Volume 38, Issue 4

The path to an economics PhD

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Abstract

We examine the pre-graduate school characteristics of PhD candidates graduating from the top 50 American economics programs. Among candidates from American undergraduate institutions, we find that those who are male, have undergraduate honors, hold an undergraduate major or minor in math and come from highly ranked undergraduate institutions are more likely to graduate from from highly ranked PhD programs. They are more likely to have research assistant experience and less likely to have a graduate degree between completing their undergraduate studies and beginning their PhD (unlike international candidates). In the top five PhD programs, nearly 60% of Americans entered with post-undergraduate research assistant experience while 10% of Americans and 75% of international students entered with a graduate degree. Finally, American candidates from liberal arts colleges or unranked undergraduate institutions graduate from lower ranked PhD programs than those from national universities, i.e. non-liberal arts, non-regional, ranked universities.

1. Introduction

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 regarding the path to an economics PhD, we connect job market candidates' PhD program ranking with their observable pre-PhD characteristics. While we focus on candidates from American undergraduate institutions—hereafter referred to as American regardless of their national origin—our analysis includes all candidates on the 2016–17 job market from the top 50 American economics PhD programs ranked by *U.S. News & World Report* (2013).

In general, we find that the results from the previous decade in Stock and Siegfried (2015) hold despite differences between our sample frames. We also examine several parameters not available to Stock and Siegfried, namely candidates' research experience, their undergraduate institution's ranking, and any honors they received before beginning their PhD.

We find that Americans with research assistant experience—those with experience as a research assistant in academia, government, economic consulting or the Federal Reserve—between completing their undergraduate degree(s) and beginning their PhD are more likely to graduate from a highly ranked PhD program. The prevalence of such experience among job market candidates appears unstudied until now and may come as a surprise to faculty who do not regularly send students to top programs.

The relative unimportance for Americans to have a graduate degree before beginning their PhD is consistent with Stock and Siegfried (2015). Only 14 percent of Americans in our sample have one, and those at highly ranked PhD programs are even less likely to. The reverse is true for international candidates, for whom there is no association between having research assistant experience and their subsequent graduate school ranking and a large, postivie association between the latter and having a previous graduate degree.

Americans with an undergraduate major or minor in math, whether or not combined with one in economics, graduate from better ranked PhD programs than candidates with a major or minor in economics rather than math. American candidates from liberal arts colleges or unranked undergraduate institutions graduate from lower ranked PhD programs than those from national universities, i.e. non-liberal arts, non-regional, ranked universities. Unsurprisingly, those from better ranked undergraduate institutions, especially the top ranked ones, are more likely to graduate from a better ranked PhD program, as are candidates with undergraduate honors.

Although advice given to those interested in pursuing a PhD in economics usually pertains to gaining admission, presumably the goal is completing the PhD. Therefore, it is more useful to look at the experiences of candidates who do so. Our findings, which are contingent upon the completion of rather than admission to a top 50 economics PhD program and the public entrance into the job market, are best thought of as descriptive of successful students rather than causal. Keeping that in mind, note that many of the correlations we observe are very strong.

2. 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 CVs with the remainder listed on the job market without a CV posted. The top 50 programs are defined using the *U.S. News* 2013 ranking of economics PhD programs (U.S. News & World Report, 2016), the ranking closest to the matriculation of most candidates in our sample. Although 96% of candidates who receive PhDs go on the job market, not all do.[1] Moreover, since only 60% of entering economics candidates complete their PhD (Stock & Siegfried, 2014), our sample is selective towards those who have done so. Hence, our results apply to job market candidates from higher ranked schools rather than to all undergraduates who seek or gain admission to economics PhD programs.

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 spread among programs. For example, the top five programs account for roughly one-fifth of the production by all 50 programs while the top 15 account for roughly half.

Figure 1: Number of PhDs by Department Rank
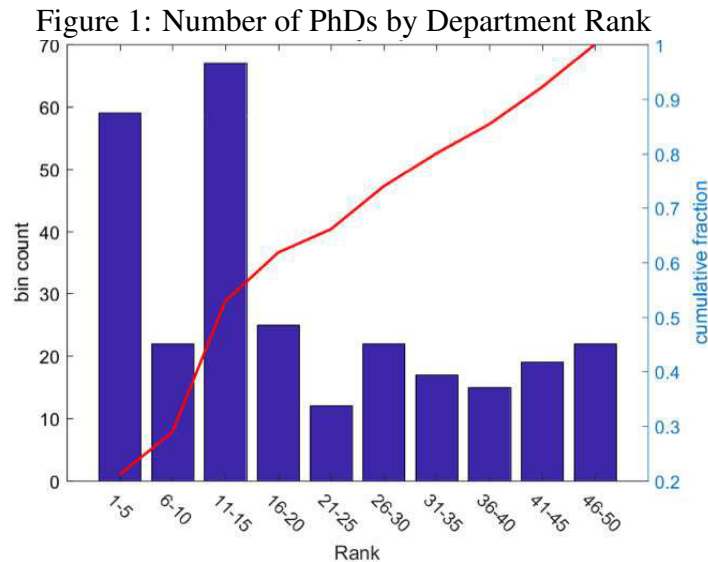
Basic descriptive statistics are presented in Table I. Of the 280 Americans in our sample, 26% are women compared to 31% of the 332 international candidates. Combined, 29% of the sample is female, close to the 34% figure reported in 2003–04 by Stock, Finegan, and Siegfried (2006).

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[1]The 2017 CSWEP census of all U.S. PhD granting programs reports 999 job candidates on the market for 2016–17 and that 1,036 PhDs were granted. (CSWEP 2018).

[2]The CSWEP census suggests that we have vitae for just over 60 percent of all U.S. economics PhDs.

|	American Mean (SD)	International Mean (SD)	Combined Mean (SD)
PhD program ranking	19.83 (14.55)	21.45 (14.86)	20.71 (14.73)
Attended a top 15 PhD program	0.53 (0.50)	0.45 (0.50)	0.49 (0.50)
TIMES Higher Education			
Undergraduate institution ranking	65.20 (75.27)	173.56 (117.33)	120.59 (112.79)
Unranked	0.37 (0.48)	0.45 (0.50)	0.41 (0.49)
U.S. News & World Report			
Undergraduate institution ranking	36.92 (34.96)		
National university ranking	37.07 (34.74)		
Liberal arts college ranking	36.49 (35.88)		
Attended a liberal arts college	0.23 (0.42)		
Unranked	0.06 (0.25)		
Undergraduate fields of study			
Economics rather than math	0.44 (0.50)	0.62 (0.49)	0.53 (0.50)
Math rather than economics	0.09 (0.28)	0.10 (0.30)	0.09 (0.29)
Economics and math	0.43 (0.50)	0.11 (0.31)	0.26 (0.44)
Neither math nor economics	0.05 (0.21)	0.17 (0.38)	0.12 (0.17)
Post-baccalaureate experience			
Research assistant	0.39 (0.49)	0.38 (0.49)	0.39 (0.49)
Graduate degree	0.14 (0.35)	0.75 (0.44)	0.47 (0.50)
Female	0.26 (0.44)	0.31 (0.47)	0.29 (0.45)
Honors	0.66 (0.47)	0.41 (0.49)	0.52 (0.50)
Observations	280	332	612

In line with the 46% figure reported in Stock et al. (2006), 47% of our sample has a previous

graduate degree, excluding masters' degrees granted as part of their PhD.[3] Having a previous graduate degree varies noticeably between American and international students: 14% versus 75% respectively. Moreover, five to six percent (15%) of American (international) candidates have a previous graduate degree in a field other than economics, with less than three percent (ten percent) in another mathematical field, namely math, statistics or physics. Almost 40% of the candidates in our sample have research assistant experience between completing their undergraduate degree(s) and beginning their PhD.

Undergraduate majors and minors are concentrated almost exclusively in economics and math: 95% for Americans and 83% for international candidates. Roughly equal fractions of Americans report a major or minor in economics rather than math or in both economics and math as a double major, joint major, or a major in one field and a minor in the other. Majoring or minoring in both economics and math is significantly more popular for Americans than international candidates: 43% vs 11% respectively, while majoring or minoring in economics rather than math is modestly less popular: 44% vs 62% respectively. Ten percent of all candidates report a major or minor in math rather than economics.

Figure 2 examines the distribution across PhD programs of American and international candidates. Although 45% of our sample is American, the fraction of Americans per 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.

Figure 2: Fraction of American PhDs by Department Rank
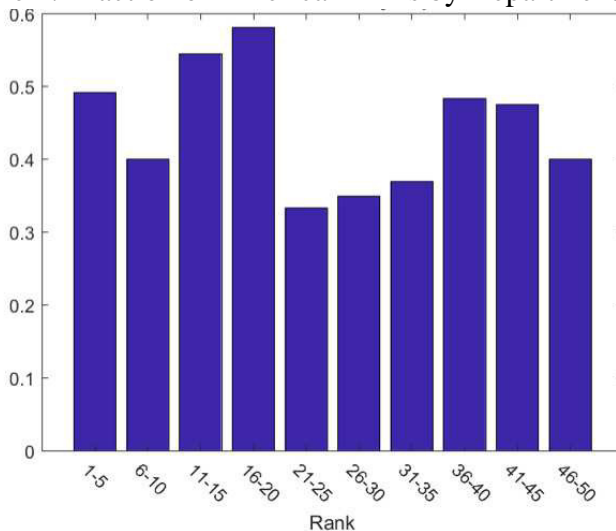
To measure undergraduate school quality, we use the *U.S. News & World Report* and *TIMES Higher Education* 2012–2013 overall rankings—the rankings closest to the matriculation of most candidates in our sample. The former are only for American institutions and are separate for liberal arts colleges and national universities. We merge the two lists by simple combination, hence there may be two or more schools assigned a given rank. The *TIMES* rankings are for American and

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[3]Note that between the time the candidates in our sample matriculated and the time they graduated, several top 50 American economics programs opened new master's programs that state preparation for PhD programs as one of their objectives. This raises the possibility that the prevalence of master's degrees and their benefit may differ in the future, 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.

international institutions and do not delineate types of schools. They are also less exhaustive of the schools attended by the Americans in our sample. Where a range was provided, we took the midpoint of that range.

Average undergraduate rankings among the 90% of Americans from undergraduate institutions ranked by *U.S. News* are lower than average PhD rankings, but this is in part collateral to there being many more undergraduate institutions than the 50 PhD programs we examine. A similar phenomenon can be seen looking at the *TIMES* rankings for any subset of candidates.

Given the very large number of American and international undergraduate institutions, it is clear from Table I that the candidates in our sample generally come from very well ranked undergraduate institutions. Moreover, 23% of American candidates are from liberal arts colleges, which on average rank similarly to the national universities in our sample.

3. The relationships between candidates' observable characteristics and their PhD program ranking

We now examine the relationships between candidates' observable characteristics and their PhD program ranking. We begin with variables largely outside candidates' control during their undergraduate years, namely their undergraduate institution's ranking. We then consider variables within candidates' control during their undergraduate years, such as their major(s) or minor(s) and their academic accomplishments signaled by undergraduate honors. Finally, we look at variables in candidates' control after their undergraduate years before beginning their PhD, specifically working as a research assistant or pursuing a graduate degree. We also examine the relationship between candidates' gender and their PhD program ranking. Because American and international students often take different paths towards obtaining an economics PhD we examine them separately, first focusing on the former and comparing both groups in section 5. Unless stated otherwise, the reported results are for Americans using the more comprehensive *U.S. News* rankings and are similar using those from *TIMES*.

The essential analysis is presented in Table II. Column 1 gives the change in rank associated with a change in a particular characteristic, though this attributes cardinality to an ordinal ranking. For robustness, we include a linear probability model on the chance of completing a top 15 PhD program.

The relationship between the rankings of the undergraduate institutions and PhD programs in our sample is strong, both statistically and substantively. Attending a highly ranked undergraduate institution, especially a top ranked one, is strongly associated with graduating from a highly ranked PhD program. Candidates from the very top undergraduate institutions graduate from PhD programs over eight rankings better than those from undergraduate institutions ranked one standard deviation (35 rankings) worse.[4] The same calculation applied to the linear probability model in Table II indicates a 30 percentage point increase in the probability of completing a top 15 PhD program.

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[4]While the quadratic coefficient is highly significant, the significance disappears if the two worst ranked undergraduate institutions are dropped. Evidence of nonlinearity should thus be taken with a grain of salt.

Table II: Predictions of PhD Program Ranking

|	Ranking	Top 15
Undergraduate institution		
Ranking	0.264***	-0.011***
	(0.061)	(0.002)
Ranking (squared)	-0.001***	0.000***
	(0.000)	(0.000)
Unranked	23.674***	-0.727***
	(2.834)	(0.072)
Attended a liberal arts college	5.605**	-0.191**
	(2.647)	(0.093)
Liberal arts college ranking	-0.066	0.001
	(0.043)	(0.002)
Undergraduate field(s) of study		
Math rather than economics	-6.043**	0.207*
	(2.715)	(0.107)
Economics and math	-4.076**	0.163***
	(1.736)	(0.058)
Neither math nor economics	-3.929	0.171
	(3.417)	(0.126)
Post-baccalaureate experience		
Research assistant	-4.943***	0.168***
	(1.759)	(0.061)
Graduate degree	4.145	-0.165**
	(2.621)	(0.083)
Female	3.887**	-0.086
	(1.922)	(0.062)
Honors	-3.682**	0.102
	(1.677)	(0.062)
Constant	16.943***	0.645***
	(2.466)	(0.089)
Number of observations	270	270
R^2	0.301	0.279

Robust standard errors in parentheses

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

Attending an unranked undergraduate institution lowers the corresponding PhD program ranking by over 23 places—very large given that we only examine 50 programs. In fact, we observe *no* candidates in the top 15 PhD programs from unranked undergraduate institutions. Those from liberal arts colleges also fair worse than those from similarly ranked national universities.

Female candidates graduate from programs three or four rankings worse than males though are not significantly less likely to graduate from a PhD program in the top 15. Candidates with undergraduate honors graduate from programs three or four rankings better than those without them yet are not significantly more likely to graduate from one in the top 15.

Figure 3 shows that those with an undergraduate major or minor in economics rather than math or in both economics and math are distributed nearly evenly across PhD department rankings. As seen in Table II, candidates with a major or minor in math, whether or not combined with one in economics, graduate from PhD programs four to six rankings better than those with a major or minor in economics rather than math.

Figure 3: Fraction of Undergraduate Majors Among Americans by Department Rank
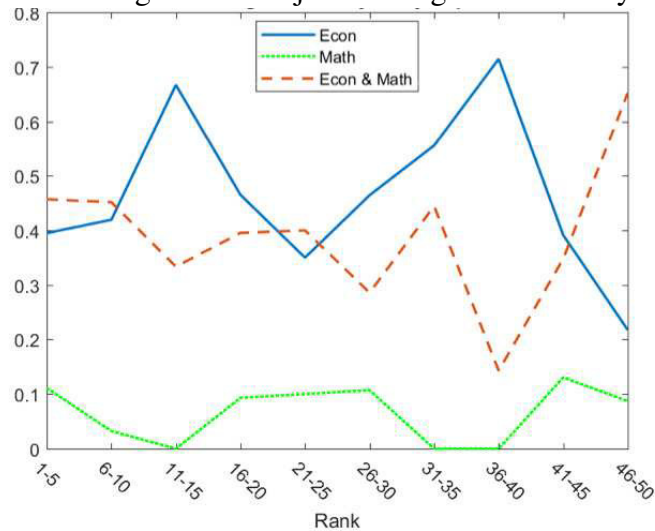
Upon graduation, undergraduates interested in pursuing a PhD in economics can choose to work as a research assistant or pursue a graduate degree. Figure 4 shows the fraction of American PhD candidates with each experience split into ten ranking groups. 90% confidence intervals computed using the binomial distribution are also provided.

Figure 4: Fraction of Americans with Research Assistant Experience (left) or a Previous Graduate Degree (right)
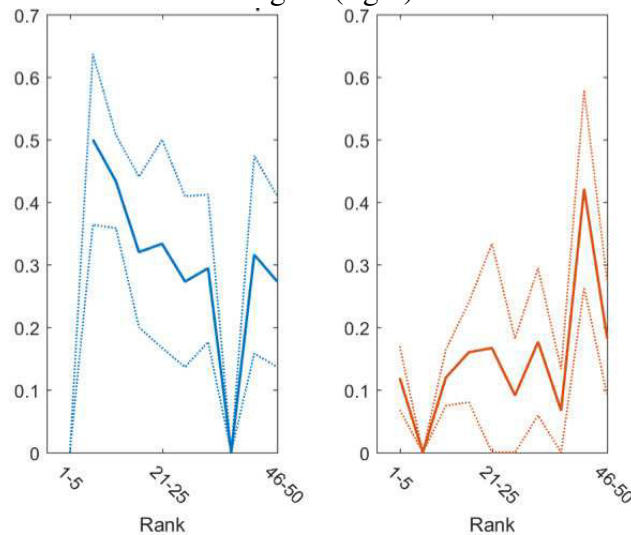
Americans from PhD programs at the upper-end of the top 50 are much more likely to have research assistant experience than a previous graduate degree. Nearly 60% of Americans in the

top five PhD programs have research assistant experience while only one-tenth have a previous graduate degree. The reverse is true for international candidates in the top five PhD programs. Less than half have research assistant experience while more than three-fourths have a previous graduate degree. Combined, graduates from the top five PhD programs hold a prior graduate degree 45% of the time, in line with the 38% figure reported in Stock et al. (2006).

The leftmost column of Table II suggests that having research assistant experience is associated with a five rank improvement in PhD program ranking. Candidates with research assistant experience are also 17% more likely to graduate from a top 15 PhD program. Having a previous graduate degree is associated with over a 16% decrease in the probability of graduating from a top 15 PhD program.

4. The relationships between candidates' pre-PhD characteristics and their experiences between undergraduate and graduate school

We now examine the relationships between candidates' pre-PhD characteristics and their experiences between undergraduate and graduate school, namely working as a research assistant or pursing a graduate degree. American candidates from highly ranked undergraduate institutions, especially the top ranked ones, are more likely to have research assistant experience. In contrast, coming from a highly ranked undergraduate institution is not associated with having a previous graduate degree.

In the leftmost column of Table III we see that candidates from liberal arts colleges are much more likely to have research assistant experience, females are modestly more likely to, those from highly ranked undergraduate institutions are modestly less likely to and those from unranked undergraduate institutions are much less likely to.[5] Interestingly, those with an undergraduate major or minor in both economics and math are less likely to have research assistant experience than those with a major or minor in economics rather than math.

Neither gender nor attending a liberal arts college seem to affect the likelihood of having a previous graduate degree. Candidates without a major or minor in economics or math are significantly more likely to have a previous graduate degree. Those with undergraduate honors or with a major or minor in math and economics are modestly less likely to have one.

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[5]The association between undergraduate institution ranking and the likelihood of having research assistant experience is lost by replacing the *U.S. News* rankings with those from *TIMES*

Table III: Linear Probability Models for Post-baccalaureate Experience

	Research assistant	Graduate degree
Undergradute institution		
Ranking	-0.007***	-0.001
	(0.002)	(0.002)
Ranking (squared)	0.000**	0.000
	(0.000)	(0.000)
Unranked	-0.400***	0.180
	(0.110)	(0.113)
Attended a liberal arts college	0.248***	0.000
	(0.094)	(0.057)
Liberal arts college ranking	-0.002	-0.001
	(0.002)	(0.001)
Undergraduate field(s) of study		
Math rather than economics	-0.037	0.035
	(0.103)	(0.089)
Economics and math	-0.182***	-0.065*
	(0.059)	(0.038)
Neither math nor economics	-0.175	0.492***
	(0.135)	(0.142)
Female	0.114*	0.020
	(0.063)	(0.040)
Honors	0.051	-0.086*
	(0.057)	(0.045)
Constant	0.598***	0.153**
	(0.083)	(0.062)
Number of observations	270	271
R^2	0.201	0.194

Robust standard errors in parentheses

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

5. American versus international students

While our primary interest is the path to an economics PhD for Americans, we now draw comparisons between American and international students. This requires replacing the *U.S. News* rankings with those from *TIMES*, resulting in some loss of sample size. Regression results are for the probability of graduating from top a 15 program, though similar results hold when predictions are made using ordinal PhD program rankings.

The first noticeable difference is the association of having a major or minor in both economics and math and graduate school ranking. Americans with the former are nearly 15% more likely to graduate from a top 15 program, in line with the figure presented in the second column of Table II. International students do not seem to benefit from studying both fields and are less likely to do so. Stronger than the result reported in the second column of Table II, females from both groups are over 10% less likely to graduate from a top 15 program.

Some of the most notable differences between the American and international results are the associations of having research assistant experience or having a previous graduate degree with the chance of graduating from a top 15 PhD program. For Americans, the former association is large, positive and statistically significant, consistent with earlier results. For international students, it is an imprecisely estimated zero. The results for having a previous graduate degree are just the opposite. For international students, having a previous graduate degree is associated with an 11% improvement in the chance of graduating from a top 15 program, while Americans who hold a previous graduate degree are 22% less likely to do so.

Table IV: Linear Probability Models for Completing a Top 15 PhD Program

	American	International
Undergraduate institution ranking	-0.000	-0.000
	(0.000)	(0.000)
Undergraduate field(s) of study		
Math rather than economics	0.246**	0.036
	(0.109)	(0.104)
Economics and math	0.144**	0.013
	(0.062)	(0.090)
Neither math nor economics	0.259*	-0.115
	(0.134)	(0.075)
Post-baccalaureate experience		
Research assistant	0.272***	0.038
	(0.058)	(0.061)
Graduate degree	-0.221**	0.119*
	(0.088)	(0.063)
Female	-0.122*	-0.131**
	(0.065)	(0.061)
Honors	0.151**	0.148**
	(0.064)	(0.062)
Constant	0.293***	0.351***
	(0.072)	(0.073)
Number of observations	270	302
R^2	0.146	0.055

Robust standard errors in parentheses

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

6. Comparison with previous results

The closest research to ours is Stock and Siegfried (2015).[6] While much of their article examines general trends in the production of economics PhDs, Stock and Siegfried also examine the characteristics of candidates entering 27 economics PhD programs in 2002, ten years prior to our examination. In particular, they examine the relationships between gaining entry to a top 15 PhD

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[6]For an overview of research in the field, we recommend Stock and Siegfried (2014).

program with undergraduate major as well as with gender. They also explore the marginal effect at the data mean and include both American and international candidates. For comparison we examine the same relationships in Table V, although our variables of direct interest and controls differ in some respects.

Reassuringly, our results largely align where comparable. 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 candidates, whom they split into two groups. Also similar to Stock and Siegfried, when examining American and international candidates together we do not find any effect of undergraduate major or undergraduate institution's ranking on the chance of graduating from a top 15 PhD program. Unlike Stock and Siegfried, we do not find a significant positive interaction between majoring in economics and being female.

Table V: Linear Probability Models for Completing a Top 15 PhD Program

	Top 15	Comparison to Stock and Siegfried (2015)
Undergraduate institution ranking	-0.000	
	(0.000)	
Undergraduate field(s) of study		
Economics rather than math	-0.030	-0.041
	(0.074)	
	(0.137)	
Math	0.105	0.170
	(0.078)	
Female interactions		
Economics rather than math	0.042	0.268***
	(0.14)	
Math	-0.095	0.246
	(0.146)	
Post-baccalaureate experience		
Research assistant	0.148***	
	(0.042)	
Graduate degreee	0.030	-0.011
	(0.051)	
Female	-0.100	-0.387
	(0.123)	
Honors	0.146***	
	(0.044)	
International	-0.015	
	(0.053)	
Constant	0.367***	
	(0.078)	
Number of observations	583	563
R^2	0.066	0.139

Robust standard errors in parentheses

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

7. Discussion

Our examination of graduating PhD candidates affirms what are likely common beliefs. American candidates who are male, have undergraduate honors, hold an undergraduate major or minor in math, and come from highly ranked undergraduate institutions are more likely to graduate from highly ranked PhD programs. Unlike international candidates, they are more likely to have research assistant experience and less likely to have a graduate degree between completing their undergraduate degree(s) and beginning their PhD.

Notwithstanding concerns regarding causality, it seems reasonable to suggest that to complete a highly ranked economics PhD program, Americans should gain research assistant experience and

major or minor in math rather than earn a graduate degree prior to applying to a PhD program.

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