Purpose

This study investigates the impact that different secondary and post-secondary trajectories have on inequality of bachelor's degree attainment.

"Non-traditional" educational trajectories are increasingly common among American students. Pathways through secondary and post-secondary education are usually designated "non-traditional" when high school graduation takes longer than expected, high school is completed by alternative routes such as the General Educational Development (GED) certification, entry into college is delayed, college enrollment is interrupted, and post-secondary enrollment includes attendance to an institution with "open door" admission policy. Current research tends to study how each of these events, in isolation, affect students' educational attainment. This paper integrates all these events to focus on students' trajectories through secondary and post-secondary education.

"Non-traditional" trajectories through secondary and post-secondary education may either exacerbate or reduce pre-existing inequalities between socioeconomically advantaged and disadvantaged social groups. On one hand, these trajectories may increase educational stratification, since following "non-traditional" pathways reduces students' chances to complete a bachelor's degree. On the other hand, "non-traditional" trajectories may provide opportunities for post-secondary education some students would not have if their only alternative were a "traditional" educational pathway. As "non-traditional" pathways through secondary and post-secondary education are likely to continue growing in the foreseeable future, it is critical to understand the impact these trajectories have on the socioeconomic stratification of higher education.

In this paper, I pose three sets of research questions: (1) What proportion of students follow "traditional" and "non-traditional" pathways in their secondary and post-secondary education? How do the trajectories that student follow to attain a post-secondary degree vary in terms of type, sequence, and timing? Do type, timing, and sequence influence bachelor's degree completion? (2) How does students' socioeconomic background (SES) affect the different pathways they pursue through secondary and post-secondary education? (3) How do cognitive and non-cognitive skills affect students' pathways? Does the inclusion of these skills in the model reduce the previously unmeasured heterogeneity?

Theoretical Framework: From Educational Transitions to Educational Trajectories

By addressing these research questions, this study seeks to fill three gaps in the literature. First, a proper analysis of educational pathways requires consideration of three factors: the *type* of educational experiences individuals have, the *timing* at which different transitions occur, and the *sequence* of events within educational levels. However, the standard sociological conceptualization of educational attainment – the educational transitions (ET) model — ignores these issues theoretically and empirically (e.g. Mare, 1980; Shavit & Blossfeld, 1993). Type, timing, and sequence are relevant for educational stratification because research indicates that deviating from the "traditional" pathway in each of these dimensions reduces students' likelihood of post-secondary enrollment and degree completion (Carroll, 1989; Breen & Jonsson, 2000; Maralani, 2003)

Second, given that the ET model ignores the current diversity of educational trajectories, further research is required to re-examine the effect of SES on educational attainment. Focusing exclusively on "traditional" trajectories, the ET model consistently shows that the effect of SES weakens as individuals progress through each consecutive educational stage (e.g. SES more

strongly affects the completion of high school than college, given that students completed the immediately previous level of schooling). This paper assesses whether this pattern of declining SES effects holds for students who follow "non-traditional" pathways. It is well documented that on average, these students have lower SES than their "traditional" counterparts (Hearn, 1992; Goldrick-Rab, forthcoming). However, research indicates that *among* students who deviate from a "traditional" trajectory, those who complete a post-secondary degree have a SES advantage (Carroll, 1989; Horn & Carroll, 1998; Breen & Jonsson, 2000; Hillmert & Jacob, 2004). These findings suggest that the effect of SES does not necessarily decline across transitions for students who follow non-traditional pathways.

Finally, this study addresses the main objection raised against the ET model, namely, unobserved heterogeneity. This problem refers to the distortion of estimates of SES effects, due to the influence of variables that affect school persistence, but are omitted from the analysis (Mare, 1993; Cameron & Heckman, 1998; Lucas, 2001). To deal with this problem, this paper seriously considers the recent interdisciplinary claims regarding the impact of both cognitive and non-cognitive skills on inequality of educational attainment. The conventional model of skill formation focuses exclusively on cognitive ability. However, research shows that behavioral traits (e.g. sociability and self esteem), work habits (e.g. discipline and perseverance, and industriousness), and health conditions are also associated with schooling success (Conley & Bennett, 2000; Rosenbaum, 2001; Farkas, 2003). Moreover, research on the GED program suggests that non-cognitive skills are particularly important to distinguish students who follow "traditional" and "non-traditional" educational pathways (Heckman & Rubinstein, 2001).

Methods

This paper uses a specific application of discrete-time event history analysis, namely multi-state hazard models, to describe the process by which individuals complete secondary or post-secondary education over their life-course. These models are an extension of two-state hazard models (Palloni & Sorensen, 1990; Hougaard, 2000). In both cases, the aim is to explain the occurrence and timing of events. In the simplest two-state model, the event is given by the transition from a single origin state to one absorbing destination state. Usually, when applied to educational attainment, this model estimates the likelihood that the transition from a state of school enrollment to a state of school non-enrollment (a "dropout" event) occurs within a given period of time (Willett & Singer, 1991; Singer & Willett, 2003). Multi-state models are better suited to describe "non-traditional" educational pathways, since they allow for multiple origin and destination states, including bidirectional flows between reversible states. Thus, these models offer a flexible approach to considering both the type of events (states) individuals experience and the timing of transitions between states that do not necessarily follow a linear sequence.

Another advantage of multi-state hazard models is that they easily allow the inclusion of covariates that vary over time. The use of at least one time-varying covariate has been proposed as a strategy to respond to the major criticism of the ET model (Cameron & Heckman, 1998). Lucas (2001) argues that time-varying covariates provide the necessary information to identify the predictive model for each educational transition.

Data Source and Measures

This paper uses publicly-available data from the National Longitudinal Survey of Youth 1979 (NLSY79), a nationally representative sample of 12,686 men and women ages 14-21 as of

December 31, 1978. This cohort was interviewed annually from 1979 to 1994, and biannually from 1994 to 2002. The original sample included supplemental samples of (1) blacks, Hispanics, economically disadvantaged nonblacks/non-Hispanics; and (2) youths in the military. The military supplemental sample was discontinued after the 1984 survey, and the economically disadvantaged nonblack/non-Hispanic supplemental sample was discontinued after the 1990 survey. My analysis includes the 9,763 respondents eligible for all interviews: the main sample and the supplemental samples of blacks and Hispanics. Throughout the 20 rounds of data collection, sample retention has been kept at 81 percent. In 2002, the last interview so far, individuals were between 35 and 41 years old. This observation period captures a substantial part of individuals' educational trajectories.

NLSY79 data are uniquely well-suited for an event history analysis of schooling trajectories. In each wave, respondents provided information on their enrollment status and highest educational degree attained, as well as the dates (month and year) when they occurred. To construct a life history file, I combine these data with information on the respondents' date of birth and date of interview. This file records the "educational state" in which each individual was at every age since 1979 (e.g. "state" at age 16, 17, 18, and so on until the respondent's age in 2002), as well as the values of time-constant and time-varying covariates accompanying each of those states. Based on this file, the cumulative and specific duration of each enrollment episode can be calculated.

As a proximate measure of cognitive ability, I include respondents' percentile scores on the Armed Forces Qualifying Test (AFQT), administered to 94 percent of the 1979 sample in April 1980. The AFQT is a general measure of trainability (CHHR, 2004). To construct the AFQT composite, scores from four out of the ten sections of the Armed Services Vocational Aptitude Battery (ASVAB) are summed up: arithmetic reasoning, world knowledge, paragraph comprehension, and numerical operations. Respondents were between 16 and 24 years old when they took this test. Because education affects AFQT scores (Winship & Korenman, 1999), I include, as a control variable, the respondents' age at the time of the test.

I use four sets of variables to measure non-cognitive skills: (i) as indicators of health status, I use height and a time-varying measure of weight relative to height (Body Mass Index, BMI); (ii) Rotter locus of control scale collected in 1979, designed to measure the extent to which individuals believe they have control over their lives through self-motivation or self-determination as opposed to the environment's control of their lives; (iii) Rosenberg self-esteem scale administered in 1980 and 1987; and (iv) two indicators of sociability measured in 1985, corresponding to respondents' perception of how shy or outgoing they were at age 6 and as adults.

As indicators of students' SES, I use respondents' reports, at the 1979 survey, of their parents' occupation and family structure at age 14, as well as their reports on their parents' current education and current number of siblings. To minimize missing data, I recoded parent's education as the highest educational attainment completed by the respondent's father or mother. For the same reasons, I use the occupation of the head of the household rather than the occupation of each parent. Since NLSY79 collects data on total household income every year, I include two time-varying covariates measuring the level of financial resources available to students in each time period: log of total net family income and poverty status. I use three-year moving averages for these two variables to reduce missing data.

The estimated multi-state hazard model is displayed in Figure 1. Each arrow represents a transition between states. I estimate each of these transitions simultaneously using CTM, a

maximum-likelihood software designed to estimate generalized continuous hazard models. To answer the first research question, I calculate crude probabilities of transitions between states and then select a specification of the baseline hazard, testing the sensitivity of the estimates to the functional form selected. To address the second and third research questions, I cumulatively introduce in the model four sets of covariates, estimating the effects of (1) SES; (2) time-varying household income; (3) cognitive ability; (4) non-cognitive skills. All models include students' gender and race and ethnicity. Finally, I use statistical tools available in CTM to evaluate whether the inclusion of cognitive and non-cognitive skills significantly reduces unobserved heterogeneity.

Results

Results indicate there is ample variation on the timing of educational trajectories. Although a substantial proportion of students follow the "normative" age of degree completion (such as 18 for the attainment of a high school diploma), a non-trivial proportion of students experience educational transitions at non-normative ages. "Non-traditional" students tend to come from more disadvantaged SES backgrounds. However, the effect of SES changes depending on the particular transition under consideration. Cognitive and non-cognitive skills affect the timing of educational transitions, in the sense that higher levels of these skills increase the risk of experiencing the specified educational transitions. In other words, cognitive and non-cognitive skills "accelerate" transitions from one state to the other, such that students with high levels of these skills experience educational transitions when they are younger than their peers. As expected, cognitive and non-cognitive skills partially mediate the effect of SES.

Policy implications

By describing the whole range of trajectories students follow through secondary and post-secondary education, findings from this study reveal which enrollment patterns – in terms of type, timing, and sequence of events — are more likely to lead students to the attainment of a bachelor's degree. By investigating the factors associated with students' college degree attainment this study provides valuable information to policy makers who seek to improve retention outcomes for students from lower SES backgrounds. Even more, because I analyze the time *when* these factors have a stronger influence, findings form this study contribute to the design and implementation of programs targeted specifically at different stages of students careers. These time-sensitive policies are likely to be more effective at mitigating the adverse consequences that "non-traditional" educational trajectories have on post-secondary degree completion.

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Figure 1: Proposed model of "traditional" and "non-traditional" educational trajectories