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The Impact of Graduate School Ranking on an Economics Professor’s Annual Earnings

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by

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ABSTRACT

What are the economic returns to attending a more selective college? This thesis adds to the growing literature on college choices and economic returns by analyzing the effects of graduate school ranking on the annual earnings of economics professors in the United States. In order to answer this question, the author collected an original data set using publicly available salary information from a number of US-based institutions. The data in this paper uses McPherson's ranking of US Economics Departments, h-index, and other factors collected from the individuals' CVs to estimate the economic returns. The results from Ordinary Least Squares regression analysis and simultaneous equation modeling indicate that graduate school rankings affect their earnings in conjunction with the current institutions; the higher-ranked the graduate school they attended, the higher their income. Additionally, regardless of their graduate school or current institution, a professor's research output (as measured by the h-index) is also a significant determinant of their economic returns, which shows that higher productivity is associated with better pay.

Keywords: economic returns, college reputation, rankings

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LIST OF ABBREVIATIONS

2SLS	Two Stages Least Squares
HEGIS	Higher Education General Information Survey
HSB	High School and Beyond
NLS72	National Longitudinal Study of High School Class of 1972
OLS	Ordinary Least Squares

CHAPTER I: INTRODUCTION

What would someone not do to get themselves (or their children) into the college or university of their choice? In 2019, a federal investigation code-named "Operation Varsity Blues" uncovered a conspiracy by wealthy Wall Street bankers, entrepreneurs, and celebrities to buy their way past the admissions requirements for elite universities. In the end, at least 53 people have been accused of conspiracy and bribery, and several have served jail terms and paid fines (Kates, 2019). But is it worth it to go to a more reputable college? Is this enticement with reputation prevalent in obtaining a graduate degree as well? This thesis tries to answer this question by analyzing the connection between economics professors' annual income and the prestige of the academic institution from which they received their doctorate degree.

The reputation of the economics programs, reflected by their rankings, is of interest to employers and students alike as it signals the quality of education to potential employers when graduates enter the job market. The reputation also indicates the research standard of an institution that academic job seekers are considering joining. These rankings also help prospective students determine the academic rigor of the department that they are seeking to attend. Additionally, the university administration and academic economists use these rankings to assess their economics programs (McPherson, 2012). However, the vast amount of existing literature on the economic returns to school selectivity focuses only on an undergraduate level, for instance, Dale and Krueger (2002). This thesis aims to bridge the gap in the literature by explicitly looking at the economic returns to attending a prestigious graduate school for economics. Using publicly available earnings information along with rankings of the professors' current institutions and graduate schools, this thesis shows that graduate school ranking in conjunction with current institution ranking is a significant determinant of annual income. The results from the regression analysis also show that productivity is positively related to earnings, holding other factors constant.

The following section presents a literature review on school selectivity and its impact on earnings and employment opportunities for undergraduate institutions. Chapter III introduces a theoretical framework on wage determination. The fourth chapter elaborates on the data sources and the methodology used in the thesis. In Chapter V, results from the Ordinary Least Squares (OLS) and two-stages least squares (2SLS) regression models are presented. The final chapter provides the conclusion and discussion.

CHAPTER II: LITERATURE REVIEW

The empirical literature on college selectivity and economic returns is mainly based on the basic Mincer equation, with other independent variables differing across studies. In addition to the basic linear regression equation, other methodologies such as regression discontinuity design and sensitivity tests have been performed to tailor to the research focus.

A significant portion of the literature uses the National Longitudinal Study of High School Class of 1972 (NLS72), High School and Beyond (HSB), and Higher Education General Information Survey (HEGIS) data to examine the impact of college reputation on earnings. Instead of using a standard log wage equation where the logarithm of wage is a function of individual and college characteristics, Brewer et al. (1996) use a structural multinomial logit model on this data to account for the systematic process through which students select the colleges based on expected labor market outcomes and costs of attending the college. They conclude that those who attended an elite or middle-tiered private college have higher earnings than those at bottom-tiered public schools. Dale and Krueger (2002), who use the same data, conclude that students from selective colleges do not earn more than students "who were accepted and rejected by comparable schools but attended less selective colleges". Instead of the college's reputation, their results show that SAT scores are critical in determining earnings. Long (2007) uses the method used in Dale and Krueger (2002) that accounts for students' unobservable characteristics along with three other methods: OLS method, Instrumental Variable method, and Black and Smith method. Unlike Dale and Krueger (2002), the results obtained using the OLS method from Long (2007) show that college quality, signaling college selectivity, significantly affects economic returns, consistent with the results from the other three methods. Fox (2002) also uses an OLS earnings regression to conclude that attending elite private institutions, an investment in human capital, provides higher returns. The study also adds that as the tuition costs rise in such institutions, the rate of return decreases, which might deter students from attending such institutions in the future.

Monks (2000) explores the earnings gap across individual and institutional characteristics and different races and gender. The results show that attending a highly selective institution provides higher earnings and attending a large graduate degree-granting institution has higher returns than a private liberal arts college. However, there is little to no support regarding higher returns to attending a private university than a public. Non-whites graduating from a highly selective university have higher returns than whites. In contrast, males and whites who graduated from a graduate-degree granting institution or a private university have higher earnings than non-whites and females, respectively. James et al. (1989) study the effect of college quality on the future income of male college graduates. Using various student and institutional characteristics and labor market variables in the earnings regression, their results show that attending a private college positively affects future earnings. Ginther and Kahn (2004) explore the reason for the underrepresentation of females in economics. Even after enrolling in prestigious economics departments, working for reputable employers, and publishing multiple papers, female assistant professors are less likely to receive tenure, indicating systemic biases. The reasons for this gender differential include women's responsibilities for raising children, few publications in reputed journals, and lack of professional networks like men. Loury and Garman (1995) examine the difference in the impact of college selectivity between blacks and whites. Using an earnings regression, Loury and Garman (1995) show that college selectivity, years of schooling, and work experience are important indicators of earnings for blacks and whites. Earnings are significantly affected by GPA, choice of major, and family background. When an individual's SAT score is less than their college average SAT score, black students are more likely to drop out of college than white students. Whites at most selective colleges have higher GPAs than blacks.

The studies conducted on the impact of college reputation on wages using school and wage data from foreign countries also show similar results; economic returns to attending a reputed college are high. MacLeod et al. (2017) find that college reputation positively affects the students' employment opportunities by using a Bayesian wage formation model on mean admission score data from Colombia. Using job placement rate data from the top five MBA universities in India, Vasantha and Bano (2019) conclude that university reputation is a valuable asset as it gives students a competitive advantage. This advantage results in students gaining higher employment opportunities and job securities due to increased trust and credibility from attending such prestigious universities. Using data collected from students enrolled for BSc Economics in UK-based universities at various ranks, Drydakis (2016) employs a probit model and Ordinary Least Squares (OLS) estimation to show that students at high-rank universities receive more employment interview invitations and higher entry-level salaries. Hartog et al. (2010) also add to the knowledge about the effect of education quality on wages across different universities and regions in China. They use a basic earnings equation on the data received from “Education and employment survey of urban people in China-2004” to conclude that students attending a top 100 university earn 23% more than those attending universities in 400-500 ranking, which explains the reason for Chinese parents and children placing a high priority on attending a top university.

Using a regression discontinuity design, Hoekstra (2009) utilizes the highly confidential application data regarding sex, social security number, admission term, standardized score, and high school GPA received from a flagship state university to study the economic returns to students from different state universities. They conclude that white people between the ages of 28 and 33 who graduated from the flagship public university earn 20% higher wages than those who were rejected, indicating the key role of selective colleges on a graduate’s economic returns. Lucas and Mbiti (2014) also use a regression discontinuity design to compare the difference in academic progress among students who attend elite national schools and students who attend other schools in Kenya. The results indicate that students attending elite national schools have similar composite scores on the exit exam like the students who attend non-national schools. Even though there are no significant differences in academic achievement, parents, students, and the government still view elite national schools with high respect because of the benefits students receive after graduating from these schools like better employment, admission to an elite college, and networking.

The importance of connections in academic promotions is explored by Zinovyeva and Bagues (2015). Their results show that candidates with strong connections are 50% more likely to be promoted. The candidates with weak connections have a 20% greater chance of being promoted, whereas the candidates with no connections enjoy no benefits.

Combes et al. (2008) also explore the roles of an individual's skills and network connections on recruiting economics professors in France. Their results show that candidates having strong connections with recruitment committee members are more likely to be hired than candidates without any connections. The results also indicate that candidates with a foreign degree have higher chances of being hired as the foreign candidates in the dataset attended prestigious universities.

Dillon and Smith (2017) study the way high school students of varying abilities are selected into colleges of different qualities. They consider various factors such as financial condition, college cost, location, student test scores, and faculty-student ratio to determine students' level of ability, which they then match with the corresponding quality of colleges. They conclude that academic mismatching is present and financial constraints and family decisions are the main contributors to such mismatch. Macleod and Urquiola (2015) hypothesize that employers infer a student's ability through the college they attend. Their results show that focusing on admission tests to get into top schools increases stratification among students, leading to top colleges always admitting a small number of students. Kinsler and Pavan (2015) examine the wage gap between different majors and conclude that students who graduated with a science degree working in a field unrelated to their degree earn approximately 40% lower than those working in a related field.

Solmon and Wachtel (1975) use an earnings function to estimate that individuals who graduated from top Carnegie classified institutions (leading research universities and large doctoral-granting institutions) have higher earnings than those from smaller colleges with few programs, small doctoral-granting institutions, and liberal arts colleges.

This estimation indicates that the type of college attended significantly affects future earnings. Behrman et al. (1996) add human capital inputs and endowment effects to a variance-components model of labor market outcomes to come to a similar conclusion as did Solmon and Watchel (1975); students who attended PhD granting universities or private institutions with low enrollments and highly paid professors have high economic returns. Wales (1973) also concludes that colleges with high rankings guarantee significantly higher earnings. In addition, Wales (1973) gives a breakdown of the earnings: a college dropout from the top fifth of colleges earns 4% to 37% more than a high school graduate, while the difference in wage between a high school graduate and an undergraduate degree holder is 29% to 39%. A PhD holder earns 53% to 98% more than a high school graduate. Wise (1975) shows that academic and nonacademic skills along with leadership ability play equal roles in job performance and productivity, concluding that colleges develop abilities for higher productivity.

CHAPTER III: CONCEPTUAL FRAMEWORK

The human capital theory explains the wage difference among graduates from various institutions. This theory suggests that an individual's income is affected by schooling, years of schooling, and innate or acquired skills that contribute to productivity. Mincer (1958) and Becker (1962) led seminal work on human capital theory based on rational choice assumption. The framework of both their work relies on the fact that difference in training (education and on-the-job training) results in a difference in occupations, and additional years of training reduces the earning life (Mincer, 1958). However, this short lifespan is compensated as they show that more training leads to higher income. Interestingly, they find that the earnings difference is much more extensive for people with ten and eight years of training than people with four and two years of training. The investment in training acts as a signal to potential employers as a measure of productivity (Spence, 1973). The experience, measured by age, that individuals gain during their work, increases their productivity, particularly in fields that require more training. Following previous literature on returns to attending an elite institution for undergraduate studies, it can be argued that the admittance of individuals to highly ranked schools is due to their innate ability, and the reputation of such universities signals employers that those graduates have high productivity. Another possible reason for the difference in human capital is school quality and pre-labor market influences. Top-ranked schools have strong job market connections, and graduate students in such schools take advantage of this resource for securing better employment opportunities, formulating the hypothesis that individuals who received a doctorate from top economics departments enjoy a higher wage premium

CHAPTER IV: DATA AND METHODOLOGY

This thesis uses an original dataset collected from various publicly available sources. The data consists of the annual income of professors as the dependent variable and six independent variables, namely current institution rank, graduate school rank, title, h-index, gender, and years since PhD. The literature on the ranking of economics programs covers a wide range of methods. There have been attempts to rank the economics departments by measuring the papers presented at annual meetings of the American Economic Association and determining the rank through citations and the pages covered in the top economic journals by the department. Though a biased form of rank determination, surveying the department heads and senior faculty is another measure. This paper follows McPherson’s (2012) ranking for current institution rank and graduate school rank, which is constructed on the basis of publication in top 50 Economics journals by individuals in their current institutions for the period 2002 to 2009. Even though the data for university rankings is outdated as compared to the annual earnings for 2018, there has not been any significant change in the top 50 rankings as expressed by McPherson and as observed in the behavior for periods 1994 to 2001, 1984 to 1993, 1978 to 1983, and 1974 to 1978 in McPherson’s table. Note that the current institutions and graduate schools used in the dataset are all based in the United States. The individual’s title, gender, and years since PhD are collected from their institutional and personal websites. Their h-index is assembled from their Google Scholar page.

Years since PhD, used as a proxy for experience, is determined from 2018 as earnings recorded are for the year 2018. The title of the individuals is a categorical variable, with four categories: Assistant Professor, Associate Professor, Professor, and

Professor with an administrative position. Title is used as an independent variable in the model to study the differences in earnings across the promotion zone in academia. The h-index is calculated as the maximum of h articles published by an individual that have been cited at least h times. It contains both the citation and publication records of a research scholar, which can be used as a measure of productivity.

Since the current institutions used in the dataset are all public universities, they are required by the federal Freedom of Information Act to disclose public records of government employees for accountability purposes. However, the open records act for exemption of certain salary-related information differs on a state-to-state basis. For instance, Illinois state law classifies certified payroll records as public records with the redaction of addresses, telephone numbers, and social security numbers (ILCS 140/2.10). Since base salaries are not highly confidential, the states of Massachusetts and Michigan also require public officials to disclose their salary "even if the disclosure is an invasion of privacy" (Reporters Committee). Minnesota classifies gross salary, gross pension, and other fringe benefits as public records. New Mexico, Connecticut, and Washington consider salary as public information, but Washington exempts employee deductions from disclosure. Likewise, the state of Virginia also allows for salary disclosure of individuals who earn more than $10,000 annually. The institutions in the dataset are located in the states discussed above. The income of the individuals in the dataset is collected either from the university's salary disclosure report or from the open data website GovSalaries. All annual earnings, as mentioned previously, are for the year 2018. In an effort to represent rankings from all quartiles, the current institutions in the dataset range from elite public universities to those on the lower side of the spectrum. Note that rankings are reverse ordered, the smaller the rank number, the higher the rankings. The dataset does not include lecturers, instructors, adjuncts, and affiliated faculty in the economics department. Summary statistics of the variables can be found in Table 1.

Figure 1 shows the grouped bar plot for current institution rank and earnings. The first group consists of the bottom third of the current institution ranks. The second group consists of the middle third rankings, and Group 3 contains the top third. It is evident from the figures that individuals working in institutions at top ranks earn the highest salaries. Associate Professors earn higher salaries than Assistant Professors, Professors earn higher salaries than Associate Professors, and Professors with an administrative position earn the highest salaries. A similar trend can be observed in Figure 2for graduate school rankings. The first group consists of the bottom third of graduate school rankings, the second group consists of the middle third, and the third group consists of the top third.

The multiple linear regression model used in this thesis is defined by:

$$\ln(income) = \beta_0 + \beta_1 grad.rank + \beta_2 curr.inst.rank + \beta_3 hindex + \beta_4 yrsincePhD + \beta_5 title + \beta_6 sex + \varepsilon ,$$

where β_0 is the intercept, $\beta_i, 1 \leq i \leq 6$, are the coefficients of the independent variables, and ε represents the residuals from the model. As results are presented, modifications are made to this equation.

Table 1: Summary statistics

Variables	Mean	Standard Deviation	Median	Minimum	Maximum	Number of observations
Annual Earnings	180768	85086.28	158100	32900	536533	300
Current Institution Rank	63.45	51.66	46	11	215	300
Graduate School Rank	24.05	34.14	12	1	227	300
Title	1.193	0.916	1	0	3	300
h-index	19.47	15.48	15	1	84	300
sex	0.193	0.396	0	0	1	300
Year since PhD	18.4	13.26	16	0	54	300

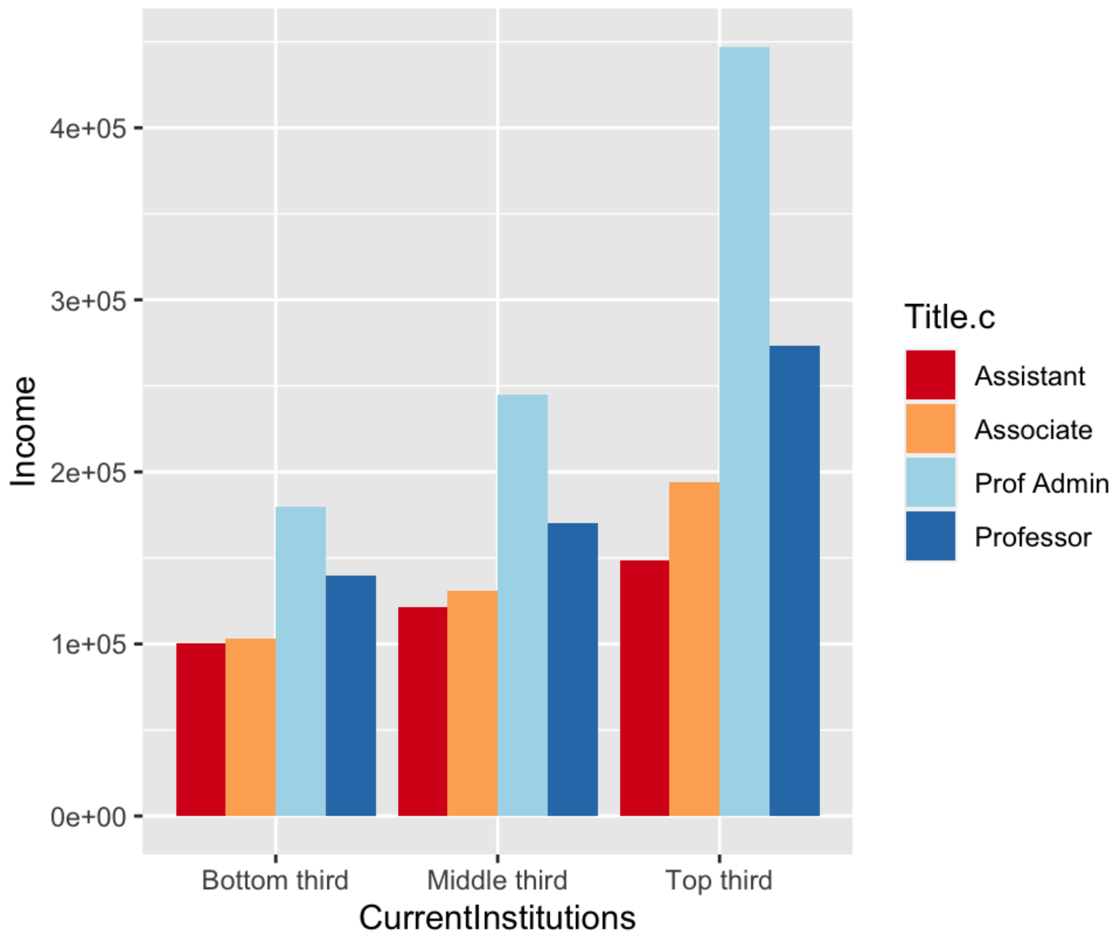

Figure 1: Current Institution Rankings vs Earnings

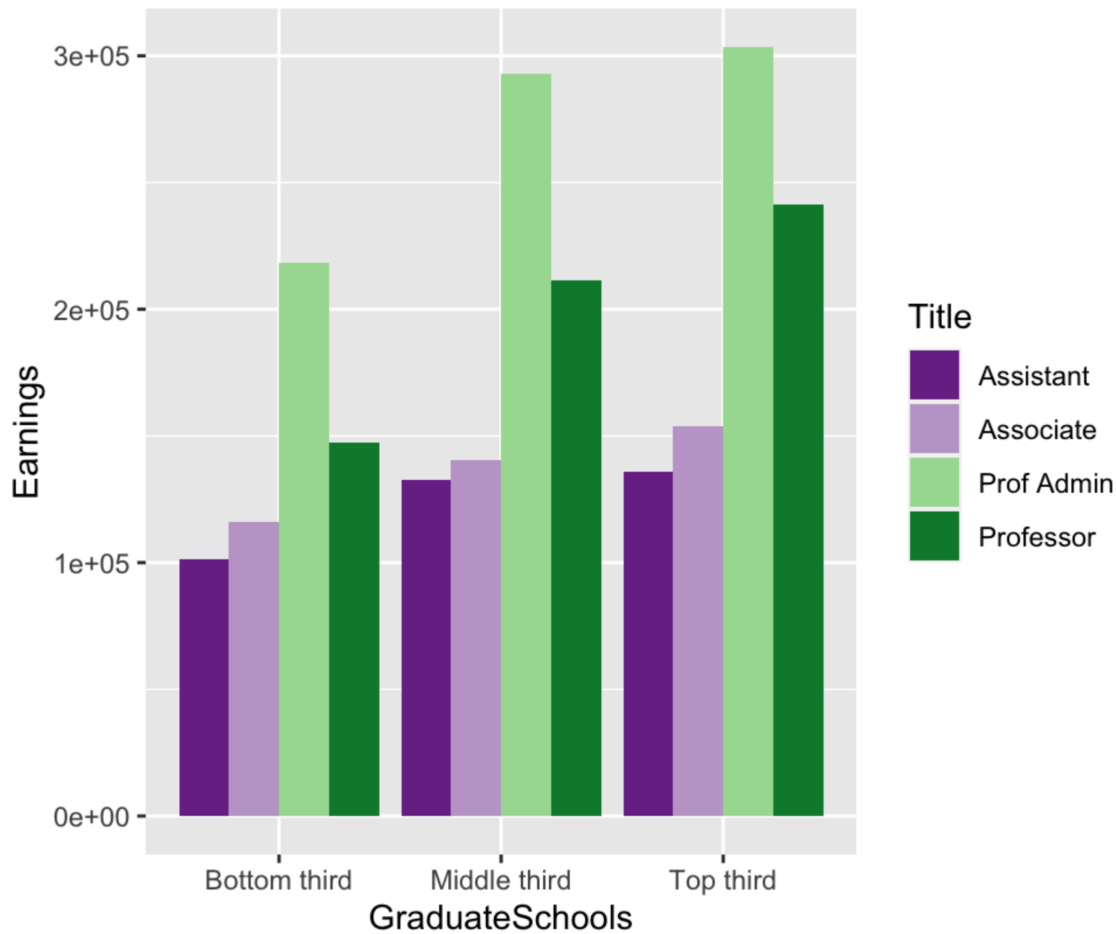

Figure 2: Graduate School Rankings vs Earnings

CHAPTER V: RESULTS

The results from the above-mentioned regression model are presented in the first column of Table 2. As can be observed, the closer the institution's rank is to 1, the higher the individual's salary. Contrary to what was initially thought, that attending prestigious universities results in higher income, the results show that the institutions faculty are currently affiliated with play a more significant role. A decrease in an institution's ranking by one place decreases earnings by 0.4%. Regardless of the institution from which an individual graduated, is currently affiliated with, or their title, their h-index is statistically significant, indicating that higher productivity is associated with better pay—an increase in h-index by 1 point increases earnings by 0.72%. Female professors, though not statistically significant, earn 3.76% lower income than their male counterparts. Likewise, as expected, Associate Professors earn more than Assistant Professors, Professors earn more than Associate Professors, and Professors with an administrative position have the highest earnings. The results show that Associate Professors earn 17.2% higher salaries, Professors earn 53.2% higher salaries, and Professors with an administrative position earn 126% higher salaries than Assistant Professors. The recent PhD graduates earn 0.6% higher salaries than those individuals who earned their PhD degree more than a decade before 2018. This difference might be because of inflation, an increase in the cost of living, and better job markets for recent PhD graduates. The high earnings of newly appointed individuals being greater than or equal to experienced academic economists is known as wage compression.

Since earnings of the professors in one current institution might be correlated, cluster correction on the OLS model was performed. Standard errors are clustered by grouping the current institutions. The estimates from cluster correction are presented in the second column of Table 2.

The first column of Table 3 shows the results for the multiple linear regression equation without current institution rank. In the absence of current institution, graduate school rank is highly significant. Individuals graduating from highly ranked schools earn more than individuals who earned their degree from low-ranked schools. An increase in h-index by 1 point increases earnings by 1%, emphasizing individual capabilities irrespective of their alma mater. Columns 2 and 3 of Table 3 introduce an interaction term to the equation above without current institution ranking. The interaction between graduate school ranking and years since PhD is presented in column 2. The term is not significant and does not affect the rest of the estimates. However, the interaction term of graduate school ranking and gender, shown in the third column, suggests that schools with lower rankings have a higher return on gender, and females suffer less from a wage penalty.

Quantile regression was also estimated for the above equation to see if there were any differences in earnings between individuals who attended highly ranked schools. Quantile regression allows for more robustness to outliers in comparison to OLS and provides a comprehensive picture by analyzing the effect of the independent variables on the entire distribution of the dependent variable rather than just on the mean. However, the results from quantile regressions are not drastically different from linear regression, as can be observed in Figure 3. The red line and surrounding red borders are linear regression coefficient estimates. The black dots surrounded by the gray shaded area are the quantile regression coefficient estimates.

Since their graduate school influences the placement of PhD graduates, current institution rank is endogenous to graduate school rank. In order to account for the correlation present, instrumental variables are used to estimate two stages least squares (2SLS) regression, which helps in obtaining consistent parameter estimates. On this basis, the distance between an individual's current institution and graduate school and binary variables of whether an individual has a Master's degree and whether an individual has an undergraduate degree from outside the US are chosen as instrumental variables.

The first stage of the regression equation is given by:

$$curr.inst.rank = \theta_0 + \theta_1 masters + \theta_2 distance + \theta_3 intl.ugrad + \theta_4 grad.rank + \theta_5 hindex + \theta_6 yrsincePhD + \theta_7 title + \theta_8 sex + \nu$$

Since the OLS model includes exogenous variables as well, those variables should be included in both stages of the 2SLS regression. Those exogenous variables "instrument themselves" in the first stage (Hanck et.al., 2020). The fitted values of current institution ranking are then used as an independent variable in the second stage. The second stage of the regression is given by:

$$\ln(income) = \pi_0 + \pi_1 curr.inst.rank' + \pi_2 grad.rank + \pi_3 hindex + \pi_4 yrsincePhD + \pi_5 title + \pi_6 sex + \xi$$

Note that explicitly running the regressions in two stages does not carry over the errors in the fitted model to the second stage, which results in smaller error estimates of the coefficients. Advanced statistical packages automatically adjust for this and use more information in estimation leading to more accurate standard errors. The results for 2SLS are presented in Table 4.

The null hypothesis for Weak Instruments states that all instruments are weak. The p-value for weak instruments in Table 4 column 1 for the distance between the two institutions clearly indicates that it is a weak instrument. The null hypothesis for Wu-Hausman states that there exists no endogeneity. The p-value for Wu-Hausman is very high, which means there is no need to reject the null hypothesis suggesting that endogeneity is not a problem. Similar results can be seen for columns 2 and 3 where Master's and international undergraduate degrees have been used as instruments individually. When the number of instrumental variables exceeds the number of variables displaying endogeneity, the model is classified as overidentified. Sargan Test tests the validity of the overidentifying restrictions of instrumental variables with the null hypothesis stating those instrumental variables are valid and are not correlated with the error term. Column 4 presents the estimates for Master's and international undergraduate degree holders together. The p-value indicates that the instruments together are not weak at 10% significance, and the overidentified instruments are valid. Wu Hausman test suggests the instruments are uncorrelated with the error term.

Graduate school rank also affects the current institution rank, so a 2SLS regression model with graduate school rank endogenous to current institution rank is also estimated. The instrumental variables for this regression include binary variables of whether an individual has a Master's degree, an international undergraduate degree, and a mathematics or statistics degree. The regression estimates for this model are presented in Table 5. The first column in Table 5 shows regression results for just one instrumental variable: whether an individual has a Master's degree or not with the p-value for Weak Instruments suggesting that the variable is barely a weak instrument. Similarly, the second column of Table 5 shows the estimates for all the instrumental variables. The p-value for instruments is significant at 10%. The high p-value of the Sargan test indicates that the over-identified instrumental variables are valid and are not correlated with the error term. The p-values for the Wu-Hausman test in both columns are high, suggesting that endogeneity is not a problem. So, it can be inferred that the OLS model is a better fit for the data.

Table 2: Regression results

Variables	1	2
Current Institution Rank	-0.0040***	-0.0040***
	(0.0004)	(0.0005)
Graduate School Rank	-0.00001	-0.00001
	(0.0005)	(0.0006)
h-index	0.0072***	0.0072***
	(0.0015)	(0.0018)
Title1 (Associate Professor)	0.1588**	0.1588**
	(0.0502)	(0.0457)
Title2 (Professor)	0.4266***	0.4266***
	(0.0692)	(0.0752)
Title3 (Professor with administrative position)	0.8170***	0.8170***
	(0.1042)	(0.0805)
Gender (Female)	-0.0370	-0.0370
	(0.0416)	(0.0453)
Years since PhD	-0.0059**	-0.0059**
	(0.0022)	(0.0026)
Intercept	11.99***	11.99***
	(0.0396)	(0.0499)
F-statistic	56.34	60.83
p-value	<2.2e-16	<2.2e-16

Significant Codes:
‘***’: 0.001, ‘**’: 0.01, ‘*’: 0.05, ‘`’: 0.1

Table 3: Regression results with interaction term

Variables	1	2	3
Graduate School Rank	-0.0024*** (0.0006)	-0.0026** (0.0009)	-0.0028*** (0.0006)
h-index	0.0105*** (0.0017)	0.0106*** (0.0018)	0.0103*** (0.0018)
Title1 (Associate Professor)	0.1033` (0.0594)	0.1021` (0.0596)	0.1032` (0.0593)
Title2 (Professor)	0.4382*** (0.0823)	0.4369*** (0.0826)	0.4385*** (0.0822)
Title3 (Professor with Administrative Position)	0.6678*** (0.1229)	0.6634*** (0.1241)	0.6724*** (0.1228)
Gender (Female)	-0.0753 (0.0493)	-0.0749 (0.0494)	-0.1178* (0.0583)
Years since PhD	-0.0086** (0.0026)	-0.0089** (0.0028)	-0.0084** (0.0026)
Graduate School Rank*Years since PhD	-	0.00001 (0.00004)	
Graduate School Rank*Gender	-	-	0.0019 (0.0014)
Intercept	11.81*** (0.0425)	11.81*** (0.0453)	11.82*** (0.0430)
F-statistic	33.15	28.93	29.32
p-value	<2.2e-16	<2.2e-16	<2.2e-16

Significant Codes:
'***': 0.001, '**': 0.01, '*': 0.05, '``': 0.1

Table 4: Estimates from 2SLS regression for current institution

Variables	1 (Distance)	2 (Masters)	3 (International Undergrad)	4 (Masters and intl ugrad)
Graduate School Rank	0.0247 (0.1182)	-0.0017 (0.0035)	-0.0068 (0.0121)	0.0001 (0.0036)
Current Institution Rank	-0.0457 (0.1993)	-0.0012 (0.0062)	-0.0021 (0.0037)	-0.0042*** (0.0011)
Years since PhD	0.0219 (0.1337)	-0.0075 (0.0047)	-0.0045 (0.0039)	-0.0057* (0.0026)
Title1 (Associate Professor)	0.7405 (2.799)	0.1354 (0.1043)	0.1463` (0.0874)	0.1783** (0.0556)
Title2 (Professor)	0.3055 (0.7480)	0.4521*** (0.0827)	0.4370*** (0.0996)	0.4551*** (0.0752)
Title3 (Professor with Administrative Position)	2.3791 (7.4949)	0.7314** (0.2752)	0.8284*** (0.1438)	0.8534*** (0.1090)
Sex (Female)	0.3635 (1.9340)	-0.0668 (0.0592)	-0.0844 (0.0822)	-0.0501 (0.0479)
h-index	-0.0276 (0.1666)	0.0082 (0.0052)	0.0044 (0.0033)	0.0058** (0.0019)
Intercept	13.97 (9.4350)	11.87*** (0.2847)	12.07*** (0.1238)	12.01*** (0.0530)
Weak Instruments Test	0.833	0.252	0.360	0.0521`
Wu-Hausman Test	0.151	0.588	0.479	0.9741
Sargan Test	NA	NA	NA	0.4283
F-statistic	0.8794	27.15	29.38	46.95
p-value	<2.2e-16	<2.2e-16	<2.2e-16	<2.2e-16

Significant Codes:
'***': 0.001, '**': 0.01, '*': 0.05, '`': 0.1

Table 5: Estimates from 2SLS regression for graduate school

Variables	1 (Masters)	2 (Math, Intl ugrad, Masters)
Graduate School Rank	0.0026	-0.0007
	(0.0050)	(0.0034)
Current Institution Rank	-0.0050**	-0.0039***
	(0.0016)	(0.0011)
Years since PhD	-0.0062*	-0.0056*
	(0.0028)	(0.0026)
Title1 (Associate	0.1898**	0.1748**
Professor)	(0.0600)	(0.0554)
Title2 (Professor)	0.4616***	0.4531***
	(0.0789)	(0.0753)
Title3 (Professor with	0.8625***	0.8507***
Administrative Position)	(0.1143)	(0.1092)
Sex (Female)	-0.0378	-0.0539
	(0.0526)	(0.0476)
h-index	0.0063**	0.0057**
	(0.0021)	(0.0019)
Intercept	11.99***	12.018***
	(0.0633)	(0.0517)
Weak Instruments Test	0.0688`	0.0783`
Wu-Hausman Test	0.5883	0.8479
Sargan Test	NA	0.6173
F-statistic	43.19	46.72
p-value	<2.2e-16	<2.2e-16

Significant Codes: '***': 0.001, '**': 0.01, '*': 0.05, '``': 0.1

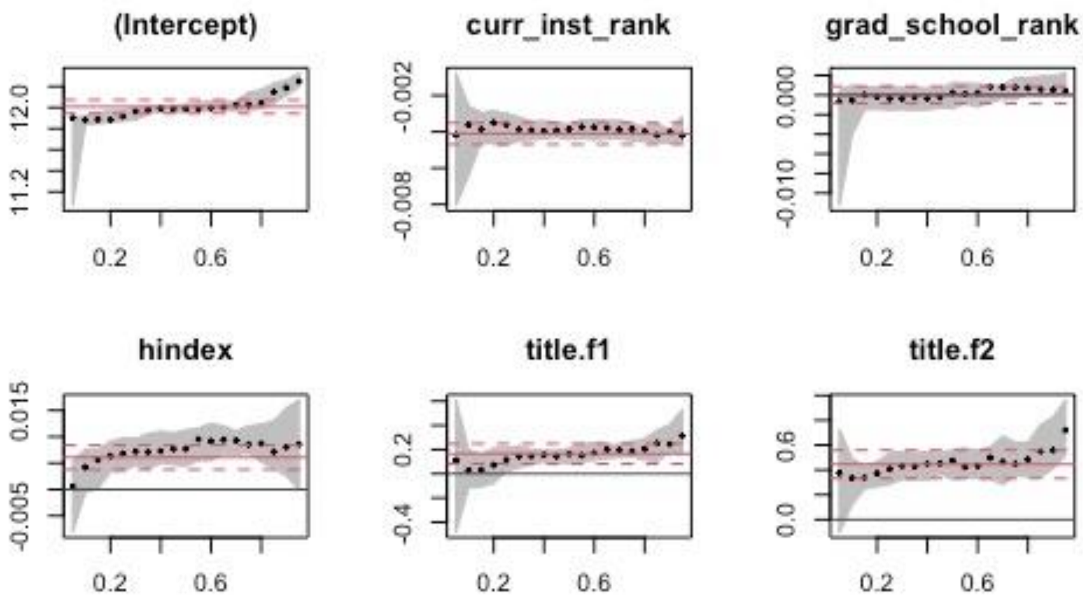

Figure 3: Quantile regression coefficient plot

CHAPTER VI: CONCLUSION

This thesis used a representative sample of economics professors at institutions with various ranks across the United States to show that graduate school ranking is significant in determining the annual earnings in the absence of current institution rank. Even in the presence of current institution rank, though not statistically significant, graduate school ranking has an indirect effect on the earnings of economics professors through connections, university reputation, and exposure to a large number of employers, as suggested by Drydikas (2016). Following the results of Ginther and Kahn (2004), the estimates show that female professors have lower earnings than male professors. The earnings for males, females, and overall, for different groups of graduate school rankings are presented in Table 6. The earnings figures are determined using the median of the top 15 graduate school rankings, top 15 to 25, top 25 to 50, and top 50 to 100 with the regression results from the third column of Table 3. The table shows that at the top 15 economics programs, females earn approximately $14,100 less than males. The earnings difference gets smaller between males and females moving down the table. At the top 50 to 100 programs, females have a higher wage premium of around $3,000 than males.

The overall earnings difference is determined with the estimates from the first column of Table 3. Holding other factors constant, there is not much of a wage penalty in attending an economics graduate program ranked between 15 and 25 instead of the top 15, since the wage difference is around $4,500. However, the earnings difference between the top 15 programs and the top 25 to 50 programs is $11,000 and between the top 15 and top 50-100 programs is $25,300. This income difference suggests that if an individual had to decide between a top 15 economics doctoral program without any financial aid and a top 15-25 economics program with aid, it is better to attend the top 15-25 economics program with funding since the earnings difference after graduation is not that drastic in comparison to the cost of a doctoral program. However, in deciding between a top 15 program without aid and a top 50 to 100 program with funding, an obvious suggestion is not possible since the earnings difference is high. Other factors should also be considered in such a case.

Professors with an administrative position enjoy the highest wage premium across all rankings. They earn at least twice the amount earned by Assistant Professors. Individuals who earned their doctorate closer to the year 2018 earn higher salaries than the individuals who graduated earlier. Regardless of the rankings of the institution with which they are affiliated or from which they graduated, productivity, measured by their h-index, is associated with higher earnings. For every article that is cited an additional time, earnings increase by at least $2,000.

The results from this study are consistent with the findings of Oyer and Schaefer (2009), who analyze the economic returns to attending an elite law school in the United States. Using OLS with several academic, demographic, and undergraduate institution controls, their results show that lawyers from the top 10 law schools earn 25% higher salaries than those from the top 10 to 20 law schools. The difference between the top 10 law schools and the lower-ranked law schools is very high. Lawyers from prestigious law schools are highly likely to gain employment in top law firms, much like economists from top programs are more likely to secure placements at highly ranked institutions.

With the availability of more data, the research direction of this project can be extended to analyze the wage penalty for non-residents without Green Card. Similarly, the impact on earnings with an international doctorate degree can also be examined with more data. Further study on determining the earnings difference between economics departments in a business/management school and those in a liberal arts school can also be conducted with more time and access to more data.

Table 6: Earnings at different groups of graduate school

Program Rank	Male ($)	Female ($)	Overall ($)
Top 15	132865.9	118721.5	131975.7
Top 15 to 25	127707.1	116641.9	127432.5
Top 25 to 50	120183.9	113609.2	120807
Top 50 to 100	104062.6	107110.4	106609.5

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