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Completion Rates and Time-to-Degree in Economics Ph.D. Programs

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Completion Rates and Time-to-Degree in Economics Ph.D. Programs

With generous financial support from the Ford and Spencer Foundations, for over eight years we have tracked the progress of 586 individuals who entered one of 27 economics Ph.D. programs in fall 2002. In this final report on the project we describe the progress the students in this entering cohort had made by fall 2010, eight years after matriculating. Statistics describing the cohort's educational outcomes, subdivided into National Research Council (NRC) quality "tiers" (Goldberger, et al., 1995), are reported in Table 1. Tier 1 contains the 6 highest-ranked programs (3 are in our sample), tier 2 the next 9 (we have 6), tier 3 the next 15 (we have 7), tier 4 the next 18 (we have 6), and tier 5 the approximately 70 other programs (we have 5, including one well regarded program that is unranked by the NRC because of its small size).

The Ph.D. programs in our sample include 15 of the 22 largest in terms of Ph.D.s awarded over the period 1998-2001, plus 12 others that each awarded, on average, at least five economics Ph.D.s annually. Collectively, the sample programs produced 42 percent of the economics Ph.D.s awarded from 1998 to 2001.

Attrition and Completion

By October 2010, 59 percent of the fall 2002 entering cohort had earned a Ph.D. in economics at the university where they initially matriculated, 37 percent had dropped out, and 4 percent were still writing their dissertations. The eight-year attrition rate of 37 percent could reach a maximum of 41 percent in the unlikely event that no one still writing ever finishes. If three-quarters of the 26 people still working toward their degree eventually finish, the final attrition rate will be about 38 percent.

Attrition is lowest at the highest ranked programs, and climbs to over half of the entering class at the lowest ranked programs. Attrition occurring after the second year constitutes less

than a third of the cumulative eight-year attrition rate. Because we have analyzed attrition rates for this sample in earlier papers (Stock, et al., 2006; Stock, et al., 2009), and because the vast majority of attrition occurred during or immediately after the first two years of study, we do not discuss attrition further in this report.

Using data from earlier empirical studies of *completion* cohorts for 1996-97 and 2001-02 (Siegfried and Stock, 1999; Stock and Siegfried, 2006), we found that 88 percent of individuals who earned an economics Ph.D. did so within eight years. In contrast, among those in the fall 2002 entering cohort who did not drop out, 93 percent had their degree in hand after eight years. If 75 percent of the remaining 26 students eventually earn their degree, the final completion rate for the entering Ph.D. class of fall 2002 will be 62 percent. This is 12 percentage points higher than the 50 percent completion rate for economics Ph.D.s reported by Bowen and Rudenstine (1992) for cohorts entering nine leading economics programs from 1972 to 1976, and four percentage points higher than the 58 percent completion rate for economics Ph.D.s reported by the Council of Graduate Schools (King, 2008) for cohorts entering six economics Ph.D. programs from 1992-93 through 1994-95. The higher expected completion rate by our sample of program entrants could reflect better information about and preparation for doctoral studies by applicants (Colander, 2005), better decisions by admissions committees, a loosening of completion requirements for those who clear the hurdle of admission into economics Ph.D. programs, or all three changes since the earlier periods. Pulling in the same direction is the overrepresentation of highly ranked programs in our entry cohort (relative to completion cohorts), since such programs have dramatically higher eight-year completion rates (see Table 1).

Like Bowen and Rudenstine, we treat students in the fall 2002 entering cohort sample who transfer from one economics Ph.D program to another as dropouts. Thus, the completion rates we report reflect completion of a Ph.D. at the program in which students initially matriculated. Because some transfers earn a Ph.D. in economics from a different university, more than 62 percent of our entering cohort will eventually hold a Ph.D. in economics.[1] After taking transfers into account, we estimate that close to two-thirds of all fall 2002 entrants will eventually earn a Ph.D. in economics somewhere.[2]

In sharp contrast with the pattern of completion rates after eight years of study, five-year completion rates at the tier 1 and 2 programs were only marginally higher than completion rates at tier 3 and 4 programs, because, thanks to lower attrition, a much higher fraction of Ph.D. students were still working on their dissertations at tier 1 and 2 programs after five years. The inventory of students still working in the tier 1 and 2 programs after five years cleared out during the next three years, however, since close to 42 percent of the fall 2002 entering classes at those programs finished during years six through eight. After eight full years, tier 5 programs had by far the highest proportion (one-eighth) of students still working toward their degree.[3]

Time-to-degree

[1] For the entrants into the Ph.D. program in economics at Syracuse University over the period 2000 through 2004, the completion rate was 64.2 percent (Dutkowsky, Grodner, and Grove 2009, p. 36).

[2] Stock, et al. (2006) identified 20 dropouts during the first two years of their Ph.D. study that enrolled in a different Ph.D. program. A few more were probably overlooked. Assuming that 25 transfers from among the original 586 achieve a 70 percent completion rate (slightly higher than average, because of what they learned in an earlier Ph.D. program), total eventual Ph.D. completions in the cohort, whether at the institution where they initially enrolled or elsewhere, would turn out to be about 66 percent of the original cohort.

[3] Only 18 percent of tier 5 entrants completed their degrees during years six through eight, compared to 33 percent for universities in tiers 1-4.

Descriptive statistics regarding time-to-degree are reported in Table 2. The median time-to-degree from entering their Ph.D. program until they were awarded their degree (not until they defended their dissertation), was 5.6 years for the 345 individuals in the *entering* class of fall 2002 who had earned their degree within eight years. The median time-to-degree from the *completing* cohorts of 1996-97 and 2001-02 among those who finished within eight years was 5.1 and 5.2 years, respectively. The right tail of the time-to-degree distribution has declined markedly, from 12 percent of the completing classes of 1997 and 2002 finishing after eight years, to a maximum of 5 percent for the entering class of fall 2002, the bulk of whom finished in 2006-07 or 2007-08. In recent years, fewer students are taking a very long time to complete their degree. At the same time, however, the median time-to-degree for those in the entering class of fall 2002 who finished within eight years is five to six months longer than the median time-to-degree for those that finished within eight years in both of the earlier classes.

There are several possible explanations for why we observe a rise in the median time-to-degree (among those who finish within eight years) for the entering cohort graduating around 2007-08 relative to completing cohorts of 1997 and 2002. First, it could be a statistical artifact because the 27 institutions in our entering class sample from fall 2002 may exclude some programs that graduate a disproportionate number of matriculants within four or five years. Second, it could be a statistical artifact because the median time-to-degree for the 1997 and 2002 completion cohorts is biased downward because the relative size of the entering cohorts was changing or because the completion cohorts could have started their Ph.D. programs at various points in the year rather than in the fall. Third, it could reflect only temporary changes because the substantially weaker demand for new economics Ph.D.s in 2008-09 and 2009-10 caused

some students to delay graduation. Finally, it could be the case that the median time-to-degree has indeed lengthened. We examine each of these possibilities in turn below.

First, we explore the impact of restricting our entering cohort sample to only students in the 27 sample programs by comparing time-to-degree when we do and do not limit the 1997 and 2002 completing cohort data to students from the same 27 programs. Among those finishing within eight years, the median time-to-degree for the combined 1996-97 and 2001-02 graduates from our 27 sample universities is 5.0 years, identical to what we find for graduates from a wider set of programs in the same years. Thus, it appears that limiting the sample to our 27 programs does not play a role in explaining the longer time-to-degree among our later graduating cohorts.

Second, Bowen and Rudenstine (1992) explain how and why trends in median times-to-degree may be misleading if calculated from completion cohorts during a period when the number of students entering Ph.D. programs is changing. The issue was apparently first recognized by Coale (1972).

> If the cohorts of entering graduate students shrink over time (as they did, beginning in the early 1970s), successive Ph.D. cohorts will contain fewer "fast" finishers and an increasing proportion of "slow" finishers. The progressively smaller entering cohorts yield smaller and smaller numbers of fast finishers to the relevant Ph.D. cohorts. It also takes more years for the slow finishers in these smaller entering cohorts to affect the medians for the Ph.D. cohorts. Thus, during a period when the size of entering cohorts is diminishing quite rapidly, the mix of students in any given graduate student population, and thus in successive Ph.D. cohorts, necessarily drifts toward a longer median time-to-degree. In other words, the change in the relative proportions of slow finishers and fast finishers carries with it a built-in bias in the direction of the former group. (Bowen and Rudenstine 1992, pp. 116-117).

Thus, the bias caused by using completion cohorts depends on the rate of change (and the second derivative) of the size of entering cohorts (Bowen, Lord, and Sosa 1992).

Although we do not have data on the size of entering cohorts, we can approximate their size from the size of completing cohorts. If most Ph.D.s completed the requirements for their

degree in either five, six, or seven years during the 1990s, the median time-to-degree person in the completing cohort of 1996-97 would have entered in fall 1991. Over three-quarters of that group would have finished in 1995-96, 1996-97, and 1997-98. The average size of those three completing cohorts is 937. A similar calculation for completing cohorts of 1991-92 and 2001-02 yields an average size of 849 and 838, respectively. The entering cohort size rose by about ten percent from 1991-92 to 1996-97 and declined by roughly eleven percent from 1996-97 to 2001-02 — modest, but not trivial changes. That suggests that the median years-to-degree estimate should be a bit higher than 5.1 for the 1996-97 cohort and a bit lower than 5.2 for the 2001-02 cohort. Adjusting for a modest bias in the median time-to-degree for the two earlier periods caused by the use of completion cohorts, the true pattern of time-to-degree for completion cohorts of 1997, 2002, and 2008 might be 5.15, 5.15, and 5.6 years rather than 5.1, 5.2 and 5.6 years—still revealing, if anything, an upward trend.

The fall 2002 entering cohort obviously all began their Ph.D. studies in fall, when the usual two-semester core Ph.D. theory and econometrics sequences begin. Of the 1154 Ph.D.s in our 1997 and 2002 graduating cohort samples, 44 started Ph.D. studies in January, which may have added nine months to their studies if they could not make much progress until the core sequences started the following fall. Although those starting in January did take a little longer to complete their degrees, the difference is not statistically significant at even the 0.10 level.

Third, Groen (2010) finds that a stronger job market increases the probability of a Ph.D. student completing his or her degree in a given year, thereby reducing time-to-degree. His estimates imply that a 20 percent decline in job listings increases expected time-to-degree by 0.52 years. Such a decline happened between 2008 and 2009, as job listings in *Job Openings for Economists* fell by about 20 percent. This plummeting demand for economics Ph.D.s affected

only the 74 completers in the 2002 entering cohort who had not earned their degree by the end of six years, however, and so probably had only a moderate effect on lengthening the median time-to-degree.

Finally, it appears that at least some of these 27 programs in our sample have changed from a norm of four years to a norm of five years. Indeed, we know of one large program in our sample that changed its completion norm from four to five years during the interval separating our earlier completion cohorts from the entering class of fall 2002. This program alone accounted for roughly one-tenth of the students who completed within four years in the earlier cohorts. It takes only a half dozen more programs with similar experiences to account for all of the difference between the 13.4 percent four-year completion rate in the earlier completion cohorts and the 2.0 percent rate in the 2002 entering cohort.

In addition to the lengthening time-to-degree, it is clear that there has been a marked decline in the tails of the time-to-degree distribution over the past fifteen years. Although methodological complications make it difficult to use completion cohorts to compare time-to-degree over different periods, it is obvious nevertheless that a larger fraction of completers are more recently finishing within eight years, but still, on average, may be taking a bit longer than similar students a decade earlier. At one end of the distribution, only two percent (just seven students out of 586 in the 2002 entering cohort) completed their degree within four years, while 13.4 percent of the combined 1997 and 2002 completion cohorts finished inside four years. At the other end of the distribution, the proportion taking over eight years has also declined dramatically, from 12 percent among the earlier cohorts to less than 5 percent among the fall 2002 entrants.

In our view, the evidence above indicates that there has been a genuine increase in the median time-to-degree in economics Ph.D. programs. In addition, student progress toward the degree is becoming more homogeneous, as programs rarely have really fast completers, but have also successfully curtailed protracted efforts that drag on for a decade or longer. In short, both tails of the time-to-degree distribution are declining in importance, while the median time-to-degree is inching upward slowly.

Predicting Completion

Of the 586 individuals who entered one of our sample Ph.D. programs in the fall of 2002, 215 had dropped out after eight years, 26 were still working on their degree, and 345 had earned their Ph.D. In an earlier report on this research project (Stock, et al., 2009), we tried to identify measureable personal and Ph.D. program characteristics associated with completing a degree within five years. We found that students in tier 1 or 2 programs were less likely to have completed their degrees within 5 years than students from tier 3 or 4 programs, that larger first-year program cohort size was associated with a higher probability of completing a degree within five years, and, not surprisingly, that students from programs with high attrition during the first two years experienced a lower probability of completing their degrees within five years. We also found lower five-year completion rates in programs not offering shared offices to at least some entering students, and in programs requiring a substantial research project prior to thesis work. Males, those with undergraduate degrees from top-60 U.S. liberal arts colleges, and those with undergraduate degrees from foreign institutions were more likely to have completed their degrees within five years. These findings confounded two effects—whether the students would complete their degree, and, if so, whether they would do so with dispatch (within five years).

With our new information on this group, we can assess what factors are associated with earning an economics Ph.D. within eight years. Because 93 percent of the students who had not dropped out had earned a degree by the end of the eighth year, this new analysis essentially allows us to distinguish those who completed their degree from those who did not. It also allows us to see whether those who finished within five years differ in important ways from those who also eventually finished, but took longer.

The completion regressions are reported in Table 3.[4] With only 26 entrants still working on their dissertations after eight years, the results of the probit for completion within eight years should indicate what is important for completing a Ph.D. in economics, regardless of when it is completed. The probit for completion within five years allows for an assessment of factors associated with completing the Ph.D. relatively quickly. A striking contrast is that only one of the factors that are significantly associated with degree completion within eight years is also associated with degree completion within five years, and the sign of that association differs across the two regressions. The variable *hold undergraduate degree in economics/math* identifies students who majored in mathematics (whether combined with an economics major or not). Compared to students with undergraduate degrees outside of economics, students with undergraduate degrees in math are *more* likely to eventually finish their degrees, but they are *less* likely to do so quickly (i.e., within five years).

Apart from the expected negative relationship between a higher program-level two-year attrition rate and the probability that students complete their degrees (within eight years), only one program-level characteristic is significantly related to the probability that the average student completes the degree. Students in programs where faculty members have regular monthly or bi-

[4] The sample is limited to 570 students because we do not have GRE or demographic information on 16 entrants.

monthly contact to check on the progress of students seeking a dissertation topic (*topic seeker meetings with faculty*) have a 13 percentage point higher probability of eventually completing their degrees. The absence of a significant association between such meetings and early completion suggests that five-year completers were less likely to need such help or obtained it on their own initiative.

Among student characteristics, the quantitative GRE score, and to a lesser extent the (now defunct) analytical GRE score, are both related to the probability of completing a degree within eight years. A ten-point increase in quantitative GRE score is associated with a modest 1.4 percentage point increase in the probability of completing the Ph.D. Stock, et al. (2009) found a significant positive relationship between both quantitative and verbal GRE scores and the probability that a student persists in the Ph.D. program through the first five years, but detected no significant relationship between GRE scores and completing the Ph.D. within the first five years after matriculation. Thus, it appears that GRE scores have more effect on whether students will, in fact, eventually earn a Ph.D. than on how fast they are likely to earn it.

Four other student characteristics significantly predict the probability of completing an economics Ph.D. Men and U.S. citizens are 15 percentage points more likely than women and non-U.S. citizens to complete their degrees.[5] Students who attended "other" foreign institutions (those outside the top-50) are 25 percentage points more likely to complete the Ph.D. than those who attended non-Ph.D.-granting U.S. institutions or liberal arts colleges ranked below 60. Finally, students who entered their Ph.D. programs without initial financial aid are 30 percentage points less likely to complete their degrees than those who entered with first-year teaching

[5] Several studies of Ph.D. completion rates across various disciplines have found higher completion rates for men than for women (King 2008, p. 3).

assistantships. The latter outcome stems primarily from its impact on attrition. In earlier attempts to predict attrition (Stock, et al., 2009), a variable indicating whether a student received any first-year financial aid was associated with a significant 19 percentage point higher probability of remaining in the program through five years, although when we controlled for the fact that those with otherwise stronger credentials are more likely to receive financial aid, the independent effect of financial aid on attrition disappeared.

In order to explore factors associated with completing the degree faster, given that the degree is earned, in the right-side panel of Table 3, we report results of a probit estimate of completion within five years, using a sample restricted to individuals who had their diploma by the end of eight years.[6] Most of the results are consistent with estimates of the probability of completing within five years reported in Stock, et al (2009), which are based on a sample that consisted only of those who had either not yet completed or had finished within five years. Students in tier 1 or 2 Ph.D. programs were less likely to complete their degrees within five years than students in tier 3 or 4 programs. Because there is no significant relationship between the tier indicators and completion within eight years, we conclude that although tier 1 and 2 program students finish more slowly, they are no less likely to eventually complete than their peers at tier 3 or 4 programs.

Those with access to shared offices during their first year of study had a 40 percentage point advantage in the probability of completing within five years, but no edge in the probability of completion eventually. Quite surprisingly, students who were required to complete a pre-thesis research paper (45 percent of the Ph.D.s enrolled, from 10 of the 27 programs) were 22 percentage points *less* likely to finish in five or fewer years, implying that the burden of writing

[6] The sample size here is 339 because 6 of the 345 completers had to be omitted due to absence of complete data.

such a paper may outweigh the advantage that accrues to those students who use the paper as a springboard to dissertation research. Also surprising is the result that students who majored in economics as undergraduates were 19 percentage points *less* likely to finish within five years. As mentioned above, students with a mathematics major (whether combined with an economics major or not) were 31 percentage points less likely to finish within five years but 21 percentage points more likely to finish eventually.[7]

We find that students whose bachelor's degrees were from a top-60 U.S. liberal arts college or an economics Ph.D.-granting university finished faster, as did those who were in Ph.D. programs with larger first-year cohort size and with access to offices during their first year of Ph.D. study. Those with a BA from a leading liberal arts college enjoyed a 37 percentage point advantage toward finishing in the first five years relative to those with degrees from other non-Ph.D.-granting U.S. institutions. Nothing else that we identified seems to matter for completing the Ph.D. quickly.

The proportion of the variation explained in both the overall completion (within eight years) regression and the speed of completion (five years versus six to eight years) regression is low. Evidently, the personal and program characteristics that we have been able to measure are not the most important determinants of whether and when a new Ph.D. student will complete his or her degree. Perhaps unobservable personal characteristics, such as ambition, motivation, attentiveness, persistence, organizational skills, ingenuity, and creativity are relatively more important.

Endogeneity of Financial Aid in Predicting Completion

[7] A possible explanation is that students with more previous work in math are more likely to be tapped as TAs and section instructors, and these tasks tend to delay degree completion.

The financial aid indicators in the completion model are likely endogenous, because aid is usually awarded on the basis of the same personal characteristics that affect completion, as well as on factors unobservable to us, such as transcripts and letters of recommendation. To address endogeneity, we used several approaches, including two stage least squares, a bivariate probit regression approach, and limiting the sample to include only those with financial aid.[8]

For the two-stage least squares and bivariate regression models, we follow Groen, et al. (2008) and Stock, et al. (2009), predicting whether each student received any first-year financial aid by using as an instrument the percentage of *other* students that received aid in each program's incoming class. This proportion is undoubtedly related to whether a specific student received first-year financial aid, as students in programs that award aid to relatively more students are more likely to receive aid themselves, ceteris paribus. The proportion of students receiving aid also is not likely to affect an individual's probability of earning a degree, because it is based on outcomes for other students at the time they all entered the program.[9]

The two-stage least squares results (available from the authors) generate an insignificant estimated relationship between financial aid and the probability of completion when we instrument for it using the percent of incoming class receiving aid. In our earlier paper on attrition and five-year completion (Stock, et al., 2009), bivariate probit estimates of attrition indicated that once the endogeneity of financial aid was controlled, it had no independent

[8] Because our endogenous variable, *received any financial aid*, is binary, traditional two-stage least squares estimation does not produce consistent estimators (see Wooldridge (2002) section 15.7.3 or Greene (2008) section 23.7). Angrist (2001) argues in support of using two-stage least squares despite its inconsistency, but Imbens (2001) disagrees.

[9] The percentage of the incoming class that receives financial aid is strongly related to whether an individual student is awarded aid. A ten percentage point increase in the proportion of the incoming class that receives aid is associated with a 4.3 percentage point increase (significant at the one percent level) in the probability an individual entering student receives aid.

association with attrition. Although most coefficients in the bivariate probit regression for completion within five years were consistent with there being no independent effect of financial aid on completion once its endogeneity was controlled, they were highly sensitive to model specification, causing us to question their validity. That is also the case in our bivariate probit estimates of completion within eight years.

We also used a simpler approach of estimating a completion model that excludes the financial aid variable, both for the full sample and for a sample that included only students who received financial aid in the first year. The only difference in these estimated equations is that the coefficients on the other foreign undergraduate institution and GRE analytical and quantitative scores are smaller and not significant in the sample restricted to aid recipients.

Differences in Completion between Men and Women

The predicted eight-year completion rate is 15 percentage points higher for men than for women, and the difference is statistically significant. Because it is possible that factors associated with completion differ between men and women, we estimated the completion regressions separately by gender. The estimates are available from the authors. As expected, a higher program-level two-year attrition rate and the absence of financial aid are associated with lower completion rates for both men and women. Surprisingly, none of the other characteristics significantly associated with female completion rates matters for men, and none of the other factors associated with male completion matters for women.

For men, regular contact with their advisor while seeking a dissertation topic is associated with a 14 percentage point higher completion probability. Also positively related to completion for men (but not women) are higher analytical GRE scores and having attended a top-60 liberal arts school or a foreign institution outside the top-50 as an undergraduate. For women, pursuing

a Ph.D. at a private university increases the probability of completion by a whopping 62 percentage points—which, however, is offset by 38 percentage points if the university also offers a terminal masters degree in economics (we have no idea why). Women are more likely to complete their degree in programs that have fewer Ph.D. students per faculty member, where a higher proportion of students write three-essay-style (versus single topic treatise) dissertations, and where there is a soft (flexible) time limit on Ph.D. study. Women who enter Ph.D. programs with a prior graduate degree in hand are less likely to complete a Ph.D. in economics. Alternatively, women who enter programs after having earned an undergraduate degree in math are 41 percentage points more likely to complete. Women who enter without a specific field of interest have a 27 percentage point lower probability of completion, and, surprisingly, those women who are awarded no-work fellowships during their first year of study have a 45 percentage point *lower* chance of graduating.[10]

Differences in Completion between U.S. citizens and non-U.S.-citizens

The predicted economics Ph.D. completion rate is 15 percentage points higher for U.S. citizens than for non-U.S.-citizens.[11] Further, when we estimate completion separately for citizens and non-citizens, several structural differences emerge (again, results are available from the authors). As expected, higher program-level two-year attrition rates and an absence of financial aid are associated with lower completion rates for both citizens and non-citizens.

The only other characteristics strongly related to completion for international students are higher analytical GRE scores and holding a bachelor's degree in mathematics. A 10 point higher

[10] A lower completion rate for those holding no-work fellowships vis-à-vis teaching and research assistantships is consistent with prior findings by Bowen and Rudenstine (1992) and Nelson and Lovitts (2001).

[11] Studies of Ph.D. completion rates among a wider set of disciplines have found that completion rates are modestly higher for international students than for students who are U.S. citizens and permanent residents (King, 2008, p. 3).

analytical GRE score is associated with a modest one percentage point higher probability of completion, while international students with an undergraduate mathematics major enjoy a 27 percentage point advantage over international students with majors outside math and economics. Among domestic students, those studying at tier 1 or 2 programs have a lower probability of completion, while those at programs requiring students to make regular contact with their adviser while seeking a dissertation topic had higher completion chances. A 10 point increase in quantitative GRE scores is associated with a 23 percent higher probability of completion, while being male is associated with a two percentage point higher completion probability among U.S. citizens.

Predicting Time-to-Degree

Research examining the time required to earn a Ph.D. in economics has found that financial aid, sex, citizenship, age, type of undergraduate institution, and starting a job prior to completing the Ph.D. all impact time-to-degree (TTD). Siegfried and Stock (2001) and Stock and Siegfried (2006) used data on individuals who completed their economics Ph.D. degrees in 1996-97 and 2001-02. Ehrenberg and Mavros (1995), using data on students who entered graduate programs at Cornell University between 1962 and 1986, had information on prior master's degree, sex, citizenship, GRE scores, and financial aid. They did not have information on age, undergraduate major, or program characteristics (because their data were all from one program).

Using information on the students in the entering class of 2002 who completed their degree within eight years, we examine factors associated with the speed at which students

complete their degrees by employing a duration model based on a Weibull distribution.[12] We report estimated exponentiated accelerated failure time coefficients and the predicted change in time-to-degree in months for statistically significant coefficients (at the 0.10 level) in Table 4.

Among the program characteristics, students who attended one of the Tier 1 or 2 programs in our sample took six months longer to earn their Ph.D. than those from Tier 3 or 4 programs. This is apparent in the descriptive statistics. The longer time might reflect higher dissertation standards, greater effort to turn a good job market paper into an article accepted at a leading economics journal, or more time spent working as a teaching assistant at higher ranked programs. Entering the Ph.D. program as part of a larger first-year cohort is negatively related to TTD, but the coefficient is tiny (a one student increase in cohort size from the mean of 27 is associated with a reduction in time-to-degree of one week). The estimated coefficient on the *no shared offices* variable is consistent with our findings on probability of completion within five rather than eight years, indicating that students in programs that provide shared office space to at least some first-year Ph.D. students take an average of seven fewer months to complete their degrees than students in other programs. Also, students in programs requiring regular meetings between those seeking dissertation topics and their mentors finished about three months sooner, on average.

Among the personal characteristics significantly associated with TTD within our set of completers is U.S. citizenship, which is associated with five months longer TTD, and holding an undergraduate degree in economics or mathematics, which are associated with a five and seven month longer TTD, respectively. Finally, those who were awarded no-work fellowships during

[12] Estimations using a Cox proportional hazards model yielded qualitatively similar results. We present the Weibull results in the table because they are easier to interpret. For an explanation of this model and the coefficients that it generates, see Wooldridge (2002), p. 699.

their first year of Ph.D. study and those who were awarded no financial aid both took about four months longer to finish their degrees than students with teaching assistantships.[13]

We have additional information on 149 of the students who completed their degrees within eight years from responses to a survey sent to all completers shortly after they received their degrees. For each survey respondent, we know the style of their dissertation (a single topic treatise versus a set of essays), whether they began a job prior to completing their Ph.D., and their marital and parental status at the start and end of their Ph.D. studies. We report analogous duration model estimates for this subset of students in the center and right panels of Table 4.

The center panel of Table 4 shows the results for survey respondents using only the regressors that we used for all completers. Many of the estimated relationships between these regressors and TTD differ for this group relative to the full set of completers. The very different patterns of significant coefficients for all completers and survey respondents may be partly explained by differences in the characteristics of survey returners and non-respondents. We find that U.S. citizens, those who attended U.S. economics Ph.D.-granting institutions as undergraduates, those with an undergraduate degree in economics, and those receiving teaching assistantships during their first year of study were significantly over-represented among the survey respondents. The survey respondents all completed their degrees prior to the end of year seven and were over representative of early completers. The two groups also differed in several program characteristics.[14]

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[13] Using data on 72,000 students in several Ph.D. disciplines in the U.S. (including economics), Groen (2010) found time-to-degree results similar to ours for financial aid, but in his sample domestic students completed degrees faster than international students.

[14] Survey respondents were more likely from tier 5 programs, programs with lower faculty-student ratios, private universities, and programs that do not require a core exam pass before the start of the second year, have a higher percent of essay-style dissertations, are less likely to have a hard completion time limit, and are more likely to require pre-thesis research.

For the survey respondents, *no shared offices*, *U.S. citizen*, *hold undergraduate degree in economics*, *hold undergraduate degree in economics/math*, and *fellowship* are not significantly related to time-to-degree. Among program characteristics, graduates from tier 5 programs completed more than six months slower than those from programs in tiers 3 or 4. The empirical results also indicate that students in the (ten) programs that require a substantial second or third year original research paper (i.e., not a literature review) under faculty supervision take eight months longer to complete their degrees than those in programs without such requirements. Program characteristics associated with shorter TTD for survey respondents include the program's faculty-student ratio. Our estimates indicate that increasing the faculty-student ratio from its mean of 0.25 to 0.35 would be associated with a 2.3 month shorter TTD. Students in programs where they are required to pass one or more core, comprehensive, or preliminary exams before the start of their second year of Ph.D. study finish five months faster than others, and those in programs with a soft completion time limit finish six months faster.

Among the student characteristics, a 10-point higher analytical GRE score is associated with a modest 0.2 month shorter TTD, while a 10-point higher quantitative GRE score is associated with a similarly modest 0.1 month longer TTD. Earning an undergraduate degree from an economics Ph.D.-granting university or top-60 liberal arts college is associated with 5.1 and 7.6 month shorter TTD, respectively, while students who attended a top-50 foreign university finished 9.4 months faster than their counterparts from non-elite baccalaureate U.S. institutions.

When the five new variables based on survey responses are added to the model in the right-hand panel, the *Tier 5* and *GRE verbal score* variables lose statistical significance but access to shared offices regains the significance it had for all completers. Among these

responders, access to a shared office is associated with a 10.2 month shorter TTD. Students who began a job prior to their completion of the Ph.D. took about half a year longer to complete their degrees, while those who had at least one child at the time they entered their Ph.D. programs took 4.4 months less time to finish.

Conclusion

Eight full years after commencing doctoral studies in one of the 27 economics departments participating in this study, 59 percent of the entering class of fall 2002 had earned their Ph.D. at the institution where they first matriculated, four percent were still working on their dissertations, and 37 percent had left without a Ph.D. We have used probit regressions to explore which program characteristics, student characteristics and indicators of the kind of undergraduate education and first-year financial aid are associated with completion within five and eight years, and with a continuous measure of elapsed time-to-degree.

Relatively few characteristics show both statistical significance and quantitative importance in explaining eight-year completion rates. Characteristics associated with higher probability of completion include topic-seeker meetings with faculty, 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.

Significantly associated with faster completion (through a higher probability of finishing in five years and lower elapsed TTD) are having earned an undergraduate degree from either a U.S. economics Ph.D.-producing university or a top-60 liberal arts college and enrolling in a Ph.D. program where first-year students have access to shared offices. In contrast, attending a Tier 1 or 2 program, arriving with a bachelor's degree in economics or mathematics, or entering

a program that requires a pre-dissertation research paper, are all associated with *reduced* chances of finishing quickly.

While the small number of student credentials and program features found to be strongly associated with successful completion of doctoral studies in economics is a disappointment, it is also reassuring on two counts. First, it serves as evidence of the success of Ph.D. admissions committees in weighing and balancing the objective measures of likely success across applicants. If these measures had large estimated probit coefficients, one would wonder why more applicants with those earmarks of success were not being admitted. Second, it suggests that it is not easy to make changes in the features of an economics Ph.D. 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.

Finally, the relatively few successful objective predictors of student success point to the larger role played by letters of recommendation and students' essays and transcripts in admissions decisions. It appears that much of the eventual success of students who enroll in economics Ph.D. programs is simply unknowable a priori.

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Table 1 - Ph.D. Program Attrition and Completion Rates, by Program Rank

	Tier					
	1	2	3	4	5	Total
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 and second year attrition rate (percentage)	**13.6**	**17.4**	32.6	**39.4**	**37.9**	27.5
Third through eighth year attrition rate (percentage)	5.8	9.4	10.6	7.1	**15.2**	9.2
Total eight year attrition rate (percentage)	**19.4**	**26.8**	**43.3**	**46.5**	**53.0**	36.7
Five year completion rate (percentage)	33.0	31.5	26.2	23.6	**16.7**	27.1
Sixth through eighth year completion rate (percentage)	**41.7**	**39.6**	28.4	**25.2**	**18.2**	31.7
Total eight year completion rate (percentage)	**74.8**	**71.1**	54.6	**48.8**	**34.8**	58.9
Still in program rate (percentage)	5.8	**2.0**	2.1	4.7	**12.1**	4.4

Attrition, still in program, and completion rates are all calculated 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).

Table 2 - Time to Degree for Three Cohorts of Economics Ph.D.s

	Cohort		
	Graduating Class of 1996-97	Graduating Class of 2001-02	Entering Class of Fall 2002
Median years to degree	5.25	5.42	-
Median years to degree among those who finished within eight years[a]	5.08	5.17	5.66
Fourth year completion rate[b]	0.14	0.13	0.02
Fifth year completion rate	0.25	0.29	0.42
Sixth year completion rate	0.28	0.22	0.31
Seventh year completion rate	0.13	0.18	0.17
Eighth year completion rate	0.08	0.07	0.02
Completed in more than eight years	0.12	0.12	0.05
Number of observations	584	570	365

[a] Number of observations for 1996-97 = 471; 2001-02 = 463; Fall 2002 entrants = 345

[b] The completion rates are calculated only among completers, and are reported as percentages. For the entering class of fall 2002, we assume that 3/4 of the 26 continuing students after eight years will eventually complete. Thus the N for that group is 365 (345 completers + (.75*26) continuing students by the end of year eight).

Table 3 - Predicting Completion, probit regression
(Dependent Variable = 1 if student completed Ph.D.)

	Complete Within 8 Years (sample includes all entrants)			Complete Within 5 Years (sample includes completers only)		
Program Characteristics	*Mean*	*dY/dX* [a]	*z-stat.*	*Mean*	*dY/dX* [a]	*z-stat.*
Tier 1 or 2	0.44	-0.067	-0.76	0.54	-0.224*	-1.79
Tier 3 or 4	0.46	-	-	0.40	-	-
Tier 5	0.10	0.028	0.26	0.06	0.192	1.11
First-year cohort size	26.39	0.002	0.25	27.04	0.019*	1.94
Faculty-student ratio	0.27	0.638	1.37	0.27	0.477	0.69
Private university	0.42	0.061	0.60	0.46	0.139	0.93
Terminal master's degree offered	0.15	-0.105	-0.85	0.13	0.201	1.14
Seminar attendance required	0.59	-0.050	-0.64	0.55	-0.049	-0.44
Core exam pass required	0.65	-0.008	-0.11	0.66	0.086	0.84
No shared offices	0.17	-0.140	-0.91	0.14	-0.402**	-2.31
Individual advisers assigned	0.32	-0.034	-0.44	0.34	0.051	0.48
Program-level two year attrition rate	0.28	-0.011**	-2.94	0.23	-0.004	-0.67
Percent of dissertations essays	67.20	0.000	0.31	67.93	0.002	1.19
More than five years full financial aid usual	0.21	0.029	0.34	0.17	-0.127	-1.05
Hard completion time limit	0.23	-0.089	-0.60	0.25	-0.008	-0.04
Soft completion time limit	0.46	0.017	0.22	0.43	0.074	0.65
Pre-thesis research required	0.46	-0.035	-0.45	0.45	-0.221**	-1.97
Topic seeker meetings with faculty	0.42	0.134**	2.03	0.45	-0.027	-0.28
Student Characteristics						
GRE analytical score ($*10^{-1}$)	72.38	0.007**	2.23	73.83	-0.002	-0.48
GRE verbal score ($*10^{-1}$)	56.32	0.002	1.00	57.31	-0.002	-0.58
GRE quantitative score ($*10^{-1}$)	77.19	0.014**	2.08	78.09	0.000	0.00
U.S. Citizen	0.34	0.153*	1.77	0.32	-0.076	-0.66
Male	0.65	0.148**	2.96	0.68	0.024	0.35
Age at entry to program	25.40	-0.005	-0.44	25.35	-0.016	-0.82
Hold prior graduate degree	0.45	0.008	0.15	0.46	-0.046	-0.63
Hold undergraduate degree in economics	0.70	0.025	0.44	0.70	-0.190**	-2.34
Hold undergraduate degree in economics/math	0.09	0.207**	2.43	0.12	-0.305**	-2.82
Years since undergraduate degree	2.66	0.017	1.23	2.67	0.009	0.40
Theory field interest	0.34	-0.004	-0.07	0.37	0.009	0.13
Other field interest	0.41	-	-	0.41	-	-
No specified field of interest	0.25	-0.034	-0.52	0.22	0.037	0.41
Type of Undergraduate Institution Attended						
U.S. economics Ph.D.-granting	0.25	0.007	0.06	0.23	0.322*	1.67
U.S. top-60 liberal arts	0.09	0.093	0.79	0.09	0.374*	1.90
Other U.S.	0.05	-	-	0.03	-	-
Top-50 foreign	0.04	0.222	1.41	0.05	0.318	1.43
Other foreign	0.57	0.250**	1.99	0.60	0.193	0.96
Financial Aid During First Year		-	-			
Fellowship	0.47	-0.102	-1.53	0.53	0.094	1.07
Research assistantship	0.05	0.018	0.12	0.06	0.168	0.86
Teaching assistantship	0.28			0.27	-	-
No aid	0.20	-0.295**	-4.13	0.14	0.076	0.69
Number of Observations	570	570		339	339	
Pseudo R-squared		0.171			0.118	

[a] Reports predicted change in the probability for a one-unit change in the independent variable at the mean. For discrete variables, reports the predicted change in the probability for a change from 0 to 1. Asterisks indicate coefficients with p-values less than 0.05 (**) or 0.10 (*).

Table 4 - Time-to-degree, Duration Model

	All Completers			Survey Respondents					
Program Characteristics	*Coefficient*	*z-stat*	*Months* [a]	*Coefficient*	*z-stat*	*Months* [a]	*Coefficient*	*z-stat*	*Months* [a]
Tier 1 or 2	1.10**	2.81	6.6	1.10**	2.03	6.3	1.11**	2.10	6.8
Tier 3 or 4	-	-	-	-	-	-	-	-	-
Tier 5	0.94	-1.51	-	1.10*	1.65	6.5	1.04	0.60	-
First-year cohort size	1.00*	-1.77	-0.3	0.99*	-1.78	-0.3	0.99**	-3.08	-0.6
Faculty-student ratio	1.07	0.40	-	0.64*	-1.93	-23.0	0.58**	-2.14	-26.8
Private university	1.04	0.97	-	0.95	-1.10	-	0.94	-1.22	-
Terminal master's degree offered	0.96	-0.84	-	0.98	-0.34	-	0.94	-1.33	-
Seminar attendance required	1.01	0.24	-	0.97	-0.62	-	1.00	-0.07	-
Core exam pass required	1.00	0.02	-	0.93**	-2.18	-4.6	0.91**	-2.86	-5.5
No shared offices	1.10*	1.87	7.3	1.07	0.86	-	1.16*	1.82	10.2
Individual advisers assigned	1.01	0.47	-	0.98	-0.55	-	0.96	-1.09	-
Program-level two year attrition rate	1.00	1.18	-	1.00	0.85	-	1.00	0.74	-
Percent of dissertations essays	1.00	0.86	-	1.00	-0.25	-	1.00*	-1.89	-0.1
More than five years full financial aid usual	0.96	-1.31	-	0.98	-0.63	-	0.97	-0.89	-
Hard completion time limit	1.08	1.38	-	0.96	-0.50	-	0.98	-0.27	-
Soft completion time limit	1.03	1.21	-	0.90**	-2.29	-6.5	0.90**	-2.22	-6.5
Pre-thesis research required	1.04	1.20	-	1.13**	3.47	8.1	1.18**	4.97	11.6
Topic seeker meetings with faculty	0.96*	-1.66	-2.7	0.99	-0.35	-	0.99	-0.41	-
Student Characteristics									
GRE analytical score ($*10^{-1}$)	1.00	1.35	-	1.00**	-2.47	-0.2	1.00**	-2.56	-0.2
GRE verbal score ($*10^{-1}$)	1.00	-0.44	-	1.00*	1.77	0.1	1.00	0.83	-
GRE quantitative score ($*10^{-1}$)	1.00	-0.81	-	1.01	1.02	-	1.01	1.54	-
U.S. Citizen	1.07**	2.03	4.7	1.06	1.19	-	1.08	1.48	-
Male	0.99	-0.54	-	1.00	-0.23	-	0.98	-1.01	-
Age at entry to program	1.01	1.06	-	1.00	0.02	-	1.00	0.56	-
Hold prior graduate degree	0.99	-0.48	-	1.02	0.69	-	1.00	-0.11	-
Hold undergraduate degree in economics	1.07**	3.24	4.9	1.05	1.42	-	1.04	0.97	-
Hold undergraduate degree in economics/math	1.10**	2.98	6.7	1.06	1.18	-	1.06	1.27	-
Years since undergraduate degree	1.00	0.85	-	1.00	-0.11	-	1.00	-0.40	-
Theory field interest	0.98	-1.26	-	1.01	0.36	-	1.00	-0.15	-
Other field interest	-	-	-	-	-	-	-	-	-
No specified field of interest	0.98	-0.68	-	1.03	0.66	-	1.01	0.27	-
Dissertation set of essays	-	-	-	-	-	-	1.04	1.29	-
Started job prior to completion of Ph.D.	-	-	-	-	-	-	1.10**	3.85	6.2
Married at matriculation	-	-	-	-	-	-	1.00	0.05	-
Had child at matriculation	-	-	-	-	-	-	0.93*	-1.82	-4.4
Had child during graduate school	-	-	-	-	-	-	0.98	-0.60	-
Type of Undergraduate Institution Attended									
U.S. economics Ph.D.-granting	0.95	-1.00	-	0.92*	-1.94	-5.1	0.91**	-2.57	-6.1
U.S. top-60 liberal arts	0.92	-1.59	-	0.88**	-2.45	-7.6	0.85**	-3.65	-9.6
Other U.S.	-	-	-	-	-	-	-	-	-
Top-50 foreign	0.97	-0.47	-	0.85**	-2.17	-9.4	0.88**	-2.11	-7.9
Other foreign	1.00	0.04	-	0.95	-0.93	-	0.94	-1.44	-
Financial Aid During First Year									
Fellowship	0.95**	-2.16	-3.7	1.02	0.59	-	1.02	0.45	-
Research assistantship	0.95	-1.25	-	1.12	1.43	-	1.04	0.39	-
Teaching assistantship	-	-	-	-	-	-	-	-	-
No aid	0.94*	-1.90	-3.9	1.08*	1.72	5.4	1.10*	1.70	6.3
Number of Observations	339			149			149		

a Predicted changes in months only reported for coefficients significant at the 0.10 level (two-tailed tests)

Table A1 - Predicting Completion, probit regressions by gender
(Dependent Variable = 1 if student completed Ph.D. within eight years)

	Males			Females		
Program Characteristics	*Mean*	*dY/dX* [a]	*z-stat.*	*Mean*	*dY/dX* [a]	*z-stat.*
Complete Ph.D. within eight years	0.62[>b]	-	-	0.53[<]	-	-
Tier 1 or 2	0.46	-0.036	-0.33	0.40	-0.255	-1.18
Tier 3 or 4	0.44	-	-	0.51	-	-
Tier 5	0.10	-0.100	-0.72	0.09	0.303	1.29
First-year cohort size	26.5	-0.004	-0.50	26.2	0.028*	1.66
Faculty-student ratio	0.27	-0.468	-0.80	0.27	5.241**	4.28
Private university	0.42	-0.141	-1.11	0.44	0.628**	3.01
Terminal master's degree offered	0.16[>]	-0.130	-0.81	0.12[<]	-0.382**	-1.67
Seminar attendance required	0.57	-0.009	-0.09	0.61	-0.250	-1.53
Core exam pass required	0.64	0.068	0.74	0.66	0.205	1.22
No shared offices	0.19[>]	-0.007	-0.03	0.13[<]	-0.332	-0.97
Individual advisers assigned	0.32	-0.063	-0.64	0.34	-0.003	-0.02
Program-level two year attrition rate	0.27	-0.011**	-2.44	0.28	-0.026**	-2.51
Percent of dissertations essays	67.2	-0.002	-1.01	67.3	0.012**	3.57
More than five years full financial aid usual	0.23	0.051	0.46	0.17	-0.003	-0.02
Hard completion time limit	0.24	-0.109	-0.62	0.21	-0.105	-0.31
Soft completion time limit	0.45	-0.024	-0.26	0.49	0.484**	2.74
Pre-thesis research required	0.47	-0.118	-1.19	0.44	-0.018	-0.11
Topic seeker meetings with faculty	0.43	0.144*	1.86	0.41	-0.193	-1.15
Student Characteristics						
GRE analytical score ($*10^{-1}$)	71.2[<]	0.010**	2.74	73.6[>]	-0.002	-0.31
GRE verbal score ($*10^{-1}$)	55.2[<]	0.002	0.67	58.5[>]	0.000	0.05
GRE quantitative score ($*10^{-1}$)	77.2	0.013	1.59	77.1	0.026	1.60
U.S. Citizen	0.36	0.135	1.31	0.29	-0.075	-0.36
Age at entry to program	25.8[>]	-0.011	-0.75	24.7[<]	0.017	0.57
Hold prior graduate degree	0.46	0.028	0.40	0.42	-0.239**	-1.96
Hold undergraduate degree in economics	0.74[>]	0.002	0.02	0.64[<]	0.010	0.09
Hold undergraduate degree in economics/math	0.08	0.063	0.54	0.12	0.409**	2.65
Years since undergraduate degree	2.9[>]	0.028	1.57	2.3[<]	0.009	0.27
Theory field interest	0.36[>]	-0.071	-1.12	0.30[<]	0.145	1.38
Other field interest	0.39	-	-	0.45	-	-
No specified field of interest	0.25	0.039	0.47	0.25	-0.267**	-2.32
Type of Undergraduate Institution Attended						
U.S. economics Ph.D.-granting	0.27[>]	0.086	0.69	0.20[<]	-0.215	-0.99
U.S. top-60 liberal arts	0.08	0.248**	1.99	0.10	-0.266	-1.13
Other U.S.	0.06	-	-	0.04	-	-
Top-50 foreign	0.05	0.219	1.22	0.04	-0.005	-0.01
Other foreign	0.54	0.245*	1.66	0.62	0.105	0.39
Financial Aid During First Year						
Fellowship	0.47	-0.013	-0.16	0.47	-0.452**	-3.00
Research assistantship	0.04	-0.048	-0.26	0.06	-0.319	-1.15
Teaching assistantship	0.28	-	-	0.28	-	-
No aid	0.21	-0.266**	-3.06	0.19	-0.502**	-3.26
Number of Observations		371			199	
Pseudo R-squared		0.188			0.331	

[a] Reports predicted change in the probability for a one-unit change in the independent variable at the mean. For discrete variables, reports the predicted change in the probability for a change from 0 to 1. Z-statistics are adjusted for heteroskedasticity. Asterisks indicate coefficients with p-values less than 0.05 (**) or 0.10 (*).

[b] 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 A2 - Predicting Completion, probit regressions by citizenship
(Dependent Variable = 1 if student completed Ph.D. within eight years)

	non-U.S. Citizens			U.S. Citizens		
Program Characteristics	*Mean*	*dY/dX* [a]	*z-stat.*	*Mean*	*dY/dX* [a]	*z-stat.*
Complete Ph.D. within eight years	0.60	-	-	0.56	-	-
Tier 1 or 2	0.48[>b]	0.023	0.20	0.37[<]	-0.356**	-2.37
Tier 3 or 4	0.43	-	-	0.51	-	-
Tier 5	0.09	0.075	0.54	0.12	-0.002	-0.01
First-year cohort size	27.2[>]	0.000	0.02	24.8[<]	0.000	-0.03
Faculty-student ratio	0.27[<]	0.382	0.66	0.29[>]	1.294	1.59
Private university	0.45	-0.007	-0.05	0.38	0.035	0.19
Terminal master's degree offered	0.12[<]	-0.162	-0.98	0.19[>]	-0.164	-0.73
Seminar attendance required	0.58	-0.115	-1.13	0.60	-0.095	-0.70
Core exam pass required	0.65	0.021	0.22	0.64	-0.049	-0.38
No shared offices	0.20[>]	-0.168	-0.81	0.10[<]	-0.010	-0.04
Individual advisers assigned	0.29[<]	-0.170	-1.55	0.38[>]	0.151	1.17
Program-level two year attrition rate	0.28	-0.012**	-2.00	0.27	-0.016**	-2.44
Percent of dissertations essays	68.9[>]	-0.001	-0.76	63.8[<]	0.003	1.48
More than five years full financial aid usual	0.22	-0.005	-0.04	0.18	0.190	1.25
Hard completion time limit	0.22	-0.204	-0.92	0.25	-0.108	-0.42
Soft completion time limit	0.48	0.003	0.04	0.42	0.014	0.10
Pre-thesis research required	0.45	-0.116	-1.19	0.48	0.178	1.23
Topic seeker meetings with faculty	0.45[>]	0.095	1.14	0.37[<]	0.216**	1.88
Student Characteristics						
GRE analytical score ($*10^{-1}$)	71.9[<]	0.008**	2.14	73.3[>]	0.005	0.68
GRE verbal score ($*10^{-1}$)	54.3[<]	0.001	0.57	60.4[>]	0.002	0.38
GRE quantitative score ($*10^{-1}$)	78.1[>]	0.013	1.14	75.4[<]	0.017*	1.76
Male	0.63	0.066	1.10	0.70	0.234**	2.45
Age at entry to program	25.8[>]	-0.003	-0.20	24.6[<]	-0.012	-0.53
Hold prior graduate degree	0.60[>]	0.019	0.29	0.14[<]	0.104	0.72
Hold undergraduate degree in economics	0.71	0.063	0.97	0.69	-0.074	-0.59
Hold undergraduate degree in economics/math	0.07[<]	0.268**	2.60	0.14[>]	0.048	0.28
Years since undergraduate degree	3.0[>]	0.027	1.39	2.1[<]	0.013	0.49
Theory field interest	0.37[>]	0.026	0.42	0.29[>]	0.019	0.16
Other field interest	0.40	-	-	0.43	-	-
No specified field of interest	0.23	-0.021	-0.26	0.28	0.002	0.02
Financial Aid During First Year						
Fellowship	0.49	-0.109	-1.30	0.43	-0.115	-0.93
Research assistantship	0.05	-0.084	-0.44	0.05	0.260	1.08
Teaching assistantship	0.27	-	-	0.30	-	-
No aid	0.19	-0.223**	-2.35	0.22	-0.416**	-3.54
Number of Observations		379			191	
Pseudo R-squared		0.176			0.253	

[a] Reports predicted change in the probability for a one-unit change in the independent variable at the mean. For discrete variables, reports the predicted change in the probability for a change from 0 to 1. Z-statistics are adjusted for heteroskedasticity. Asterisks indicate coefficients with p-values less than 0.05 (**) or 0.10 (*).

[b] 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).