper briefly discusses the OLS models that include dummy variables for specific degree field. The estimates are shown in tables 9 & 10 for men and women respectively. The main difference between the fixed effects versus the OLS approach for these models is that there is an increase in the significance of most of the quality measure variables. For men each quality measure becomes significant, with the exception of associate professor salary. Unfortunately this increase in significance does not spread to the degree field dummy variables, which remain relatively the same as in the fixed effects model for men. The estimates for women follow a similar trend. Each quality measure becomes significant, with the exception of student-professor ratio in column (1) of table 10. Examining the degree field effects for women shows that significance is lost under the OLS approach. The social sciences field and having no specialization are no longer significant and the education field becomes less significant. Also, both male and female OLS models report lower R-squared values than their fixed effects counterparts.

The OLS model estimates for women provide evidence to support the results of James et al. (1989). Similar to the fixed effects model the largest benefit to graduate earnings is shown through the specific degree field chosen. This OLS approach does show significant quality measure effects but they are relatively small when compared to the degree field effects.

Table 9: Estimates of Log Earning for OLS Models for Men with Degree Field Dummy Variables

VARIABLES	(1)	(2)	(3)	(4)
Student-professor ratio	-0.00280	0.0351***		
	(0.00792)	(0.00669)		
Tuition	-2.22e-06		0.000116***	
	(3.41e-05)		(2.83e-05)	
Full-professor salary	1.59e-05**			1.46e-05***
	(7.01e-06)			(5.33e-06)
Associate professor	2.33e-05			2.17e-05
salary	(1.59e-05)			(1.36e-05)
Assistant professor	-4.20e-05*			-3.80e-05*
salary	(2.33e-05)			(2.01e-05)
Age	0.0387***	0.0191***	0.0270***	0.0391***
	(0.0116)	(0.00731)	(0.00865)	(0.0109)
Age squared	-0.000286**	-0.000117	-0.000185**	-0.000289***
	(0.000114)	(8.04e-05)	(9.01e-05)	(0.000108)
Education	0.0724	0.0524	0.0526	0.0731
	(0.232)	(0.249)	(0.241)	(0.231)
Arts	-0.472*	-0.484*	-0.481*	-0.471*
	(0.249)	(0.267)	(0.260)	(0.248)
Humanities	-0.229	-0.243	-0.240	-0.228
	(0.237)	(0.255)	(0.247)	(0.237)
Social Sciences	-0.113	-0.123	-0.112	-0.113
	(0.234)	(0.250)	(0.242)	(0.233)
Commerce & business	0.194	0.167	0.170	0.195
	(0.230)	(0.248)	(0.240)	(0.230)
Agricultural	-0.142	-0.160	-0.157	-0.141
	(0.233)	(0.251)	(0.243)	(0.233)
Engineering	0.329	0.306	0.315	0.329
	(0.231)	(0.248)	(0.239)	(0.230)
Engineering technologies	0.0693	0.0545	0.0634	0.0693
	(0.242)	(0.259)	(0.251)	(0.241)
Health related fields	0.331	0.316	0.321	0.332
	(0.233)	(0.250)	(0.242)	(0.232)
Mathematics	0.140	0.117	0.123	0.141
	(0.233)	(0.250)	(0.242)	(0.233)
No Specialization	-0.00513	-0.0127	-0.0424	-0.00469
	(0.237)	(0.254)	(0.247)	(0.236)
Father education	0.00175	0.00237	0.00245	0.00175
	(0.00199)	(0.00183)	(0.00183)	(0.00199)
Mother education	-0.00167	-0.00178	-0.00169	-0.00168
	(0.00176)	(0.00171)	(0.00172)	(0.00175)
Marital status	-0.00687*	-0.00644*	-0.00680*	-0.00686*
	(0.00356)	(0.00367)	(0.00381)	(0.00355)
# of dependent children	0.0819***	0.0867***	0.0808***	0.0816***
	(0.0165)	(0.0164)	(0.0167)	(0.0164)
Prior education	-0.000307	0.00463	0.00159	-0.000384
	(0.00555)	(0.00470)	(0.00466)	(0.00553)
Prior work experience	-0.0246	-0.0153	-0.0102	-0.0246
	(0.0204)	(0.0204)	(0.0205)	(0.0204)
Constant	8.701***	9.304***	9.409***	8.662***
	(0.479)	(0.308)	(0.311)	(0.480)
Observations	3,641	3,641	3,641	3,641
R-squared	0.140	0.128	0.123	0.140

Note: Professor salaries are median salaries. Robust standard errors in are parentheses and *** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations

Table 10: Estimates of Log Earning for OLS Models for Women with Degree Field Dummy Variables

VARIABLES	(1)	(2)	(3)	(4)
Student-professor ratio	-0.00540	0.0358***		
	(0.00692)	(0.00564)		
Tuition	-7.10e-05**		9.61e-05***	
	(3.16e-05)		(2.38e-05)	
Full-professor salary	3.39e-05***			2.21e-05***
	(6.16e-06)			(4.63e-06)
Associate professor	2.29e-05*			2.81e-05***
salary	(1.35e-05)			(1.03e-05)
Assistant professor	-7.81e-05***			-6.98e-05***
salary	(2.02e-05)			(1.62e-05)
Age	0.0288***	0.0311***	0.0367***	0.0340***
	(0.00923)	(0.00649)	(0.00737)	(0.00845)
Age squared	-0.000180*	-0.000203***	-0.000262***	-0.000234**
	(0.000102)	(7.67e-05)	(8.40e-05)	(9.37e-05)
Education	0.326**	0.340**	0.365**	0.320**
	(0.145)	(0.145)	(0.144)	(0.144)
Arts	0.0738	0.0917	0.116	0.0672
	(0.156)	(0.156)	(0.156)	(0.155)
Humanities	0.0975	0.117	0.150	0.0883
	(0.149)	(0.148)	(0.148)	(0.148)
Social Sciences	0.162	0.182	0.213	0.153
	(0.146)	(0.145)	(0.145)	(0.145)
Commerce & business	0.473***	0.472***	0.491***	0.467***
	(0.146)	(0.146)	(0.145)	(0.145)
Agricultural	0.143	0.156	0.177	0.137
	(0.148)	(0.148)	(0.148)	(0.147)
Engineering	0.690***	0.701***	0.727***	0.682***
	(0.150)	(0.150)	(0.149)	(0.149)
Engineering	0.191	0.242	0.241	0.183
technologies	(0.237)	(0.232)	(0.226)	(0.237)
Health related fields	0.558***	0.570***	0.590***	0.552***
	(0.145)	(0.145)	(0.144)	(0.144)
Mathematics	0.495***	0.499***	0.521***	0.489***
	(0.149)	(0.149)	(0.149)	(0.148)
No Specialization	0.126	0.116	0.126	0.105
	(0.155)	(0.155)	(0.154)	(0.153)
Father education	-0.000331	-0.000264	-0.000344	-0.000370
	(0.00105)	(0.00104)	(0.00104)	(0.00104)
Mother education	-3.35e-05	0.000333	0.000571	-2.77e-05
	(0.00166)	(0.00165)	(0.00163)	(0.00165)
Marital status	-0.00275*	-0.00281*	-0.00275*	-0.00277*
	(0.00158)	(0.00151)	(0.00142)	(0.00160)
# of dependent children	0.0734***	0.0710***	0.0681***	0.0727***
	(0.0166)	(0.0169)	(0.0169)	(0.0167)
Prior education	0.00666*	0.00497	0.00380	0.00592
	(0.00393)	(0.00359)	(0.00363)	(0.00392)
Prior work experience	-0.0471***	-0.0458***	-0.0422**	-0.0477***
	(0.0163)	(0.0163)	(0.0164)	(0.0163)
Constant	8.955***	8.659***	8.829***	8.881***
	(0.353)	(0.209)	(0.216)	(0.342)
Observations	4,329	4,329	4,329	4,329
R-squared	0.146	0.134	0.125	0.145

Note: Professor salaries are median salaries. Robust standard errors in are parentheses and *** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations

5.3. Gender Dummy Models

In the final part of our results section we discuss the estimates of a fixed effects model including a gender dummy variable instead of dividing the sample into male and female sub samples. The new gender dummy variable we include is titled Male. Men earn more than women, on average, so we hypothesize that this gender variable will have a significant and positive correlation with future earnings. Table 11 provides the estimates for this model.

The sign and significance of the coefficients of this model are similar to the coefficients for women (see table 4), with the exception of a loss in significance in some of the personal trait variables. This would be due to the sample having both male and female respondents and that the male respondents had less significant coefficients as shown in table 3. The R-squared of this model is much larger than that of the male model but slightly lower than the R-squared for the female model. As discussed earlier, there are benefits and advantages to both model approaches.

Table 12 presents the coefficients for the gender dummy fixed effects model with specific degree field dummy variables. The sign of the estimates in this table are the same as for women (see table 6). The coefficients have similar significance levels as well, with the exception of some changes in the degree field coefficients. These changes include a loss of significance in education, social sciences, and no specialization, and an increase in significance for arts and engineering technologies. The other notable change is that the R-squared for this model is larger than the previous models for men and women separately. This suggests that a gender dummy model would be preferable to the gender specific models but again there are benefits to both. Note that the gender dummy variable in both models is positive and significant.

Table 11: Estimates of Log Earning Fixed Effects Models Including a Gender Dummy Variable

VARIABLES	(1)	(2)	(3)	(4)
Student-professor ratio	-0.0358	0.0703***		
	(0.0284)	(0.00731)		
Tuition	3.92e-05		0.000118***	
	(5.67e-05)		(1.67e-05)	
Full-professor salary	1.54e-05			1.01e-05
	(1.33e-05)			(1.52e-05)
Associate professor salary	-4.62e-05**			-4.45e-05***
	(1.90e-05)			(8.12e-06)
Assistant professor salary	5.33e-05			5.71e-05**
	(4.95e-05)			(2.44e-05)
Age	0.0434***	0.0430***	0.0425***	0.0427***
	(0.00321)	(0.00612)	(0.00544)	(0.00349)
Age squared	-0.000345***	-0.000344***	-0.000340***	-0.000337***
	(3.37e-05)	(5.98e-05)	(5.61e-05)	(3.62e-05)
Degree field	0.00123**	0.00133**	0.00129**	0.00122**
	(0.000401)	(0.000455)	(0.000424)	(0.000410)
Father education	-0.000340	-0.000472	-0.000400	-0.000326
	(0.000718)	(0.000723)	(0.000745)	(0.000708)
Mother education	-0.000187	-0.000609	-0.000328	-0.000152
	(0.000648)	(0.000867)	(0.000784)	(0.000618)
Marital status	-0.00343***	-0.00307***	-0.00328***	-0.00343***
	(0.000736)	(0.000541)	(0.000606)	(0.000735)
# of dependent children	0.0617***	0.0593***	0.0602***	0.0617***
	(0.00455)	(0.00560)	(0.00552)	(0.00467)
Prior college	0.0560***	0.0598***	0.0592***	0.0569***
	(0.0100)	(0.0102)	(0.00979)	(0.0102)
Some university	0.112***	0.111***	0.111***	0.113***
	(0.0202)	(0.0194)	(0.0199)	(0.0200)
Prior bachelor's	0.0798***	0.0791**	0.0807**	0.0812***
	(0.0233)	(0.0319)	(0.0304)	(0.0235)
Prior master's	0.0974*	0.119**	0.108**	0.101*
	(0.0521)	(0.0437)	(0.0469)	(0.0503)
Prior work experience	-0.0367***	-0.0430***	-0.0387***	-0.0366***
	(0.00587)	(0.00451)	(0.00462)	(0.00587)
Male	0.138***	0.136***	0.137***	0.138***
	(0.0110)	(0.0105)	(0.0111)	(0.0110)
Constant	8.751***	8.304***	9.002***	8.494***
	(0.251)	(0.186)	(0.116)	(0.140)
Observations	13,124	13,124	13,124	13,124
R-squared	0.085	0.080	0.083	0.085

Note: Professor salaries are median salaries. Robust standard errors in are parentheses and *** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations

Table 12: Estimates of Log Earning Fixed Effects Models Including Gender and Degree Field Dummy Variables

VARIABLES	(1)	(2)	(3)	(4)
Student-professor ratio	-0.00737	0.0199		
	(0.0409)	(0.0212)		
Tuition	1.99e-05		0.000105*	
	(0.000214)		(5.00e-05)	
Full-professor salary	-0.000139			-0.000145**
	(0.000128)			(6.11e-05)
Associate professor salary	-8.39e-05*			-8.99e-05***
	(4.55e-05)			(2.65e-05)
Assistant professor salary	0.000361			0.000381**
	(0.000247)			(0.000136)
Age	0.0331***	0.0215***	0.0302***	0.0330***
	(0.00216)	(0.00512)	(0.00283)	(0.00197)
Age squared	-0.000231***	-0.000123*	-0.000204***	-0.000231***
	(3.16e-05)	(5.90e-05)	(3.36e-05)	(3.01e-05)
Education	0.175	0.177	0.180	0.174
	(0.111)	(0.117)	(0.116)	(0.111)
Arts	-0.175**	-0.165**	-0.167**	-0.175**
	(0.0667)	(0.0679)	(0.0672)	(0.0663)
Humanities	-0.0834	-0.0788	-0.0772	-0.0835
	(0.104)	(0.109)	(0.108)	(0.104)
Social Sciences	0.00312	0.00769	0.00847	0.00300
	(0.105)	(0.113)	(0.111)	(0.105)
Commerce & business	0.318**	0.321**	0.325**	0.317**
	(0.114)	(0.120)	(0.117)	(0.114)
Agricultural	-0.0133	-0.0101	-0.00489	-0.0134
	(0.0812)	(0.0887)	(0.0855)	(0.0816)
Engineering	0.465***	0.469***	0.471***	0.465***
	(0.0835)	(0.0909)	(0.0888)	(0.0835)
Engineering technologies	0.151**	0.166**	0.165**	0.150**
	(0.0533)	(0.0587)	(0.0575)	(0.0552)
Health related fields	0.407***	0.411***	0.415***	0.407***
	(0.0761)	(0.0808)	(0.0784)	(0.0759)
Mathematics	0.283***	0.287***	0.291***	0.283***
	(0.0745)	(0.0803)	(0.0775)	(0.0747)
No Specialization	0.0365	0.0348	0.0355	0.0362
	(0.133)	(0.140)	(0.140)	(0.133)
Father education	0.000439	0.000525	0.000428	0.000442
	(0.000451)	(0.000459)	(0.000469)	(0.000455)
Mother education	-0.000651	-0.000535	-0.000542	-0.000651
	(0.000922)	(0.000846)	(0.000854)	(0.000923)
Marital status	-0.00367***	-0.00344***	-0.00357***	-0.00367***
	(0.000921)	(0.000960)	(0.000964)	(0.000922)
# of dependent children	0.0817***	0.0840***	0.0814***	0.0816***
	(0.00641)	(0.00643)	(0.00621)	(0.00645)
Prior education	0.00323	0.00625**	0.00385*	0.00324
	(0.00198)	(0.00262)	(0.00176)	(0.00195)
Prior work experience	-0.0410***	-0.0389***	-0.0409***	-0.0410***
	(0.00370)	(0.00342)	(0.00365)	(0.00356)
Male	0.107***	0.107***	0.106***	0.107***
	(0.00819)	(0.00841)	(0.00828)	(0.00821)
Constant	8.380***	9.207***	9.138***	8.261***
	(0.683)	(0.376)	(0.193)	(0.135)
Observations	7,970	7,970	7,970	7,970
R-squared	0.165	0.161	0.163	0.165

Note: Professor salaries are median salaries. Robust standard errors in are parentheses and *** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations

The models reported in table 11 predict that being male will increase earnings by approximately 14% and the models in table 12 predict that being male will increase earnings by roughly 11%. This shows a gender wage gap close to 12.5%.

6. Limitations

One of the main limitations of this paper stems from the availability of data as touched upon earlier. This study was unable to gather information on university attended by graduate and so we were unable to conduct our fixed effects analysis at the university level as done in Betts et al. (2013). Another limitation regards the consistency between the NGS cohorts. Although each dataset included the majority of the same information, the way in which that information was gathered and stored was slightly different from cycle to cycle. The author did attempt to synergize the information as best as possible but there may be some error in the results due to these inconsistencies. The last limitation arises from the nature of the models and not being able to currently test the fixed effects model against the OLS model properly. To account for bias, the standard errors were clustered at the provincial level and because of this the test proposed for testing the models (Hausman test) could not be completed. At this stage it is more beneficial to account for the standard error bias.

7. Conclusion

This paper uses a process similar to Betts et al. (2013) to analyze more current data to add to the information on the university to earnings effect. Two types of models are used to discuss this effect, a fixed effects model using province fixed effects and an OLS model. It finds that earnings of men and women are affected by associate professor salary and that the major influence on earnings stems from the choice of degree field which supports the findings of James

et al. (1989). Due to limitations there is room for future studies to improve and expand upon the results of this paper given access to the data on university attended.

8. Appendix 1

Additional descriptive statistics for individual cohorts:

Table 13: Descriptive Statistics for the 1990 Cohort

Variable	*Women (N=2280)*		*Men (N=1920)*	
	Mean	*Std. Dev.*	*Mean*	*Std. Dev.*
University				
Student to Professor Ratio	11.88	2.07	11.84	2.04
Tuition Fees	1156.94	428.35	1156.40	425.64
Full Professor Salary	68933.52	3395.44	68881.94	3340.50
Associate Professor Salary	55344.61	2300.22	55243.69	2288.38
Assistant Professor Salary	41926.87	1231.85	41880.68	1230.95
Graduate Background				
Age	31.45	7.25	30.24	6.39
Father's Education Level	6.68	4.17	7.28	4.26
Mother's Education Level	6.43	3.41	6.59	3.34
Marital Status	2.50	6.86	2.13	2.59
Dependent Children	0.29	0.86	0.18	0.63
College Diploma	0.26	0.44	0.26	0.44
Some University	0.05	0.22	0.05	0.21
Bachelor's Degree	0.12	0.32	0.07	0.25
Master's Degree	0.01	0.08	0.01	0.09
Work Experience	1.31	0.46	1.28	0.45
Field of Study				
Education	0.20	0.40	0.13	0.33
Arts	0.03	0.18	0.02	0.13
Humanities	0.13	0.34	0.10	0.29
Social Sciences	0.26	0.44	0.22	0.41
Commerce	0.13	0.34	0.19	0.40
Agriculture	0.07	0.25	0.05	0.21
Engineering	0.02	0.13	0.16	0.37
Health Related	0.08	0.27	0.01	0.09
Mathematics	0.03	0.18	0.10	0.30
No Specialization	0.03	0.17	0.03	0.17

Note: Std. Dev.=standard deviation
Source: Author's calculations

Table 14: Descriptive Statistics for the 1995 Cohort

Variable	*Women (N=2040)*		*Men (N=1720)*	
	Mean	*Std. Dev.*	*Mean*	*Std. Dev.*
University				
Student to Professor Ratio	13.40	1.81	13.36	1.78
Tuition Fees	1945.78	293.74	1961.91	290.43
Full Professor Salary	85641.60	4774.52	85595.30	4732.63
Associate Professor Salary	69869.04	4292.73	69635.62	4303.98
Assistant Professor Salary	51916.58	2133.18	51821.81	2142.26
Graduate Background				
Age	23.40	2.12	23.86	2.14
Father's Education Level	11.22	16.72	11.04	15.15
Mother's Education Level	9.19	12.87	9.32	12.82
Marital Status	2.55	7.23	2.41	5.13
Dependent Children	0.11	0.39	0.12	0.42
College Diploma	0.21	0.41	0.20	0.40
Some University	0.03	0.17	0.02	0.16
Bachelor's Degree	0.17	0.38	0.13	0.33
Work Experience	1.96	1.03	1.70	0.95
Field of Study				
Education	0.25	0.43	0.13	0.33
Arts	0.03	0.17	0.02	0.15
Humanities	0.15	0.36	0.11	0.31
Social Sciences	0.28	0.45	0.22	0.42
Commerce	0.11	0.32	0.19	0.39
Agriculture	0.05	0.23	0.06	0.23
Engineering	0.02	0.14	0.16	0.37
Engineering Technologies	0.00	0.05	0.02	0.12
Health Related	0.06	0.23	0.01	0.07
Mathematics	0.02	0.15	0.08	0.27
No Specialization	0.02	0.14	0.01	0.12

Note: Std. Dev.=standard deviation
Source: Author's calculations

Table 15: Descriptive Statistics for the 2000 Cohort

Variable	*Women (N=2970)*		*Men (N=2180)*	
	Mean	*Std. Dev.*	*Mean*	*Std. Dev.*
University				
Student to Professor Ratio	14.77	1.89	14.68	1.89
Tuition Fees	2984.62	715.41	2937.49	741.75
Full Professor Salary	89475.97	4739.57	89305.99	4717.05
Associate Professor Salary	71386.14	3835.55	71290.04	3734.68
Assistant Professor Salary	54932.99	2309.94	54902.54	2248.82
Graduate Background				
Age	25.66	2.34	26.07	2.37
Father's Education Level	3.92	13.92	3.33	10.05
Mother's Education Level	2.12	7.38	2.35	7.55
Marital Status	3.80	6.85	3.69	4.08
Dependent Children	0.12	0.43	0.12	0.43
College Diploma	0.20	0.40	0.24	0.43
Some University	0.04	0.19	0.02	0.15
Bachelor's Degree	0.11	0.31	0.08	0.26
Master's Degree	0.01	0.08	0.00	0.07
Work Experience	1.33	0.47	1.27	0.45
Field of Study				
Education	0.19	0.39	0.09	0.29
Arts	0.04	0.21	0.05	0.22
Humanities	0.12	0.33	0.10	0.30
Social Sciences	0.24	0.42	0.19	0.39
Commerce	0.13	0.34	0.19	0.39
Agriculture	0.02	0.13	0.04	0.20
Engineering Tech.	0.04	0.18	0.15	0.36
Health Related	0.12	0.33	0.05	0.22
Mathematics	0.02	0.13	0.05	0.22

Note: Std. Dev.=standard deviation
Source: Author's calculations

Additional tables for averaged public university data by province:

Table 16: Public Data on Average University Quality Measures from 1990

Province	Student-Professor Ratio	Tuition Fees	Median Full Professor Salary	Median Associate Professor Salary	Median Assistant Professor Salary
Newfoundland	6.3124	1152	62318.75	49475	38793.75
PEI	14.6241	1621.5	62318.75	49475	38793.75
Nova Scotia	11.173	1668.5	62318.75	49475	38793.75
New Brunswick	12.7233	1655.75	62318.75	49475	38793.75
Quebec	9.4479	512.25	66237.5	56012.5	42856.25
Ontario	13.8105	1418	72112.5	56900	42387.5
Manitoba	10.7326	1227.5	69850	54287.5	41337.5
Saskatchewan	12.2359	1275	69850	54287.5	41337.5
Alberta	13.101	1026	69850	54287.5	41337.5
British Columbia	11.2425	1617.25	69850	54287.5	41337.5

Source: Author's calculations

Table 17: Public Data on Average University Quality Measures from 1995

Province	Student-Professor Ratio	Tuition Fees	Median Full Professor Salary	Median Associate Professor Salary	Median Assistant Professor Salary
Newfoundland	6.7181	1848.5	74750	60181.25	46125
PEI	13.682	2398.75	74750	60181.25	46125
Nova Scotia	12.6221	2588.5	74750	60181.25	46125
New Brunswick	14.7752	2271.5	74750	60181.25	46125
Quebec	11.7684	1505.75	82237.5	69043.75	52187.5
Ontario	15.0702	2030.5	89918.75	73937.5	53475
Manitoba	10.6545	2168.25	86150	66950	51056.25
Saskatchewan	13.3914	2218.25	86150	66950	51056.25
Alberta	13.747	2014.75	86150	66950	51056.25
British Columbia	11.7387	2193	86150	66950	51056.25

Source: Author's calculations

Table 18: Public Data on Average University Quality Measures from 2000

Province	Student-Professor Ratio	Tuition Fees	Median Full Professor Salary	Median Associate Professor Salary	Median Assistant Professor Salary
Newfoundland	11.0975	3125.5	79162.5	62293.75	48831.25
PEI	12.7095	3234	79162.5	62293.75	48831.25
Nova Scotia	13.81	3956.25	79162.5	62293.75	48831.25
New Brunswick	15.2335	3099	79162.5	62293.75	48831.25
Quebec	12.2899	1781.5	84887.5	70487.5	54818.75
Ontario	16.6317	3502.25	92843.75	75056.25	56800
Manitoba	12.3896	3061.75	92250	70100	54568.75
Saskatchewan	14.7911	3111.5	92250	70100	54568.75
Alberta	15.9428	3364.5	92250	70100	54568.75
British Columbia	13.6106	2547	92250	70100	54568.75

Source: Author's calculations

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