The Path to an Economics PhD

Garrison Schlauch
Richard Startz[1]
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Abstract

We examine the pre-graduate school characteristics of PhD students graduating from the top 50 American economics programs. For PhD students coming from American undergraduate institutions, attending a highly ranked undergraduate institution is strongly associated with graduating from a highly ranked PhD program, as is having research assistant experience between undergraduate and graduate school. For both American and international PhD students, having a master's degree is not associated with graduating from a highly ranked PhD program. Without research assistant experience, women from American undergraduate institutions graduate from lower ranked PhD programs than men. Women also receive significantly more benefit than men from majoring or minoring in math rather than in economics. Students from liberal arts colleges do worse than students from national universities, i.e. non-liberal arts, non-regional, ranked universities. Students from American undergraduate institutions who major or minor in math or in both economics and math graduate from significantly better ranked PhD programs than do students who major or minor in economics but not math.

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Academic economists are particularly interested in the training of economics PhDs. This interest begins at the undergraduate level, where academics often advise undergraduates considering a career in economics. To provide statistical evidence on the path to an economics PhD, we connect graduation outcomes for PhD candidates graduating from the top 50 economics PhD programs ranked according to US News (2013) on the 2016-17 job market with their observable pre-PhD characteristics, with the most focus on candidates who completed their undergraduate degree in the United States.

We find candidates from American undergraduate institutions (hereafter referred to as "American") with research assistant (RA) experience—those with experience as a research assistant in academia, government, economic consulting or the Federal Reserve—after completing their undergraduate studies and prior to beginning their PhD are more likely to graduate from a better ranked program, while for all candidates having a master's degree is not associated with graduating from a better ranked program. With regards to undergraduate field of study, students who major or minor in math but not economics or in both math and economics graduate from significantly better ranked PhD programs than do students who major or minor in economics but not math. As evidence of gender disparity, women without RA experience are significantly more likely to graduate from a worse ranked PhD program than men. Women also receive significantly more benefit than men from majoring or minoring in math rather than in economics. Candidates from undergraduate liberal arts colleges graduate from worse ranked PhD programs than candidates from equally ranked national universities. Unsurprisingly, candidates from better ranked undergraduate institutions are far more likely to

graduate from better ranked PhD programs, as are students who received honors upon

graduation.

It is important to note that our findings are conditional on success in rather than admission to a top 50 economics PhD program. This is important in that we cannot determine whether, for instance, working as an RA before graduate school increases an applicant's chances of gaining admission to a better ranked PhD program or teaches them skills that help them succeed once they are in the program. Although advice to those interested in getting a PhD in economics is usually phrased in terms of admission, presumably the real goal is getting the PhD. To achieve this goal, it is most useful to look at the pre-PhD characteristics of successful PhD candidates.

The closest research to ours is Stock and Siegfried (2015). (For an overview of research in the field we recommend Stock and Siegfried (2014).) While much of their article examines general trends in the production of economics PhDs, the authors also examine the characteristics of students entering 27 economics PhD programs in 2002. Because the paths to graduate school for American and international students often differ, we intentionally focus on the former while Stock and Siegfried include both groups in their analysis. One advantage of Stock and Siegfried's sample, though, is that they have data on GRE scores. Instead we use a dummy for having received undergraduate honors. While receiving honors might be a more general measure of academic ability, we suspect that variation in the practice of recording honors on CVs induces measurement error while GRE scores are at least accurate records of GRE score.

Despite differences in our sampling frames, where comparable our results largely align. We find similar effects on the chance of admission to a top 15 PhD program for international students and across undergraduate fields of study. Unlike Stock and Siegfried, we do not find females majoring in economics but not math do better than males from otherwise observably equal backgrounds.

I.   Data

Our data consists of a census of all economics PhD candidates posting curricula vitae for the 2016-17 job market from the top 50 economics PhD programs. Of the 650 identified job market candidates, we were able to find 612 usable CVs. The "top 50" programs are defined using the *U.S. News & World Report* 2013 ranking of economics PhD programs (U.S. News & World Reports 2016), which is the ranking closest to the point at which most candidates in our sample applied to graduate school. Because it is likely almost all candidates posted curricula vitae, our sample is nearly exhaustive of the drawn population. Since only 60% of entering students complete their PhD in economics Stock, Siegfried (2014), our sample is selective towards successful candidates rather than all PhD entrants.

Before considering the association between candidate characteristics and PhD program ranking, it is useful to examine the raw data. The 50 programs in our sample account for roughly 60% of all new PhDs on the market.[2] Figure 1 shows the production of PhDs, with counts on the left axis and the cumulative percentage on the right. This production is not evenly

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[2] The 2016 CSWEP census of all U.S. PhD granting programs reports 1,056 job candidates on the market for the previous year. (CSWEP 2016).

spread among program rankings: the top five programs account for roughly one-fifth of the

production by all 50 programs while the top 15 account for roughly half.
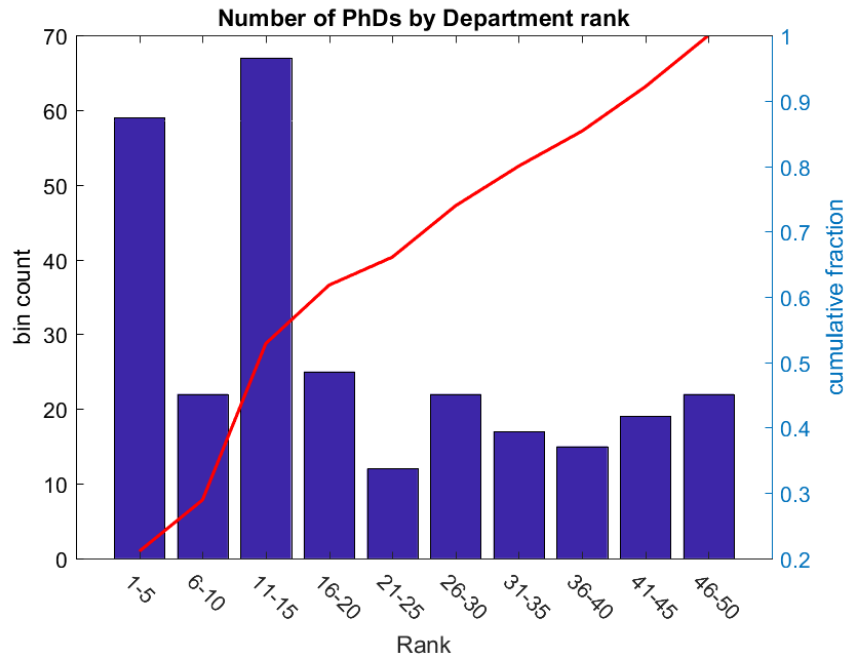
Number of PhDs produced in 2016-17 by department ranking binned in groups of five

Figure 1

Table 1: Descriptive Statistics

	American mean/sd	International mean/sd	Combined mean/sd
PhD program ranking	19.83	21.45	20.71
	(14.55)	(14.86)	(14.73)
Attended a top 15 PhD program	0.53	0.45	0.49
	(0.50)	(0.50)	(0.50)
Combined undergraduate institution ranking	34.53		
	(35.01)		
National university undergraduate ranking	37.07		
	(34.74)		
Liberal arts undergraduate ranking	36.49		
	(35.88)		
Attended unranked undergraduate institution	0.06		
	(0.25)		
Attended undergraduate liberal arts college	0.23		
	(0.42)		
Female	0.26	0.31	0.29
	(0.44)	(0.47)	(0.45)
Majored/minored in economics, not math	0.44	0.62	0.53
	(0.50)	(0.49)	(0.50)
Majored/minored in math, not economics	0.09	0.10	0.09
	(0.28)	(0.30)	(0.29)
Majored/minored in economics and math	0.43	0.11	0.26
	(0.50)	(0.31)	(0.44)
Did not major/minor in math or economics	0.05	0.17	0.12
	(0.21)	(0.38)	(0.32)
Has RA experience	0.39	0.38	0.39
	(0.49)	(0.49)	(0.49)
Has a previous graduate degree	0.14	0.75	0.47
	(0.35)	(0.44)	(0.50)
Received undergraduate honors	0.66	0.41	0.52
	(0.47)	(0.49)	(0.50)
Observations	280	332	612

Basic data descriptives are presented in Table 1. Of the 280 American PhD candidates 26% are women compared to 31% among the 332 international students, though the difference is not statistically significant. Combined, 29% of the sample is female compared to 34% in 2003-04 Stock, Finegan, Siegfried (2006), which includes American and international students. Candidates with a master's degree, defined to exclude master's degrees granted as part of the

candidate's PhD, comprise 14% of the American sample[3] and 75% of the international sample.

In line with the 46% figure reported in Stock, Finegan, Siegfried (2006) for all incoming graduate

students, 47% of the candidates in our sample have a master's degree. Five to six percent of

American candidates have a master's degree in a field other than economics, with less than

three percent in another mathematical field, i.e. math, statistics or physics, compared to 15%

and 10%, respectively, for international students. Additionally, almost 40% of the sample have

RA experience, where we only include RA experience after completing an undergraduate

degree and before beginning graduate school.

Undergraduate majors and minors among the 98% of the sample who report a major or

minor are concentrated almost entirely in economics and math: 95% for Americans and 83% for

international candidates. Roughly equal fractions of American candidates report a major or

minor in economics but not math or in both economics and math (a double major, a joint

major, or a major in one field and minor in the other). Majoring or minoring in both economics

and math is significantly more popular for American candidates than for international

candidates: 43% vs 11%, while majoring or minoring in economics but not math is modestly less

popular: 44% vs 62%. Ten percent of all candidates report a major or minor in math but not

economics.

We use the *U.S. News & World Report* 2012-2013 undergraduate rankings, which

correspond roughly to the year the candidates began graduate school. These rankings are

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[3] Note that between the time students in our sample matriculated and the time they graduated, several economics programs in the top 50 opened new master's programs that included preparation for PhD programs as one of their stated objectives. This raises the possibility that the prevalence of master's degrees might be different at some future date, although the number of candidates proceeding from these programs to well-ranked PhD programs appears to be small compared to the overall flow into such PhD programs.

separate for national universities and liberal arts colleges and only for American undergraduate institutions. We merge the two lists by simple combination, hence there may be two or more schools assigned a given ranking – some from the national university list and some from the liberal arts list. We do not have data on undergraduate institution rankings for international students.

Comparing rankings between PhD programs and undergraduate institutions requires some caution, beginning with the reminder that rankings are ordinal. Average undergraduate rankings among the 90% of Americans who attended ranked undergraduate institutions are lower than average PhD rankings, but this is in part an artifact of their being so many more undergraduate institutions than the 50 PhD institutions we examine. Given the very large number of undergraduate institutions in the country, it is clear from Table 1 that the candidates in our sample generally attended very well ranked undergraduate institutions. Moreover, 23% of candidates attended a liberal arts college, with the average undergraduate rankings between liberal arts colleges and national universities being similar.

II.   The relationships between candidate characteristics and graduate school ranking

We now examine the relationship between PhD candidate characteristics and graduate school ranking. We begin with variables largely outside candidates' control during their undergraduate years, namely the ranking of the institution granting their undergraduate degree. Then we consider variables within candidates' control during their undergraduate years, such as their major or minor and their academic accomplishments as signaled by graduation honors. Finally, we look at variables in candidates' control after their undergraduate

years before enrolling in graduate school, specifically working as a research assistant or getting a master's degree. In all cases we include graduation honors as a control variable. We also examine the relationship between gender and graduate school ranking. Because the paths to graduate school often differ between American and international students, we look separately at both groups with a focus on the former. Unless stated otherwise the reported results are for Americans.

First, we raise the obvious caution about interpreting the results as causal. Some of the correlations may simply reflect screening, e.g. students from higher ranked undergraduate institutions may have higher innate ability. Observable characteristics may also be correlated with characteristics graduate schools observe that do not appear in our data. While controlling for honors status gives a measure of ability, it is surely an imperfect measure. Keeping these cautions in mind, note that many of the correlations are very strong.

The relationship between the rankings of undergraduate institutions and PhD programs is strong and essentially linear. The coefficient in Table 2 is 0.12, implying that attending an undergraduate institution ranked one standard deviation (35) better corresponds to graduating from a PhD program ranked four places better. In both columns we see that students who attended a liberal arts college do roughly 5 rankings worse than students from a national university with otherwise observably equal backgrounds. Coming from an unranked undergraduate program lowers the predicted graduate ranking by 20 to 21 places. In fact, we observe *no* students in the top 15 PhD programs from unranked undergraduate schools.

Before interacting gender on various controls, female candidates graduate from PhD programs ranked roughly four rankings worse than male candidates. After adding the final set

of interactions in the rightmost column, however, the purely gender effect loses statistical significance. Moreover, there is no interesting interaction between gender and undergraduate ranking.

Unsurprisingly, graduating with honors is associated with graduating from a better ranked graduate program. The effect is three to four rankings, with two-thirds of the sample reporting honors.

We turn now to the relationship between undergraduate major or minor and graduate school ranking. Figure 2 shows that candidates who majored or minored in economics but not math or in both economics and math are distributed nearly evenly across PhD department rankings. Table 2 shows that compared to candidates who majored or minored in economics but not math, those who majored or minored in math but not economics (both math and economics) graduate from PhD programs seven to eight (four to six) rankings better. According to the second column of Table 2, females benefit nine more rankings than males from majoring in math.
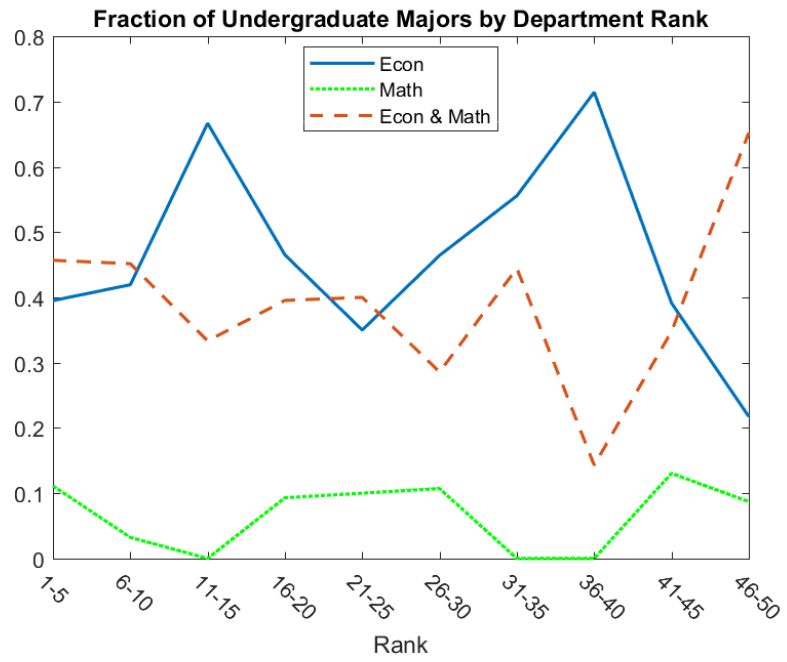
Figure 2

Table 2: Predictions of PhD Institution Ranking

	PhD program ranking	PhD program ranking
Combined undergraduate institution ranking	0.116***	0.115***
	(0.034)	(0.033)
Attended unranked undergraduate institution	21.188***	19.850***
	(2.750)	(2.817)
Attended undergraduate liberal arts college	5.358*	4.876*
	(2.743)	(2.709)
Liberal arts undergraduate ranking	-0.061	-0.048
	(0.046)	(0.046)
Received undergraduate honors	-3.711**	-3.680**
	(1.669)	(1.672)
Majored/minored in math, not economics	-7.659***	-6.834**
	(2.837)	(3.095)
Majored/minored in economics and math	-3.994**	-5.558***
	(1.739)	(1.871)
Did not major/minor in math or economics	-3.456	-3.584
	(3.414)	(3.601)
Has RA experience	-5.395***	-3.556*
	(1.763)	(1.886)
Has a previous graduate degree	3.525	1.672
	(2.731)	(3.008)
Female	4.051**	4.984
	(1.924)	(3.603)
Female * majored/minored in math, not economics		-9.269*
		(4.897)
Female * majored/minored in economics and math		3.999
		(4.007)
Female * has RA experience		-6.510*
		(3.782)
Female * has a previous graduate degree		5.353
		(5.688)
Constant	19.695***	19.978***
	(2.353)	(2.401)
Observations	270	270
R^2	0.283	0.306

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Upon graduation, undergraduates interested in getting a PhD in economics can choose to work as a research assistant or to pursue a master's degree. Figure 3 shows the fraction of PhD candidates with RA experience and the fraction with a master's degree for each of the 10 PhD program ranking bins. 90% confidence intervals are also given, computed using the binomial distribution. For Americans graduating from PhD programs at the upper end of the top 50, having RA experience is much more common than having a master's degree. In the top five graduate programs roughly three-fifths of American candidates have RA experience, while only one-tenth have a master's degree. (For International candidates in the top five graduate programs the reverse is true: less than half have RA experience while more than three-fourths have a master's degree. Combined, graduates from the top five graduate programs hold master's degrees 45% of the time, in line with the 38% figure reported in Stock, Finegan, Siegfried (2006).)

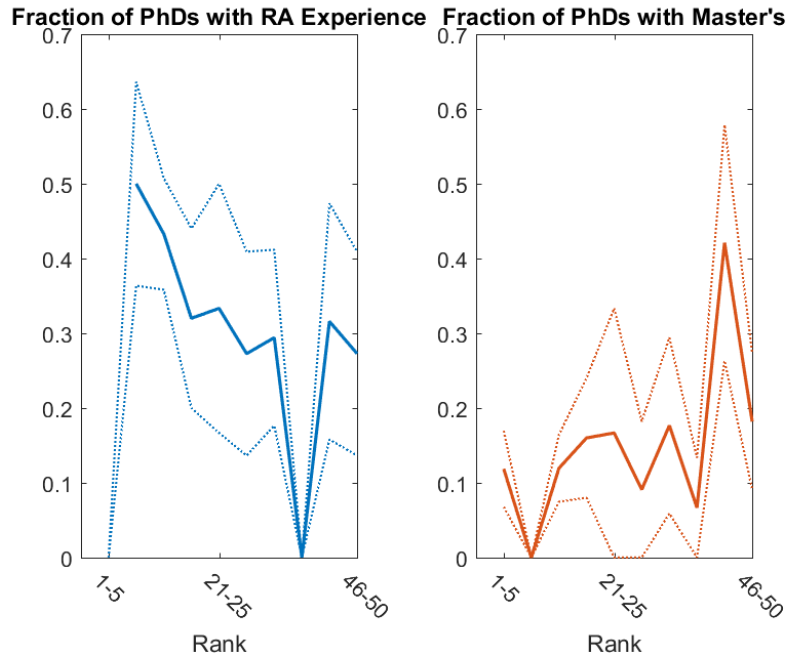**Fraction of PhDs with RA Experience   Fraction of PhDs with Master's**

Figure 3

Before interacting the controls on gender, the leftmost column of Table 2 suggests having

RA experience is associated with over a five rank improvement. This effect also appears to be

gender driven. Indeed, the rightmost column of Table 2 suggests the RA effect is much larger

for women than for men. In general we find no significant benefit in terms of graduate program

ranking associated with having a master's degree. In fact, having a master's degree is associated

with graduating from a worse-ranked PhD institution, although not significantly so.

III.   The relationships between candidate characteristics and experience between undergraduate and graduate school

American candidates who attended better ranked undergraduate institutions are much

more likely to have RA experience, with the opposite being true for candidates with a master's

degree. This relationship can be seen in Figure 4, which plots having RA experience (left) and

having a master's degree (right) against undergraduate institution ranking. Note that if the two

observations with the lowest undergraduate ranking were omitted, the relationship between

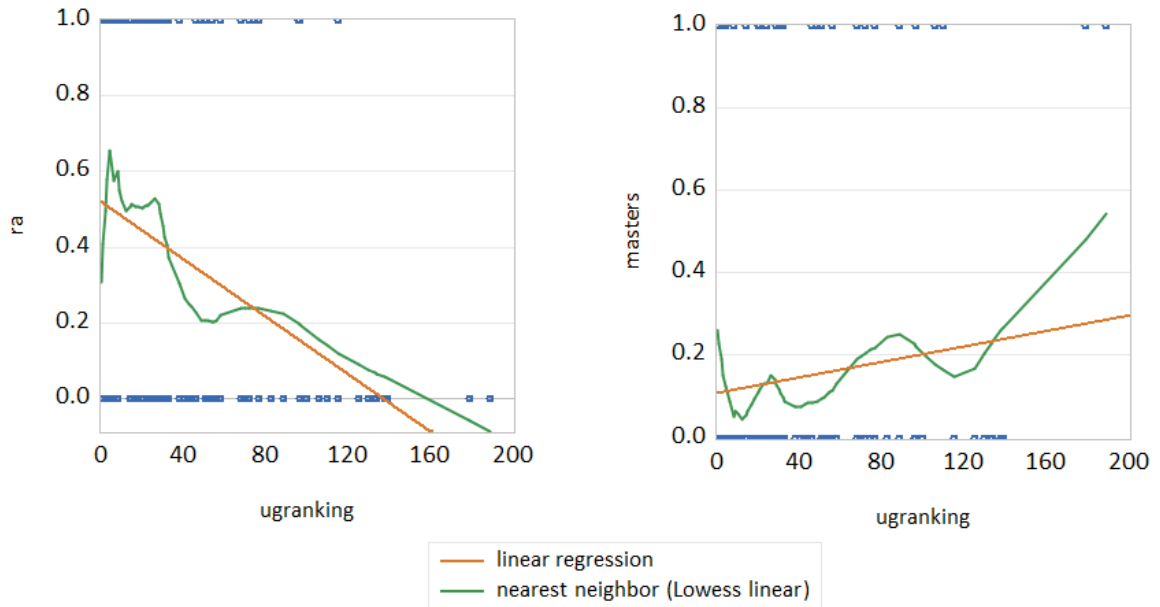undergraduate ranking and having a master's degree would be nearly flat.

Figure 4

Linear probability models for having RA experience or having a master's degree are

reported in Table 3. Candidates who attended a liberal arts college, especially a better ranked

one, are much more likely to have RA experience, while females are modestly more likely to

have RA experience and candidates from unranked undergraduate institutions are much less

likely to have RA experience. Interestingly, those majoring or minoring in both economics and

math are less likely to have RA experience than are students majoring or minoring in economics

but not math. Such candidates might have seemed especially qualified for competitive RA

positions, though perhaps they are perceived by advisors as being in less need of RA

experience.

In contrast, candidates from unranked undergraduate institutions are much more likely to have a master's degrees while neither gender nor attending a liberal arts college seems to affect this likelihood. The coefficient on "other major" is large and strongly significant, suggesting that for these candidates earning a master's degree may have been an important step towards graduate school, though this result is only based on five observations.

Table 3: Linear Probability Models for Post-Baccalaureate Experience

	Has RA experience	Has a previous graduate degree
Combined undergraduate institution ranking	-0.004***	0.002**
	(0.001)	(0.001)
Attended unranked undergraduate institution	-0.343***	0.217*
	(0.104)	(0.112)
Attended undergraduate liberal arts college	0.257***	0.006
	(0.093)	(0.056)
Liberal arts undergraduate ranking	-0.003*	-0.001
	(0.002)	(0.001)
Received undergraduate honors	0.051	-0.086*
	(0.058)	(0.045)
Majored/minored in math, not economics	0.001	0.060
	(0.100)	(0.089)
Majored/minored in economics and math	-0.187***	-0.068*
	(0.059)	(0.038)
Did not major/minor in math or economics	-0.181	0.488***
	(0.134)	(0.141)
Female	0.111*	0.019
	(0.064)	(0.040)
Constant	0.542***	0.116**
	(0.075)	(0.058)
Observations	270	271
R^2	0.191	0.186

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

While our primary interest is in outcomes for students with American undergraduate degrees, we briefly examine outcomes for international students both as being of interest in its own right and for comparability to the literature. Figure 4 examines the distribution by program ranking of American and international candidates. Although 45% of PhDs go to Americans, the fraction of Americans by program varies from almost all to none. Americans also comprise a modestly higher fraction of the candidates at the upper end of the top 50.
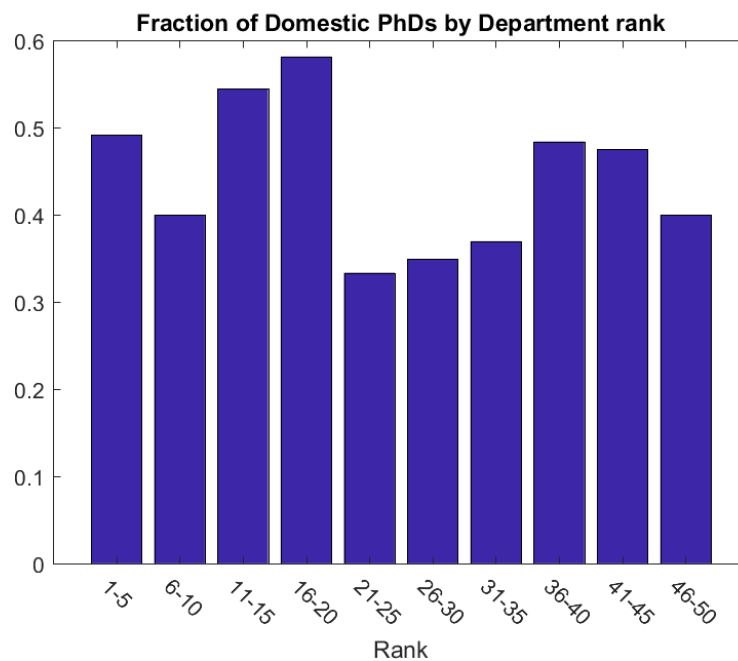

Fraction of Domestic PhDs by Department rank

Figure 4

Stock and Siegfried provide estimates from a sample roughly a decade earlier than ours which includes American and international candidates of the relationship between PhD program ranking and undergraduate major and gender on the probability of attending a top 15 program and on the marginal effect at the data mean. For comparison we provide linear probability model estimates in Table 4.

Where comparable our results largely align. We do not find evidence that international candidates are more or less likely than Americans to graduate from a top 15 PhD program. This result is similar to the average of Stock and Siegfried's estimates for international students, who they split into two groups. Also similar to Stock and Siegfried, we do not find any effect of major or minor on the chance of graduating from a top 15 program. Stock and Siegfried also find a positive interaction between majoring in economics and being female. We find the same sign on the interaction but not a significant effect.

Table 4: Linear Probability Model for Graduation from Top 15 Institutions

	Combined
Received undergraduate honors	0.146***
	(0.044)
Female	-0.092
	(0.146)
Has RA experience	0.134***
	(0.050)
Has a previous graduate degree	0.044
	(0.059)
Majored/minored in economics, not math	-0.022
	(0.075)
Majored/minored in math, with or without economics	0.113
	(0.080)
Female * majored/minored in economics, not math	0.031
	(0.141)
Female * majored/minored in math, with or without economics	-0.104
	(0.151)
Female * has RA experience	0.047
	(0.091)
Female * has a previous graduate degree	-0.035
	(0.093)
International	-0.022
	(0.051)
Constant	0.355***
	(0.080)
Observations	583
R^2	0.066

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

IV. Discussion

Our examination of graduating PhD candidates affirms what is probably the received wisdom: American candidates graduating from better ranked PhD programs are more likely to come from better ranked undergraduate institutions and to have RA experience after completing their undergraduate studies prior to entering a PhD program. Having a master's degree is not associated with graduating from a better ranked PhD program. International students are significantly more likely to have a master's degree than their American counterparts.

Without RA experience, American females do worse than American males from otherwise observably equal backgrounds, though females are also more likely to have RA experience and receive a greater boost in graduate institution ranking than men from having RA experience. Moreover, females receive a significant benefit from majoring or minoring in math but not economics.

Students with a major or minor in math but not economics or in both math and economics do better than students with a major or minor in economics but not math, i.e. students with a degree in math do better than students with a degree in economics but not math. Students from a national university also do better than students from a liberal arts college. Repeating the earlier caveat about causality, it nonetheless seems reasonable to suggest that for students at ranked American undergraduate institutions gaining RA experience is worthwhile while pursuing a master's degree is probably not.

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