Curriculum Intensity in Graduate Preparatory Programs: Impact on Performance and Progression to Graduate Study among Minority Students in Economics

Charles M. Becker
Duke University

Gregory N. Price
Jackson State University

2006 Cornell Higher Education Research Institute Policy Research Conference
Doctoral Education and the Faculty of the Future
Cornell University
Ithaca, NY
October 8-10, 2006

This paper is part of a larger project to assess the impact of the AEA Summer Program and Minority Scholarship Program, involving the authors together with Cecilia Rouse of Princeton University and Sue Stockly of Eastern New Mexico University. We gratefully acknowledge discussions with them that have influenced this paper. This paper has further benefited from conversations with Wayne Grove of Le Moyne College. We are also grateful to Karl Boulware, Jinghui Lim, and Tammy Tieu for valuable research assistance.

1. INTRODUCTION

Considerable resources are devoted to preparing students for doctoral study, especially in quantitative disciplines. This is especially true in the United States, where most domestic students come from liberal arts backgrounds that have not given them the complete background necessary for success in doctoral programs with large numbers of prerequisites. The United States also suffers from a legacy of discrimination against various minority groups – especially Blacks, Native Americans, and Hispanics. American minorities continue to experience inferior primary and secondary education, on average, and are disproportionately likely to attend non-research, largely non-competitive colleges and universities that neither encourage nor prepare students for rigorous academic graduate programs. The combination of historic discrimination, lack of encouragement, and weaker preparation has resulted in low representation of American minorities within the "STEM" (science, technology, engineering, and mathematics) disciplines. In consequence, many disciplines have taken pro-active steps, creating programs aimed at reducing minority under-representation.

These programs have been subject to little serious analysis of design or effectiveness. Some disciplines encourage students to first earn a master's degree, largely substituting for supplemental preparatory programs; others do not. The need for such programs is particularly great in Economics in light of a confluence of forces. First, there is a huge gap between undergraduate study in Economics -- something of a service program for business and other fields, and with modest quantitative requirements – and doctoral study, for which a bachelor's degree in mathematics is ideal preparation. Second, most American MA programs still leave a substantial gap in terms of quantitative preparation between themselves and doctoral study, and are generally not seen as a step worth taking to prepare for PhD work. Thus, few American students enter leading doctoral programs in Economics with MA degrees. However, most international students who join US PhD programs in Economics *do* have highly quantitative masters' degrees, thereby further extending the gap between them and American liberal arts undergraduates, especially from non-elite institutions.

In short, while American math majors with bachelors' degrees from MIT or Swarthmore are hardly at a disadvantage in Economics doctoral programs *vis-à-vis* international students with B.Sc. and M.Sc. degrees from Seoul National or LSE, the gap that must be covered by American economics majors from with BA degrees from San Diego State University or Tougaloo College is enormous. This point is not made to denigrate these schools, but simply to note the huge disadvantage faced by students without advanced work, without study in quantitative disciplines, and without experience in a competitive, research-oriented environment.

In response to this gap and the tiny representation of American minorities in the Economics profession, in 1973 the American Economic Association (AEA) set up a Summer Minority Program (AEASP) aimed at encouraging and preparing minority students to embark on doctoral study and ultimately to enter the profession. The program started the following year, spending its first year hosted by the University of California, Berkeley, and then moving to Northwestern for the following five years. Yale (1980-82) and the University of Wisconsin – Madison (1983-85) followed with three-year stints. Temple (1986-90), Stanford (1991-95), and the University of Texas, Austin (1996-2000) all served as hosts for five years. Most recently, the program moved to the University of Colorado at Denver (2001–03), in affiliation with North Carolina A&T State University, and then to Duke University (2004-07), also in affiliation with NC A&T. During its first 33 years of history, the program had some 821 alumni.

In light of the AEASP's pattern of switching hosts, and hence modest but non-trivial design changes, and its chronically tenuous funding situation, the Summer Program never has been formally evaluated for its effectiveness, save for one striking exception. Price (2005) creates a data set of black economists teaching at US colleges and universities during AY 2000-01, and matches it with an AEASP alumni list. Since some 93% of AEASP alumni prior to 2000 were black, the exclusion of other minorities can have little impact on the results – and the number of US citizen Hispanic and Native American economics faculty is small even relative to the numbers of black faculty. Of the 180 black university economists Price identified, 14.4% had attended the AEASP. This sampling does not make it possible to determine whether the program has an impact on applying to graduate school, earning a doctoral degree, or entering the profession thereafter. However, it does allow Price to examine the "treatment" impact of exposure to the AEASP on scholarly productivity. Econometric results indicate that AEASP participation raises the likelihood of publishing in top journals, securing NSF grants, and NBER membership. Likelihood of being employed at a research university, a liberal arts institution, or a selective liberal arts institution does not depend on program participation, nor does one's total number of publications.

This paper takes an initial step toward evaluating the effectiveness of different AEASP treatments, and at the same time asks about the extent to which selection of less prepared and "advantaged" students affects performance and progression to graduate school. Specifically a recent design shift enables us to draw initial conclusions as to which sort of interventions are most effective, as we discuss in more detail in the following section. The largest questions – whether and to what extent the AEASP increases flows into and through Economics doctoral programs – are left to subsequent papers as part of a project undertaken jointly by the authors together with Cecilia Rouse and Sue Stockly.

The findings below indicate that performance in the AEASP itself depends on several but hardly all plausible explanatory variables. Of particular interest, father's education has a reliably positive effect. However, only a small portion of the variance in GPA can be explained, and we attribute this to the competitive nature of the program itself, and, to a lesser extent, admissions to the program. Of greater importance, results from both single equation and bivariate Probit regressions find that taking a two-summer sequence has a positive impact on both intending to apply and actually applying to doctoral programs in Economics. Moreover, this impact is independent of effects due to numbers of courses completed and academic performance.

While the AEASP has never been comprehensively evaluated, there can be no doubt that it has mattered. It has had some 821 alumni during its 33-year history, an average of 25 participants per summer. After more than three decades, the program enjoys growth and renewed energy, rather than sputtering: during the past six years, there have been 162 minority alumni, including 28 students who participated in two summers, the average enrollment has been 32. Since the program expanded to a two-level (Foundations and Advanced) structure in 2001, some 64 of the 162 alumni over the past six years have entered doctoral programs, another 12 MA students and 25 others are preparing to do so, and many others are considering taking the plunge. To emphasize the obvious, having 100+ minority students enter doctoral programs from the 2001-06 classes is not a small number, and reflects a significant effort by the Economics profession to diversify.

To get a back-of-the-envelope sense of the current proportionate impact of the program, let us assume that the 2001-2006 classes will include 100 students who head to doctoral programs. Only a small fraction – 15% would be a reasonable upper bound – would have entered PhD study absent the AEASP experience, so that the program created or will create an increment of about 85 minority students in doctoral programs, of whom about 90% are US citizens. If half of these US students ultimately complete their PhDs – that is, about 40, they will account for one-quarter of the roughly 156 minority US citizens who will earn their doctorates in Economics during a 6-year period. This estimate provides a floor if AEASP participants' attrition rates prove to be lower.

2. THE AEA SUMMER PROGRAM: AN INADVERTENT EXPERIMENTAL DESIGN

For its first 27 years, the AEASP conducted a single program of roughly eight weeks in duration. Then, starting in 2001, a second level was added, enabling the program to sort participants into

"Foundations" and "Advanced" levels. Moving to two levels offered several advantages: most immediately, it reduced classroom heterogeneity, thereby making the experience less demoralizing for those who were relatively under-prepared. It also made it possible to offer more rigorous study at the top end, a fortuitous development in light of the growing technical demands of graduate economics. More important still, the second level made it possible to focus recruiting efforts on students at institutions other than major research universities and selective liberal arts colleges, thereby enhancing the social diversity of the program. The program's move in 2001 to a non-elite, non-flagship state university, the University of Colorado at Denver, further emphasized the desire to recruit students from a broad range of institutions.

The redesigned program also held out the possibility that participants could return to the AEASP for a second summer. While doing so is costly in that a potential new student is displaced, the two summer option has the advantages of providing additional training and enabling the program administrators to strongly influence students' course selections in the intervening year (since readmission is not automatic). At the outset, the program administrators had no idea whether students would return, but thus far more than 21% of participants have done so.

The combination of multiple levels and a two-summer option makes for a natural experiment, since there are now three types of treatment: Foundations study, Advanced study, and both. A superficial reading of the data might easily lead one to conclude that two summers are better than one, and that Advanced dominates Foundations. However, simple descriptive statistics do not account for the possibility that group characteristics are different (hopefully, this is the case!), and that returning for a second summer is a non-random event. Thus, the more interesting question is whether the multi-tier and multi-summer options increase the likelihood of progression to graduate school conditional on student attributes. A second question of interest is whether there are differential effects for certain groups, which we handle by adding interaction terms. Again, the more complex design was added largely to increase the potential applicant pool, and to draw in less prepared students. On the surface, the program would appear to be successful in this regard, but there has been no formal analysis of its impact. Taken together, answers to these questions should offer insights into what sorts of strategies might best reach the "hard to reach" – students with little exposure to research, little encouragement to enter academe, and little pressure to take advanced mathematics and statistics courses.

The empirical analysis that follows is based on data from the 2003 program at UC – Denver, and the 2004 and 2005 programs at Duke. A revised version will incorporate 2001-2003 UCD observations, and 2004-2006 Duke participants. It is important to emphasize the continuity of the program as it moved from UCD to Duke. The course structure has been virtually unchanged – the only substantive change was the

addition of a game theory component to the Foundations Level in 2004. Thus, in all three years of the study, students were expected to take a grueling load of 12 academic credits. Three credits are devoted to mathematics (with a focus on economics applications), three are devoted to statistics and econometrics, and microeconomics and game theory courses each receive 1.5 credits at the Advanced level, and are combined into a 3.0 credit course at the Foundations level. In addition, students are required to participate in a 3.0 credit research seminar in which they produce a major paper. The continuity between UCD and Duke is further strengthened by the presence of two instructors who taught all three years in both programs, and teaching assistants at Duke who participated in the program when it was at UCD.

This continuity in content is important, since it permits course comparability over time, allowing year dummies and host fixed effects pick up two apparent phenomena. First, there is evidence that the 2003 Summer Program students were academically stronger than their 2001 and 2002 counterparts. All but one of the Advanced Level students had taken mathematics at least through differential equations. Nearly all of the Foundations students had completed a full year of calculus, and many had much more: about half of the students were mathematics, statistics, or engineering majors. This strong quantitative background was reflected in extremely high grades. For the participants as a whole, the mean GPA was 3.64. Excluding incompletes, some 75% of all grades given were A or A- marks, a rise from 61% in 2002 and 43% in 2001. Since the instructor pool changed little, it is difficult other than to conclude that student performance substantially improved in 2003 relative to earlier years.

Second, grading standards at Duke are higher than at UCD. Although the participants' quantitative backgrounds continued to improve, mean GPA declined to 3.22 in 2004. Indeed, the continued improvement in student quality inspired a conscious decision to further raise the difficulty of the course content, especially at the Foundations Level. With higher workloads and more demanding material, GPAs inevitably declined. Most Duke faculty felt that the 2004 Foundations Level was not as strong as the top half of Duke undergraduate economics majors who take challenging courses (though there was no adjustment for workload differential). That sentiment did not hold in 2005: there was widespread belief that the Foundations class was comparable to Duke undergraduate Economics majors – virtually none of whom would ever take 12 credit hours in one summer. The Advanced group appeared stronger yet, and their grades bore this out. The weighted average GPA rose to 3.30 in 2005. There was a large difference between the Foundations group (mean GPA of 3.07) and the Advanced group (mean GPA of 3.52) that, indeed, closely mirrors the undergraduate/MA performance differential at Duke.

3. AEASP PARTICIPANT CHARACTERISTICS

The AEA Summer program included 30 minority scholarship students in 2003, and 36 in both 2004 and 2005. In 2005, a typical year in terms of admissions, just over 40 minority students were admitted to the AEASP. More than 90% of those admitted accepted the admission offer. Of the 39 who attended, 36 received a need-based AEA Minority Scholarship, though precise amounts varied according to need. All students completed the program. As in recent years, the 2005 Summer Program could not admit many qualified applicants. **Table 1** provides the ethnic and gender distribution of the 2005 participants. The years 2003 and 2004 were exceptional in that the majority of participants were women. To our knowledge, these two years were the first time that the program has been predominately female, though the underlying applicant pool in 2002-2004 was approximately 50% female in each year. The 2005 class swung sharply in the other direction, and the historic gender pattern for the program at Duke is now similar to that at other recent hosts (**Table 2**). Information on the entire 2005 applicant pool is presented in **Table 3**.

TABLE 1
CHARACTERISTICS OF AEA SUMMER MINORITY PROGRAM STUDENTS, 2003-2005

Minority/Gender	Males			Females			Total		
	2005	2004	2003	2005	2004	2003	2005	2004	2003
African-American	14	8	8	8	11	11	22	19	19
Hispanic	6	7	3	3	7	5	9	14	8
Native American	0	0	1	1	0	1	1	0	2
Indochinese – American	3	0	0	0	3	1	3	3	1
Filipino-American	1	0	0	0	0	0	1	0	0
Non-minority	3	0	0	0	0	0	3	0	0
TOTAL	27	15	12	12	21	18	39	36	30

TABLE 2
BREAKDOWN OF RECENT SUMMER PROGRAM PARTICIPANTS BY RACE AND GENDER
(annual average number of Program participants)

	Stanford University 1993-1995	University of Texas 1996-2000	University of Colorado at Denver 2001-2003	Duke University 2004-2005
African American	14.3	9.2	18.0	20.5
Hispanic	10.3	8.8	9.3	11.5
Native American	0.3	0.6	1.7	0.5
Other Disadvantaged Minorities	0.0	0.0	0.7	3.5
Female (percent)	37	41	47	43

TABLE 3
CHARACTERISTICS OF 2005 AEA SUMMER MINORITY PROGRAM APPLICANTS
(those with incomplete data prorated)

	New applications	Returning students (2003 and 2004 program participants)	**Total**
African-American	52	5	57
Hispanic	17	0	17
Native American	1	0	1
Vietnamese-American & other	23	1	24
Female	30	5	35
Male	57	1	58
Total	87	6	93

TABLE 4
PROGRESSION TO DOCTORAL PROGRAMS, AEA MINORITY SCHOLARS, 2001-2006
As of September 2006; including Fall 2006 entries

Total number of participants, AEASP 2001-2006			162
Of whom:	Entered PhD programs in Economics/related fields		64
		Still enrolled	52
		No longer enrolled	12
	Entered MA programs in Economics/related fields		38
		Eventual progression to PhD expected	12
		PhD progression possible but not certain	11
		Progression to PhD unlikely	15
	No graduate experience (undergraduate or BA complete)		37
		Eventual progression to PhD expected	25
		PhD progression possible but not certain	9
		Progression to PhD unlikely	3
	Progression to PhD program not expected		23
Eventual total progression to PhD (excluding those no longer enrolled and not planning to return)			
(a) expected			89 *(55%)*
(b) possible but not certain			109 *(67%)*

Table 4 provides summary statistics on progression to graduate school for the 162 minority scholars over the past six years. In terms of a sheer numbers count, the program has been successful: as noted above, this effort, if sustained, is likely to increase the number of minority PhD economists emerging from the cohorts over the next several years by 25% or more.

The program's success notwithstanding, there has been increased question as to whether the economics profession should be promoting a program that, at best, imperfectly targets underrepresented socio-economic groups with few opportunities. Do we know the AEASP is not simply an expensive program

that draws from upper-income minority groups and highly select, motivated immigrants – that is, from populations that would succeed on their own, and that do not have an exceptional claim to proactive support? In response to these concerns, AEASP administrators and the AEA have deliberately narrowed the program's focus, introducing financial need requirements to receive a scholarship, and restricting recruiting mainly to non-research institutions with predominantly minority and low-income student bodies.

Table 5 presents social background information culled from those 2005 participants who submitted online applications. There is considerable variation within the student population, but it seems safe to assert that the students' social backgrounds are not abnormally elite. Rather, the exceptional feature is that so many of the students are financially independent of their parents, implying that a very high proportion are simultaneously working and going to school. A second feature is that a high proportion has a parent – usually a mother – who is a teacher or nurse.

TABLE 5
SOCIAL BACKGROUND CHARACTERISTICS OF 2005 MINORITY SCHOLARSHIP PROGRAM STUDENTS

Living independently of parents:	Yes	21
	No	9
Both parents living	Yes	21
	No	9
Parents married (to each other)	Yes	12
	No	18
Father's education	> BA	4
	BA	4
	Associate degree/some college	7
	High school	12
	Elementary school	2
Mother's education	> BA	4
	BA	11
	Associate degree/some college	2
	High school	10
	Elementary school/some HS	3
Father's occupation	White collar	3
	Blue collar/clerical	13
	Retired/unknown	6
Mother's occupation	Schoolteacher	4
	Nurse/ nurse's assistant	7
	Blue collar/clerical/sales	8
	Homemaker	5
	Other/retired/unknown	6

4. ESTIMATION STRATEGY

There are two inter-related questions we seek to answer. First, does the AEASP's two-level, two-summer option make a difference in terms of progression to graduate school? Secondarily, what factors explain performance within the Summer Program itself? Understanding this second question is important in part because we need to control for selectivity, and in part because performance allows us to infer otherwise unobserved attributes.

To begin with performance in the AEASP, our point of departure is the available dataset. Thanks to a fairly intrusive set of questions on the application form, we have considerable information on the applicant and actual participant pools, including gender, age, race/ethnicity, citizenship, and prior academic record. Beyond estimating an overall GPA from past schooling, we also compile estimates of the number of courses in, separately, economics, mathematics, and statistics; we further calculate separate GPAs for economics and mathematics courses. Our information also includes parents' education and occupation; it is possible as well to infer (imperfectly) whether the applicant comes from an intact family. Applicants are required to furnish income data, but this turns out to be of little use, since a large number of students are self-supporting, so that we do not have complete data on parental incomes. Since we have transcripts from previous academic institutions, we make rough inferences as to the nature and quality of prior schooling (such as whether the student attended a public or private university, a minority-serving or traditionally white institution, or a research university or elite liberal arts college). Finally, we have information on the level into which a student is placed (Foundations or Advanced), and whether or not they are returning for a second year. In terms of explanatory variables, we know performance in the AEASP, whether the student has actually entered a master's or doctoral program, and whether the student has indicated an intention to enter a master's or doctoral program (and is taking steps to fulfill that intention).

The obvious difficulty in estimating an equation that explains AEASP performance is that the potential explanatory variables are highly collinear. Socioeconomic background (as measured by parental income, occupation, or education) influences choice of university, and likely affects academic performance as well. All of the academic performance measures are bound to be collinear: those who do well in mathematics tend to take more of it, and also do better in economics classes – and hence take more economics. There is not a great deal we can do to address this problem: estimating a multi-equation model would necessitate additional, truly exogenous variables, and we do not have any. The weak alternative is to provide a variety of alternate regressions, taking care not to include too many very closely related terms in any one equation.

A reasonable model of performance would start from a human capital model in which some of the students' attributes are endogenously chosen. Let performance depend on inputs **n** and observable effort **e**, as well as unobserved factors, including unobservable effort and ability, **a**. Then,

$$gpa = g(n, e; a) \tag{1}$$

All three explanatory vectors will be influenced strongly by parents' characteristics **p**. Genetic attributes and imitation effects will influence **a**. Highly educated parents are more likely to value education for their children (hence more **n**), and will push them to higher quality colleges, both directly and indirectly (by sending them to better secondary schools, assisting in finding scholarships, and so on). The sorts of courses students take (our main **e** term) is also subject to parental influence. As noted above, **e** depends on **n**, and both **e** and **n** depend on **a**. Thus, the actual relationship if linear would be something like:

$$gpa = g_0 + [g_1 n_0 + g_1 n_1 p + g_2 n_2 a] + [g_3 e_0 + g_4 e_1 p + g_5 e_2 a] + g_6 a\,. \tag{2}$$

By including observable **n**, **e**, and **p** variables, some of the effect of personal characteristics **a** will be captured in levels of **n** and **e**, so that the coefficients estimated in a simple econometric model will be biased upward. Brighter and more driven individuals will attend better schools, earn higher grades in their universities, and take harder courses. These same people will do better in the AEASP and have higher grade point averages. The coefficients on these observable explanatory terms will therefore capture some of the unobservable characteristics' effects. Note as well that the **p** terms in principle should interact with **e** and **n**, though this point is sensitive to functional form specification.

This same omitted variables' bias problem would operate in a somewhat more complex form when we try to estimate the likelihood of entering a doctoral program. Virtually all of the same variables that affect performance in the AEASP will affect the likelihood of going on to a doctoral program, π. The main difference in estimating a probit with similar explanatory variables as in (2) is that at least some students will learn about their relative talents from participating in the summer program, so that a plausible model would take the form

$$\pi = g(n, e, p, gpa; a)\,. \tag{3}$$

The coefficients on **n**, **e**, and now *gpa* all will be biased upward. Adding in treatment effects will compound the problem: those returning for a second summer are likely to have done relatively well in Foundations

Level, adding yet another mechanism for ability to exert a positive selection effect. Of course, we emphasize the word "likely" here: it is also the case that the most gifted students will have a higher opportunity cost of their time, and will have received attractive offers (from PhD programs, Fed branches, law schools…) or taken sufficient coursework at their home institutions to make a second summer unattractive.

The chance to observe students before they decide whether or not to proceed to graduate school also gives us the opportunity to modify the bias in our primary equation. Notice that the error term ε_{GPA} in an equation based on (2) will be proportionate to **a**, if it is possible to reduce the vector of unobserved attributes to a single scalar (some combination of IQ and effort). Thus, probit regressions based on (3) modified to include treatment effects and ε_{GPA} need not have biased coefficients.

Our approach to estimating the impact of the recent AEASP intense curriculum innovation is to view participant's intentions and actual decisions to apply to a doctoral program in economics as latent decision variables that are a function of observable and unobservable characteristics. This allows us to condition the decision of a participant to either plan to apply, or actually apply to a doctoral program in economics on a particular treatment----having completed both the foundations and advanced curriculum --- and estimate its effect.

The variables that comprise **e**, **n**, and **p** have been subject to vast discussion in the sociology, education, and economics literatures. Economists have a natural interest in exploring the effectiveness of a program supported by the profession for one-third of a century, though to our knowledge, only Price (2005) has completed a formal econometric study, and only Leeds (1992) has addressed the question of determinants of performance in the summer program. In results described but not presented, Leeds (1992: 154) finds that AEASP grades are unaffected by the number of economics courses taken, but increase substantially for those who come from a professional family (with parental occupation especially important), or who attend a "high quality" college. AEASP GPA rises with undergraduate GPA, but the coefficient estimated is only about .33.

Given the huge effort that goes into selecting graduate students and their high failure rate in Economics, it is perhaps surprising that more effort has not been devoted to exploring determinants of success in graduate school. An obvious rejoinder is that picking winners is not easy, and that the model is likely to vary with the eliteness of the university in question. Despite difficulties in identifying successful determinants, work has proceeded, to our knowledge starting with Krueger and Wu (2000), who find that the quality of job placement depends on initial GRE scores, initial admission committee ratings, and a students'

references. Women and international students also do slightly better, though there may be a selection bias in the latter case. From our perspective, the Krueger-Wu study points to the importance of mathematics background, and initial college quality (as this surely influences admissions committees).

As anyone who has recent experience with graduate admissions knows, students in recent years have begun investing far more time in preparing for GRE exams. Incidentally, this is also true for AEASP students who go on to graduate study: while we do not have a comprehensive data set, it would appear that median GRE quantitative scores have risen perhaps 50 points in the past six years, an extraordinary rise not likely to be fully attributable to participant quality. Consequently, GRE score variance must be decreasing, and hence its ability to explain performance variation must be declining as well. However, underlying mathematics performance is likely to remain highly important.

While Krueger and Wu focused on the outcomes of Princeton doctoral students and considered information available both before and after admission, Grove *et al.* (2005) use only information available prior to admission to examine determinants of successful completion of the doctorate at a mid-rank institution, Syracuse. They also examine likelihood to completion of various stages along the way. Explanatory variables include demographic factors, GRE scores, prior master's degree, the number of prior courses in mathematics and, separately, economics, and prior research experience. GRE quantitative score, the number of mathematics courses, and prior research experience all consistently contribute to the likelihood of passing comprehensive exams and to completing the PhD. The GRE analytic score has a positive effect in single-equations runs, while age has a positive effect on completion in simultaneous, ordered logit regressions.

Building on prior work, Grove and Wu (2007, forthcoming) use information in application files to "top 10" departments in 1989 to examine determinants of degree completion and subsequent research productivity. Once again, math GRE score is positively associated with earning a PhD and producing research; so, too, is having reference letters from prominent scholars, and having a foreign undergraduate degree. Age, gender, and attending an Ivy League institution do not matter; attending an "other elite" institution (defined as Berkeley, Chicago, Duke, MIT, Northwestern, and Stanford) has a weakly negative effect. However, since students from elite schools nearly all have prominent recommenders, while relative few other applicants do, these unpromising results are taken to mainly reflect the performance of lower tier students.

Of these various studies, the one closest to ours in terms of student composition and econometric design is Grove *et al.* (2005). They use GRE as an aptitude/ability measure; we use AEASP performance.

Both we and they use the number of mathematics courses as an indication of inputs; we also include economics courses, along with grades as an indication of effort. Grove *et al.* include a prior master's degree as an additional measure of inputs; as we are dealing with a younger population, we use instead the number of years of study. Both studies explore the quality of undergraduate institutions on performance and progression to doctoral work. As noted, we also have some social background and parental information.

Our study does not include an indication of prominent recommenders; nor do we consider prior research experience. The first omission stems from the AEASP's mission, which includes a focus on recruiting students from non-research institutions. While not all students come from such backgrounds, and while the program does receive recommendations from distinguished scholars, this is far less common than among applications to doctoral programs in general.[1] Thus, we redefine "elite" status considerably more broadly than Grove and Wu (2007, forthcoming), and do not add in a separate recommender quality term. The second omission reflects the fact that very few if any applicants have had research experiences prior to the AEASP, which includes research work as part of the program. However, the finding by Grove *et al.* (2005) that prior research matters may contribute to explaining any beneficial impact of participating in the program for two years.

5. WHO SUCCEEDS IN THE AEA SUMMER MINORITY PROGRAM?

We tried a large number of alternate regressions, as many measures are problematic in some way or another. Representative OLS regressions appear in Table 6. The coefficient estimates for the most part are surprisingly insensitive to specification, especially given the small sample size (just over 100 observations).

Considering first demographic variables, gender had no impact on performance. Asian minority students (Vietnamese or Filipino-Americans) did 0.3 to 0.4 grade points higher than Black and Hispanic counterparts. The few non-minority students also did better, but they tended to be a highly select group. While US citizenship was not significant, its sign was consistently positive, and it will be interesting to see whether permanent residents and refugees continue to do somewhat worse as we expend the sample in future work. In most regressions, GPA declined with age: being 34 instead of 21 years old costs about one-third of a grade point.

[1] Indeed, one of the important aspects of the Summer Program is that it does give students from non-research institutions the chance to obtain references from prominent scholars. Together with the AEASP grades, this provides a more standardized evaluation than would be available to such students otherwise.

This last result reflects several features of the AEASP. Older students have several disadvantages. Some have been out of a full-time schooling situation for several years. Some have weaker math skills than their younger peers, while others have taken lots of mathematics, but not recently. Several older students have children and families, and whether they are present or not, children compete for attention. Above all, we sense that the effort required to succeed in the program favors younger students, who are simply more energetic than at least some of the older students.

This is not to say that older students never do well, or even that ability declines linearly with age. When we replace age with completed schooling variables, it appears that very young students are also at a disadvantage, even though the program tends to pair them in roommate assignments with older, prospective mentors.

Our measures of past achievement and effort do not have a strong effect. The only variable that tends to be significant is undergraduate GPA, with coefficients of 0.3 to 0.4, virtually the same as that found by Leeds (1992) 15 years earlier. GPA in mathematics and economics courses do not appear to matter, regardless of whether taken separately or together. Nor do the number of math and economics courses taken have an apparent impact. There are several possible forces at work here. Students who do poorly in one mathematics course, for example, may repeat or take a non-identical but similar course, thereby biasing estimated coefficients downward. Many students take a large number of low level courses (and typically do well), while math grades tend to decline in higher level courses. The rigor of mathematics and economics coursework also may vary markedly from one institution to another. We are working on alternative measures of effort and ability, but at present our measures are problematic. However, even if we do generate improved measures, it is possible that the effect will be null or modest. Since selection to the program weights math skills and economics background heavily, and since admission to the program is competitive, those with weaker skills admitted should have demonstrated some other drive or aptitude features in the application that the Admissions Committee noted. Since these features are not captured in the variables included, there is an effect an omitted variables' bias caused by a negative correlation between observed achievements and omitted drive and aptitude factors.

This same argument could in principle explain the lack of significance of the elite college/university variable. In practice, it is unlikely to do so, since we actively discriminate in favor of those from non-elite institutions. One possible explanation is that participants from lesser institutions are more likely to stand out,

and hence receive more faculty inputs; another is that the very best from elite universities do not need a program such as the AEASP, and hence do not apply.

Turning to family background, it turns out that only one variable, father's education, has a consistent, positive impact on performance. Having a father who completed college and two years of professional school rather than leaving high school in 10th grade is worth about 0.4 grade points. Maternal education does not appear to matter. We hypothesized that maternal drive and achievement may matter more in Black than other minority families, but this was not borne out by our regressions. Being part of an intact family did not appear to matter either.

What about the program itself? Grading appears to be stiffer at Duke than Colorado-Denver: UCD grades are about one-third point higher. Advanced Level students as a whole do better, but there are only tiny differences in coefficients for returning and new (non-returning) Advanced participants. Moreover, while the coefficients for returning students tend to fall just shy of being significant at the 10% level, performance by the non-returning students is significant.

Since there is considerable selection going on, these results are not surprising. New students put in the Advanced Level either have prior graduate school admissions, or are placed there following a battery of entry placement exams. The returning students are also selected both on prior performance and demonstrated effort. It is also possible that there is an experiential effect from the first summer, but, in the absence of effective control for selection, we have not identified it.

Taken as a whole, the striking result is not that several variables are statistically significant, but rather that, despite a large amount of information, only a very small proportion of the variance in performance can be explained. From the program's perspective, this outcome is not disheartening. Rather, it reflects the highly competitive nature of the program: resting on laurels due to past knowledge gained does little good. The heavy work-load also means that unobserved personal attributes (drive, ability to function with little sleep) and fortune (good health, an effective study group) will count for a great deal.

Table 6

Simple OLS Parameter Estimates: Determinants of AEASP grade point average

Regression	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
Regressors:							
Constant	0.743	2.013[c]	1.545	3.892[a]			
Elite college or university	0.107	0.024	-0.006				-0.007
Male	-0.069	-0.058	-0.005				
U.S. Citizen							
Father's Education		0.052[c]	0.066[b]	0.046[c]	0.046	0.051[c]	0.046[c]
Mother's Education		-0.003	-0.005				
Mother's education (black students only)						-0.034	
Undergraduate GPA in math and economics courses	-0.008	0.241					
Undergraduate math GPA					0.195		
Undergraduate GPA (all courses)	0.094		0.357[c]				
Intact family (two parents living together)	0.065						
Hispanic race/ethnicity	0.069	0.039	0.029				
Asian race/ethnicity	0.403[a]	0.404[a]	0.329[b]				
Other non-black race	0.485[a]						
Foundations level	-0.129	-0.252[b]	-0.199				
Advanced (non-returning)				0.267[c]	0.223	0.239	0.268[c]
Full course load	0.109	0.104	0.145				
Foundations + some advanced courses		0.192	0.116				

US citizen		0.312	0.359				
Age	0.175			-0.026[c]	-0.025[c]	-0.027[c]	-0.026[b]
Age^2	-0.004						
Total number of undergrad math and econ courses taken		0.002	0.001				
Sophomore			-1.375[b]				
Junior			0.697				
Completed college			-0.358				
Taken graduate work			-0.397				
Enrolled in graduate program			0.076				
Program site (Duke = 1; UC-Denver = 0)				-0.328[b]	-0.379[b]	-0.321[b]	0.328[b]
Treatment: Completed Foundations and Advanced Curriculum				0.209	0.223	0.236	0.210
R^2	.092	.130	.238	.112	.179	.125	.112
N	102	103	103	104	104	104	104

Notes: Standard errors in parentheses N = Number of observations [a] Significant at the .01 level [b] Significant at the .05 level [c] Significant at the .10 level

6. CURRICULUM INTENSITY TREATMENT EFFECTS: SOME PRELIMINARY RESULTS

The summary results reported in Table 4 suggest that the AEASP has a causal effect on the decision of minority students to enroll in graduate economics programs. Administrative data on AEASP students' intent and actual application to doctoral programs in economics—captured through surveys at the end of each foundations and advanced course sequence during Duke University's hosting of the program—permit a preliminary assessment of whether or not there are actual causal effects associated with the dual curriculum innovation of the AEASP. Let Y^*_i be an unobserved latent variable representing an AEASP student's decision to apply to a doctoral program in economics. This choice problem can be viewed within the context of the following latent variable model:

$$Y^*_i = X_i \beta + T_i \delta + \mu_i \quad \textbf{(4)}$$

where X_i is a vector of individual characteristics, T_i is a dummy variable indicating whether the student has completed both the foundations and advanced curricula, and μ_i is an error term.

Our main interest is in identifying δ, the parameter measuring the so-called treatment effect of having completed both the foundations and advanced curriculum. If the decision to complete both the foundations and advanced course sequence is exogenous (*i.e.*, uncorrelated with any omitted and/or unobserved variables) and the error term is normally distributed, then the probability that an AEASP participant applies or intends to apply to an economics doctoral program is:

$$Prob(Y^*_i > 0) = Prob(Y_i = 1) = Prob(X_i \beta + T_i \delta + \mu_i > 0) = \mathbf{\Phi}(X_i \beta + T_i \delta) \quad \textbf{(5)}$$

where $\mathbf{\Phi}$ is the cumulative normal distribution function. Equation (5) is a simple Probit specification, and when the treatment is exogenous, it will identify the effects of a binary treatment indicator on a binary outcome.

Table 7 reports simple Probit parameter estimates of equation (5), where we condition the probability of intent (column 1) and actually applying to (column 2) graduate school on a whether or not the student attend a Historically Black College University (HBCU), gender, citizenship status, having a mother with a high level of education, having a father with a high level of education, having two parents with a high level of education, number of economics course completed to date at the student's undergraduate institution,

student's overall grade point average in their major, and a binary treatment indicator measuring whether or not the student has completed both the foundations and advanced curriculum in the AEASP.[2] As a goodness-of-fit measure, Pseudo-R^2 — the likelihood ratio index of McFadden (1974) — is reported. In general, for both specifications, only one individual characteristic explains the intent or actual decision to apply to an economics doctorate program, and the treatment—having completed both the foundations and advanced curriculum—has no significant effect. Taken seriously, the simple Probit parameter estimates in Table 7 suggest that if the decision to complete both the foundations and advanced curriculum in the AEASP is exogenous, it has no effect on whether or not minority students go on to pursue doctoral studies in economics.

[2] Mother and Father education are binary variables equal to one if the mother and father have a level of education that exceeds the median reportable category of having a baccalaureate degree---which is the same basis for the two parent's education binary variable.

Table 7

Simple Probit Parameter Estimates: The Treatment Effect of Curriculum Intensity on The Probability of Pursuing an Economics Doctorate

Outcome:	*Intent to Apply: Economics Doctorate Program*	*Actually Applied: Economics Doctoral Program*
Regressors:		
Constant	.0345 (2.28)	-.6566 (.3479)[b]
HBCU Student	.5254 (.4273)	5125 (.3479)
Male	.0222 (.3082)	-.1589 (.2688)
U.S. Citizen	-.7866 (.5551)	-.3452 (.3848)
Mother's Education	.3221 (.4271)	.0651 .(3945)
Father's Education	.3378 (.5217)	-.0238 (.4965)
Parent's Education	.1847 (.6597)	.3665 (.5916)
Number of Economics Courses	.0711 (.5697)[b]	.0617 (.0277)[a]
Grade Point Average in Major	.0701 (.5697)	.0324 (.4698)
Treatment: Completed Foundations and Advanced Curriculum	-.0933 (.3659)	.1910 (.3185)
Pseudo-R^2	.1196	.0694
N	100	100

Notes: *Standard errors in parentheses* *N = Number of observations* [a] *Significant at the .01 level* [b] *Significant at the .05 level* [c] *Significant at the .10 level*

It is conceivable that the decision to take both the foundations and advanced curium is not exogenous. For example, students with high levels of motivation may more inclined to apply to graduate school in economics and complete both the foundations and advanced curriculum. Since we do not observe motivation, the simple Probit estimates in Table 7 could suffer from omitted variable bias—or unobserved heterogeneity—which introduces a bias to the parameter estimates. We explore this possibility by allowing for the outcomes of intending/applying to a doctoral program in economics and taking both the foundations and advanced curriculum to be a joint decision by estimating the parameters in a bivariate Probit specification.[3] We assume that the decision to take both the foundations and advanced curriculum is determined by an unobserved latent variable:

$$T_i^* = X_i\beta + Z_i\pi + \nu_i \qquad \textbf{(6)}$$

where $T_i^* > 0$ is observed when student takes both the foundations and advance curriculum, Z_i is a vector of identifying covariates, and ν_i is an error term. In a bivariate Probit model, it is assumed that $\rho = \text{Corr}(\mu_i, \nu_i) \neq 0$.

To identify the system of equations in (4) and (6) we use as instruments the age of the AEASP student and its square.[4] This implies that conditional on being a participant in the AEASP, age does not affect the probability of intending or actually applying to doctoral programs in economics, but it does affect the probability of taking both the foundations and advanced curriculum. We argue that this is a reasonable assumption, as older AEASP participants may be more inclined to finish their graduate education given a shorter time horizon to reap the benefits of it. Bivariate Probit parameter estimates are reported in Table 8, for both the probability of intending and actually applying to a doctoral program in economics. As a test for the adequacy of a bivariate Probit specification, a chi-square test for the null hypothesis the correlation between the errors in the two latent variables equals zero ($\rho = 0$) is reported.

For intent to apply, the bivariate Probit parameter estimates reveal that for the AEASP participant, the treatment of taking both the foundations and advanced curriculum as a positive and significant impact on

[3] For examples of using bivariate Probit models for parameter identification when there is unobserved heterogeneity, see Evans and Schwab (1995) and Fairlie (2005).

[4] Bivariate Probit parameter estimates are essentially two-stage instrumental variable estimates (Mallar, 1977), and require exclusion restriction for identification.

the probability of applying to a doctoral program in economics. The instruments of age and its square are also significant suggesting that our identification strategy is sensible. As ϱ is significantly different from zero, a bivariate Probit specification of the intent to apply to a doctoral program in economics is appropriate relative to a simple Probit specification. Comparing the parameter estimates for intent to apply in Tables 7 and 8 suggests that failure to account for the endogeneity of selection into the treatment—a student taking both the foundations and advanced curriculum—introduces a downward bias on parameter estimates of the treatment effect. The simple Probit parameter estimates suggest that the treatment has no effect on the intent to apply probability, whereas the bivariate Probit parameter estimates suggest that the treatment effect is positive.

The bivariate Probit parameter estimates of the effect of the treatment on the probability of actually applying to a doctoral program in economics are approximate those for intent to apply. Being exposed to the treatment has a positive and significant effect on the probability of actually applying to a doctoral program in economics. The exception being that the chi-square test for ϱ being equal to zero cannot be rejected. As such, the simple Probit parameter estimates for the effect of the treatment on the probability of actually applying are appropriate—suggesting that taking both the foundations and advanced curriculum has no effect on the probability of actually applying to a doctoral program in economics. Of course the difference between intending and actually applying to a doctoral program in economics may be subject to a lag, rendering the treatment effect insignificant. For example, while the treatment effect of taking both the foundations and advanced curriculum may have a positive effect on intentions, the administrative data may not cover a sufficient time horizon capturing the full execution of intents to apply to a doctoral program in economics. Some, while expressing intent, may actually apply at a later date. Of course some may change their minds and not actually apply.

Table 8
Bivariate Parameter Estimates: The Treatment Effect of Curriculum Intensity on The Probability of Pursuing an Economics Doctorate

Outcome:	*Intent to Apply: Economics Doctorate Program*	*Actually Applied: Economics Doctoral Program*
Regressors:		
Constant	-.9217 (1.80)	-1.49 (1.51)
HBCU Student	.1337 (.3217)	.1318 (.3454)
Male	.1839 (.2534)	-.0040 (.2434)
U.S. Citizen	-.4467 (.4155)	-.1184 (.3676)
Mother's Education	-.1565 (.3556)	-.2191 .(3584)
Father's Education	.0649 (.4477	-.1543 (.4466)
Parent's Education	.7263 (.5578)	.7390 (.5360)
Number of Economics Courses	.0402 (.0277)	.0417 (.0276)
Grade Point Average in Major	.2481 (.4511)	.2038 (.3729
Treatment: Completed Foundations and Advanced Curriculum	1.34 (.1932)[a]	1.64 (.2037)[a]

Instruments:		
Constant	-.22.05 (4.12)[a]	-16.33 (4.70)[a]
HBCU Student	.8812 (.4014)[b]	.7971 (.4233)[b]
Male	-.2094 (.2842)	-.2827 (.2861)
U.S Citizen	-.5332 (.4084)	-.5405 (.4175)
Mother's Education	.4565 (.4252)	-.5763 (.4063)
Father's Education	.5713 (.4694)	.5460 (.5136)
Parent's Education	-1.26 (.5972)[a]	-1.29 (.6313)[b]
Number of Economics Courses	-.0009 (.0334)	-.0074 (.0365)
Grade Point Average in Major	-.0687 (.4719)	-.1280 (.4352)
Age	1.56 (.2853)[a]	1.14 (.3366)[a]
Age^2	-.0270 (.0049)[a]	-.0191 (.0061)[a]
Pseudo-R^2	.1973	.1386
X_1^2: ($\rho = 0$)	34.97[a]	1.19
N	99	99

Notes:
Standard errors in parentheses *N = Number of observations* [a] *Significant at the .01 level*
[b] *Significant at the .05 level* [c] *Significant at the .10 level*

In general, the bivariate Probit parameter estimates in Table 8 suggest that the innovation of curriculum intensity in AEASP has the effect on increasing the likelihood that minority participants make the transition to doctoral programs in economics. To the extent that one must have an intent before one actually applies to a doctorate economics program, the bivariate Probit parameter estimates for the intent to apply probabilities are probably more relevant for assessing the treatment effects of an AEAMP participant being exposed to an intense curriculum in economics. That the treatment parameter is the only significant one in the specification for intent to apply in the first-stage is even more suggestive of a positive treatment effect.

It is possible that the causal nexus presumed in our bivariate Probit specification is opposite of what is specified. That is to say, it could be that AEASP participants intend, or actually applied to a doctoral program in economics, and then take both the foundations and advanced curriculum to prepare for graduate school. This could particularly be the case if an AEASP participant has formulate an intent, or actually applied to a doctoral program in economic after taking just the foundations curriculum. If this is the case, the parameter estimates in Table 8 are upwardly biased, as the causality is reversed—the decision to take both the foundations and advanced curriculum is caused by a prior intent or decision to apply to a doctoral program in economics.

To check the sensitivity of the results to possible reverse causality, we reestimate the simple Probit and bivariate Probit specifications on data that exclude those AEASP participants who had expressed an intent, or actually applied to a doctoral program in economics after they completed the foundations curriculum. For this restricted sample, Tables 8 and 9 report the parameters estimates for the simple Probit and bivariate Probit specification, respectively. In general, the results differ little from the parameter estimates in Tables 7 and 8 on the full sample. The exception being that on the restricted sample, the treatment parameter is significant in the simple Probit specification for actually applying to a doctoral program in economics, and for both intent and actually applying, the hypothesis that $\varrho = 0$ is rejected for both intent and actually applying to a doctoral program in economics in the bivariate Probit specification. This suggests that the effects of the treatment under consideration—an AEASP student taking both the foundations and advanced curriculum—is indeed positive. As the treatment parameters in Table 10 are large relative to those reported in Table 8, it also suggests that while the effects of taking only the foundations curriculum my be positive, taking both has an even larger effect on the probability of a AEASP participant having a demand for pursuing a doctorate in economics (intent), and actually applying.

Table 9
Simple Probit Parameter Estimates: The Treatment Effect of Curriculum Intensity on The Probability of Pursuing an Economics Doctorate (Restricted Sample)

Outcome:	*Intent to Apply: Economics Doctorate Program*	*Actually Applied: Economics Doctoral Program*
Regressors:		
Constant	-3.64 (2.57)	-3.07 (.2.50)
HBCU Student	.1088 (.5016)	-.1006 (.5182)
Male	.0322 (.3593)	.2612 (.3425)
U.S. Citizen	-1.01 (.5527)[b]	-.2566 (.4286)
Mother's Education	.6783 (.5097)	.2528 .(4973)
Father's Education	.4499 (.6201)	-.1151 (.6644)
Parent's Education	-.1555 (.7793)	.5234 (.8015)
Number of Economics Courses	.1058 (.0477)[b]	.0811 (.0335)[a]
Grade Point Average in Major	.8805 (.6418)	.4486 (.6285)
Treatment: Completed Foundations and Advanced Curriculum	.5840 (.4239)	.7285 (.3971)[b]
Pseudo-R^2	.2208	.1499
N	65	65

Notes:
Standard errors in parentheses *N = Number of observations* [a] *Significant at the .01 level*
[b] *Significant at the .05 level* [c] *Significant at the .10 level*

Table 10
Bivariate Parameter Estimates: The Treatment Effect of Curriculum Intensity on The Probability of Pursuing an Economics Doctorate (Restricted Sample)

Outcome:	*Intent to Apply: Economics Doctorate Program*	*Actually Applied: Economics Doctoral Program*
Regressors:		
Constant	-4.34 (2.31)[c]	-3.63 (2.12)[c]
HBCU Student	-.4752 (.3257)	-.7618 (.4398)[c]
Male	.1719 (.3335)	.3023 (.3092)
U.S. Citizen	-.7329 (.5058)	-.2309 (.3881)
Mother's Education	.1821 (.4619)	-.0835 (.4217)
Father's Education	.1257 (.5347)	-.3349 (.6059)
Parent's Education	.5161 (.6766)	.9694 (.7182)
Number of Economics Courses	.0681 (.0393)[c]	.0514 (.0327)
Grade Point Average in Major	1.04 (.5571)[c]	.6450 (.5432)
Treatment: Completed Foundations and Advanced Curriculum	1.74 (.2628)[a]	1.99 (.2947)[a]
Instruments:		
Constant	-22.66 (7.27)[b]	-15.87 (6.99)[b]
HBCU Student	1.46 (.4316)[a]	1.56 (.4875)[b]
Male	-.1740 (.3364)	-.3338 (.3522)
U.S Citizen	-.4810 (.5168)	-.5733 (.4859)
Mother's Education	.3266 (.5272)	.5009 (.4647)
Father's Education	.6916 (.6068)	.6194 (.6968)

Parent's Education	-1.38 (.7188)[b]	-1.43 (.7971)[c]
Number of Economics Courses	-.0058 (.0412)	-.0052 (.0442)
Grade Point Average in Major	-.6010 (.6827)	-.5941 (.6309)
Age	1.76 (.4468)[b]	1.26 (.4642)[b]
Age^2	-.0305 (.0081)[a]	-.0216 (.0079)[b]
Pseudo-R^2	.2679	.1964
X_1^2: ($\rho = 0$)	280.78[a]	503.73[a]
N	65	65

Notes:
Standard errors in parentheses *N = Number of observations* [a] *Significant at the .01 level*
[b] *Significant at the .05 level* [c] *Significant at the .10 level*

To summarize, the AEASP does appear to have a positive impact on motivating applications to graduate school, and specifically to doctoral programs in Economics. Surprisingly, virtually nothing else appears to matter, at least for this sample, though it is worth noting that students from HBCUs are more likely than others to return for a second summer, and hence to benefit fully from the program. The initial regressions in Tables 7-10 do not include residuals from Table 6: these will be incorporated in a subsequent draft.

7. WHAT HAVE WE LEARNED?

The AEA Summer Program has many potential effects on its participants. There is a direct learning effect, one hopes, resulting in improved performance in undergraduate courses, and improved competitiveness in graduate study. For some, this will translate into improved performance in a given graduate program; for others, it will mean admissions to a higher-ranked and more competitive graduate program.

Beyond its direct instructional effect, the AEASP has the effect of recruiting into the profession and into academe people highly unlikely to consider graduate Economics. In large part, this is due to lack of

exposure: the Summer Program raises the profession's visibility in front of a new audience. In part, the program offers a dramatic demonstration effect, with large numbers of minority students and professional economists at different stages of their careers. The AEASP thus builds self-confidence simply by creating an environment of a large group of like-minded people – a giant peer-group effect, while the AEA's Pipeline Program builds on this and creates a supportive network. The Summer Program also offers mentoring and placement assistance, and, by providing credible recommendations and transcripts, makes participants more attractive to graduate programs. To the extent participants realize the value of such support, it should further increase interest in going to graduate school, as the offers students can expect will be improved.

These benefits described are available to and recognized by all AEASP participants, regardless of whether they come for one or two summers. The benefit we identify here is a different one: as our observations are limited to those who participated in the AEASP, we cannot determine the value of the effects hypothesized above. But we can ask whether attending for a second summer confers additional benefits – to the Economics profession, that is, in terms of its efforts to diversify. Our preliminary results suggest that it does matter, and further increases the likelihood of going on to doctoral study, even after controlling for endogeneity of returning to the program.

At present, we can only speculate as to the reasons for this effect. Additional learning and preparation, and hence additional confidence – in general, "more of the above" – is one such route. Strengthened peer effects almost certainly matter as well. We further suspect that increased enthusiasm for research is a critical contributor, which is consistent with the findings of Grove *et al.* (2005) that the experience contributes to graduate success, perhaps in part because it drives motivation. This avenue also would be consistent with those who observe the vastly disproportionate share of doctoral students coming from elite liberal arts colleges, as these too offer undergraduate research experiences.

REFERENCES

Evans, William N. and Robert M. Schwab. 1995. "Finishing high school and starting college: do catholic schools make a difference?," *Quarterly Journal of Economics*, **110**(4): 941 – 974.

Fairlie, Robert W. 2005. "The effects of home computers on school enrollment", *Economics of Education Review,* **24**(5): 533- 547.

Grove, Wayne, Donald Dutkowsky, and Andrew Grodner, 2005 (January), "Survive then thrive: determinants of success in the Economics Ph.D. program," Greenville, NC: East Carolina University, Department of Economics working paper # *ecu0504*, http://www.ecu.edu/econ/wp/05/SurviveThenThrive.pdf.

Grove, Wayne and Stephen Wu, 2007 (forthcoming), "The search for talent: doctoral completion and research productivity of economists," *American Economic Review* **95**(2).

Krueger, Alan and Stephen Wu, 2000, "Forecasting successful economics graduate students," *Journal of Economics Education* **31**(1).

Leeds, Michael, 1992, "Who benefits from affirmative action? The case of the AEA Summer Minority Program 1986-1990," *Journal of Economic Perspectives* **6**(2): 149-156.

McFadden, Daniel 1974. "The measurement of urban travel demand", *Journal of Public Economics* **3**(4): 303 – 328.

Mallar, Charles D. 1977. "The estimation of simultaneous probability models", *Econometrica,* **45**(7): 1717 – 1722.

Price, Gregory N., 2005 (July), "The causal effects of participation in the American Economic Association Summer Minority Program," *Southern Economic Journal* **72**(1): 78-97.