

COVER SHEET

Paper Title: Completing an Economics Ph.D. in Five Years

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Session Title: Completing an Economics Ph.D. in Five Years: Let the Data (Literally) Speak for Themselves

Session Chair: JAMES POTERBA

Discussants: Sarah Bohn, Ethan Cohen-Cole, Paul Heaton, Todd Schoellman, Emma Stephens

Completing an Economics Ph.D. in Five Years

by

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Although the median time-to-degree for economics Ph.D.s was near 5.5 years in 2002, and appears to be rising (Wendy A. Stock and John J. Siegfried 2006), some students can and do earn the degree in under five years. Of 586 individuals who began Ph.D. study in economics in 2002, 27 percent had a diploma they could display on their office wall by fall 2007.

Many economics Ph.D. programs advertise that it normally takes five years to earn the degree. Some programs encourage completion by limiting financial aid to five years. Students who take more than five years incur high opportunity costs of remaining in school, as their peers frequently take jobs paying more than \$100,000 annually.¹ Those that never earn a degree also incur opportunity costs: for universities in terms of financial aid and faculty time, and for themselves in terms of psychological costs, foregone earnings, and delayed entry into alternative careers that better match their skills and interests. Holding constant the prospects of a graduate making a seminal research contribution, economics graduate admissions committees prefer to admit students who will eventually earn a degree, preferably as soon as possible.

I. Completion Rates

The goal of this paper is to inform admissions committees and potential graduate students about factors associated with Ph.D. program completion, with the hope that such information will help admissions committees decide whom to admit to their programs and help students decide which programs to attend. To examine these relationships, we have tracked the progress

of all of the fall 2002 enrollees at 27 U.S. economics Ph.D. programs – a total of 586 students – for the past six years. As of fall 2007, we had sufficient information to estimate the proportion of these entrants that had dropped out, the proportion that was still working toward a degree, and the proportion that had earned a Ph.D. These statistics are reported in Table 1, categorized by 1993 National Research Council (NRC) program ranks (grouped into “tiers”) (Marvin Goldberger, Brendan Maher, and Pamela E. Flattau 1995).

The Ph.D. programs include 15 of the 22 largest plus 12 others, each graduating, on average, at least five Ph.D.s per year from 1998 to 2001. The programs are diverse in terms of 1993 NRC ratings, including nine of the top 15 (Tiers 1 and 2), seven of the next 15 (Tier 3), and 11 of those in Tiers 4 and 5 (ranked 31-48, and above 48, respectively).² Collectively, the sample programs graduated 42 percent of economics Ph.D.s awarded in the United States from 1998 to 2001. Higher ranked programs are over-represented: 22 of the 27 are among the top NRC-rated 48 programs. Because higher ranked programs recruit more qualified students and have lower early attrition, our data likely understate attrition rates for the entire population of economics Ph.D. students.

As noted earlier, 27 percent of the 2002 entering class had completed work on their Ph.D. within five years of matriculation. Thirty-four percent of the original cohort had dropped out by their fifth anniversary, leaving 39 percent still toiling in the academic vineyard.³ Based on a sample of 1,154 economics Ph.D.s who graduated in 1996-97 and 2001-02 (two cohorts who all completed their degrees during the same years), Siegfried and Stock (1999, 2004) found that 41 percent *of those who eventually earn a Ph.D. degree*, do so by the end of five years. A similar completion distribution for our 2002 entering class sample, adjusted for likely attrition at our

disproportionately higher tier sample programs, implies an eventual completion rate around 60 percent for all 2002 economics Ph.D. program entrants.

Completion falls monotonically as program rank declines, ranging from a five-year completion rate of 33 percent for the three Tier 1 programs in our sample, to only 17 percent of the entrants into programs ranked below 48th (Tier 5). Given their higher completion rates and because Tier 1 and Tier 2 programs appear to better avoid attrition among their students than programs in lower tiers (the Tier 1 and 2 two-year attrition rates average less than 18 percent of entrants, while those of lower tier programs are above 32 percent of entrants), we group Tier 1 and Tier 2 programs together when estimating completion. Because five year completion rates of students in Tier 3 and Tier 4 programs are similar, but those for Tier 5 programs are much lower, we group programs in Tiers 3 and 4 together, and use that large group as a benchmark.

II. Predicting Completion

The ultimate goal of economics Ph.D. programs is to produce new Ph.D.s. Efficiency is higher if they graduate as quickly as possible (without sacrificing necessary learning). The target time-to-degree at most Ph.D. programs is five years. It is rare for individuals to complete a Ph.D. in three years (none in our sample of 586 did) or even in four years (seven in our sample did). The largest numbers finish in their fifth or sixth years.

In Table 2 we report results of probit estimates designed to predict which individuals among the original matriculants completed their degrees within five years.⁴ We include in the completion regression program characteristics that we expect to influence completion rates: tier, class size, faculty-student ratio, whether the university is private, whether the program offers a terminal master's degree, whether students are required to attend research seminars, whether individual advisors are assigned to students, whether students must pass comprehensive exams

before proceeding to the second year of their program, whether offices are provided to at least some first-year students, each program's two-year attrition rate, the percent of a program's dissertations that consist of a set of essays rather than a single-topic treatise, whether students usually are awarded aid beyond their fifth year, whether the program has a hard (inflexible) completion time limit, whether the program has a soft (flexible) completion time limit (versus no time limit at all), whether a pre-thesis research paper is required in the program, and whether students seeking dissertation topics must meet systematically with faculty in order to identify a topic.

Few of these program characteristics are significantly related to the probability of completion at the five percent level. The coefficient on *no shared offices* suggests that students at programs without office space for any first year students have a five-year graduation probability 25 percentage points lower than students at programs where at least some first-year students had access to office space. The coefficient on *first-year class size* implies that an increase of one student in the entering class is associated with an increase in the expected probability of completion by one percentage point. Both the direction and size of this correlation are surprising. William G. Bowen and Neil L. Rudenstine (1992) found contrary evidence, attributing higher completion rates at smaller programs to the ability of faculty dealing with fewer students to devote more attention to their Ph.D. students.

The estimated coefficient on *program-level two year attrition rate* suggests that a ten percentage point increase in the dropout rate during the first two years of a student's program is associated with an expected decline in the probability of graduating within five years of about six percentage points. Although this finding is consistent with the hypothesis that a higher early dropout rate fosters low morale among survivors and slows their completion, the relationship

disappears when the same equation is estimated using a sample restricted to survivors (those who did not drop out). Thus, it is likely that the apparent relationship reflects merely the fact that dropouts cannot possibly graduate.

Two other program-specific characteristics are significant at the ten percent level. First, students at Ph.D. programs in Tier 1 and 2 universities have lower expected five-year completion probabilities (by 13 percentage points) than students at Tier 3 and 4 universities. Second is the requirement for a pre-thesis research paper. Unfortunately, the estimated coefficient surprisingly indicates that this requirement likely *reduces* the five-year completion probability by 12 percentage points, implying that such a paper detracts from thesis progress rather than generating a head-start on a thesis.

Among the student-specific characteristics included in the regression, having earned a bachelor's degree at a *U.S. News & World Report* rated Top-60 selective liberal arts college appears systematically related to completion, increasing the probability of earning a Ph.D. within five years by 27 percentage points relative to having attended an "other" U.S. college or university (those not offering a Ph.D. in economics and not among the Top-60 selective liberal arts colleges). Students holding bachelor's degrees from foreign institutions seem to have substantially higher expected five-year graduation rates than those from "other" U.S. colleges and universities, although the estimated coefficients are statistically significant at only the ten percent level. The estimated coefficients indicate that those from Top-50 foreign institutions enjoy a 34 percent greater probability of earning their Ph.D. in five-years than matriculants from "other" U.S. colleges and universities, while those from other foreign institutions have a 19 percent advantage.

None of the GRE scores is significantly related to the probability of completing the Ph.D. within five years. The results also show a six percentage point greater expected five-year completion rate for men, and a nine percentage point lower expected five-year completion rate for those whose bachelor's degree was in economics; both results are significant at the ten percent level.

Although the estimates imply that first-year financial aid does not matter for completion, in separate estimates for U.S. citizens and non-U.S. citizens (see Wendy A. Stock, T. Aldrich Finegan, and John J. Siegfried 2008), we find that among U.S. citizens, recipients of financial aid for their first year of Ph.D. study are about twenty percentage points more likely to complete their degree within five years. Among non-citizens, those who received aid their first year are no more or less likely to earn their degree in five-years than are those who did not.

It is possible that the financial aid indicators are endogenous in the completion regression (see, e.g., Jeffrey A. Groen, George H. Jakkubson, Ronald G. Ehrenberg, Scott Condie, and Albert Y Liu (2008)). We attempted to address endogeneity by estimating a bivariate probit regression, identifying an equation to predict whether each student received any first-year financial aid using the percentage of the rest of each program's incoming class that received aid as the instrument.⁵ This percentage is certainly related to whether a given student receives financial aid, as students in programs that give aid to relatively more students should be more likely to receive aid themselves, *ceteris paribus*. It is also not likely to affect a given individual's probability of graduating, as it is based on outcomes for other students at the time of entry into the program. Although most coefficients in the bivariate probit regression are qualitatively consistent with those reported in Table 2 (these results are available from the authors), they are highly sensitive to model specification, causing us to question their validity.

Although our sample is more representative across program tiers, our completion estimates are quite similar to those in Susan Athey, Lawrence F. Katz, Alan B. Krueger, Steven Levitt, and James Poterba (2007), who estimated probit regressions to predict completion probabilities for 782 Ph.D. students who entered four Tier 1 economics programs during the 1990s. In unpublished probit estimates of completion by the year 2006 (allowing different time lengths for each cohort) on GRE scores, gender, and indicators of the type of undergraduate institution the students attended, they found no difference in completion probabilities based on GRE scores or gender, but found higher expected probabilities of completion for Ph.D. students whose undergraduate degrees were earned at a 2006 *U.S. News & World Report* ranked U.S. Top-15 National University or a foreign college or university. They found that students who attended an elite (top 5) liberal arts college were more likely to complete their degree, but the effect is specification-dependent and only marginally significant.

Our results are quite similar to theirs, with the exception that our estimates indicate that students whose undergraduate degree is from one of the Top-60 liberal arts colleges as ranked by *U.S. News & World Report* have higher completion probabilities, but that alumni of U.S. economics Ph.D.-granting institutions (which includes all of the Top-15 national universities in the Athey, et al. categorization) do not. The difference in results could arise if liberal arts graduates have a higher probability of completing their Ph.D. degree at programs in Tiers 2-5 universities, while the relative advantage of alumni of the undergraduate programs of leading Ph.D.-granting institutions is concentrated among Tier 1 economics Ph.D. programs.

III. Conclusion

The empirical results reported here do not provide much guidance about how to improve completion rates in U.S. economics Ph.D. programs. It appears that increasing cohort size would

help, although how and why is a mystery, since the usual hypotheses about cohort size imply higher completion rates for smaller rather than for larger cohort sizes. Avoiding situations where no first-year students have access to office space seems to be important for degree completion, and might be singled out as the most obvious policy change that we could recommend for those programs that do not currently provide space for at least some first year economics Ph.D. students.

Perhaps giving more admission preference to applicants who earned a bachelor's degree at one of America's selective liberal arts colleges would improve completion rates marginally. But, in the end, it appears that many considerations unique to individual students and faculty that we cannot measure--such as ambition, motivation, persistence, organizational skills, and the creativity of students, and interest in students' success as well as mentoring and motivational skills among graduate faculty-- matter more than the myriad of characteristics we were able to measure, which collectively account for less than 15 percent of the variation in completion among students.

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ENDNOTES

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¹ For example, as of April 1, 2008 the PhD-granting schools' starting salary offers listed on www.bluwiki.com/go/Econjobmarket_offer averaged \$107,000.

² One unranked program was assigned to Tier 5.

³ For a sample of 1001 individuals who entered one of six unidentified economics Ph.D. programs between 1992 and 2000, the Council of Graduate Schools (2008) found that, after five years, 33 percent had completed their degree, 25 percent had dropped out, and 42 percent remained at work on the degree. These outcomes are close to what we find for those students who enrolled in nine of the top-15 (Tiers 1 and 2) (NRC) ranked economics Ph.D. programs in Fall 2002.

⁴ Sixteen of our 586 observations are lost because of missing data on explanatory variables listed in Table 2.

⁵ Because our endogenous variable, *received any financial aid*, is binary, traditional two-stage least squares models will not produce consistent estimators [see Jeffrey M. Wooldridge (2002), section 15.7.3, and William H. Greene (2008), section 23.7]. We also took the simpler approach of estimating a completion model that excludes the financial aid variable, for the full sample and for a sample that only included students who received financial aid in the first year. The only notable difference between these two sets of estimates is that although the coefficient on the FRE quantitative score is positive and significant at the 10 percent level in the regression that uses the full sample (but excludes the financial aid variables), it becomes smaller and insignificant in the restricted sample.

Table 1 - Ph.D. 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 students	103	149	141	127	66	586
First year attrition	2.9 ^{<}	12.8	10.6	22.0 ^{>}	22.7 ^{>}	13.7
Second year attrition	10.7	4.7 ^{<}	22.0 ^{>}	17.3	15.2	13.8
Third year attrition	1.0	3.4	2.1	3.1	9.1 ^{>}	3.2
Fourth year attrition	0.0	2.7	2.8	2.4	0.0	1.9
Fifth year attrition	0.0	1.3	2.8 ^{>}	0.0 ^{<}	1.5	1.2
Total two year attrition	13.6 ^{<}	17.4 ^{<}	32.6 ^{>}	39.4 ^{>}	37.9 ^{>}	27.5
Total five year attrition	14.6 ^{<}	24.8 ^{<}	40.4	44.9 ^{>}	48.5 ^{>}	33.8
Still in program	52.4 ^{>}	43.6	33.3	31.5 ^{<}	34.8	39.1
Ph.D. completion	33.0	31.5	26.2	23.6	16.7 ^{<}	27.1

Attrition, still in program, and completion rates all calculated relative to original population of 586 Fall 2002 entering students, and reported as percentages. The > and < superscripts indicate that the mean is statistically different from the mean for the rest of the sample at the 0.05 significance level (two-tailed tests).

Table 2 - Predicting Completion, probit regression.

(Dependent Variable = 1 if student completed Ph.D. within five years)

<u><i>Program Characteristics</i></u>	<i>Mean</i>	<i>dY/dX^a</i>	<i>z-stat.</i>
Tier 1 or 2	0.44	-0.132*	-1.66
Tier 3 or 4	0.46	-	-
Tier 5	0.10	0.092	0.90
First-year class size	26.39	0.013**	2.17
Faculty-student ratio	0.27	0.623	1.43
Private university	0.42	0.127	1.37
Terminal master's degree offered	0.15	0.097	0.88
Seminar attendance required	0.59	-0.039	-0.58
Core exam pass required	0.65	0.028	0.43
No shared offices	0.17	-0.247**	-2.75
Individual advisers assigned	0.32	0.023	0.36
Program-level two year attrition rate	0.28	-0.632*	-1.64
Percent of dissertations essays	67.20	0.002	1.36
More than five years full financial aid usual	0.21	-0.057	-0.79
Hard completion time limit	0.23	0.016	0.13
Soft completion time limit	0.46	0.073	0.97
Pre-thesis research required	0.46	-0.116*	-1.67
Topic seeker meetings with faculty	0.42	0.028	0.43
<u><i>Student Characteristics</i></u>			
GRE analytical score (*10 ⁻¹)	72.38	0.002	0.70

GRE verbal score (*10 ⁻¹)	56.32	0.000	-0.17
GRE quantitative score (*10 ⁻¹)	77.19	0.008	1.39
U.S. Citizen	0.34	0.044	0.58
Male	0.65	0.065*	1.64
Age at entry to program	25.40	-0.009	-0.80
Hold prior graduate degree	0.45	-0.027	-0.56
Hold undergraduate degree in economics	0.70	-0.087*	-1.77
Hold undergraduate degree in economics/math	0.09	-0.101	-1.39
Years since undergraduate degree	2.66	0.012	1.01
Theory field interest	0.34	0.009	0.19
Other field interest	0.41	-	-
No specified field of interest	0.25	-0.011	-0.21
<u>Type of Undergraduate Institution Attended</u>			
U.S. economics Ph.D.-granting	0.25	0.164	1.41
U.S. top-60 liberal arts	0.09	0.273**	1.98
Other U.S.	0.05	-	-
Top-50 foreign	0.04	0.337*	1.89
Other foreign	0.57	0.194*	1.71
<u>Financial Aid During First Year</u>			
Fellowship	0.47	-0.005	-0.09
Research assistantship	0.05	0.116	0.96
Teaching assistantship	0.28	-	-
No aid	0.20	-0.092	-1.61

Number of Observations	570	570
Pseudo R-squared		0.128

^a Reports predicted change in the probability for a one-unit change in the independent variable at the mean. Asterisks indicate coefficients with p-values less than 0.05 (**) or 0.10 (*).