

Proposal Details

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1. Secondary Investigator Information

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Project Description I

Title: Relating Socioeconomic Status to Enrollment Flows and College Success: Using the BPS:96/01 Data to Estimate a Competing Hazards Model

Statement of the research problem and national importance:

Knowledge concerning progress toward a degree by both traditional students and socioeconomically disadvantaged students following a standard enrollment path, as well as by the now substantial number of students following non-traditional enrollment paths has improved in recent years. However, there is still substantial work to be done. In particular we need a better understanding of how student characteristics affect the enrollment decisions students make following matriculation and of how these enrollment decisions in turn affect their chances of graduating, not only at the institution at which they initially enrolled but at any post-secondary institution. This research will utilize a nationally representative sample of students from the NCES Beginning Post-Secondary Students Longitudinal Study: 1996-2001 (BPS:96/01) to provide both descriptive and multivariate analyses, culminating in the use of a discrete time hazard function to study enrollment flows. Of special interest will be the impact socioeconomic status and behavioral choices have on the probability of obtaining a Bachelor's degree, after controlling for family and educational background. Our focus on socioeconomic status directly addresses the NPEC topic. The goal of the proposed research is to add to the stock of knowledge more information regarding the factors affecting enrollment choices and their influence on time-to-graduation and graduation itself.

This research problem is of substantial policy interest at both the state and the national level because of the costs imposed by both those who fail to graduate as well as by those who progress very slowly. These costs accrue at both the personal and the societal level.

At the individual level, the longer it takes a student to graduate, the greater the direct costs associated with tuition and the indirect costs associated with foregone employment. Taking longer to graduate also reduces the lifetime benefits associated with a college degree as the time period over which these benefits will be received is shortened. If it is students from less advantaged socioeconomic backgrounds who take longer to graduate, it is no wonder that they may still find it difficult to catch up in terms of income and wealth with those from more advantaged backgrounds. The relative socioeconomic position of those who attempt but fail to attain a degree is further impaired, especially if they incur

substantial debt, as they incur the costs but fail to receive the financial benefits of a college degree.

At the societal level, both students who fail to graduate and those who take longer to graduate impose opportunity costs as they reduce the space available to other students who may be more successful and at a faster pace. Public institutions are highly subsidized by taxpayers, but many students attending private institutions also receive subsidized financial aid. Public subsidies are provided, in part, on the expectation that higher education will increase future productivity and earnings for the population as a whole. When students fail to graduate, or take longer to do so, the size of the economic gains to be divided across the nation in future generations is reduced.

To assess the magnitude of these concerns it is important to use a fully representative national sample. This sample should include both traditional as well as historically underrepresented students. It should also include both students who enroll full-time continuously for four years as well as students following "nontraditional" enrollment patterns. "Nontraditional patterns" such as matriculation during a non-fall term, part-time enrollment, transfer behavior, and stopout are now recognized as relatively common. The BPS:96/01 data set includes a nationally representative sample of all students initially enrolling in the 1995-96 academic year and follows them no matter their subsequent enrollment status for a period of about six years.

Our goal will be to use student characteristics - demographic, parental, familial, and educational - and institutional/economic variables to model behavior and success in the post-secondary education sector. Of substantial interest is the role of students' household income and parental education (key indicators of socioeconomic background) as well as race/ethnicity. However, these characteristics are not subject to policy intervention. If public support of college education is to be beneficial for both students and society, we need to understand also the factors underlying post-secondary success that can be influenced by policy makers. If the stumbling block is financial then further support for post-secondary education may be necessary; if the stumbling block is poor academic preparation then public money may be better spent at the primary and secondary level; if the stumbling block is poor institution-individual matching then improved counseling could be provided.

Review the literature and establish a theoretical grounding for the research:

A great deal of research has been conducted on college enrollment and persistence. Becker (1964) discusses enrollment from a decision-making perspective in the context of human capital formation: individuals enroll in college if the benefits of doing so outweigh the opportunity costs. Tinto (1975) and Bean

(1980) extended the literature to consider persistence, emphasizing the importance of the institution-individual match and the individual's intentions when enrolling.

Bean and Metzner (1985); Pascarella and Terenzini (1978, 1980); and Cabrera, Castaneda, Nora, and Hengstler (1992) have further advanced these early models of attrition. These efforts have established a framework for evaluating post-matriculation enrollment decisions. Kuh et al. (2006) provide a recent review of much of the literature related to student success. More recently, Bowen, Chingos, and McPherson (2009) provide a remarkably detailed analysis of full-time first-time students and transfer students of traditional college-going age at 21 public flagship institutions across the country as well as four state systems.

Most work accounts for an array of demographic, familial, educational, institutional, and economic characteristics. Some researchers focus on historically underserved demographic populations (Kane 1994 on African Americans; Nora 1997 and Swail, Cabrera, and Lee 2004 on those of Latino origin; Hu and St. John 2001 on minority populations more generally). Others focus attention on first-generation college students (Ishitani 2003, 2006) or on social status (Paulsen and St. John 2002). To control for ability and academic preparation, some (Rothstein 2004; Stratton, O'Toole, and Wetzel 2004, 2005) utilize first year college grades. Adelman (2004) advocates the direct use of test scores and measures of high school preparation. He concludes that perceived racial and ethnic differences in college success are substantially decreased when adjusted for academic preparation. Bowen, Chingos, and McPherson (2009) and Light and Strayer (2000) focus on the academic fit between student and institution and discuss mismatching and its implications for success. A substantial literature focuses on the role of financial aid and the explicit cost of enrollment (Long 2004a and 2004b, Baird 2006, and Dynarski 1999 and 2000).

A smaller number of researchers concern themselves with enrollment paths. Bradburn (2002) shows that those who stop out or enroll part-time are less likely to graduate in a fixed time period. Stratton and Wetzel (2008) perform a similar analysis incorporating transfer behavior. Others model graduation using a logit specification including dummy variables to identify part-time enrollment (Montmarquette, Mahseredjian, and Houle 2001; Adelman 2006) and/or attendance at multiple institutions (Goldrick-Rab and Pfeffer 2007, Adelman 2006). However, Stratton, Wetzel, and O'Toole (2008) demonstrate that stopout and dropout are distinct decisions and (2004) that the decision to enroll full-time is different from the decision to enroll part-time. Clearly a more dynamic approach is needed to incorporate these enrollment decisions in models of post-secondary success. Enrollment flow is a decision that is an endogenous, not an exogenous, factor driving subsequent outcomes and this endogeneity needs to be recognized in the estimation process.

Researchers have begun to take such an approach. In early efforts, Weiler and Pierro (1998) use a two-stage model to relate part-time enrollment to graduation, while Stratton, Wetzel, and O'Toole (2007) use a switching model. Heiberger (1993) uses more dynamic Markov models to follow students over time. More recently, DesJardins, Ahlberg, and McCall (1999, 2002), DesJardins et al. (2002), and Ishitani (2006) use event history modeling. DesJardins, Ahlberg, and

McCall (2006) estimate a multiple spells, competing risks model that distinguishes between enrollment, stopout, dropout, and graduation. They allow past behavior to influence current enrollment as well as graduation. Nonstandard enrollment flows are usually found to be negatively related to degree completion.

These studies represent a substantial step forward, however, many are conducted using nonrandom samples. Some use data from only a single institution. Others focus exclusively on students who initially enroll full-time in the fall term and fail to account for subsequent part-time enrollment. Our analysis will advance this research by following for about six years a nationally representative sample of students matriculating at any time during the 1995-96 academic year.

Conceptual Framework

Theoretical grounding for this research is based on Becker's human capital theory (1964), modified to address attrition. The result is a more complex time-varying model since individuals alter their enrollment path primarily in response to revised expectations driven by new information. For example, college experiences, particularly grades, may cause students to revise their expectations regarding the time needed to graduate, the course load they can reasonably maintain, and/or the likelihood of graduating. Changes in students' family or parental status as well as changes in employment opportunities may likewise cause students to reevaluate. Work by Altonji (1993); Stratton, O'Toole, and Wetzel (2007, 2008); and Light (1995) supports the notion that students use new information to revise enrollment decisions.

Following Tinto's theoretical lead, college experiences can also provide students with new information regarding their institutional match and lead them to alter their enrollment path or to transfer. As stated earlier, there is evidence from Bowen, Chingos, and McPherson (2009) as well as Light and Strayer (2000) that students who are mismatched academically are more likely to drop out. Other institutional characteristics (such as the fraction of part-time students or of minority students) may indicate poor fits at the social level and lead to revisions. Sometimes the decision is to drop out and other times it may be to stop out and then return. Given the individual and social costs associated with prolonged enrollment as well as failure to graduate at the post-secondary level, truly evaluating college success requires one look not just at the final outcome but also at the path taken to reach that outcome.

To this end, we will use a comprehensive national data set that follows students term-by-term for approximately six years. Information on enrollment status is available every term no matter what institution is attended. Information on grades, marital status, parental status, and local labor market conditions is updated periodically and so allows us to model the impact of new information on enrollment decisions and their subsequent outcomes.

Describe the research method that will be used:

Research Questions

- What are the unadjusted differences in graduation rates by socioeconomic status (as measured by first generation college status and income) and race/ethnicity?
- How do these unadjusted differences in success rates change when other pre-enrollment factors such as academic background are taken into account?
- How do enrollment patterns such as part-time enrollment, stopout, and graduation differ by socioeconomic status and race/ethnicity for this national sample both before and after adjustment for other pre-enrollment factors?
- How do enrollment patterns influence graduation rates in the context of a static but simultaneous framework model? What is the relative role of pre-enrollment factors versus unobservables?
- How do enrollment patterns influence graduation rates in the context of a more dynamic competing risks hazard model? What is the relative role of pre-enrollment factors versus time-varying covariates?

Descriptive and Static Probit Analyses of Success

The research will proceed on two levels. The first level will describe how socioeconomically challenged (as reflected by income and family background) and minority students progress through college relative to their more advantaged counterparts. We will begin with descriptive analyses comparing degree receipt and enrollment patterns against socioeconomic status and race/ethnicity. We will then conduct static multivariate analyses of bachelor's degree receipt.

Here we will begin by estimating a simple probit model of college graduation and/or dropout six years following matriculation using only information available when the individual initially enrolled and no behavioral variables (specification 1). Explanatory variables (X) will be of five broad types including (1) family background information such as parental education and family income; (2) personal demographic information on race, ethnicity, gender, and age; marital and parental status as of matriculation; (3) academic background information including college entrance exam scores, high school grade point average, and individual and curriculum quality information; (4) institutional-specific information on selectivity and enrollment; and (5) economic factors such as the local unemployment rate and type of financial aid received upon entrance.

$$(1) \quad \text{Success} = X \beta + \varepsilon$$

Estimation will proceed with a multivariate probit model of both college success and enrollment behaviors. This model will have three binary dependent variables indicating student success (again distinguishing in different estimates

between graduation and dropout), part-time enrollment, and stop-out behavior (specification 2 below). Estimates from this trivariate model, using methodology established by Hajivassiliou and McFadden (1998), will help identify how individual/family/institutional characteristics are related to various enrollment behaviors (via the γ) and how enrollment behaviors and college outcomes are related in the unobservables (i.e. through correlated errors u).

$$(2) \quad \text{Success} = X \gamma_1 + u_1$$

$$\text{Part-Time Enrollment} = X \gamma_2 + u_2$$

$$\text{Stopout Behavior} = X \gamma_3 + u_3$$

This model contributes to the literature on college graduation by jointly modeling several enrollment behaviors as well as outcomes, but does not incorporate any time varying covariates that theory suggests are important.

A Discrete Time Competing Hazards Model

The second level, and the main research effort, will be to utilize a discrete time competing hazard function to model dynamically both the enrollment path and bachelor's degree receipt. This model will incorporate time varying covariates. It will also allow all past choices, not just the most recent choice, as well as the time sequence of those choices, to influence choices today and the subsequent outcome. A discrete time analysis is appropriate because higher education is organized into discrete periods known as terms. A discrete choice model is feasible because only a discrete number of enrollment possibilities exist for any term.

Since the choices available are different for the first term than for subsequent terms, the log likelihood function for this model is divided into two parts. The first reflects the initial enrollment decision, the second the subsequent term-by-term progress. The initial enrollment decision entails only a choice between part-time and full-time status for the first term. A simple logit specification is employed using as explanatory variables only information available to the student at the time of initial enrollment – the X variables in the first level analysis. In subsequent terms, individuals can decide (1) to not enroll, (2) to enroll part-time, (3) to enroll full-time, or (4) to graduate. Graduation is an absorbing state from which respondents do not subsequently exit. We estimate the probability of each transition using a competing risks hazard model, implemented using a multinomial logit specification. In doing so, we account for state dependence, specifically assuming a first order Markov process. This recognizes that the probability of moving from full-time enrollment to part-time enrollment is different from the probability of moving from either part-time or non-enrollment to part-time enrollment. We account for some degree of further state dependence by also including controls for time-to-date spent enrolled part-time and spent not enrolled. The number of distinct incidences of such enrollment may also be incorporated.

Other explanatory variables at this stage include all the information available at matriculation (X) as well as covariates that change over time such as college grades, student's marital and parental status, and labor market conditions. By proceeding in such a fashion we can examine not only the impact of "traditional" variables/characteristics used in enrollment studies but also the role of prior enrollment decisions. Finally, this specification naturally controls for right censoring as it recognizes that individuals who are enrolled but do not graduate in the last term they are observed are still 'at-risk' for graduation.

Project Description II

Will you use NCES target dataset? Yes

Please check all NCES datasets that apply

- Beginning Postsecondary Student (BPS) Longitudinal Study
- IPEDS Fall Enrollment (EF)
- IPEDS Institutional Characteristics (IC)

Explain why each dataset best serves this research. Include a variable list for each dataset used.

The BPS96/01 data set we will use follows a nationally representative sample of students whether they matriculated as full-time or part-time students, in the fall or the spring term. These students are followed for six years no matter their subsequent enrollment decisions. We will focus our analysis on those who initially enroll at a four-year institution as those attending two-year institutions often have very different goals, but the sample size is still sufficient to include a substantial number of students from lower socioeconomic backgrounds. Much of the work constructing this sample was completed under previous AIR grants.

Partial list of variables to be considered:

Personal Demographics

Race/Ethnicity

Gender

Age

Region of residence

Marriage status at time of matriculation

Number of children at time of matriculation

Family Background

Parental education

Household income

Academic Preparation

High school degree indicator

SAT score

High school GPA

Rigor of high school curriculum

Rigor of high school courses taken

Highest high school mathematics course completed

Institutional Characteristics *

Type of institution (public/private) (from IPEDS Institutional data)

Selectivity (from Peterson's ranking)

Fraction of minority students (from IPEDS Fall Enrollment data)

Distance from primary residence

Economic Factors

Type of financial aid (work study, grant, loan)

Unemployment rate (at time of matriculation)

Interactions of Interest *

Institutional selectivity & Individual SAT score

Institution's minority enrollment & Individual characteristics

Time Varying Covariates

Changes in marital status

Changes in parental status

College grades

Unemployment rate

Term-by-Term Status

Part-time enrollment

Non-enrollment

Bachelor's degree receipt

* Institutional characteristics may change if a student transfers.

Will you use NSF target dataset? No

Explain why each dataset best serves this research. Include a variable list for each dataset used.

Will you address the NPEC focus topic? Yes

If yes, please briefly describe:

We propose to examine the impact socioeconomic factors, such as household income and parental education, as well as race/ethnicity have upon degree receipt, enrollment behaviors, and time-to-degree, while simultaneously controlling for academic background and measures of academic and social institution-individual fit.

Project Description III

Provide a timeline of key project activities:

- Data construction for first level analysis: Substantially complete as of December 2009.
- Programming for first level analysis: Substantially complete as of December 2009.
- Identification of final specification for first level analysis in May 2010.
- Write draft of first "deliverable" paper in Summer/Fall 2010.
- Data construction for discrete time hazard model: June-July 2010.

The data used for the first level analysis consists of one record per individual recording all the information available at matriculation. However, the data must be restructured for the discrete time hazard model such that there is one record per term per individual and be revised to include time-varying information.

- Programming for discrete time hazard model: July-August 2010.
- Write draft of second "deliverable" paper in September 2010 - May 2011

Reflects slower progress during academic year with teaching schedule.

- Presentation at AIR Forum May 2011.
- Presentations at other conferences Spring/Summer 2011. This may include the Western Economic Association meeting in San Diego and/or the Society of Labor Economists meeting in Vancouver.
- Complete revisions based on feedback and submit for review Summer 2011.

Please note that we have submitted a 2-year budget. This is necessary to cover the required trip to the 2011 AIR Forum. We have also requested funding to cover our AIR membership fees for 2010 and 2011.

List deliverables such as research reports, books, and presentations that will be developed from this research initiative:

We expect to deliver two papers to AIR under this grant. One will detail the results from the first level of the analysis including the trivariate probit model of behavior and progress. The other will cover the discrete time hazard model. We expect the trivariate probit paper to be complete in late fall 2010 prior to the AIR Forum. The discrete time hazard paper will follow in the summer 2011.

Describe how you will disseminate the results of this research:

Possible outlets for these two articles include economics journals such as Economics of Education Review and education journals such as Research in Higher Education. These papers will be submitted to the Working Paper series at the Department of Economics at Virginia Commonwealth University for local exposure and to the IZA Discussion Paper series for international exposure. We anticipate making presentations at the 2011 AIR Forum, at a local AIR meeting for practitioners/policy makers, and at either or both the Western Economic Association (WEA) and/or the Society of Labor Economists (SOLE) meeting in 2011. As described below, we have been quite successful publishing results from previous AIR grants in these journals. We expect these papers to be of at least as high a quality as those completed under previous grants.

Budget Detail: We have included \$1600 for attendance at the 2011 AIR Forum, \$2000 that we hope will cover 2 other conferences as well as a local AIR meeting, and \$500 to cover 2 2-year AIR membership fees (for 2010 and 2011). Following discussion with AIR personnel, the more detailed budget we have submitted to VCU

is a 2-year budget. We know from prior experience that we must obtain a no-cost extension of the grant in order to attend the Forum as the Forum is held after the grant formally expires. The more detailed budget also has Stratton paid for 1.5 months in summer 2010 and 0.5 months in summer 2011 in order to cover her attendance at the Forum.

Provide a reference list of sources cited:

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IRB Statement

Statement of Institutional Review Board approval or exemption:

This research is exempt under 45 CFR, 46.101 (b) (4) from all 45 CFR part 46 requirements (as described at the following VCU website: <http://www.hhs.gov/ohrp/humansubjects/guidance/decisioncharts.htm#c5>). We have confirmation of this from VCU's Internal Review Board.

Statement of Use of Restricted Datasets

This proposal requires use of the NCES Restricted Access data set Beginning Post-Secondary Students Longitudinal Study: 1996-2001. We currently have access to these data until October 14, 2010 under license agreement control number 9908190454E and should be able to extend this license. We have six published/forthcoming works using these data or the earlier 1990-95 data, as well as two working papers.

Biographical Sketch

Leslie Stratton's Biography Sketch

Leslie Stratton is a Professor of Economics at Virginia Commonwealth University. She earned her Ph.D. in Economics from M.I.T. in 1989 with an analysis distinguishing between women's choices of full-time, part-time, and non-employment. Her expertise with limited dependent variables estimation has since been applied to empirically model a number of different decisions – including hiring decisions and time spent on housework and childcare. She has been teaching a

Master's level methods course in panel data, limited dependent variables, and duration analysis almost annually since 1997. Since 1998 she has been using these techniques to analyze college enrollment choices. Her analysis distinguishing between full-time, part-time, and non-enrollment behavior is a natural extension of her analysis of women's labor market decisions. She contributed substantially to a working paper that uses multinomial logit techniques to estimate a competing risks hazard model of time use for adolescents – the same model proposed for estimation here.

Stratton has been the recipient of grants from the Association for Institutional Research and the Spencer Foundation as well as the Danish Council for Strategic Research for projects concerned with education, enrollment, and attrition. She has presented her work on higher education at several AIR Forums, VAMAP, and a variety of economics conferences and institutions in the US and Europe. Her 2001 AIR Forum presentation was awarded the Charles F. Elton Best Paper Award. She will be primarily responsible for the data handling and estimation, but will contribute in all dimensions to the project described here.

James Wetzel's Biography Sketch

James Wetzel is a Professor of Economics at Virginia Commonwealth University. He earned his Ph.D. in Economics from UNC-Chapel Hill in 1974. His interest in student enrollment, persistence and higher education finance emerged from a three grant from the Fund for the Improvement of Post-Secondary Education (FIPSE) in the early 1990s involving the use and evaluation of tuition differentials for the financing of higher education. A substantial part of that evaluation concerned student's enrollment responses to college pricing strategies. Three years of service on the University Budget Committee made him acutely aware of the debt burden faced by many students, both those who graduate and more importantly, those who fail to graduate. The knowledge gained from the FIPSE Grant and the time on the budget committee has lead to further research, funded in part by the Association for Institutional Research as well as the Spencer Foundation, concerning both initial access and the enrollment behaviors after initial enrollment that lead to graduation or the failure to graduate. Of particular research interest is how those students often referred to as historically underrepresented or socioeconomically disadvantaged persist or leave the higher education system. As a result of their research over the last decade, Wetzel and Stratton have presented and published a number of papers on initial enrollment as well as post-enrollment behaviors.

His paper with Dr. Stratton and Dr. O'Toole at the 2001 AIR Forum was awarded the Charles F. Elton Best Paper Award.

Budget Requirements

Leslie Stratton' Budget

Personnel-Time on Project

%(FTE) Academic Year: 0

%(FTE) Summer: 65.00%

Personnel-Salary & Benefits

9 Month w/o benefits

Academic Year: \$126,545.00

Summer: \$34,445.47

James Wetzel's Budget

Personnel-Time on Project

%(FTE) Academic Year:

%(FTE) Summer: 40%

Personnel-Salary & Benefits

9 Month w/o benefits

Academic Year: \$118,721.00

Summer: \$32,316.09

Total Salary and Wages:

Leslie Stratton \$22,389.79

Jim Wetzel \$12,926.44

Total: \$35,316.23

Tuition and Fees \$-

Travel to AIR meetings: \$1,550.00

Other travel related expenses: \$1,600.00

Other research expenses: \$500.00

Total Request: \$38,966.23

Funding History

No prior, current, or pending research support exists for the research proposed herein. We have received funding from the AIR in the past.

We received an AIR grant in 2005 for a project entitled, "Progress Towards a Degree: A Comparison of Academic Degree Seeking Students from the 1990-94 and 1996-2001 Beginning Postsecondary Surveys". The results were presented at the 2006 AIR Forum, the 2009 Society of Labor Economists meetings in Boston, MA., and in seminar at Aarhus School of Business in Denmark in 2006. Working papers entitled, "*Increasing Returns to Education and Progress towards a College Degree*" and "*Relating Student Behavior and Student Characteristics to Student Outcomes at the College Level*" are currently being revised. Another ("*Reported Progress under the Student Right-to-Know Act: How reliable is it?*") is forthcoming in the AIR Professional File.

We also received awards in 2003 and 2000. These awards included fellow researcher Dennis O'Toole. These grants yielded five publications (see Appendix A) as well as presentations at the 2006, 2004, the 2002, and the 2001 AIR Forums; a 2006 NPEC symposium, the SEA 2005; the VEA 2005; the Midwest Economic Association 2004; the VAMAP conference 2004; the Aarhus School of Business 2003; VCU and the Western Economic Association 2002 and 2006. Our 2001 AIR Forum presentation was awarded the Charles F. Elton Best Paper Award.

Finally, Leslie Stratton received a Fellowship in 1999 to attend the Summer Institute on the Databases of the NCES.