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## RESEARCH IN ECONOMIC EDUCATION

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# Fifteen Years of Research on Graduate Education in Economics: What Have we Learned?

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In this article, the authors summarize their 15 years of research on graduate education in economics in the United States. They examine all stages of the process, from the undergraduate origins of eventual economics PhDs to their attrition and time-to-degree outcomes. For PhD completers, the authors examine job market outcomes, research accomplishments, and career paths over the first five and 10 years of their careers.

**Keywords** *attrition, economics job market, graduate education, time-to-degree*

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Each year, thousands of students begin doctoral studies at one of the 141 economics PhD programs in the United States.<sup>1</sup> The students enter with varying levels of economics, mathematics, and other training in preparation for graduate school. They increasingly come from divergent demographic and national backgrounds and with a wide array of career goals. About one-fourth of these students succeed at completing the economics PhD within five years, and almost 60 percent succeed in completing the PhD within eight years. For better or worse, approximately 40 percent of entering students are unlikely to ever earn a PhD in economics.

Almost all of those who complete their degree find immediate employment, and the vast majority work in full-time permanent jobs. Almost half change employers within their first six years post-graduation. The primary sector of employment for economics PhDs is academia, followed distantly by government, international organizations, and research organizations, and even more distantly by business/industry. Their starting salaries and salary growth over time are

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strongly associated with their sector of employment, as well as the market conditions at the time they completed their PhD.

Over the past 15 years, we have undertaken a project to investigate many aspects of economics PhD education, including the undergraduate origins of eventual economics PhDs, the levels and factors associated with matriculation into and attrition from economics PhD programs, the time it takes to earn a PhD in economics, the eventual labor market and career outcomes, and the match between skills learned in graduate school and those that economists use on the job. In this article, we provide a summary of this work.

## DATA

The data for this project have come primarily from two types of sources. First, we documented the career progress after degree completion for two graduating cohorts of economics PhDs: those who completed degrees between July 1, 1996, and June 30, 1997 (the “class of 1997”), and those who completed degrees between July 1, 2001, and June 30, 2002 (the “class of 2002”). We identified the population of graduates for each of these cohorts via the listings of dissertations in the December 1997 (for the class of 1997) and 2002 (for the class of 2002) *Journal of Economic Literature*.<sup>2</sup> We estimated that about 950 economics PhDs were awarded by U.S. PhD programs in 1996–97 and about 850 were awarded in 2001–2.<sup>3,4</sup> We sent each of the graduates a questionnaire asking about their employment status and job characteristics, salary, time to degree, and selected demographic characteristics. We also surveyed the dissertation advisors of nonrespondents to the survey of graduates. For each graduating cohort, we received either direct responses or advisor responses for roughly two-thirds of the graduating classes. Finally, we also gathered longer-term career information for the class of 1997 in two re-surveys that were conducted in 2002 and 2007, at five and 10 years post-graduation.<sup>5</sup>

A second source of data came from tracking the progress of an entering cohort of 586 students who began their PhD studies in the fall of 2002 at one of 27 U.S. economics PhD programs.<sup>6</sup> In the years since they started their PhD programs, we have been able to document the attrition and completion outcomes for all but three of these 586 individuals. These three are still working on their PhD studies after 10 years.

We supplement these primary data with information on PhD dissertations available from the ProQuest database (a depository for dissertations from all disciplines), with publication data available in EconLit, and with the National Science Foundation Survey of Earned Doctorates, which we use as a comparison against our survey data and as an additional source of information on economics PhDs.

## THE UNDERGRADUATE ORIGINS OF ECONOMICS PHDS

Students beginning economics PhD programs in the United States arrive with a wide array of backgrounds. As illustrated in figure 1, the countries from which eventual economics PhDs originate have changed markedly over the past several decades. In 1970, the vast majority of the roughly 950 economics PhDs earned in the United States—76 percent—were earned by male U.S. citizens. Male non-U.S. citizens earned 19 percent of U.S. economics PhDs, while female

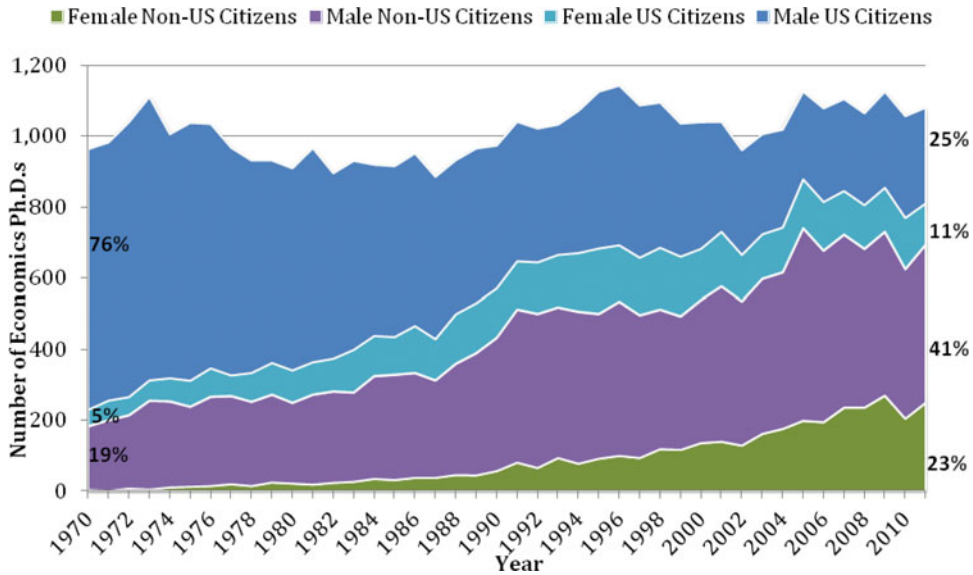


FIGURE 1 U.S. economics PhD recipients. *Source:* Authors’ tabulations from NSF Survey of Earned Doctorates, [www.webcaspar.gov](http://www.webcaspar.gov).

U.S. citizens and female non-U.S. citizens earned 5 and less than 1 percent, respectively, of the economics PhD degrees awarded in the United States in 1970.

The number of PhDs awarded by U.S. economics programs has fluctuated around roughly 1,000 per year since 1970, but the demographic composition of those PhDs has changed dramatically. The share of economics PhDs earned by female U.S. citizens grew from 5 percent in 1970 to a high of 16 percent in the mid-1990s, but has fallen to about 11 percent since then. The share of economics PhDs earned by female non-U.S. citizens was below 1 percent in 1970, hovered at 2 to 3 percent in the early 1980s, but has grown steadily since then to about 23 percent at the end of the 2000s’ first decade. The share earned by male non-U.S. citizens grew from 19 percent in 1970 to a peak of nearly 50 percent in the middle of the 2000–2010 decade, but has fallen to 41 percent in 2011. Finally, the share of economics PhDs awarded to male U.S. citizens has declined steadily from 76 percent in 1970 to a low of 22 percent in 2005 and has only recently recovered slightly, to 25 percent in 2011.

The gender and citizenship trends are similar to those in other potential disciplines that those who earn PhDs in economics might have considered, including mathematics and statistics (math), business and management (business), and political science and public administration (political science). Figures 2 through 4 illustrate the trends in U.S. PhDs earned in math, business, and political science, respectively, during 1970 to 2011. As was the case with economics in 1970, the vast majority of PhDs in math (83 percent), business (87 percent), and political science (90 percent) were earned by male U.S. citizens. Since 1970, the proportion of PhDs in these disciplines that were awarded to other groups has grown steadily. From 1970 to 2011, the proportion of U.S. PhDs earned by female U.S. citizens grew from 6 percent to 13 percent in math, from 2 percent to 22 percent in business, and from 5 percent to 34 percent in political science. The growth in the

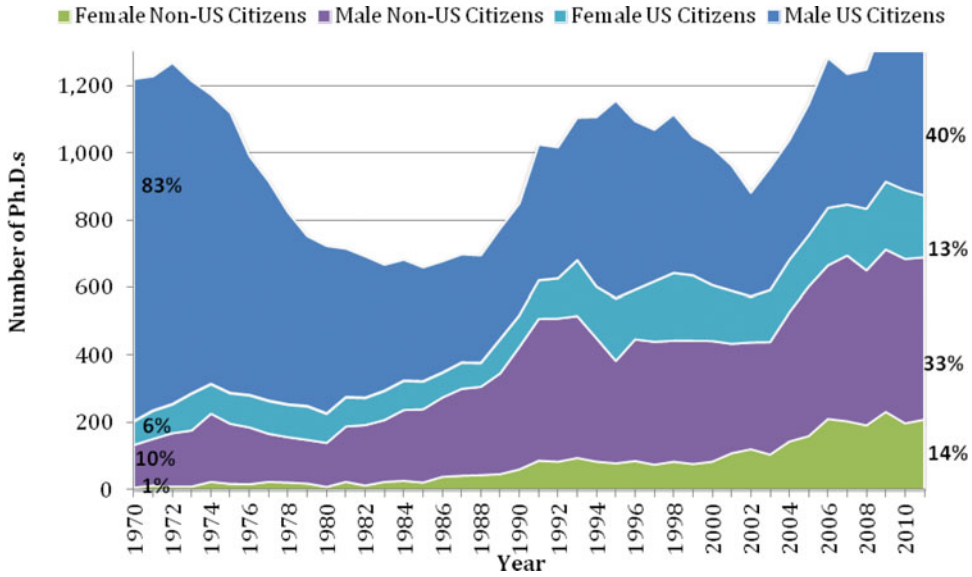


FIGURE 2 U.S. mathematics and statistics Ph.D recipients. *Source:* Authors' tabulations from NSF Survey of Earned Doctorates, [www.webcaspar.gov](http://www.webcaspar.gov).

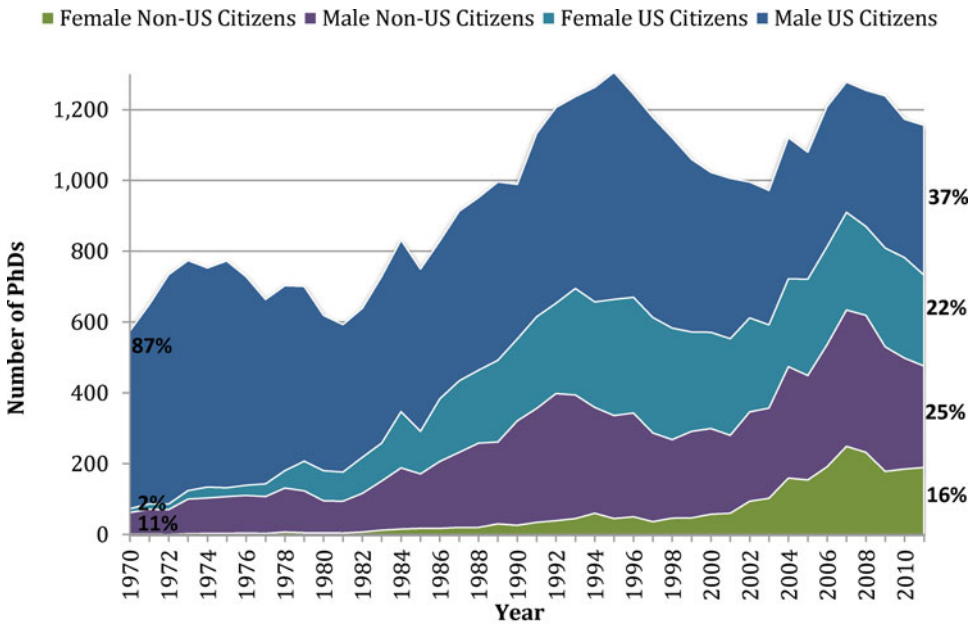


FIGURE 3 US business and management Ph.D recipients. *Source:* Authors' tabulations from NSF Survey of Earned Doctorates, [www.webcaspar.gov](http://www.webcaspar.gov).

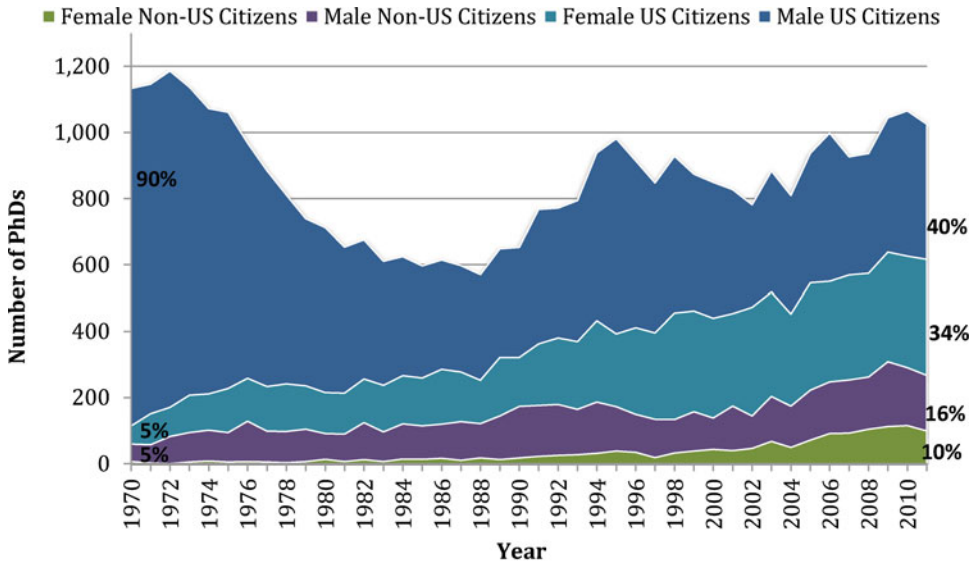


FIGURE 4 US political science and public administration Ph.D recipients. *Source:* Authors’ tabulations from NSF Survey of Earned Doctorates, [www.webcaspar.gov](http://www.webcaspar.gov).

percent of PhDs in these disciplines awarded to female U.S. citizens over the 1970–2011 period masks relative declines in these values in recent years, however. The proportion of PhDs awarded to women in economics, math, and business peaked in 1997–99 (at 16, 18, and 28 percent, respectively). The peak in the percent of female U.S. citizens earning PhDs in political science occurred later, in 2002, when 42 percent of U.S. PhDs were earned by female U.S. citizens.

The growth and decline in the percentage of PhDs awarded to U.S.-citizen females is in stark contrast to the trend for non-U.S.-citizen females. In all four disciplines, there has been near continuous growth in the share of PhDs earned by non-U.S.-citizen women since 1970, with the largest growth occurring in economics (23 percentage points), followed by business (19 percentage points), math (14), and political science (10).

The PhDs awarded to male non-U.S. citizens also display similar patterns across these disciplines. The percentages of PhDs earned by male non-U.S. citizens peaked in the early 1990s at 42 percent in economics, 43 percent in math, 30 percent in business, and 24 percent in political science. The shares declined during the mid-to-late 1990s but began climbing again in the early 2000s. In 2011, non-U.S. citizen males earned 41 percent of the U.S. PhDs in economics, 33 percent in math, 25 percent in business, and 16 percent in political science.

We further document the undergraduate origins of individuals who earned economics PhDs in the United States in Siegfried and Stock (2007). Consistent with the trends shown in figure 1, the number of new economics PhDs who earned their undergraduate degrees from U.S. universities fell from a peak of about 800 in 1972 (75 percent of all economics PhDs degrees awarded in the United States) to 420 by 2002 (40 percent). Indeed, among the roughly 5,100 individuals who earned a PhD in economics in the United States between 1997 and 2002, Seoul National University in South Korea was the undergraduate alma mater for the largest number of them

(162). Harvard, the second largest incubator of eventual economics PhDs in the world at that time, graduated fewer than half as many students who went on to earn an economics PhD (74). Harvard was followed closely by National Taiwan University (63 eventual PhDs) and the University of Delhi (61).

For the roughly 40 percent of economics PhD graduates in 2002 who completed their undergraduate degrees in the United States, the majority (55 percent) earned their bachelor's degrees from a research university that also grants economics PhDs (top sources here are Harvard, Berkeley, Cornell, and Stanford). Roughly 15 percent earned their undergraduate degrees from top-50 liberal arts colleges (e.g., Swarthmore, William and Mary, Williams), and a similar percentage earned their undergraduate degrees from public colleges that do not offer a PhD in economics (e.g., Montana State, Cal-State) and from other private colleges (e.g., Brigham Young, Hillsdale College) (Siegfried and Stock 2007, Table 3).

It is no surprise that large research universities are a primary source of eventual economics PhDs. What is surprising, however, is that after adjusting for the size of their undergraduate economics programs, liberal arts colleges represent the primary source of eventual economics PhDs. At the top in terms of this productivity measure is Illinois Wesleyan University, which produced one eventual economics PhD in 1997–2003 for every five undergraduate economics degrees it awarded during the prior decade. Earlham, Reed, Grinnell, and Wheaton College each produced one eventual economics PhD for every 10 undergraduate economics degrees awarded. In comparison, Harvard produced one eventual economics PhD for every 20 undergraduate economics degrees awarded, while Berkeley and Stanford produced one eventual economics PhD for every 33 undergraduate economics degrees awarded.

### ATTRITION AND COMPLETION OF ECONOMICS PHDS

We know of no study that examines the graduate school application decisions of undergraduates and the factors that influence their choices to apply and enroll in economics PhD programs. What we do know is that nearly all of those who are admitted to an economics PhD program in the United States do pursue graduate study in economics. Although it is common for economics PhD programs to admit students who do not enroll, in our study of nonmatriculation (Finegan, Stock, and Siegfried 2006), we estimated that only about 12 percent of those offered admission did not eventually enroll in an economics PhD program in the United States. Thus, for the vast majority of students, admittance into an economics PhD program is the first step toward eventually completing the PhD.

Table 1 details the attrition and completion rates for the fall 2002 entering class of PhDs.<sup>7</sup> Roughly 38 percent of those who began an economics PhD program in 2002 ended up dropping out of their program within 10 years, while 61 percent earned their PhD within a decade. Although these overall rates of completion and attrition are favorable when compared against the roughly 50 percent attrition rate in doctoral programs in a wider range of disciplines as reported in Bowen and Rudenstine (1992) for an earlier period, the aggregate attrition and completion rates mask different trends across time and tier of PhD program.

Students who begin PhD study at higher-ranked PhD programs are much less likely to drop out and much more likely to complete their degrees. For example, of the students who began their PhD study at a tier 1 program,<sup>8</sup> 22 percent dropped out within 10 years, while 77 percent

TABLE 1  
PhD Program Attrition and Completion Rates, by Program Rank

	Tier					Total
	1	2	3	4	5	
Program rank	1–6	7–15	16–30	31–48	48	—
Number of programs	3	6	7	6	5	27
Number of entering students, fall 2002	103	149	141	127	66	586
First–second year attrition rate (%)	<b>0.14</b>	<b>0.17</b>	0.33	<b>0.39</b>	<b>0.38</b>	0.28
Third–fifth year attrition rate (%)	<b>0.01</b>	0.07	0.08	0.06	0.11	0.06
Sixth–tenth year attrition rate (%)	<b>0.08</b>	0.03	0.04	0.03	0.06	0.04
Total five-year attrition rate (%)	<b>0.15</b>	<b>0.25</b>	0.40	<b>0.45</b>	<b>0.49</b>	0.34
Total ten-year attrition rate (%)	<b>0.22</b>	<b>0.28</b>	0.44	<b>0.48</b>	<b>0.55</b>	0.38
Five-year completion rate (%)	0.33	0.32	0.26	0.24	<b>0.17</b>	0.27
Sixth–seventh year completion rate (%)	<b>0.41</b>	0.36	0.26	0.24	<b>0.17</b>	0.27
Eighth–tenth year completion rate (%)	0.03	0.05	0.04	0.03	<b>0.11</b>	0.04
Total ten-year completion rate (%)	<b>0.77</b>	<b>0.72</b>	0.56	<b>0.52</b>	<b>0.44</b>	0.61
Still in program rate (%)	0.01	0.007	0.00	0.00	0.015	0.005
Median years to degree among those who finished within 10 years	5.42	5.67	5.67	5.46	<b>5.83</b>	5.67

*Note:* Attrition, still in program, and completion rates are all calculated as of September 2012 relative to the original population of entering students ( $N = 586$ ) and are reported as percentages. Numbers in bold indicate that the rate is statistically different from the rate for the rest of the sample at the 0.05 significance level (two-tailed tests). For the years-to-degree variable, bold indicates a statistically significant difference in the tier's mean relative to the rest of the sample's mean.

completed their degrees (roughly 1 percent are still toiling toward their PhD). In contrast, 55 percent of students who began their economics PhD study at tier 5 programs dropped out, and only 44 percent completed their PhDs within 10 years.

Fortunately, for the sake of minimizing new opportunity costs, nearly three-fourths of the 38 percent of new students who eventually drop out of their economics PhD programs do so within the first two years of study. The two-year attrition rate was 28 percent for the entering class of 2002. For most programs, attrition rates decline monotonically after the first two years, falling to 6 percent during the third through fifth years and to 4 percent during years six through 10. The one exception is among tier 1 programs, where the year 6 through year 10 attrition rate of 8 percent is higher than the attrition rate between the third and fifth year of study (1 percent) and is higher than the 6–10 year attrition rate at lower-tier PhD programs. Thus, it appears that although students at lower-ranked programs are more likely to eventually drop out, they do so earlier than those at tier 1 programs, perhaps because the opportunity cost of dropping out of a higher-ranked PhD program is higher.

In addition to finding differences in attrition and completion across tiers, our earlier studies found that those enrolled in programs where shared offices were available to at least some first-year graduate students, students with higher verbal and quantitative GRE scores, and students on research assistantships were less likely to drop out, as were males and students who earned their undergraduate degrees from foreign universities or from top liberal arts colleges in the United States (Siegfried and Stock 1999, 2001; Stock, Finegan, and Siegfried 2006, 2009a, 2009b).



Characteristics associated with higher probability of completion include whether students were in programs where faculty members had regular monthly or bi-monthly contact to check on the progress of students seeking a dissertation topic, U.S. citizenship, male gender, holding an undergraduate degree in mathematics, and having earned an undergraduate degree at a non-elite foreign institution as compared to a non-elite U.S. institution. A factor associated with lower probability of finishing is the absence of first-year financial aid, although once characteristics correlated with receiving aid and completing a degree are controlled, financial aid does not seem to exert an independent effect on the probability of completion.

We also uncovered differences in completion probabilities across gender and citizenship. Males and non-U.S. citizens are more likely to complete their economics PhDs than their female and U.S. citizen counterparts. Among women, but not men, the probability of completion is higher for those at PhD programs with higher faculty-student ratios, at private universities, at programs that do not offer a terminal master's degree, at programs where a higher percentage of students write dissertations consisting of a set of essays rather than a traditional treatise, and from programs where there is a more flexible time limit for completing the PhD (compared to programs where there is a strictly enforced time limit for completion). Women (but not men) who hold undergraduate degrees in math (whether combined with an economics major or not) are also more likely to complete their degrees. Women who hold prior graduate degrees upon beginning their economics PhD study are less likely to complete their degrees than women without this credential. Among men (but not women), analytical GRE scores and type of undergraduate institution attended (top liberal arts and foreign institution) are associated with higher degree completion probabilities.

Factors associated with degree completion among U.S. citizens and among non-U.S. citizens include the finding that for U.S. citizens (but not foreign students) those who attended a tier 1 or 2 program had lower probability of degree completion within eight years than their peers at lower tier programs. Attending a program where faculty advisors had regular meetings with their dissertation students is associated with higher probability of completion among U.S. citizens but not among non-U.S. citizens. Among non-U.S. citizens (but not U.S. citizens), analytical GRE scores and holding undergraduate degrees in math are associated with higher degree completion probabilities.

Despite our findings that a few program and demographic characteristics do relate to the probability of economics PhD completion, many factors that we anticipated would influence degree completion do not appear to matter. At the program level, these include whether the program required the students to pass a core exam before the start of the second year and whether the program generally offered more than five years of full financial aid. Student characteristics that do not appear to influence completion include the student's age at entry into the PhD program and whether the student indicated a particular economics subfield of interest on their program application.

The small number of student credentials and program features found to be strongly associated with successful completion of doctoral studies in economics means that we are able to explain only 17 percent of the variation in the probability of completion within eight years and only 12 percent of the variation in the probability of completion within five years. The low level of explanatory power also suggests that it is not easy to make changes in the features of an economics PhD program that will predictably lead to faster student completion, although providing access to shared offices for first-year students appears to be an important exception.



TABLE 2  
Time to Degree for Three Cohorts of Economics PhDs

	Cohort		
	Graduating class of 1996–97	Graduating class of 2001–2	Entering class of fall 2002
Median years to degree	5.25	5.42	—
Median years to degree among those who finished within 10 years <sup>a</sup>	5.08	5.17	5.67
Fourth year completion rate <sup>b</sup>	0.14	0.13	0.02
Fifth year completion rate	0.25	0.29	0.38
Sixth year completion rate	0.28	0.22	0.33
Seventh year completion rate	0.13	0.18	0.18
Eighth year completion rate	0.08	0.07	0.05
Ninth year completion rate	0.04	0.04	0.02
Tenth year completion rate	0.03	0.03	0.02
Completed in more than 10 years	0.05	0.05	0.007
Number of observations	584	570	363

<sup>a</sup>Number of observations for 1996–97 = 471; 2001–2 = 463; Fall 2002 entrants = 360.

<sup>b</sup>The completion rates are calculated only among completers and are reported as percentages. For the entering class of 2002, we estimated the rates based on the 360 completers plus the three students still working on their PhDs after 10 years.

## TIME TO DEGREE

Most students entering economics PhD programs survive the critical first two years of graduate education and go on to complete their degree. Additional time taken to complete the degree may generate benefits in terms of training and mentoring, but it also creates opportunity costs in the form of forgone earnings and potential job opportunities for the students, as well as faculty time and funding for other students in the PhD programs.

We have examined time-to-degree outcomes for three separate groups of economics PhD students: the cohorts of students who completed their PhDs in either 1996–97 or 2001–2 and the entering PhD class of fall 2002, the majority of whom completed their economics PhDs between 2007 and 2009 (Siegfried and Stock 2001; Stock and Siegfried 2006a, 2013; Stock, Finegan, and Siegfried 2009a, 2009b; Stock, Siegfried, and Finegan 2011).

The bottom row of table 1 summarizes the median years to degree by tier for the entering class of fall 2002 (graduating, on average, in 2008). The median time to degree for the cohort is 5.67 years. The time to degree is only significantly different from this median for students at tier 5 institutions, for whom the median time to degree is 5.83, or about two months longer than for those in the other tiers.

Table 2 compares time to degree and yearly completion rates for the three cohorts of PhDs that we study. The comparison of time to degree across the three cohorts reveals that the time taken to earn the economics PhD has lengthened by roughly five months over the past 15 years, from 5.25 to 5.42 to 5.67 years. Most of this increase appears to result from a reduction in the percentage of students in the left tail of the time-to-degree distribution. For the classes of 1996 and 2002, roughly 13 percent of the students completed their PhD within four years of matriculation. For

TABLE 3  
Employment Outcomes for Economics PhDs

	1997	2002	2008	2011
Percent employed after doctorate <sup>a</sup>	83.7	80.2	63.2	58.4
Percent of employed in academe	63.7	55.7	59.3	56.3
Percent of employed in business/industry	13.6	18.3	18.1	16.8
Percent of employed in government	8.7	16.0	12.5	14.9
Business/industry/higher education salary ratio	1.16	1.15	1.40	1.22
Government/higher education salary ratio	0.87	1.10	1.27	1.17

*Sources for percent employed by sector:* NSF Survey of Earned Doctorates Summary Reports for 1997 (Appendix Table A-3a), 2002 (Appendix Table A-3a), 2008 (Table 38), and 2011 (Table 61). Percentages do not add to 100 because the nonprofit and “other” sectors are not included here.

*Sources for salary ratios:* 1997: Siegfried and Stock (1999), Table 3; 2002: Siegfried and Stock (2004), Table 3; 2008: Survey of Earned Doctorates 2009, Table 45; 2011: Survey of Earned Doctorates 2011, Table 49. To keep data as consistent as possible across these samples, the ratios compare median salaries of those in academic positions (regardless of 9–10 month or 11–12 month appointment) against annual salaries in other sectors.

<sup>a</sup>The employment questions in the SED refer to “planned employment after doctorate” in 1997 and 2002, and “definite employment” in 2008 and 2011. The percentages in each sector are percentages of those reporting planned or definite employment plans.

completers in the entering class of 2002, only 2 percent were able to earn a degree this quickly. Alternatively, much larger proportions of the entering class of 2002 completed their degrees in years five and six. Pushing against the rising time to degree for the later cohort is the smaller fraction of students finishing their PhD after eight years for the entering class of 2002. While 12 percent of the classes of 1997 and 2002 completed their degrees in nine or more years, only 4 percent of the entering class of 2002 did so. Overall, our data indicate a reduction in the variance of time to degree across the cohorts as well as an upward shift in the median time to degree.

## JOB MARKET OUTCOMES

For the roughly 60 percent of entering PhD students who complete their degrees, the job search begins the career shift from “student” status to “employee” status. As part of our investigation of the job market outcomes of economics PhD students, we surveyed the graduating classes of 1997 and 2002 to inquire about their job outcomes, including their employment sector and salary.<sup>9</sup> We supplement these data in table 3 with information from the National Science Foundation (NSF) Survey of Earned Doctorates (SED), which provides a census of data for graduating cohorts in each year. Using the SED, we report the employment sector distribution of graduates into academe, business/industry, and government across time, including for 1997 and 2002 (the years of graduation for two of our samples) as well as for 2008 (the most common year of graduation for our entering cohort of economics PhD students). We also report outcomes for the class of 2011, the most recent SED data available.

The percent of employed graduates who took jobs in academe fell from 64 to 56 percent between 1997 and 2002, and then rose slightly in later periods. Business/industry employment

TABLE 4  
Publication and Employment Outcomes

Group	Median journal publications	Mean journal publications	Median top-50 journal publications	Mean top-50 journal publications	<i>N</i>
<b>In full-time permanent academic positions in 1997</b>	5.0	6.8	1.0	2.0	99
With tenure in 2008	7.0	7.8	0.0	2.2	63
At same employer as in 1997	5.0	6.8	0.0	1.8	33
At different employer than in 1997	7.5	8.6	1.0	2.7	30
Without tenure in 2008	2.0	4.1	1.0	1.6	31
<b>Outside full-time permanent academic positions in 1997</b>	1.0	4.0	0.0	1.3	108
In full-time permanent academic positions in 2008	6.0	7.8	1.0	2.8	34
In other positions in 2008	1.0	2.2	0.0	0.6	74

Source: Authors' survey. The subsample sizes for those in full-time permanent academic positions in 1997 do not sum to 99 because five individuals are missing information on their tenure status.

rose slightly across the cohorts, from 14 percent in 1997 to nearly 18 percent in later years. The percent taking jobs in government rose from 9 percent in 1997 to 15 percent by 2011.

Not shown in table 3 is the international distribution of graduates' jobs, for which we have information from the classes of 1997 and 2002 (Siegfried and Stock 1999, 2004; Stock and Siegfried 2001). Twenty-three percent of employed new PhDs in the class of 2002 found jobs outside the United States, down from 31 percent for the class of 1997. The largest numbers of non-U.S. jobs were located in Canada, followed by South Korea, the UK, Brazil, Taiwan, and Turkey. Nine percent of the employed U.S. citizens in the class of 2002 accepted employment outside the United States, which is only slightly higher (and not significantly different from) the 6 percent who emigrated in 1996–97. In comparison, 67 percent of employed non-U.S. citizens found employment inside the United States, significantly higher than the 46 percent who landed domestic jobs in 1996–97. The international mobility of young non-U.S.-citizen PhD economists appears to be growing.

Also not reported in table 3 is the employment sector of graduates' jobs by citizenship, which we previously reported for the class of 2002 (Siegfried and Stock 2004, Table 4). Although U.S. citizens account for a statistically significantly larger share of those employed in research organizations (67 percent) and a smaller share of those employed in international organizations

(15 percent), there is no significant difference in the percent of U.S. citizens who find jobs in academe, business/industry, or government relative to their non-U.S.-citizen peers.

Because starting salaries rose rapidly over the course of our study, reporting starting salaries for these cohorts is not particularly informative.<sup>10</sup> Instead, the bottom rows of table 3 highlight the *relative* starting salaries for graduates employed in government and business/industry as compared to those in academe. For the classes of 1997 and 2002, the data come from our surveys of graduates (Siegfried and Stock 1999, 2004). For the classes of 2008 and 2001, the data come from the SED, which in 2008 began asking employed graduates about their salaries. To keep the salary information consistent between these sets of samples, we compare median salaries for the cohorts without adjustment for academic year versus 12-month salaries.

The ratio of annual salaries for those who took jobs in business/industry relative to the salaries of those who took jobs in academe is always greater than one for the cohorts, with the business/industry economists earning between 1.15 and 1.40 times as much as those in academe. The ratio of salaries for government economists relative to academic economists rose from 0.87 for the class of 1997 to a peak of 1.27 for the class of 2008. For the class of 2011, government economists earned about 1.2 times as much as academic economists.

In addition to asking about salaries and sectors of employment, we also asked graduates about their job satisfaction (Siegfried and Stock 2004). Although those employed in business/industry earn more than their colleagues employed in most other sectors, they are less satisfied with their jobs. They view their jobs as less closely related to economics, less well connected to their education and training, and not what they expected to be doing upon graduation. Only 69 percent of them would have sought an economics doctorate if they had known at matriculation what they knew after graduation, compared to nearly 90 percent of those in the other employment sectors. Academics, on the other hand, earn lower salaries than those in other sectors but view their jobs as more related to economics, more commensurate with their training, and more like what they expected to be doing when they began their PhD study. Our research that further assesses the relationships between what economics PhD students learn during their graduate programs and the skills and proficiencies they perceived as most valuable to them in their jobs is described in the next section.

## PHD PROGRAM LEARNING AND JOB DEMANDS

Following the lead of the 1988 AEA Commission on Graduate Education in Economics (COGEE), we asked class of 1997 and 2002 graduates about the emphasis their PhD programs placed on mastering various economic proficiencies and the importance of an array of skills for success in graduate school and in subsequent job performance (Hansen 1991; Stock and Hansen 2004). Although most of our survey respondents reported that the emphasis given in their PhD programs to many economic proficiencies was “about right,” many graduates wanted more than their PhD programs delivered.

At least half our survey respondents reported too little emphasis by their PhD programs on *applying economic theory to real-world problems*, on *understanding economic institutions and history*, and on *understanding the history of economic ideas*. In addition, graduates reported that skills in *application*, *communication*, and *instruction* are much more important for success in their jobs than for success in graduate school, while the opposite is true for mathematics. Although

graduates in all sectors report that *application* skills are significantly more important in their jobs than they were in graduate school, nonacademics have a higher probability of reporting a larger gap than do those in academe. Similarly, though graduates in all sectors report that *mathematics* is less important for success on the job than it was for success in graduate school, nonacademics report a larger gap. The gap in the importance of *creativity* is larger for academics than for those in other sectors.

## CAREER OUTCOMES

In addition to tracking students during the years up to and immediately after their graduation, we also examined outcomes for the class of 1997 five and 10 years after they completed their degrees (Stock and Siegfried 2006c, 2014). The most dramatic changes over the first five years in the careers of these economists are in salary growth and job mobility. In the first five years of their careers, the nominal salaries of the group grew by an average of 8.2 percent annually. Those who started full-time permanent jobs in the United States in 1997 earned median salaries of \$54,000 in 1997 and \$80,000 in 2003. The largest salary growth was in the private sector, where salaries increased by 15 percent annually. Academic salaries rose a much more modest 5.7 percent per year. In comparison, computations using the Consumer Price Index indicate that the average annual increase in the cost of living over the same period was 2.3 percent.

This slower growth in salaries for academics led to apparent salary inversion for this group relative to newly hired economics faculty members five years later. Indeed, the median salaries of graduates of full-time permanent 9–10 month academic economists hired in 2002–3 actually *exceeded* the median 2003 salaries of their counterparts initially hired in 1997–98. Some, but not all, of this apparent salary inversion reflects a different mix of employers and departments between the two cohorts, with the younger group securing relatively more jobs at higher paying institutions.

When examining demographic and graduate school factors associated with salary growth during the early career years, we found that marriage was significantly associated with salary growth, with those who were married at the time they earned their degree experiencing roughly 15 percent higher salary growth over the first five years of their careers. For males, getting married within the first five years after graduation was associated with a 25-percent salary growth premium relative to other males. For females, however, getting married was associated with a 23-percent salary growth penalty relative to other females, perhaps reflecting compromises incurred in a two-career job search. We did not find salary growth differences for those who graduated from higher-tier relative to lower-tier institutions, or for those specializing in any particular subfield of economics.

During the first five years of their careers, roughly one half (45 percent) of the economists switched employers. The largest job mobility occurred among those initially working for government, international organizations, or research organizations. Roughly 22 percent of those who started in that sector in 1997 had switched to a different sector by 2003, with the majority of the job switchers migrating into the academy. Despite the relatively low pay, only 10 percent of those initially hired into academic jobs moved out of that sector during the first five years of their careers.

We also examined outcomes for the class of 1997 after 10 years. Our panel of economists earned overall median nominal salaries of \$54,000 in October 1997, \$80,000 in February 2003, and \$108,000 in March 2008, implying an annual raise of 8.2 percent over the first five years and 6.2 percent over the second five years. Those on 9–10 month academic salaries, the largest single sub-category, earned a nominal median of \$49,000, \$66,000, and \$90,000 in 1997, 2003, and 2008, respectively, implying an annual increase of 6.1 percent over the first five years and 6.4 percent over the second five years. These rates of increase compare to an average annual inflation rate of 2.3 percent during the first five years and 3.0 percent during the second five years of their careers. Salary growth was fastest for economists employed in government and the private sector. While nominal permanent 9-month academic salaries grew 84 percent over the decade, nominal salaries of those with full-time jobs in business and industry rose by 125 percent, and salaries of economists working in government, research institutes, and international organizations climbed by 145 percent. As expected, the dispersion of salaries grows over time. While the mean salary for all full-time jobs in the United States exceeded the median by only 4 percent in 1997, that difference had grown to 33 percent by 2008.

Publication records for the 1997 cohort are reported in table 4, divided between economists who started out in academe and those who did not. The publication data were extracted from EconLit in August 2008. We report both total journal publications and publications in “top-50” journals.<sup>11</sup> We do not use total EconLit entries because many of those include working papers that duplicate subsequent publications. We also exclude publications of books and chapters in books.

The most striking observation from the publication data is the fact that almost half the 99 economists with 10 years of experience holding full-time permanent academic appointments in 2007–8 did not publish anything in a top-50 journal in their career (the median number is one, but 49 of the 99 had zero top-50 journal publications). The other half of the distribution includes 13 with one top-50 publication, 25 with two to five top-50 publications, and 12 economists with six or more publications in top-50 journals. There are four individuals in the sample with 10 to 13 articles in top-50 journals. It is ironic that the 63 economists in our sample who earned tenure have a median of zero top-50 publications, while those who do not have tenure report a median of one. Of course, their appointments are not at the same universities.

When journal articles are expanded beyond the top-50 journals, the data show a median of five articles per full-time permanent academic, seven articles for those with tenure, and only two for those without tenure. As would be expected, those who started in academe (not all of whom were still there in 2008) published more than those who began their careers elsewhere, but the publication record of the graduates who started in a sector other than academe and then moved to an academic appointment is quite similar to those who remained in academe throughout the period.

## CONCLUSION

In our 15 years of examining the many factors associated with students’ PhD attrition, completion, time to degree, and job market outcomes, several factors stand out as notable. First, the demographic makeup of economics PhD students and graduates has changed markedly over time. Roughly two-thirds of the PhDs in economics in the United States are earned by non-U.S. citizens, and increasingly earned by female non-U.S. citizens. Today, female U.S. citizens earn

a smaller share of economics PhDs awarded by U.S. institutions than they did in the mid-1990s. These demographic trends are not unique to economics, however, as similar patterns exist for PhDs in mathematics, business, and political science.

Second, of the thousands of students who begin an economics PhD program each year, almost 60 percent will eventually succeed in completing the PhD, while 40 percent are unlikely to do so. Among those who drop out, the majority do so within the first two years of graduate study. Factors consistently associated with higher attrition are attendance at a lower-ranked PhD program and lack of financial aid during graduate study, both of which are associated with other indicators of student quality. Indeed, once the endogeneity of financial aid is controlled, it does not appear to exert an independent impact on the probability of completing the PhD. Students with higher verbal and quantitative GRE scores and those who earned their undergraduate degrees from top liberal arts colleges were less likely to drop out than their peers. Males and non-U.S. citizens are more likely to complete their economics PhDs than their female and U.S. citizen counterparts, but many of the factors related to completion differ across these groups. Despite these findings, many observable characteristics of graduate students do not appear to be systematically related to attrition and completion.

Third, the time it takes to earn a PhD in economics has been inching upward over time, increasing by about five months since 1997. In addition to the slightly longer time to degree among more recent graduates, the variation in their time to degree among those who do finish has shrunk, with smaller proportions of students finishing within four years or taking nine or more years to finish.

Fourth, almost all economics PhDs find employment immediately after completing their degrees. Most take jobs in academe, although the fraction of new graduates going into that sector appears to have declined since the late 1990s. Instead, graduates are increasingly taking jobs in business/industry and government, where the salaries were between 1.2 and 1.4 times larger than those of academics. Despite the salary premium, however, fewer PhD economists employed in business/industry report being satisfied with their jobs, and a smaller fraction of them would have sought an economics doctorate had they known at matriculation what they knew after graduation.

Fifth, although graduates perceive that the emphasis placed by their graduate programs on an array of economic proficiencies was “about right,” graduates report that skills in application and communication are much more important for success in their jobs than for success in graduate school. Alternatively, skill in mathematics was much more important for success in graduate school than for success on the job.

Sixth, almost half of new PhD economists changed employers during the first five years of their careers, with the largest mobility (22 percent) occurring among those initially working in government, international organizations, or research organizations. Only about 10 percent of those initially hired into academic jobs moved out of academe during their early careers. Among those in academics who we were able to track for 10 years of their careers, slightly under half were able to publish their research in one of the top 50 journals in the discipline.

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## NOTES

1. The American Economic Association, "Graduate Study in Economics Web Pages" at [www.aeaweb.org/gradstudents](http://www.aeaweb.org/gradstudents) lists all of the economics PhD programs in the United States.
2. Complete descriptions of the survey methodology, response rates, and sample representativeness for the class of 1997 and class of 2002 are available in Siegfried and Stock (1999) and (2004), respectively.
3. The 2012 *Digest of Education Statistics* reports in Table 364 that there were 968 doctoral degrees awarded in economics by U.S. universities in 1996–97 and 826 awarded in 2001–2. For more information on differences in the counts of economics PhD degrees awarded as tabulated by different sources, see Finegan (2014).
4. We also separately examined the labor market for Agricultural and Natural Resource Economics PhDs in these cohorts (Stock and Siegfried 2006b).
5. Information on these surveys is available in Stock and Siegfried (2006c) and (2014).
6. The programs include 15 of the 22 largest, plus 12 others. Each program graduates an average of at least five PhDs per year. Together, the 27 programs produced 42 percent of the PhDs issued by U.S. programs awarding at least one degree from 1998 to 2001. Higher-ranked programs are over-represented: 22 of the 27 are among the top-rated 48 programs. Because these programs recruit more qualified students, help them finish faster, and place them in better jobs, our data may understate attrition for the entire population of economics PhD-producing programs.
7. For more detail on the attrition and completion rates of this cohort at varying stages of their PhD education, see Stock, Finegan, and Siegfried (2006), (2009a), and (2009b), and Stock, Siegfried, and Finegan (2011).
8. We assigned the programs in our data to tiers based on the 1993 National Research Council (NRC) ratings (Goldberger, Maher, and Flattau 1995). Tier 1 in the ratings consists of Chicago, Harvard, MIT, Princeton, Stanford, and Yale. The second tier is California-Berkeley, Columbia, Michigan, Minnesota, Northwestern, Pennsylvania, Rochester, UCLA, and Wisconsin. The third tier is the 15 programs ranked 16–30 (UC-San Diego, NYU, Cornell, Cal-Tech, Maryland, Boston University, Duke, Brown, Virginia, UNC-Chapel Hill, University of Washington, Michigan State, University of Illinois-Urbana, Washington University-St. Louis, and the University of Iowa). The fourth tier programs ranked 31–48, and the fifth tier includes the remainder of the programs. The one unranked program in our study was assigned to Tier 5.
9. Because our study of the entering class of 2002 was focused on attrition and completion, and because the students finished their PhDs in different years, we did not formally survey that group regarding their employment outcomes.
10. Nominal salaries rose from an average of \$53,000 for those in 9–10 month academic positions in 1997 to \$71,000 for those starting similar jobs in 2002 (Siegfried and Stock 1999, 2004) to nearly \$90,000 for those starting in 2010 (Deck, Jebaraj, and Currington 2011).
11. Journals among the top-50 were determined from Kalaitzidakis, Theofanis, and Stengos (2001).

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