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Econ 196 Honors Thesis

Title

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Publication Date

2020-03-01

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How Gender-based Relationships Between a Student and Advisor in Economics Ph.D. Programs Impact Future Student Success

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March 2020

Abstract

This paper examines how an economics PhD student's gender-based relationship with their advisor impacts their success. Women are historically underrepresented in the field of economics, and this paper examines student-advisor gender configurations to determine if the gender matching of a student and advisor is an early indicator of future success. I use data on the first job placement of a student, their PhD advisor, and their tenure status at their first job to determine if there are gender differences in the success rate of students with female advisors. This paper finds that female advisors are more likely to have female students and that there is no gender difference in the success rate of students with female advisors.

I. Introduction

Women are historically underrepresented in the field of economics. The persistent underrepresentation has not improved in the past twenty years: in 2018, women made up approximately 33% of entering economics PhD students[1]. This number has seen little to no improvement in the past 20 years; in fact, there has been a slight decline in the past 20 years, according to the Committee on the Status of Women in the Economics Profession (CSWEP) survey and annual report. This paper adds new data on the relationship between advisor-student gender matching and the success of a PhD student. This paper address the question: is there a gender difference in the success rate of students with female advisors? This paper focuses on success within academia and defines success by whether or not a student's first job was at a top-50 economics department. I use the 2013 US News report top-50 ranking, so a student is only ranked if their first job was at a top-50 department. First, I examine such questions as to whether or not female advisors are more likely to have female students and what fraction of female students start in academic jobs. The goal is to examine what makes a PhD student successful, in hopes of understanding why there are fewer female students than male. I use two main data sources: the Proquest Dissertations and Theses database along with CVs and personal/ department websites of economics PhD recipients. From the Proquest Dissertations and Theses database, I match advisors who graduated from top-fifty PhD programs between 1971-2003 to all the students they advised. I compile this data into a new data set that lists each PhD student, organized by their advisor. For each student, I collect additional data such as first job placement,

[1] CSWEP Annual Report (2018).

gender, ethnicity, and whether or not they received tenure at their first job. This data is collected from CV's and personal/departmental websites. The empirical strategy is to perform difference in difference analysis to isolate the effect of an advisor's gender on their students' success. This paper finds that the gender of an advisor has a statistically significant impact on their students' success; students who have female advisors are less likely to start their first job at a top-50 department. Male and female students of a female advisor are equally likely to be successful; the gender of a student is not a significant factor in determining success. In this sample, I found no gender difference in the success rate of students with female advisors.

II. Literature Review

The following three papers are representative of past research on the topic of student and advisor gender and differential success: Variation in Women's Success Across PhD Programs in Economics, by Leah Boustan and Andrew Langan, Gender Differences in Academic Career Paths of Economists, by Shulamit Khan, and Women Helping Women, Men Helping Women? Same-Gender Mentoring, Initial Job Placements, and Early Career Publishing Success for Economics PhDs, by Christiana Hilmer and Michael Hilmer.

Variation in Women's Success Across PhD Programs in Economics looks at first job placement, publications, and promotions to rank US economics departments on outcomes of women relative to men[2]. The authors also conduct interviews of various faculty to suggest

[2] Boustan and Langan (2019).

practices to economics departments for fostering female success. Using data sources such as surveys conducted by the CSWEP and faculty rosters collected from PhD-granting economics departments from 1994-2017, the authors show that departments who have more women faculty also tend to have more female students. This paper finds that there is a wide variation in the share of women in economics PhD programs ranging from 10% to 50% and that the share of women graduating from a program rises as the share of female faculty increases. There is also a larger share of female students as the department rank lowers. The authors find that male and female students who graduate from the same program have the same likelihood of being offered positions at PhD granting economics departments. However, men are more likely to be hired at higher-ranked departments and have more publications in top journals in the first seven years after receiving their PhD. The authors show that the average gap in placement rank of their first job for men and women who graduate from the same program is 4.8 rank points. This paper finds that PhD programs with more female faculty and whose faculty are aware of gender issues have more successful female students relative to other departments. In my analysis, I add data on whether or not advisor gender affects the department ranking of a student's first job. I postulate that this difference in placement rank may be because male students had better advisors than female students. To address this issue, I look at if there is a difference in the placement rank of female and male students who have the same advisor. This approach will isolate the effect of gender to determine if gender is a factor in determining success.

In the second paper, Gender Differences in Academic Career Paths of Economists, the author examines women's progress in the academic field of economics and management[3]. This

[3] Khan (1993).

paper uses panel data collected from the Survey of Doctorate Recipients (SDR). The survey data used in this paper dates back to 1973 and includes information on the careers of PhD economists and how they succeed. Based on the SDR, women are less likely than men to begin their first job in academia. This paper finds that of the men and women who enter academia, only 58.1% of women enter tenure-track jobs, whereas 73.3% of men enter tenure-track positions. The analysis in the paper suggests that tenure differences are primarily due to gender as opposed to other factors. In summary, this paper finds many gender differences in the career success of economists. The most significant difference appears to be in the length of time to receive tenure. While this paper focuses on the career of economists, my analysis examines early factors in a student's education that impacts their future careers. I add to the results from this paper by examining if males are more likely to be hired at higher-ranking programs.

Finally, Women Helping Women, Men Helping Women? Same-Gender Mentoring, Initial Job Placements, and Early Career Publishing Success for Economics PhDs considers the effect on the success of females of pairing female economics PhD students with female advisors[4]. This paper uses data on economics PhD students as well as publication data. The authors use a sample of 1,900 students who graduated from top-30 economics PhD programs from 1990-1994. The paper uses data on selected graduate students from top-30 programs, and it defines research productivity as the total number of publications in top-5 economics journals. The authors use this data to study the impact of student-advisor gender matching on the first job of a student and their research productivity. First, the paper notes that less than 2% of advisors at top tier universities are female. The authors find that only 9% of female students chose to work with a female

[4] Hilmer and Hilmer (2007).

advisor, whereas 91% of female students chose to work with a male advisor. This choice might be because there are far more male professors. The authors find that regardless of their advisor's gender, female students publish significantly fewer papers than male students who have male advisors. The authors attribute this discrepancy to female students having less access to top-ranked advisors. In summary, female students have fewer publications than male students working with male advisors. As the rank of a department decreases, female students are more likely to choose female advisors. I approach a similar problem, but from a new angle. By considering every advisee of a professor, I can isolate the effect of gender and look at the success of different students within the same advisor. The Hilmer's analysis is similar to mine, but can't take into account differences within a specific advisor. My analysis also uses more recent data[5]. The paper uses data from top-30 programs, whereas I focus on advisors who graduated from top-50 programs, and I examine their advisees.

III. Empirical Strategy

The goal of my empirical analysis is to determine if there is a gender difference in the success of students with female advisors. This paper defines success to be whether or not a student's first job was at a top-50 department. I only consider the top-50 rankings, so if a student's first job was not at a top-50 economics department, then the student is unranked. This

[5] The sample in this paper includes students who graduated from top-50 programs primarily from 2000-2009.

model will show us how the gender of an advisor impacts a student's probability of getting a job in a top-50 program.

The primary analysis in this paper uses the following model:

(1) $$T = \beta_0 + \beta_1 F_s + \beta_2 F_a + \beta_3 F_s * F_a + \varepsilon_i$$

In this equation T is a dummy variable indicating whether or not the student's first job is at a top-50 department, F_s is a dummy variable indicating whether or not the student is female, F_a is a dummy variable indicating whether or not the advisor is female, $F_s * F_a$ is an interaction term for the female student and female advisor mentor configuration, and ε_i is an error term. Based on estimation equation (1), I list the formula for each mentorship configuration. There are four student-advisor mentorship configurations to consider: male-male (3), male-female (4), female-male (5), and female-female (6):

(3) $$\text{Male}_{\text{student}}, \text{Male}_{\text{advisor}} = \beta_0$$

(4) $$\text{Male}_{\text{student}}, \text{Female}_{\text{advisor}} = \beta_0 + \beta_2$$

(5) $$\text{Female}_{\text{student}}, \text{Male}_{\text{advisor}} = \beta_0 + \beta_1$$

(6) $$\text{Female}_{\text{student}}, \text{Female}_{\text{advisor}} = \beta_0 + \beta_1 + \beta_2 + \beta_3$$

To isolate the added premium or negative of having a female advisor for male and female students I use the following two equations:

(7) $(\text{Male}_{\text{student}}, \text{Female}_{\text{advisor}}) - (\text{Male}_{\text{student}}, \text{Male}_{\text{advisor}}) = (\beta_0 + \beta_2) - (\beta_0)$

$= \beta_2$

and

(8) $(\text{Female}_{\text{student}}, \text{Female}_{\text{advisor}}) - (\text{Female}_{\text{student}}, \text{Male}_{\text{advisor}}) = (\beta_0 + \beta_1 + \beta_2 + \beta_3) - (\beta_0 + \beta_1)$

$= \beta_2 + \beta_3$

I use difference in differences again between equations (7) and (8) to isolate β_3 , the added premium or negative of having a female advisor (for a female student). I also run this model with faculty fixed effects. Generally, specific advisors may be better or worse than others, so including the faculty fixed effects, will allow us to see if there is variation in student success between different advisors.

I add additional controls for PhD year and institution to equation (1). The following model takes into account additional controls:

(2) $$T = \beta_0 + \beta_1 F_s + \beta_2 F_a + \beta_3 F_s * F_a + \beta_4 Y_s + \beta_5 Y_a + \phi_a + \varepsilon_i$$

In this equation T is a dummy variable indicating whether or not the student's first job is at a top-50 department, F_s is a dummy variable indicating whether or not the student is female, F_a is a

dummy variable indicating whether or not the advisor is female, $F_s * F_a$ is an interaction term for the female student and female advisor mentorship configuration, Y_s is a control for the year of the student's PhD, Y_a is a control for the year of the advisor's PhD, ϕ_a is a set of dummy variables for the university where the advisor received their PhD, and ε_i is an error term. Again, we consider the same four student-professor mentorship configurations and perform difference in difference analysis in the same way. The result is the female student-female advisor interaction term, β_3, indicating the added premium or negative of having a female advisor. In these models, there is no control for student ability, student field of study, or faculty ability. Future research on this topic can take these factors into account.

IV. Data

This paper uses two primary data sources: the Proquest Dissertations and Theses database and CVs accessed online.

The Proquest Dissertations and Theses database is an online database that gives access to abstracts and the full text of dissertations and theses spanning from 1637 to the present. One can search directly for an author, advisor, or title of a thesis. Proquest also provides information on the year in which the dissertation was written, the university the author attended, and who the author's advisor was. I use a dataset consisting of 2,052 PhD recipients who graduated from

top-50 economics PhD programs between 1971 and 2003[6]. This dataset includes their name, the university from which they received their PhD, the year they received their PhD, the year they received tenure, all professional positions they have held since receiving their PhD, and all PhD students whom they have advised. I use Proquest Dissertations and Theses to find the advisor of each of the graduates from top-50 programs and to find all students whom they have advised. Note that not everyone in the list had advisees; some PhD recipients did not enter into academia and instead took jobs in other sectors.

Using the student and advisor data from the first set, I create a new subset that lists PhD students organized by their advisor. So for each advisor, all their PhD students are listed in the dataset[7]. The set is organized by the advisor; in the data set, there are 80 advisors with all their advisees listed. For each advisor, I can examine and compare the success of all their students. This set has 1,144 observations, and they include a mix of students with male and female advisors. In this set, I removed observations when specific advisors had only unranked students, leaving a sample size of 1,007. Given each of these students, I then collect additional data by searching for CVs and looking through personal or departmental websites. I collect data on their first job, their gender, their advisor's gender, and whether or not they received tenure at their first job. I also note the rank of the department of their first job, if it is in the top-50 rankings, according to the 2013 US News report[8]. For departments that are not in the top-50, ranking is omitted. Table 1 summarizes descriptive statistics in this paper.

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[6] Thank you to Kelly Bedard and Jenna Stearns for helping to collect and compile this data.

[7] I used a subset of the original dataset, so I do not use all 2,052 advisors.

[8] I use the 2013 ranking, but note that top-50 rankings change very little over time so the 2013 rankings are still relevant today.

Table 1
Summary statistics

	Number	Proportions
Female Students with Female Advisors	46	0.045
Male Students with Female Advisors	56	0.056
Female Students with Male Advisors	266	0.264
Male Students with Male Advisors	639	0.635
Sample size	1,007	

Note the original sample size is 1,144; some observations were removed.

V. Results

The goal of the empirical analysis in this paper is to determine if there is a gender difference in the success rate of students with female advisors. In table 2, I look at the gender proportions of students of female and male advisors.

Table 2
Proportions by gender

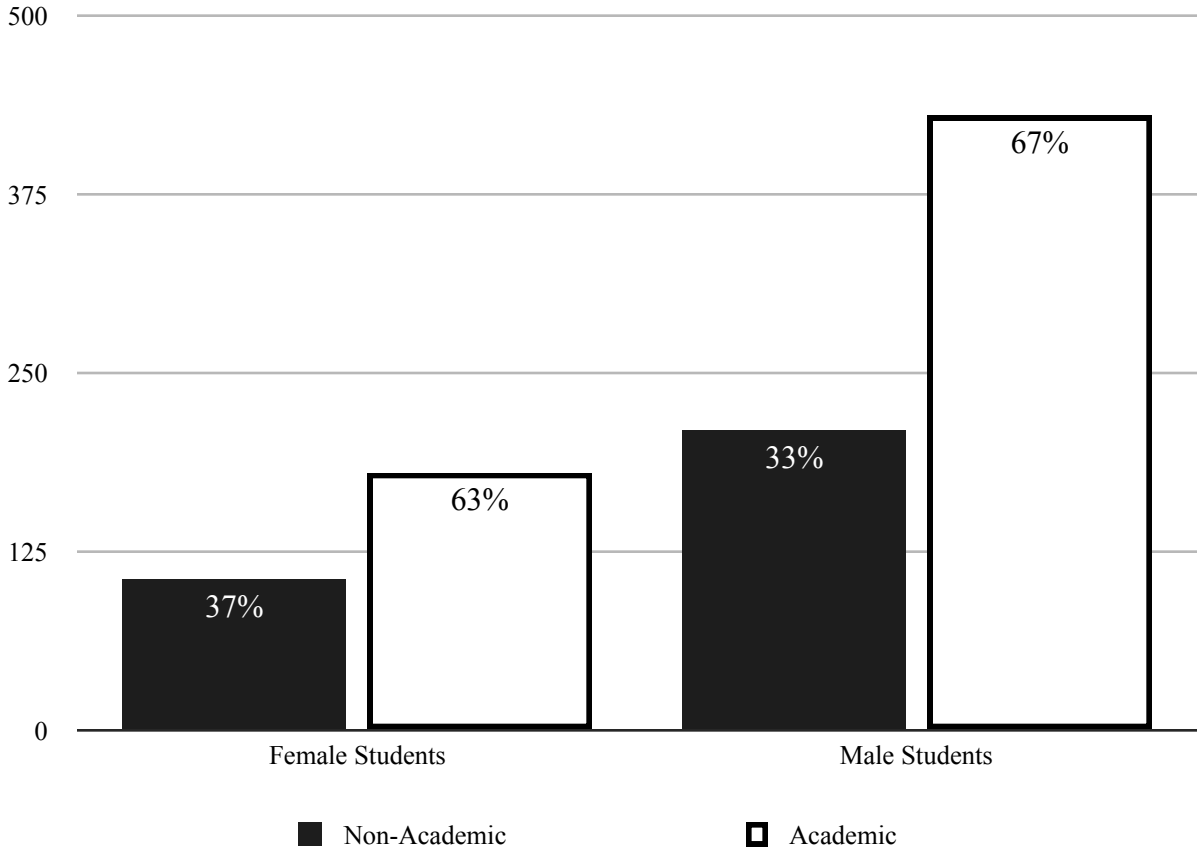
	Proportions for Female Advisors	Proportions for Male Advisors
Female Students with Female Advisors	0.45	
Male Students with Female Advisors	0.55	
Female Students with Male Advisors		0.29
Male Students with Male Advisors		0.71

This data uses the smaller sample of 1,007.

We see that for female advisors, 45% of their students are female, and 55% of their students are male. These proportions indicate that the female advisors in this sample have a relatively even mix of male and female students. Referring back to table 2, we also see that for male advisors, 29% of their students are female, and 71% of their students are male. This result is not unsurprising; these proportions suggest that in this sample, female advisors are more likely to have female students than male advisors are.

Next, I look at the proportion of male and female students whose first job is in academia. Figure 1 shows the proportion of male and female students who enter academic and non-academic jobs.

Figure 1



In figure 1, we see that in this sample, approximately 63% of female students start their first job in academia, whereas approximately 67% of male students start their first job in academia. Thus we see that 37% of women and 33% of men start in non-academic jobs. This result indicates that men are slightly more likely than women to start their first job in academia. Regardless of gender, students are more likely to start in an academic job.

Table 3 displays the results from estimation equations (1) and (2). Column 1 lists the results from estimation equation (1). Recall that this model does not include controls for PhD year or institution. This model shows us how various factors affect the probability of getting a job in a top-50 program.

Table 3
The impact of advisor gender on getting first job at a top-50 economics department

	(1)	(2)	(3)	(4)
Female Student	-0.0207	-0.0258	-0.0134	-0.0207
	(0.0336)	(0.0334)	(0.0338)	(0.0337)
Female Advisor	**-0.1034**	**-0.1185**	**-0.1182**	**-0.1397**
	(0.0580)	(0.0579)	(0.0612)	(0.0604)
Female Student and Female Advisor	0.0021	-0.004	0.0218	0.0161
	(0.0871)	(0.0865)	(0.0883)	(0.0879)
Constant	**0.3178**	**-21.5938**	**0.3378**	**-29.1346**
	(0.0185)	(10.4045)	(0.1956)	(11.5808)
Advisor PhD Year		**0.0091**		**0.0131**
		(0.0050)		(0.0056)
Student PhD Year		0.0019		**0.0017**
		(0.0033)		(0.0033)
R-Squared	0.01	0.01	0.04	0.04
Sample Size	1,007	1,007	1,007	1,007

Standard errors in parentheses.
Bold coefficients are statistically significant at the 10 percent level.
Columns 3 and 4 include controls for PhD institution.

In column (1), we see that being a female student, holding all else constant, decreases the probability of getting a job in a top-50 department by approximately 2%. This result is not statistically significant, however, so there does not appear to be a difference in the success rate of male and female students. Referring back to column (1), we see that having a female advisor decreases the probability of success by approximately 10.3%, holding all else constant. This result is statistically significant and suggests that for this sample, all students, regardless of gender, are worse off if they have a female advisor. We see that for a female student, having a female advisor will increase the probability of success by 0.2%. This result is not statistically significant, so having a female advisor will not make a female student better off. Women are historically underrepresented in the field of economics, but this data suggests that they have similar success rates within the same advisor. When we include faculty fixed effects in equation (1), we can see if specific advisors are better or worse at placing students. In general, we can expect that some advisors are better than others, and this could be for a multitude of reasons such as network and age. Indeed when we include faculty fixed effects, we see there is a wide variation in success among advisors. The results indicate that certain advisors have much more successful students than others, so a lot of the variation in student success may be due to the inherent ability of an advisor. Column (2) lists the result when we include a control for both advisor and student PhD year. These results are very similar to column (1). Female students are slightly worse off, but the result is not statistically significant. Once again, we see that having a female advisor decreases the probability of success by approximately 11.9%. This result is statistically significant and suggests that, in this sample, students of female advisors are worse off. The female student and female advisor interaction term is not statistically significant, so in this sample, having a female advisor will not make a female student better off. Even when we

control for the advisor and student PhD year, we see that students of female advisors are still worse off. In column (3), I include a control for the department where the advisor received their PhD, but remove the control for student and advisor PhD year. Here we see that female students are slightly worse off, but once again, the result is not statistically significant. Having a female advisor decreases the probability of success by approximately 11.8%. This result is statistically significant and suggests that, so in this sample, students of female advisors are worse off. Again, the female student and female advisor interaction term is not statistically significant, so it does not appear that having a female advisor will make a female student better off. Even when we control for the advisor and student PhD year, we see that students of female advisors are still worse off. In column (4), I include controls for student and advisor PhD year and advisor PhD institution. The coefficient on female student is not statistically significant. We see that having a female advisor decreases the probability of success by approximately 14%, holding all else constant. This result is statistically significant, so in this sample, students of female advisors are worse off. The female student and female advisor interaction term is not statistically significant. In this sample, we see that having a female advisor decreases the probability of starting a job in a top-50 department, regardless of student gender, and this result persists even with additional controls.

VI. Discussion

This paper finds that female advisors are less successful at placing students who are completing their PhD in economics. Students who have a female advisor are more likely to have

a lower-ranked first job. This result holds for both male and female students of female advisors. This result is contrary to my hypothesis that female students would benefit from having female advisors. Based on this data, the results indicate that both male and female students of female advisors are worse off. But, we can't generalize this result to all economics PhD students; more research on women in other PhD programs is needed. While women are still underrepresented in the field today, only 33% of entering economics students are female; they are still successful within their PhD programs. Women are starting their first jobs in programs that have similar rankings to those of their male counterparts. We also see that the majority of women enter into academic jobs. However, readers should note that this paper contains a significant amount of data on male advisors and students and far less on female advisors and students. Future research on this topic will include more data on female advisors so that we can learn more about their gender-based relationships with their students and the future success of their students. Upon examining faculty fixed effects, I found that there is significant variation in student success between different advisors. Some advisors produce much more successful students, whereas other advisors are generally not as successful in placing students. The results suggest that the ability of an advisor plays a significant role in determining student success. We can conclude that more focus should be placed on bringing women into economics PhD programs to increase the representation of women in economics, but matching them with female advisors may not increase success.

VII. Conclusion

This paper examines whether or not there is a gender difference in the success of students with female advisors. I find that there is no gender difference in the success rate of students with female advisors. We see that students are equally likely to be successful regardless of gender. However, both male and female students of female advisors are less likely to start their first job in a top-50 department, so the advisor gender does have a statistically significant effect on the success of their students. By examining advisor fixed effects, we see that there is a significant variation in student success between different advisors. These results suggest that the ability of an advisor plays a significant role in determining student success. To improve the status of women in economics, we need to increase representation, but based on the results in this paper, it is unlikely that matching female students to female advisors will have a significant, positive impact on their success.

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