Estimating the Effect of Obtaining a Ph.D. Degree in Economics in U.S. Universities

by

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Abstract

It is meaningful to explore the effect of obtaining a PhD degree on the finding a faculty job after graduation. Two factors are important: the first is observable ranking of the PhD degree granting department; the second is the student's unobservable research potential or ability. This paper tries to find an indicator for the unobservable factor so that the omitted variable problem is solved.

Keywords: Economics PhD Ranking

Table of Contents

List of Tables

Chapter 1.

Introduction

The supply of economic professors is from economics PhD graduates. If graduates from high ranking PhD program have advantages in finding a faculty job, then what is the magnitude of the advantage? This paper explores the effect of the ranking of the economics departments where job market candidates get the PhD degrees on the chance of getting a good faculty job.

The focus in this paper is new assistant professors. This is because the effect of their PhD degrees is clearer. If the graduates have been working for many years then many factors could affect their job seeking. Potential employer will consider their academic contribution, teaching experience, evaluation from previous employers, referee and editorial activity and so on. The rank of the department granting the PhD degree is less important than before as experienced professors have proved themselves. Reputation and academic contribution are more important.

An OLS regression of the ranking of first employer on the ranking of the department granting the PhD degree will suffer from omitted variables bias. When economics departments hire new assistant professors, two main factors are considered. The first is the ranking of the Ph.D. degree. In the job market, graduates from Harvard University are more popular than those from a lower-ranking economics department. The second is the research potential of the graduates. Unlike the observable degree, research potential is difficult to measure. A potential indicator is the number and quality of the papers that the graduate has published at the time of graduation.

After a literature review in Section 2, Section 3 explains the model and methods used in this paper. Section 4 describes the data source. Section 5 shows the estimation results and Section 6 concludes.

Chapter 2.

Literature Review

Many publications estimate the relationship between the quality of educational institutions and the earnings in the labor market. This relationship is of obvious importance for both students who will spend their energy and time in these educational institutions and the parents who will pay the tuition fees for their children. A major concern with estimates of the payoff to attending an elite college is that more selective schools tend to accept students with higher earnings capacity. It is very possible that more able students could go to a better or higher ranking universities. However, their high salary in the job market after graduation is due to ability, but not because of the education from these institutions.

Dale and Krueger (2002) adjust for selection on the part of schools by comparing earnings and other outcomes among students who applied to, and were accepted and rejected by, a comparable set of institutions. Behrman, Rosenzweig and Taubman (1996) use data on female twins to difference out common unobserved effects. Behrman, et al. (1996) use family variables to instrument for college choice.

However, these papers focus on the relationship between the measured quality or ranking of the educational institution (for example, the average SAT score of the admitted students in class) and the earnings in the job market after graduation. The quality of the whole university is measured by some indicators in these papers. In my work only the department of economics is measured by some different kinds of rankings. This is because my work pays attention to the

PhD graduates in economics. The quality of the whole university sometimes is not a good indicator for the quality or impact of the particular economics department.

In addition, the relationship that is studied is that between the ranking or quality of the PhD program and the ranking of the department where graduates get the first job as assistant professor. The ranking of the department where the graduates get the first faculty job is not equal to the salary, but it denotes prestige which is one kind of compensation. Only faculty positions are studied, others like jobs in industry are not included.

The two topics will face the similar questions. The first topic mainly focuses on the undergraduates so the number of students is very high. Every year each university will provide large amount of students to the job market. The higher salary in the job market maybe is due to the innate ability of the students but not because of the undergraduate education. So the researchers who want to estimate the effect of education have to difference out the unobserved effects such as innate ability.

Chapter 3.

Method

My work studied the job hunting of the successful PhD graduates in economics in the top 50 economics department in the United States. Generally these departments are believed as the best in the world even though several departments outside of the United States are also believed to have the same impact in the world.

To know the effect of the ranking of economics department where a graduate gets the PhD degree, we can regress the ranking of economics department where a graduate gets the first faculty job on a few factors. The first factor, obviously, is the ranking of economics department where a graduate gets the degree.

Other factors will include the number of papers he or she has published at the time of graduation and the year after that graduation year. The department committee could infer the research potential of the graduate from the paper published at the time of graduation. Apart from this, the committee will estimate the potential and ability of the graduate from the essays and working papers in progress. Good working papers mean published papers some time later. So papers published one year after graduation is also included. The argument here is that the publication of paper will cost some time. Papers published one year later will have the form of working paper at the time of graduation. When a hiring committee tries to evaluate the ability of a job applicant, quality of these working papers must also be considered. In another word, if the graduate gets the faculty job successfully, these working papers contribute.

The quality of the paper will be taken into account. When the graduates are trying to get the job, these published papers are new. So it is impossible to measure the influence of the papers some years later. One possible way to measure the quality of the papers is to see the ranking of the journals where the papers are published. Papers in the top journals are considered to be more convincing.

$$Rank\ of\ Job_i = \beta_0 + \beta_1 Rank\ of\ PhD_i + \beta_2 Number\ of\ Paper_i + \beta_3 Quality\ of\ Paper_i + \varepsilon_i$$

β_1 is interpreted as the effect of rank of PhD granting departments on rank of first employer. β_2 is interpreted as the effect of number of publications in ranked journals on rank of first employer. Similarly, β_3 is interpreted as the effect of quality of papers on rank of first employer. Epsilon represents the effect of all other factors on the outcome and is potentially heteroskedastic. I assume that no omitted factors that are correlated with explanatory variables so the expectation of epsilon conditional on *Rank of PhD*, *Number of Papers*, and *Quality of Papers* is zero.

Rank of Job is the ranking of economics department where the graduate gets the first job as an assistant professor. Other jobs such as research fellow, postdoctoral fellow, visiting scholar and visiting assistant professor are not counted as the first job. Here the definition of the first faculty job is the full time professor job. *Rank of PhD* is the ranking of economics department where the graduate gets his or her PhD degree. Nowadays there are many different kinds of rankings. In this paper, five different rankings are used. Section 3 will explain the source of the different rankings. Here *i* refers to the particular professor in the data set.

Number of Articles means number of all articles published by the graduate at the year of graduation and the year after it. *Number of Papers* is the number of papers the graduate has published at the year of graduation and the year after it. These papers are in ranked journals. I do not adjust *Number of Articles* or *Number of Papers* for the number of coauthors or whether the senior supervisor is a coauthor. If one job market candidate is one of the authors in one paper, then this paper is a positive signal for the job hunting.

The ranking of the journal where paper is published is used to denote the quality of that paper. If the graduate publishes more than one paper, then average ranking of these journals where these papers are published is calculated. This average number is *Quality of Papers*. *Quality of Papers* is the index for quality of the papers.

Later in regression, if one professor does not have any publication, then this professor is not included in the regression when *Quality of Papers* is used to measure the quality of published papers.

Chapter 4.

Data

The data set I is Assistant Professors who were employed at a top 50 US economics department in December, 2011 and who finished their PhD at a top 50 US economics department after 2000.

The data set II is Assistant Professors who were employed at a top 100 world economics department in December, 2011 and who finished their PhD at a top 50 US economics department after 2000.

Only current faculty members with the title of assistant professor are included in the data set. The data source is the curriculum vitae of these professors. The curriculum vitae will show the department where the graduate earned the PhD degree and the department where he or she was first hired as an assistant professor. Some professors did not provide curriculum vitae and so cannot be included. Only professors who obtained a PhD degree in economics are included. Those who have PhD degrees in Public Policy or Management are deleted. The data set only includes professors obtaining their PhD degrees from US universities. This has trivial influence as almost all of these assistant professors are US graduates. This is necessary because one ranking is only provided for US departments. Professors in the data set get their degrees after 2000. This is because I want to estimate the effect of a recently-earned PhD degree.

There are many different kinds of rankings. To take only one of them will be controversial. Five different rankings of economics departments are used. The

first one is from Kalaitzidakis, Mamuneas and Stengos (2003). This ranking is based on research productivity, so it is closely related to ranking of top journals. According to the authors, a common problem of economics department rankings is that the period of institution ranking does not match that of journal ranking even though the two rankings are made closely related. The characteristic of this paper is that the authors update the journal rankings and then use the updated ranking to produce a world wide economics department ranking. Then the two rankings are matched. This ranking is well-known academically but its drawback is that the time period covered by the ranking is from 1995 to 1999.

The second ranking is from Amir and Knauff (2008). The authors argue that the central value of an economics department is the sum of value of its PhD graduates, which is reflected in the values of their current employing departments. "*It is the first ranking that places PhD students and graduate education in a key position, within the class of objective ranking*." But number of institutions is limited. There are only 58 departments in the ranking. If the department where a professor gets the PhD degree cannot be found in the list, then that professor will be excluded in regression when k=2.

The third ranking is from Grijalva and Nowell (2007). They used all journals in which economists at the PhD granting institutions in the US had published during a 20-year period. The final rank is an overall productivity rank. Their result includes more information than Kalaitzidakis, Mamuneas and Stengos (2003) and Amir and Knauff (2008). However, this list only includes US institutions.

The fourth ranking is provided by IDEAS, using RePEc data. It is based on data about authors who have registered with the RePEc Author Service, institutions listed on EDIRC, bibliographic data collected by RePEc, citation analysis performed by CitEc and popularity data compiled by LogEc. It is based on the information that IDEAS could collect. However, this list includes over 200

institutions so almost all professors could find their PhD granting departments and institutions where they have worked. This ranking is renewable.

The last ranking is published by Tilburg University. All other rankings are published by scholars. But this one is an academic ranking published by a university. It is worldwide and includes 100 universities. The database covers publications in 68 journals since 2004. The ranking is based on a subset of journals in the database, over a 5-year period. This ranking is also renewable and the latest ranking is based on the academic contribution by departments from 2005 to 2010.

The ranking of journal is from Kalaitzidakis, Mamuneas and Stegos (2011), which is based on Kalaitzidakis, Mamuneas and Stengos (2003). The characteristic of this paper is that the authors use a rolling system to count the number of citations of articles published in the previous ten years. So this will give a smoother longer view of the evolution of rankings in the period under consideration.

Below are two tables of summary of the datasets. Table 1 is for the assistant professors that are currently employed at and get their PhD degrees from the top 50 US universities. Table 2 is for the assistant professors that are currently employed at world top 100 departments and get their PhD degrees from the top 50 US universities.

Table 1. Summary of Data Set I

	Number of Observations	Mean	Std. Dev.	Min	Max
Rank of Job1	213	17.67	12.59	1	46
Rank of PhD1	223	9.11	8.62	1	45
Rank of Job2	200	17.55	11.63	1	57
Rank of PhD2	222	9.55	9.32	1	43
Rank of Job3	224	15.99	11.32	1	59
Rank of PhD3	226	10.09	10.49	1	60
Rank of Job4	190	19.56	12.95	1	53
Rank of PhD4	207	10.76	9.97	1	80
Rank of Job5	210	19.85	15.38	1	68
Rank of PhD5	220	10.97	11.86	1	77
Number of Articles	226	1.47	2.39	0	21
Number of Papers	226	0.66	1.28	0	12
Quality of Papers	84	18.70	16.70	1	80

Note:
Rank of Job1 and Rank of PhD1 are from Kalaitzidakis, Mamuneas and Stengos (2003).
Rank of Job2 and Rank of PhD2 are from Amir and Knauff (2008).
Rank of Job3 and Rank of PhD3 are from Grijalva and Nowell (2007).
Rank of Job4 and Rank of PhD4 are from IDEAS.
Rank of Job5 and Rank of PhD5 are from Tilburg University.

Table 2. Summary of Data set II

	Number of Observations	Mean	Std. Dev.	Min	Max
Rank of Job1	255	22.29	17.77	1	98
Rank of PhD1	271	10.06	9.47	1	46
Rank of Job2	222	19.56	13.49	1	57
Rank of PhD2	260	10.67	10.24	1	57
Rank of Job3	248	19.56	15.79	1	72
Rank of PhD3	278	11.24	11.13	1	60
Rank of Job4	227	23.65	17.14	1	71
Rank of PhD4	253	12.13	11.35	1	80
Rank of Job5	288	29.92	24.44	1	91
Rank of PhD5	290	12.04	12.71	1	77
Number of Articles	305	1.33	2.18	0	21
Number of Papers	305	0.59	1.18	0	12
Quality of Papers	106	18.66	17.23	1	95

Note:
Rank of Job1 and Rank of PhD1 are from Kalaitzidakis, Mamuneas and Stengos (2003).
Rank of Job2 and Rank of PhD2 are from Amir and Knauff (2008).
Rank of Job3 and Rank of PhD3 are from Grijalva and Nowell (2007).
Rank of Job4 and Rank of PhD4 are from IDEAS.
Rank of Job5 and Rank of PhD5 are from Tilburg University.

Chapter 5.

Estimation

From Table 3 we can see that the coefficients on *Rank of PhD* are significantly different from 0. The sign is positive and this matches the intuition. The only exception is in the fourth regression when *Rank of Papers, Number of Papers* and *Quality of Papers* are used together as explanatory variables. In the fourth regression of part A, B, D and E, the coefficients on *Rank of PhD* are not significant.

This means that when the ranking of the *PhD* degree granting department is higher, then it is helpful for the graduates to find an assistant professor in a better department. This regression supports the intuition.

All coefficients on *Number of Articles* are significantly different from 0. In part B, C, D and E the coefficients are significantly different from 0 at 1% significance level while in part A, the coefficients are significantly at 5% level. The sign is reasonable. All the significant coefficients are negative.

This means that when the graduates have published more articles, which include papers in ranked journals and some other articles, it is helpful for the job seeking in the faculty. The absolute value of the coefficient on *Number of Articles* in each part of Table 3 is close to one. This means that the publication plays an important role for the job market candidates. This result is from the second column of the tables.

The coefficients on *Number of Papers* are also significantly different from 0 in part A, B, C, D and E. The signs are all negative. Again, this is reasonable. *Number of Papers* denotes the number of published papers in the ranked journals. These journals are the most important ones for economics faculty.

The estimation result means that more published paper in these journals will help get a job in a better economics department. The magnitude is larger than that of *Number of Articles*. Sometimes it even doubles. This means that these papers are more important than articles.

In the fourth column of regressions, the coefficients on *Rank of PhD* are not significant except that in part C. But the coefficients on *Number of Papers* are still significant. Here, *Quality of Papers* is included in the regression to denote the quality of the papers in the listed journals. In the fourth regression of part C, both coefficients on *Rank of PhD* and *Number of Papers* are significant.

Table 3. OLS Estimation Results Using Data Set I

Part A: Ranking from Kalaitzidakis, Mamuneas and Stengos (2003) is used

	Rank of Job	Rank of Job	Rank of Job	Rank of Job
Rank of PhD	0.48***	0.45***	0.47***	0.22
	(0.12)	(0.12)	(0.12)	(0.17)
Number of Articles		-0.92***		
		(0.29)		
Number of Papers			-1.61***	-1.19**
			(0.52)	(0.53)
Quality of Papers				-0.04
				(0.09)
Number of Observations	211	211	211	78
R-squared	0.11	0.14	0.14	0.08

Part B: Ranking from Amir and Knauff (2008) is used

	Rank of Job	Rank of Job	Rank of Job	Rank of Job
Rank of PhD	0.36***	0.35***	0.36***	0.18
	(0.10)	(0.10)	(0.10)	(0.12)
Number of Articles		-0.88**		
		(0.35)		
Number of Papers			-1.96***	-1.46***
			(0.54)	(0.53)
Quality of Papers				-0.06
				(0.07)
Number of Observations	197	197	197	73
R-squared	0.06	0.12	0.13	0.10

Part C: Ranking from Grijalva and Nowell (2007) is used

	Rank of Job	Rank of Job	Rank of Job	Rank of Job
Rank of PhD	0.24***	0.21***	0.23***	0.21**
	(0.07)	(0.07)	(0.07)	(0.10)
Number of Articles		-1.05***		
		(0.32)		
Number of Papers			-1.68***	-1.14*
			(0.55)	(0.61)
Quality of Papers				-0.06
				(0.09)
Number of Observations	224	224	224	83
R-squared	0.05	0.10	0.09	0.11

Part D: Ranking from IDEAS is used

	Rank of Job	Rank of Job	Rank of Job	Rank of Job
Rank of PhD	0.28***	0.26***	0.28***	0.11
	(0.09)	(0.08)	(0.09)	(0.08)
Number of Articles		-0.90***		
		(0.30)		
Number of Papers			-1.44***	-2.17**
			(0.56)	(1.02)
Quality of Papers				0.08
				(0.13)
Number of Observations	177	177	177	69
R-squared	0.05	0.08	0.07	0.11

Part E: Ranking from Tilburg University is used

	Rank of Job	Rank of Job	Rank of Job	Rank of Job
Rank of PhD	0.27**	0.24**	0.25**	-0.06
	(0.12)	(0.12)	(0.12)	(0.15)
Number of Articles		-1.09***		
		(0.32)		
Number of Papers			-2.03***	-2.03***
			(0.60)	(0.77)
Quality of Papers				0.11
				(0.17)
Number of Observations	206	211	206	76
R-squared	0.04	0.08	0.08	0.06

Note: Numbers in parentheses are heteroskedasticity-robust standard errors.
*: 10% significance level. **: 5% significance level. ***: 1% significance level.

The quality of the papers is also important. The ranking of the journal is an indicator for the quality of the papers. But *Quality of Papers* is not successful. This set of five regressions estimates the role of PhD degree granting economics department. The regression result matches the original expectation. However, this regression is conditional.

The PhD graduates from these top departments not only go to the top departments in the United States, but also go to the economics departments below 50 in the US and some departments in other countries. Here I focus on the effect of PhD degree on the job hunting as assistant professor so the graduates who go to industry are not considered.

To compensate the negative effect of conditional estimation in the first set of five regressions, I collect data on graduates from top 50 departments that are working in US economics departments below 50 and those in other countries. This new data set will alleviate the selection bias problem. No ranking includes all the economics departments in the world. It is typical that the researchers only include the top 100 economics departments in the world. If the top 50 graduates are working in the departments with a ranking below 100 then the data is not available.

The next set of regression is still OLS regression using data set II. PhD graduates from the top 50 economics departments in US could go to industry, join the top 50 US economics department, join the economics departments below 50 in US and join the economics departments in other countries such as Canada, United Kingdom, Hong Kong and Singapore.

The regression in Table 3 is conditional because the data only contains the graduates working at the top 50 economics departments in US. Table 4 will use data that includes more graduates. The data for graduates that are working at an economics department with a very a low ranking (lower than 100) are not included because this part of data is not available.

We can compare the results from Table 3 and Table 4. The magnitude of the coefficients on *Rank of PhD* in Table 4 is larger than that in Table 3. This means that the role of PhD degree is even larger when the regression includes more data.

Apart from this, the result from Table 4 is similar to that from Table 3. The coefficients on *Number of Papers* and *Number of Articles* are both negative. The absolute value of coefficient on *Number of Papers* is larger than that on *Number of Articles. Number of Paper* shows more importance than *Number of Articles*. Unfortunately the variable *Quality of Papers* is still not successful. Once *Quality of Papers* is added in the regression, the coefficient on *Rank of PhD* is not significant except in part B.

Table 4. OLS Estimation Results Using Data Set II

Part A: Ranking from Kalaitzidakis, Mamuneas and Stengos (2003) is used

	Rank of Job	Rank of Job	Rank of Job	Rank of Job
Rank of PhD	0.53***	0.50***	0.52***	0.25
	(0.14)	(0.14)	(0.13)	(0.16)
Number of Articles		-1.37***		
		(0.38)		
Number of Papers			-2.34***	-1.65**
			(0.69)	(0.74)
Quality of Papers				-0.10
				(0.10)
Number of Observations	250	250	250	91
R-squared	0.07	0.10	0.10	0.07

Part B: Ranking from Amir and Knauff (2008) is used

	Rank of Job	Rank of Job	Rank of Job	Rank of Job
Rank of PhD	0.46***	0.45***	0.46***	0.22*
	(0.09)	(0.09)	(0.09)	(0.13)
Number of Articles		-1.06***		
		(0.38)		
Number of Papers			-2.33***	-1.77***
			(0.63)	(0.62)
Quality of Papers				-0.10
				(0.07)
Number of Observations	217	217	217	79
R-squared	0.12	0.16	0.17	0.13

Part C: Ranking from Grijalva and Nowell (2007) is used

	Rank of Job	Rank of Job	Rank of Job	Rank of Job
Rank of PhD	0.41***	0.38***	0.40***	0.33**
	(0.11)	(0.11)	(0.11)	(0.14)
Number of Articles		-1.20***		
		(0.39)		
Number of Papers			-2.01***	-1.17
			(0.72)	(0.73)
Quality of Papers				-0.14**
				(0.11)
Number of Observations	248	248	248	89
R-squared	0.08	0.11	0.10	0.11

Part D: Ranking from IDEAS is used

	Rank of Job	Rank of Job	Rank of Job	Rank of Job
Rank of PhD	0.49***	0.45***	0.47***	0.08
	(0.13)	(0.12)	(0.11)	(0.07)
Number of Articles		-1.40***		
		(0.43)		
Number of Papers			-2.43***	-2.66**
			(0.84)	(1.16)
Quality of Papers				0.00
				(0.13)
Number of Observations	210	210	210	77
R-squared	0.11	0.15	0.14	0.10

Part E: Ranking from Tilburg University is used

	Rank of Job	Rank of Job	Rank of Job	Rank of Job
Rank of PhD	0.40***	0.35***	0.38***	-0.06
	(0.13)	(0.13)	(0.13)	(0.14)
Number of Articles		-1.84***		
		(0.48)		
Number of Papers			-3.19***	-2.52**
			(1.01)	(1.14)
Quality of Papers				0.09
				(0.17)
Number of Observations	275	275	275	94
R-squared	0.05	0.08	0.07	0.03

Note: Numbers in parentheses are heteroskedasticity-robust standard errors.
*: 10% significance level. **: 5% significance level. ***: 1% significance level.

Chapter 6.

Conclusion

The results in Table 3 show that the ranking of the PhD degree granting department has a positive effect on the first job department. The number of articles published at the time of graduation and the year after that also help find a faculty job at a better department. The number of papers published in listed journals plays a key role in the job seeking. The estimates in Table 4 show similar results. When graduates from top 50 economics departments working at departments below 50 in the US and in other countries are included in the dataset, the magnitude of the coefficient on PhD program rank is larger. The sign matches the expectation that higher ranking PhD programs help graduates find teaching positions at higher ranking economics departments. However, the coefficient on the variable that denotes the quality of published papers is not significant once it is added into the regression.

If every department of economics provides information for placement history, then all graduates who choose faculty jobs could be included in the regression. This could avoid the selection bias problem. Another way to measure the research potential of graduates is to use the number of citations of refereed papers. Apart from the ranking of PhD degree granting department and research potential, another factor that will have an effect on job hunting is evaluation from committee of supervisors.

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Appendix .

List of Top 50 US Economics Departments:

Harvard U, UC Berkeley, Princeton U, MIT, Yale U, U Michigan, New York U, UCLA, Stanford U, U Chicago, Columbia U, Northwestern U, UC San Diego, U Wisconsin-Madison, Boston U, U Pennsylvania, Ohio State U, Michigan State U, Cornell U, U Virginia, U Maryland, U Illinois-Urbana, Carnegie Mellon U, Duke U, UC Davis, U Southern California, U Texas-Austin, Brown U, U Minnesota, Iowa State U, Vanderbilt U, Johns Hopkins U, Pennsylvania State U, Boston College, California Institute Technology, U of Rochester, UNC-Chapel Hill, UC Santa Cruz, U Washington, Arizona State U, U Pittsburgh.

The list is from Grijalva and Nowell (2008).