Revising the Pattern of Declining Socioeconomic Background Effects Across Educational Transitions

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Abstract

"Non-traditional" educational trajectories are increasingly common among American students. This study relies on data from the NLSY 1979-2002 to examine "traditional" and "non-traditional" pathways through post-secondary education. An underutilized application of event history methods, namely multi-state hazard models, is used to analyze the influence that type, timing, and sequence of educational experiences have on post-secondary access and degree attainment. The inclusion of time-varying covariates allows the proper identification of effects of socioeconomic background (SES) throughout educational trajectories. The pattern of SES effects across educational transitions is consistent with findings of declining SES effects documented in the literature. Findings also reveal that SES effects are stronger in the educational trajectory associated with four-year colleges as compared with the trajectory for two-year colleges. Further analysis that accounts for individual-specific unobserved heterogeneity yields smaller SES effects for transitions associated with college entry (entry in two- or four-year college). Since SES effects remain the same in the transitions associated with degree completion, the overall pattern of decline in SES effects is less pronounced in these results.

The educational transitions (ET) model represents the standard sociological conceptualization of the educational attainment process. The ET model treats students' schooling as a sequence of consecutive educational transitions. At each transition, students opt to stop or continue in school, such that only those who complete high school may enter college, and only those enrolled in college may obtain a bachelor's degree. Across several industrialized countries, research shows two empirical regularities regarding the effect of socioeconomic background (SES) on educational attainment (Shavit & Blossfeld, 1993). On one hand, there is a strong effect of SES on the highest level of education individuals attain. On the other, the effect of SES weakens as individuals progress through educational transitions. Thus, the ET model reveals that the effect of SES is stronger for the transition between high school graduation and college entry than for the transition between college entry and college completion.

In this paper I estimate the effect of SES on college entry and college completion. The estimates are an improvement over previous estimates in that they account for the complexity of students' trajectories. I take into account the *type* of educational experiences individuals have, the *timing* at which different transitions occur, and the *sequence* of events within educational levels – three increasingly important dimensions of students' educational trajectories that the ET model ignores. Incorporating the criticism raised against the ET model (Breen & Jonsson, 2000; Lucas, 2001) as well as insights from my own previous work, I distinguish qualitatively different *types* of educational experiences individuals have, in particular the difference between entering a two- versus a four-year college, and between attaining an associate's versus a bachelor's degree. I consider the *timing* of educational attainment by estimating not only whether an educational transition occurred but when it did. I attend to the issue of *sequence* of educational events by taking into account transfers between different types of colleges ("classical transfers" between two-year and four-year colleges and "reserve transfers" between four-year and two-year colleges) and discontinuity in students' enrollment in post-secondary education. Furthermore, I evaluate whether the pathway a student has followed through school has any bearing on the probability of ultimately attaining a post-secondary degree. The estimates of SES effects I provide in this paper are also an improvement over current estimates because I seriously address the issue of unobserved heterogeneity. I described this problem and the strategies I pursue in this regard in the next section.

The Lurking Problem of Unobserved Heterogeneity

In the original formulation of the educational transitions model, unobserved heterogeneity was crucial to explain the pattern of declining SES background effects across educational transitions (Mare, 1980). At that time, Mare postulated that, because of the differential selection of students over schooling, omitted variables that mediate the effect between SES background and educational attainment (such as cognitive ability) would *reduce* the effect of SES background across educational transitions. In the conclusion to Shavit and Blossfeld's volume (1993) – which contained studies of inequality in educational attainment in thirteen industrialized countries – Mare reexamined his rendition of the unobserved heterogeneity problem. In this later publication, Mare discussed the educational transitions model as a variant of discrete-time hazard models, a variant in which the hazard corresponds to the probability that an individual leaves school at a particular transition given that she completed all previous transitions. Thus, Mare referred to unobserved heterogeneity within the framework others had developed for duration dependent processes (e.g. Vaupel & Yashin, 1985). Mare defined the problem of unobserved heterogeneity as the existence of “determinants of the hazard that are unobserved by the analyst” (1993: 353). He pointed out that in all regressions the presence of unmeasured determinants that are *correlated* with the regressors in the model bias the estimated effects of the independent variables. However, he acknowledged unobserved heterogeneity is an even deeper problem in models that estimate transition-specific slopes (such as hazards models), since omitted variables can bias these estimates even if they are *uncorrelated* with other independent variables in the model.

Compared to his earlier work (1980), Mare (1993) recognized that differential attrition on unmeasured variables does not always reduce the observed effects of SES background. He pointed out that the effect of SES background may either increase or decrease across educational transitions. Thus, he acknowledged, “my argument (Mare, 1980) that differential selection *requires* the observed effects of social background to decline over school transitions is incorrect" (1993: 358, emphasis in original). Mare presented two possible circumstances where unmeasured heterogeneity causes the effect of father’s schooling to decline across transitions. However, he argued, the size and direction of the distortion must be resolved empirically.

In this paper I use three robust strategies to deal with the issue of unobserved heterogeneity. I assess whether estimates of SES effects vary and whether the pattern of declining SES effects holds when I use these different strategies. The first strategy is to use an ample, theoretically defensible set of covariates (Lucas, 2001). To this end, in addition to considering the heterogeneity that arises from students’ educational trajectories, I incorporate the mounting interdisciplinary claims regarding the impact of cognitive and non-cognitive skills on inequality of educational attainment. The conventional model of skill formation focuses exclusively on cognitive ability. Indeed, Cameron and Heckman (1998) assert that cognitive ability is the main component of unobserved heterogeneity. However, research shows behavioral traits (e.g. sociability and self esteem), work habits (e.g. discipline, perseverance, and industriousness), and health conditions are also associated with schooling success (Conley & Bennett, 2000; Rosenbaum, 2001; Farkas, 2003). Non-cognitive skills may be particularly important to distinguish students who follow alternative educational pathways. Evidence on the GED program for instance (Heckman & Rubinstein, 2001), indicates that GED holders have similar levels of cognitive ability compared to traditional high school graduates who do not go on to college, and higher levels of cognitive ability compared to high school dropouts who do not obtain a GED. However, GED holders have lower levels of non-cognitive skills than both groups of students. This paper evaluates the contribution of cognitive as well as non-cognitive factors (in particular, cognitive ability, self-esteem, and cumulative health conditions) to the process of educational attainment.

Including a comprehensive set of covariates may reduce the presence of unobserved heterogeneity in models of educational transitions, but it is unlikely to be a sufficient strategy. Thus, I utilize two other strategies. One involves dealing with state specific heterogeneity, also referred to as the mover-stayer type of heterogeneity. This issue arises when a subgroup of individuals has a zero or a very low risk of making the transition of interest, such that they will stay in their current state no matter what (Palloni et al, 2001). If this issue is present, the composition of the population – in terms of individuals who experience/do not experience the transition of interest – changes over time in a way the observer is unaware of. When this issue is neglected, and when the difference between movers and stayers is not accounted by the covariates included in the model, estimates of the effects of covariates are biased. I address this issue by accounting for the probability of being a "mover" in different transitions. If state-specific heterogeneity is a problem, estimates of the effects of covariates should differ between a model that does and does not account for state-specific heterogeneity.

The final strategy I pursue is to account for individual-specific heterogeneity. I follow the non-parametric procedure proposed by Heckman and Singer (1984). This strategy postulates the existence of more than one latent subpopulation, with distinctive risks of experiencing the transitions of interest. This method estimates the probability of belonging to each unobserved group as well as the effect of the unobserved characteristic that induced this partition of the population in the first place. An important advantage of this non-parametric procedure is that it does not require making any assumptions about the distribution of the error term. Cameron and Heckman (1998) use this procedure to compare the sensitivity of SES effects to different assumptions of the error term. They presented heterogeneity-corrected estimates of parental education and family income on educational transitions by carrying out a two-point version of the nonparametric heterogeneity correction that Heckman and Singer (1984) introduced. As they expected, the pattern of waning SES background effects did not hold under this different distribution of the error term. Compared to the strict replication of Mare's analysis, the heterogeneity-corrected estimates of parental education and family income in the higher transitions were greater in absolute value and exhibited a higher frequency of statistical significance (comparison of Tables 1 and 4: 269 and 280).

Data and Methods

Data

I use 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. The original NLSY79 data were comprised of three subsamples (CHHR, 2004):

(1) the main sample of 6,111 respondents designed to be representative of the noninstitutionalized civilian segment of young people living in the U.S. in 1979 and born between January 1, 1957, and December 31, 1964 (ages 14–21 as of December 31, 1978);

(2) a supplemental sample of 5,295 respondents designed to oversample civilian Hispanic, black, and economically disadvantaged non-black/non-Hispanic youth living in the U.S. during 1979 and born between January 1, 1957, and December 31, 1964;

(3) a military sample of 1,280 respondents designed to represent the population born between January 1, 1957, and December 31, 1961 (ages 17–21 as of December 31, 1978), and who were enlisted in one of the four branches of the military as of September 30, 1978.

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. Of the initial 12,686 respondents, 9,763 are eligible for all interviews, including the main sample and the supplemental samples of blacks and Hispanics. These respondents have been interviewed annually from 1979 to 1994, and biannually from 1994 to 2002. Throughout these 20 rounds of data collection, the response rate has been kept at 81 percent. The observation period is long enough to capture a substantial part of individuals' trajectories and the non-standard times at which non-traditional trajectories occur.

NSLY79 respondents were between 14 and 22 years old at the first interview, in 1979. In this analysis, I only consider respondents who were between 14 and 17 years old in the first interview because some key variables on schooling are only reported prospectively. By restricting the analysis to the younger members of the cohort I can capture respondents' transition out of secondary education and into post-secondary education as they actually experience it. This restriction eliminates 49 percent of the 9,763 respondents who were eligible for all interviews. The sample I utilize is composed of 4,938 respondents.[1]

Reconstructing Educational Histories

The NLSY79 data are uniquely well-suited for an event history analysis of schooling trajectories. In each wave, respondents provided information on the educational credentials they had attained, as well as the dates (month and year) at which they occurred. Starting in the 1981 wave, respondents reported on their status of school enrollment (whether they were enrolled or not) for all the months that elapsed between the last interview and the current interview. School enrollment considered any type of school, such as high school, college, or graduate school, excluding training programs. To determine whether these months of school enrollment corresponded to months of enrollment in college, I combined this information with respondents' reports on the beginning and end of each spell of college enrollment. Along with the information of the month and year when each enrollment spell began and ended, respondents reported the type of college they attended (two- of four-year college), and whether the school they attended considered them a full- or part-time student. I only considered as college enrollment that occurred after high school completion.

I constructed a person-month file where I recorded the "educational state" in which each individual was at every month since January 1979 to December 2002. For instance, for the month January 1988, I record whether the student had graduated from high school, which type of high school credential he/she had received, whether he/she was enrolled in college, in which type of college she/he was enrolled in that moment, whether he/she attained an

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[1] Researchers have imposed similar age restrictions in analyses of schooling and labor market careers using NLSY79 data (see Light, 1995; Light, 1996; Keane & Wolpin, 1997; and Eckstein & Wolpin, 1999).

associate's or bachelor's degree that particular month, as well as the values of time-constant and time-varying covariates corresponding to that month. Standard errors are properly adjusted for the clustering of records within individuals.

Independent Variables

Table 1 specifies the operationalization of all independent variables. The independent variables of interest refer to social background, cognitive skills, and non-cognitive attributes. As indicators of students' family background, I use respondents' reports, at the 1979 survey, of their family structure at age 14, as well as their reports on their parents' current education. To minimize missing data, I recoded parent's education as the highest educational attainment completed by the respondent's father or mother. I also use a measure of the cumulative proportion of time the respondent has spent in poverty. This proportion is time-varying, so that it represents, up to each particular month, the proportion of time the respondent has spent living in poverty, rather than the state in which the respondent was at each particular month.

As a proximate measure of cognitive ability, I include an indicator of whether the respondent was in the top quartile of the Armed Forces Qualifying Test (AFQT). The AFQT is a general measure of trainability and it was administered to 94 percent of the 1979 sample in April 1980 (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. To assess students' academic preparedness I constructed an indicator of whether the respondent participated in the academic preparatory curriculum at the last high school he or she attended.

I use a set of four variables to measure non-cognitive attributes. First, as indicators of health status I use the proportion of time the respondent has been obese (body mass index equal or more than 30), and with a health limitation that prevents or limits work – proportions that potentially vary every month. I also use the 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, and the Rosenberg self-esteem scale administered in 1980 and 1987. Finally, I account for individual characteristics such as gender, age, and race and ethnicity.

Single versus Multi-State Hazard Models

Hazard models in general take into account the amount of time the respondent spends in each state (duration) and the exposure to the risk of making a transition (Singer and Willett, 2003). Multi-state hazard models fulfill this purpose, but with multiple transitions at the same time. Thus, in estimating the hazard of making a transition between two particular states I am also accounting for the exposure to other risks (i.e. the risks of making other educational transitions). The fact that the model is flexible enough to accommodate multiple states streamlines the estimation of bidirectional transitions between states, such as the transition from a two-year college to a four-year college and vice versa. Multi-state hazard models permit a direct comparison of estimates of the effect of covariates across transitions. Thus, I can easily assess whether the effects of SES, cognitive and non-cognitive skills vary among different transitions. A crucial advancement of this model is that it allows estimating the effect of covariates while accounting for state-specific and individual unobserved heterogeneity.

Definition of State Space

I define the process of post-secondary educational attainment as a set of 6 mutually exclusive states and 11 possible transitions among those states. A respondent can eventually pass through each of the six states, but not all the transitions among states are considered, as some are implausible or not of intrinsic interest. The six states are:

1. high school graduation
2. enrollment in two-year college
3. enrollment in four-year college
4. not enrolled in college
5. attainment of an associate's degree
6. attainment of a bachelor's degree

Figure 1 displays these states as boxes and the transitions among them as arrows. In the case of all states, respondents can either stay in their current state or transition into other state(s). Depending on the state that respondents are in, they have one or several alternatives to exit the state. Some transitions are unidirectional, meaning that the transition from an origin state to a destination state occurs only once. The transition from enrollment in a two-year college to attainment of an associate’s degree is an example of such transition. Other transitions correspond to bidirectional flows between reversible states, meaning that respondents can enter and exit those states multiple times. The transition between enrollment in a two-year college and enrollment in a four-year college is an example of a directional flow – respondents can move back and forth between these two states repeatedly.

All respondents start in state 1. By definition, I restrict this analysis to high school graduates, about 87 percent of the sample. The focus of the analysis is enrollment and completion of post-secondary education, so it is appropriate to begin the observation of respondents (entry into the risk set) at the moment they graduate from high school. It should be noted that respondents enter this first state whenever they graduate by means of a high school diploma or a GED. I take into account the differences between high school diploma recipients and GED holders by including the type of secondary credential they attain as a covariate in the model. Respondents can exit state 1 by enrolling in a two-year college (state 2) or by enrolling in a four-year college (state 3). Once an individual is enrolled in a two-year college, he/she can exit by means of transferring “up” to a four-year college (transition from state 2 to state 3, or transition 2->3), by interrupting his/her enrollment in a two-year college temporarily or permanently (transition 2->4), or by attaining an associate’s degree (transition 2->5). Similarly, once an individual is enrolled in a four-year college, he/she can exit by means of transferring “down” to a two-year college (transition 3->2), by interrupting his/her enrollment in a four-year college temporarily or permanently (transition 3->4), or by attaining a bachelor’s degree (transition 3->6).

A respondent may enter state 4 after he/she enrolls in college, but not directly after graduating from high school. In other words, I define state 4 as “not enrolled in college after the respondent has ever enrolled in either a two-year college or a four-year college.” That is, if a respondent graduated from high school but never attends any college, he/she will remain in state 1, he/she will not make the transition from state 1 to state 4. In contrast, if a respondent graduates form high school, enrolls in a two-year college and then interrupts his/her enrollment, he/she will transition from state 1, to state 2, to state 4. This definition of state 4 allows me to interpret the transition to state 4 as the transition into a permanent or temporary state of college drop-out.

State 6 (attainment of a bachelor’s degree) is an absorbing state. Once respondents attain a bachelor’s degree they do not contribute observations to the analysis. In contrast, after attaining an associate’s degree (state 5), an individual may enroll in a four-year college (transition 5->3) and eventually attain a bachelor's degree. I do not consider re-enrollment in a two-year college that occurs after attaining an associate's or a bachelor's degree.

Transition Matrix

Table 2 presents the number of transitions between different states, the crude probability associated with each transition (i.e. the cell frequency divided the row total), and the average number of months respondents spend in each state before making a transition. The table is read from the vertical to the horizontal axis. The main diagonal cells represent the state respondents where in at the end of the observation period (i.e. when respondents attrited from the survey, experienced the last event of interest – attainment of a bachelor's degree – or when the last month of data collection occurred in the 2002 survey). Among these main diagonal cells, the first line represents the number of respondents who were in each state at the last month of observation. The sum of respondents across the main diagonal corresponds to the total number of respondents considered in this analysis: 3,350. The main diagonal indicates that when respondents were last observed, 1,307 had remained in state 1 – meaning that 39 percent of all high school graduates had never been enrolled in either a two- or a four-year college. About a third of high school graduates had been enrolled in college but were not attending college at that moment (i.e. 1,159 respondents were in state 4). Out of all high school graduates, 4 percent had attained an associate's degree as their highest degree (150 respondents were in state 5, without later attending a four-year college and/or attaining a bachelor's degree) and 20 percent had attained a bachelor' degree (667 respondents were in state 6). Only a few respondents were still enrolled in a two- or four-year college by the end of the observation period (33 and 34 respondents, respectively).

The off-diagonal cells represent transitions between two states. In the case of transitions that are unidirectional, the count (first row of each cell) represents the number of respondents who experience the transition. In contrast, in the case of transitions that are bidirectional, the count represents the number of transitions between states but not the number of respondents who experience those transitions, since respondents can experience those transitions more than once.

Out of all high school graduates, 30 percent enters a two-year college (transition 1->2) and another 30 percent enters a four-year college (transition 1->3). The average number of months it takes to enter a two-year college is about twice as large as the time it takes to enter a four-year college (31.9 versus 15.2 months after high school graduation). The count associated with the transition 1->2 (N=1,018) corresponds to the number of respondents who enters a two-year college right out of high school, as the first college after high school graduation. However, this count does not represent the total number of respondents who ever enter a two-year college. Since respondents can also enroll in a two-year college after attending a four-year college (transition 3->2) and after not being enrolled in any college (transition 4->2), the total number of transitions into a two-year college is represented by the sum of 1->2, 3->2 and 4->2, which corresponds to 2,196 and is displayed in the column labeled “number of transitions into each state.” The same logic applies to the number of transitions out of each state. As Table 2 shows, the number of transitions into each state is equivalent to the sum of the number of transitions out of each state and the number of respondents remaining in each state.

For all other transitions, the mean duration needs to be interpreted as the average number of months respondents spend in a state just before making the transition, not as the average *total* number of months the respondent spend in that state. For instance, the mean duration associated with the transition into the attainment of an associate's degree (transition 2->5) is 22.3 months. This means that in the *last spell* of enrollment in a two-year college, respondents were enrolled for an average of 22.3 months before transitioning into the attainment of an associate's degree. Indeed, for associate's degree recipients, the average total number of months respondents have been enrolled in a two-year college is 30.1. Furthermore, if we take into account interruptions in college enrollment and transfers back and forth between two- and four-year college, the average time elapsed between entry into a two-year college and attainment of an associate's degree is much longer than 22.3 months: 4.5 years.

Transfers "up" from two- to four-year colleges are more frequent than transfers "down" from four- to two-year colleges. Table 2 shows there are 190 "up" or "classical" transfers (transition 2->3) and 95 "down" or "reverse" transfers (transition 3->2). It is also the case that respondents are enrolled in a two-year college for a slightly longer amount of time before transferring "up" (mean of 17.2 months), compared to the amount of time respondents spent enrolled in a four-year college before transferring "down' (mean of 12.7 months).

Interruptions of enrollment are remarkably common. In fact, the majority of transitions out of college enrollment are related to interruption of enrollment rather than transfers between different types of colleges or attainment of post-secondary degrees. Interruptions among two-year college enrollees are indicated by the transition 2->4 and interruptions among four-year college enrollees are indicated by the transition 3->4. As one would expect, interruptions among two-year college enrollees are slightly more frequent than interruptions among four-year college enrollees.

Re-entry into college is also widespread. Once respondents interrupt their enrollment in college, about two thirds return to college (36 percent remains in state 4 by the end of the observation period). The transitions out of the state of no college enrollment are about equally distributed between the ones who re-enter a two-year college (transition 4->2) and the ones who re-enter a four-year college (transition 4->3). However, it takes longer to re-enter a four-year college than to re-enter a two-year college (35.6 versus 25.7 months on average, respectively).

Analytic Strategy

The transition matrix displayed in Table 2 shows that the process of educational attainment is complex. The flexibility of the multi-state hazard models is particularly well-suited to examine the process of entry into college and attainment of post-secondary degrees in this context. I estimate the model using CTM, a maximum-likelihood program developed by George Yates, James Heckman, and James Walker to estimate generalized continuous hazard models (CTM stands for Continuous Time Models). To represent the time dependence of the risk of making an educational transition I use a Weibull baseline hazard, which can model monotonically increasing or monotonically decreasing hazard functions by means of a level parameter (intercept) and slope parameter (which indicates change in the hazard over time). Since the state space defines 11 transitions, the basic model, without any covariates, requires 22 parameters. I tried different specification of the baseline hazard – exponential, Gompertz, and quadratic. Estimates that used the Weibull function proved to be the most stable.

The hazard associated with the transition from one state to another may also a function of covariates. Covariates may be similar or different across transitions, and the effect of covariates may be allowed to vary or not across transitions. Give the complexity of the model, I only estimate the effect of covariates on four transitions. I estimated the baseline hazards for all 11 transitions, but focused on the most relevant transitions when estimating the effect of covariates on the risk of passing from one state to another:

- transition 1->2: entry into a two-year college, conditional on high school graduation
- transition 1->3: entry into a four-year college, conditional on high school graduation
- transition 2->5: attainment of an associate’s degree, conditional on enrollment in a two-year college
- transition 3->6: attainment of a bachelor’s degree, conditional on enrollment in a four-year college

When I compare the effects of covariates on college entry versus college completion I am addressing the evidence on the declining SES effect. When I compare the effects of covariates on entry and completion of two-year colleges versus entry and completion of four-year colleges I am addressing the qualitatively different nature of colleges discussed above under the rubric of different *types* of educational experience.

I present three main sets of models. In the first set, I estimate the impact of SES, cognitive skills, non-cognitive skills, and educational trajectory on transitions between states. The covariates I include in the model are the same across transitions, except for the covariates regarding educational trajectories, which vary somewhat depending on the transition of interest (for instance, the indicator for whether the respondent has previously attained an associate’s degree is only included in the transition that predicts the attainment of an associate's degree). I allow the *effect* of covariates to vary across transitions (i.e. I do not constraint the effects to be the same across transitions). The second set of models assesses whether the effects of covariates change once state-specific heterogeneity is taken into account. The final set of models assesses whether these same effects change once unobserved heterogeneity among individuals is taken into account.

Uncovering Socioeconomic Background Effects on Educational Trajectories

Model 2 of Table 3 shows that having a parent with 12 years or less of education decreases the risk of entering post-secondary education.[2] Low parental education has a stronger effect in entering a four-year college than in entering a two-year college: the likelihood of making the transition 1->2 decreases by .38 (relative risk of .62), while the likelihood of making the transition 1->3 decreases by .55 (relative risk of .45) for respondents whose parents have low levels of education. Parental education is more strongly associated with the hazard of entering college than family poverty and family composition, but these two indicators of family background also have stronger effects on entering a four-year college than a two-year college. The effects of parental education, family poverty, and family composition on the risk of attaining an associate's degree are all statistically insignificant. For the risk of attaining a bachelor's degree, the parental education matters, but poverty and family composition do not: the likelihood of making the transition 3->6 decreases by .33 (relative risk of .67) for respondents whose parents have low levels of education. Comparing estimates of parental education across these four transitions confirms the pattern of declining SES effects. Between entry in a two-year college and attainment of an associate's degree, the effect of parental education disappears completely. Between entry

[2] The effects of covariates need to be interpreted as the relative risk of making the transition from one state to another in contrast with either not making that transition or making the transition to another state.

in a four-year college and attainment of a bachelor’s degree, the effect of parental education reduces by almost half.

Once the model takes into account cognitive skills, non-cognitive skills, and educational trajectories, the effect of parental education decreases but is not fully accounted for. Including these covariates reduces the effect of parental education by 14 percent in transition 1->2, by 32 percent in transition 1->3, and by 23 percent in transition 3->6 (the effect of parental education on the transition 2->5 is null to begin with). The impact of covariates on the risk on making these three transitions is not trivial, but it does not mediate the impact of parental education on the risk of transitioning from one state to another. In particular, it should be noted that an academically rigorous high school curriculum is a important predictor in these three transitions. Cognitive and non-cognitive skills are important in college entry, but not in college completion. Consistent with the previous paper, deviating from a traditional educational trajectory – such as graduating from high school by means of a GED and being enrolled part-time – reduces the risk of progressing through school.

Accounting for Unobserved Heterogeneity

Tables 4 and 5 display estimates that take into account the two types of unobserved heterogeneity described above: state-specific heterogeneity and individual-specific heterogeneity, respectively. I consider state-specific heterogeneity that arises from the unaccounted composition of movers and stayers in three different states: high school graduates (state 1), not enrollment in any college (state 4), and attainment of an associate’s degree (state 5). As shown in Table 2, these are the three states where there are more stayers. Substantially, accounting for state-specific heterogeneity in theses cases means that I account for unobserved differences between those who ever attend post-secondary education and those who not; between those who re-enter college after interrupting their enrollment and those who stay out of college; and between associate's degree holders who attend a four-year college and those who do not pursue any further schooling after attaining their associate's degree. Table 4 shows that the estimates of all covariates remain virtually unchanged across these different scenarios of state-specific heterogeneity. Thus, the pattern of SES estimates is not sensitive to accounting for unobserved differences between those who make a specific transition and those who do not.[3]

A different story emerges when I consider individual-specific heterogeneity (Table 5). I estimate a model that allows non-parametric heterogeneity. Specifically, I postulate the existence of two latent subgroups with different risks of making educational transitions (two points of support).[4] When I account for this type of unobserved heterogeneity, the effects of covariates decrease substantially for transitions 1->2 and 1->3, but remain the same for transitions 2->5 and 3->6. In other words, the effects of covariates decrease for college entry but not for college completion. For the transition into enrollment in a two-year college (transition 1->2), accounting for unobserved heterogeneity reduces the effect of parental education by 25 percent, and the effect of cognitive skills, non-cognitive skills, and having graduated from high school by means of a GED all become statistically insignificant. For the transition into enrollment in a four-year college (transition 1->3), accounting for unobserved heterogeneity reduces the effect of parental education by 30 percent, the effects of cognitive

[3] I also tested the sensitivity of SES estimates to a scenario in which I accounted for the mover-stayer problem simultaneously in states 1 and 4. The results were the same as those presented here, namely estimates remain the same across the different specifications.

[4] I also estimated a model with 3 points of support. Estimates were less stable, but the results followed the same pattern described here – the effects of parental education become even smaller in the risk of entering a two- or a four-year college.

skills and high school preparation reduce by about a third, and the effects of non-cognitive skills and having graduated from high school by means of a GED become statistically insignificant.

This decrease in the effect of SES on college entry combined with the maintenance of SES effects on college completion results in a lessening of the pattern of declining SES effects across educational transitions. The implication of this finding is that without accounting for unobserved heterogeneity among students, there is an overstated pattern of decline in SES effects, such that the effects of parental education on college entry are inflated. This evidence is inconsistent with Mare's original argument (1980), in which he states that the presence of unobserved heterogeneity *reduces* the observed effects of SES, but consistent with Mare's more recent recognition (1993) that unobserved heterogeneity may either *increase or decrease* the observed effect of SES across educational transitions.

Conclusions

This paper revises the pattern of declining SES effects documented widely in the educational transitions literature. This revision contributes to the literature in that it proposes a flexible statistical model that allows incorporating the increasing variation in students' trajectories. In particular, I incorporate qualitatively different *types* of destinations within educational transitions, the *timing* at which individuals make educational transitions, and the *sequence* of events students experience within the "major milestones" of their schooling careers. This revision is also warranted in that the model permits to account for two types of unobserved conditions among individuals, one arising from an unaccounted subgroup of individuals who has a zero risk of making certain educational transitions, and another arising from unaccounted conditions among individuals that lead them to have different (but unobserved) risks of progressing through school.

The observed SES effects across educational transitions are consistent with the pattern of waning SES effects documented by the educational transitions literature. The evidence also reveals that SES effects are stronger in the educational trajectory associated with four-year colleges (entry in a four-year college and attainment of a bachelor's degree) than in the educational trajectory associated with two-year colleges (entry in a two-year college and attainment of an associate's degree). However, the *decline* of SES effects seems more dramatic in the case of two-year colleges – since the effect of SES becomes zero between college entry and post-secondary degree attainment.

The effect of SES does not change when I account for state-specific unobserved heterogeneity. However, when I account for individual-specific unobserved heterogeneity, the effect of SES diminishes in the transitions associated with college entry (entry in a two-year college and entry in a four-year college). Since the effect of SES remains the same in the transitions associated with college completion (attainment of an associate's and bachelor's degree), the overall pattern of decline in SES effects is less prominent. This last finding suggests that ignoring unobserved differences among individuals overstates the effect of SES on college entry. More research is needed to shed light on what this unobserved condition may be. This unobserved condition may bias the estimates of SES even if it is not associated with other covariates in the model. The models I estimate include extensive controls for sociodemographic characteristics, cognitive skills, non-cognitive skills, and educational trajectories. Clearly, research needs to go further in investigating other possible factors that may affect the different rates at which individuals progress through school.

Cognitive skills and high school academic preparation are positively associated with post-secondary enrollment and degree attainment. In contrast, non-cognitive attributes and cumulative health are only associated with post-secondary enrollment.

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Table 1: Definition of Independent Variables Used in Statistical Analysis

Variables	*Description*	*Notes*
Age [1]	Years	Respondent's age at each of month
Race and ethnicity	Coded as a set of three dummy indicators: Black, Hispanic, and White (reference category)	From sample identification screener of all NSLY79 subsamples interviewed in 1979
Female	1=yes 0=no	From sample identification screener of all NSLY79 subsamples interviewed in 1979. Male is reference category
Two-parent household	1=yes 0=no	Respondent's living arrangement at age 14, from 1979 interview. The reference category includes female-headed households and other family arrangements (e.g. father-stepmother, stepfather-mother)
Below poverty threshold [1, 2]	1=yes 0=no	Respondent's family was below poverty threshold in previous calendar year. This measure varies annually (e.g. in each calendar year) in the person-month file.
Parents' education	Coded as a set of two dummy indicators: 12 years or less, and 13 or more years (reference category)	Highest grade completed by respondent's mother or father at 1979 interview (0-20 years). In case any of the parents' education was missing, the other parent's education was included.
Top quartile in AFQT test	1=yes 0=no	Original variable corresponds to the 1989 revised percentiles in Armed Forces Qualification Test.
College preparatory high school curriculum	1=yes 0=no	Type of school curriculum pursued in last high school grade attended, measured in surveys 1979-1985. Original categories of curriculum types were Vocational, Commercial, General program, and College preparatory. The reference category includes the first three types of curriculum.
Above median self-esteem [1]	1=yes 0=no	Recoded into dummy category indicating self-esteem above median. Original scale: 0-30, with higher values reflect higher self-esteem. Reliability of 1980 measure: .8309. Reliability of 1987 measure: .8652. In the person-month file this variable changes at the month of the interview in 1987.
External locus of control	1=yes 0=no	Rotter Locus of Control Scale, measured in 1979 interview. Original scale was 4-16, with low scores indicating high internal control and high scores indicate high external control. Values at or above the median (=10) were recoded into a dummy category indicating external locus of control.
Obesity [1, 2]	1=yes 0=no	Body Mass Index >=30. Body Mass Index is weight in kilograms divided by height in meters squared. Height corresponds to average height, self-reported in surveys of 1981, 1982, and 1985. Weight is self-reported in 1981, 1982, 1985, 1986, 1988, 1989, 1990, 1992, 1993, 1994, 1996, 1998, 2000, and 2002. In the person-month file this variable changes at the month of the interview of every available survey wave when weight was reported.

Table 1: Definition of Independent Variables Used in Statistical Analysis (cont.)

Variables	*Description*	*Notes*
Presence of any health limitation [1, 2]	1=yes 0=no	In each survey, respondents report whether health keeps them from working on a job for pay, whether they are limited in the kind of work they do on a job for pay because of their health, and whether they are limited in the amount of work they do on a job for pay because of their health. If respondents respond affirmatively to any of these questions, they get asked the question "when did the health limitation started" and they report a corresponding month and year. Based on this information I constructed a series that registers, for every month, the presence of a health limitation for each respondent.
High school completion via GED	1=yes 0=no	Respondent completed high school by passing GED test (reference category: high school diploma).
Delay in post-secondary enrollment (any college)	1=yes 0=no	Eight or more months elapsed between respondent's high school graduation and his/her first enrollment in any college (either two- or four-year college).
First college is two-year college/four-year college	1=yes 0=no	Respondent first month of post-secondary enrollment corresponds to a two-year college/four-year college.
Interruption in enrollment in two-year college/four-year college	1=yes 0=no	Respondent had at least one gap (e.g. one stop-out episode) in his/her enrollment in a two-year college/four-year college that lasted eight or more months.
% of part-time enrollment in post-secondary education (in each type of college) [1, 2]	0-100	Proportion of time the respondent has been enrolled in college as a part-time student up to each particular month.
Ever transferred from two- to four-year college	1=yes 0=no	Respondent transferred at least once from a two-year college to a four-year college until the attainment of an associate's degree/bachelor's degree, until attrition from the sample, or until last month of observation (month of interview in 2002 wave)
Ever transferred from four- to two-year college	1=yes 0=no	Respondent transferred at least once from a four-year college to a two-year college until the attainment of an associate's degree/bachelor's degree, until attrition from the sample, or until last month of observation (month of interview in 2002 wave)
Running number of months enrolled in two-year college		Cumulative number of months the respondent has been enrolled in a two-year college since high school graduation. This running sum includes any two-year college (not necessarily enrollment the same institution) and at any moment after high school graduation (not necessarily continuous enrollment that occurs in the same spell)
Running number of months enrolled in four-year college		Cumulative number of months the respondent has been enrolled in a four-year college since high school graduation. This running sum includes any four-year college (not necessarily enrollment the same institution) at any moment after high school graduation (not necessarily continuous enrollment that occurs in the same spell)
Running number of months not enrolled in any college		Cumulative number of months the respondent has not been enrolled in any college since high school graduation. This running sum includes non-enrollment that occurs continuously or intermittingly.

[1] Time-varying covariates

[2] Variables used in the analysis as cumulative proportions (0-100)

Table 2: Observed Transition Matrix between States

State of origin		State of destination 1 HSG	2 2-yr col.	3 4-yr col.	4 no college	5 AA	6 BA	row total	# transitions out of each state	# transitions remaining in each state	# transitions into each state
1	count	1,307	1,018	1,025	--	--	--	3,350	2,043	1,307	3,350
high school	crude probab.	0.3901	0.3039	0.3060	--	--	--	1.0000	61.0%	39.0%	100%
graduation	mean duration	229.09	31.89	15.22	--	--	--				
2	count	--	33	*190*	*1,734*	239	--	2,196	2,163	33	2,196
enrollment in	crude probab.	--	0.0150	*0.0865*	*0.7896*	0.1088	--	1.0000	98.5%	1.5%	100%
two-year college	mean duration	--	8.94	*17.21*	*9.14*	22.29	--				
3	count	--	*95*	34	*1,471*	--	667	2,267	2,233	34	2,267
enrollment in	crude probab.	--	*0.0419*	0.0150	*0.6489*	--	0.2942	1.0000	98.5%	1.5%	100%
four-year college	mean duration	--	*12.73*	15.44	*12.79*	--	39.72				
4	count	--	*1,083*	*963*	1,159	--	--	3,205	2,046	1,159	3,205
no enrollment in	crude probab.	--	*0.3379*	*0.3005*	0.3616	--	--	1.0000	63.8%	36.2%	100%
any college	mean duration	--	*35.60*	*25.66*	144.47	--	--				
5	count	--	--	89	--	150	--	239	89	150	239
attainment of	crude probab.	--	--	0.3724	--	0.6276	--	1.0000	37.2%	62.8%	100%
associate's degree	mean duration	--	--	40.36	--	153.73	--				
6	count	--	--	--	--	--	667	667	0	667	667
attainment of	crude probab.	--	--	--	--	--	1.0000	1.0000	0.0%	100.0%	100%
bachelor's degree	mean duration	--	--	--	--	--	1.00				

Unidirectional transitions betweeen states

Bidirectional transitions betweeen states

State in which respondents were during the last period of observation

Table 3: Estimates from multi-state hazard model

	Model 1				Model 2				Model 3				Model 4			
	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)
Transition from high school graduation to enrollment in two-year college (1 -> 2)																
Baseline hazard																
Intercept	-2.73	0.03	***	0.06	0.27	0.25		1.31	-0.04	0.26		0.96	-0.07	0.26		0.93
Slope	-0.72	0.02	***	0.49	-0.45	0.03	***	0.63	-0.42	0.03	***	0.65	-0.43	0.03	***	0.65
Demographic and socioeconomic characteristics																
Age					-0.14	0.01	***	0.87	-0.14	0.01	***	0.87	-0.13	0.01	***	0.88
Black					0.07	0.08		1.07	0.12	0.09		1.13	0.11	0.09		1.12
Hispanic					0.38	0.09	***	1.47	0.42	0.09	***	1.52	0.42	0.09	***	1.53
Female					0.28	0.06	***	1.33	0.30	0.06	***	1.35	0.29	0.06	***	1.34
Parental education: 12 or less years					-0.47	0.08	***	0.62	-0.40	0.08	***	0.67	-0.40	0.08	***	0.67
Family below poverty threshold in 1979/80 interview					-0.21	0.08	**	0.81	-0.19	0.08	*	0.83	-0.18	0.08	*	0.84
Two-parent household at age 14					-0.13	0.07		0.88	-0.13	0.07		0.88	-0.14	0.07	*	0.87
Cognitive skills and academic preparation																
High school curriculum: College preparatory									0.29	0.07	***	1.34	0.28	0.07	***	1.33
Test scores: Top quartile									0.45	0.09	***	1.56	0.43	0.09	***	1.54
Non-cognitive traits																
Self-esteem: Above median									0.17	0.06	**	1.19	0.17	0.06	**	1.18
% of time spent in with a health limitation									-0.01	0.13		0.99	0.00	0.13		1.00
Educational trajectories																
High school completion via GED													-0.22	0.11	*	0.80

Table 3: Estimates from multi-state hazard model (cont.)

	Model 1				Model 2				Model 3				Model 4			
	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)
Transition from high school graduation to enrollment in four-year college (1 -> 3)																
Baseline hazard																
Intercept	-2.75	0.03	***	0.06	4.21	0.35	***	67.53	2.91	0.35	***	18.44	2.91	0.36	***	18.41
Slope	-0.88	0.03	***	0.42	-0.44	0.04	***	0.65	-0.31	0.04	***	0.74	-0.31	0.04	***	0.74
Demographic and socioeconomic characteristics																
Age					-0.33	0.02	***	0.72	-0.32	0.02	***	0.73	-0.31	0.02	***	0.73
Black					0.03	0.08		1.03	0.31	0.09	***	1.36	0.29	0.09	***	1.34
Hispanic					0.05	0.10		1.05	0.16	0.09		1.18	0.17	0.09		1.19
Female					0.07	0.06		1.07	0.14	0.06	*	1.15	0.12	0.06	*	1.13
Parental education: 12 or less years					-0.80	0.09	***	0.45	-0.54	0.09	***	0.58	-0.54	0.09	***	0.58
Family below poverty threshold in 1979/80 interview					-0.32	0.09	***	0.73	-0.23	0.09	**	0.80	-0.20	0.09	*	0.82
Two-parent household at age 14					0.27	0.08	***	1.32	0.26	0.08	***	1.30	0.25	0.08	**	1.28
Cognitive skills and academic preparation																
High school curriculum: College preparatory									1.04	0.06	***	2.82	1.02	0.06	***	2.78
Test scores: Top quartile									1.20	0.07	***	3.32	1.18	0.07	***	3.25
Non-cognitive traits																
Self-esteem: Above median									0.23	0.06	***	1.26	0.22	0.06	***	1.24
% of time spent in with a health limitation									-0.40	0.14	**	0.67	-0.38	0.14	**	0.69
Educational trajectories																
High school completion via GED													-0.55	0.17	**	0.58

Table 3: Estimates from multi-state hazard model (cont.)

	Model 1				Model 2				Model 3				Model 4			
	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)
Transition from enrollment in two-year college to attainment of an associate's degree (2 -> 5)																
Baseline hazard																
Intercept	-2.88	0.10	***	0.06	-3.23	0.34	***	0.04	-3.42	0.40	***	0.03	-3.79	0.43	***	0.02
Slope	1.12	0.07	***	3.06	1.09	0.08	***	2.98	1.10	0.08	***	3.00	1.13	0.08	***	3.09
Demographic and socioeconomic characteristics																
Age					0.00	0.01		1.00	0.01	0.01		1.01	0.03	0.02	*	1.03
Black					-0.30	0.21		0.74	-0.23	0.22		0.80	-0.48	0.22	*	0.62
Hispanic					-0.28	0.21		0.75	-0.23	0.22		0.79	-0.38	0.23		0.68
Female					0.17	0.16		1.19	0.20	0.16		1.22	0.26	0.17		1.29
Parental education: 12 or less years					0.03	0.17		1.03	0.04	0.17		1.05	0.17	0.19		1.18
Family below poverty threshold in 1979/80 interview					0.32	0.18		1.38	0.34	0.19		1.40	0.29	0.19		1.33
Two-parent household at age 14					0.30	0.17		1.35	0.29	0.17		1.34	0.22	0.17		1.25
Cognitive skills and academic preparation																
High school curriculum: College preparatory									0.02	0.16		1.02	0.03	0.17		1.03
Test scores: Top quartile									0.23	0.18		1.26	0.18	0.19		1.20
Non-cognitive traits																
Self-esteem: Above median									0.04	0.14		1.04	0.04	0.15		1.04
Cumulative % of time spent in with a health limitation									-0.13	0.30		0.88	-0.21	0.30		0.81
Educational trajectories																
High school completion via GED													-0.05	0.32		0.95
First college attended is four-year college													0.08	0.22		1.08
Cumulative % of part-time enrollment in 2-yr col.													-1.10	0.20	***	0.33
Running # months enrolled in 4-year college X 10													0.20	0.09	*	1.22
Running # of months not enrolled in any college X 10													-0.03	0.04		0.97

Table 3: Estimates from multi-state hazard model (cont.)

	Model 1				Model 2				Model 3				Model 4			
	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)
Transition from enrollment in four-year college to attainment of a bachelor's degree (3 -> 6)																
Baseline hazard																
Intercept	-4.02	0.11	***	0.02	-5.52	0.30	***	0.00	-6.11	0.33	***	0.00	-6.40	0.36	***	0.00
Slope	1.83	0.06	***	6.21	1.74	0.06	***	5.69	1.73	0.06	***	5.64	1.81	0.06	***	6.10
Demographic and socioeconomic characteristics																
Age					0.07	0.01	***	1.07	0.08	0.01	***	1.09	0.09	0.01	***	1.09
Black					-0.36	0.10	***	0.70	-0.28	0.12	*	0.76	-0.28	0.12	*	0.75
Hispanic					-0.44	0.15	**	0.64	-0.41	0.15	**	0.66	-0.40	0.16	*	0.67
Female					0.15	0.09		1.16	0.17	0.09		1.18	0.20	0.10	*	1.22
Parental education: 12 or less years					-0.40	0.14	**	0.67	-0.31	0.15	*	0.73	-0.31	0.16		0.73
Family below poverty threshold in 1979/80 interview					-0.01	0.16		0.99	0.00	0.16		1.00	-0.01	0.16		0.99
Two-parent household at age 14					0.03	0.10		1.03	0.02	0.10		1.02	0.04	0.11		1.04
Cognitive skills and academic preparation																
High school curriculum: College preparatory									0.25	0.09	**	1.28	0.27	0.10	**	1.31
Test scores: Top quartile									0.19	0.11		1.21	0.20	0.11		1.22
Non-cognitive traits																
Self-esteem: Above median									0.05	0.09		1.05	0.00	0.09		1.00
Cumulative % of time spent in with a health limitation									-0.20	0.18		0.82	-0.14	0.19		0.87
Educational trajectories																
High school completion via GED													-1.10	1.39		0.33
Completed AA degree only or before bachelor's													-0.55	0.15	***	0.58
First college attended is two-year college													0.23	0.15		1.26
Cumulative % of part-time enrollment in 4-yr col.													-0.93	0.16	***	0.39
Running # months enrolled in 2-year college X 10													0.19	0.03	***	1.21
Running # of months not enrolled in any college X 10													0.00	0.02		1.00

Table 3: Estimates from multi-state hazard model (cont.)

	Model 1				Model 2				Model 3				Model 4			
	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)
Transition from enrollment in two-year college to enrollment in four-year college (2 -> 3)																
Intercept	-2.80	0.08	***	0.06	-2.80	0.08	***	0.06	-2.80	0.09	***	0.06	-2.80	0.09	***	0.06
Slope	0.59	0.08	***	1.81	0.59	0.08	***	1.81	0.59	0.08	***	1.81	0.59	0.08	***	1.81
Transition from enrollment in two-year college to enrollment in no college (2 -> 4)																
Intercept	-0.55	0.02	***	0.58	-0.55	0.02	***	0.58	-0.55	0.02	***	0.58	-0.55	0.02	***	0.58
Slope	-0.04	0.02		0.96	-0.04	0.02		0.96	-0.04	0.02		0.96	-0.04	0.02		0.96
Transition from enrollment in four-year college to enrollment in two-year college (3 -> 2)																
Intercept	-4.05	0.11	***	0.02	-4.05	0.11	***	0.02	-4.05	0.11	***	0.02	-4.05	0.11	***	0.02
Slope	-0.16	0.11		0.85	-0.16	0.12		0.85	-0.16	0.12		0.85	-0.16	0.12		0.85
Transition from enrollment in four-year college to enrollment in no college (3 -> 4)																
Intercept	-1.31	0.03	***	0.27	-1.31	0.03	***	0.27	-1.31	0.03	***	0.27	-1.31	0.03	***	0.27
Slope	-0.25	0.02	***	0.78	-0.25	0.02	***	0.78	-0.25	0.02	***	0.78	-0.25	0.02	***	0.78
Transition from enrollment in no college to enrollment in two-year college (4 -> 2)																
Intercept	-2.67	0.03	***	0.07	-2.67	0.03	***	0.07	-2.67	0.03	***	0.07	-2.67	0.03	***	0.07
Slope	-0.44	0.02	***	0.64	-0.44	0.02	***	0.64	-0.44	0.02	***	0.64	-0.44	0.03	***	0.64
Transition from enrollment in no college to enrollment in four-year college (4 -> 3)																
Intercept	-2.73	0.03	***	0.07	-2.73	0.03	***	0.07	-2.73	0.03	***	0.07	-2.73	0.03	***	0.07
Slope	-0.54	0.03	***	0.58	-0.54	0.03	***	0.58	-0.54	0.03	***	0.58	-0.54	0.03	***	0.58
Transition from attainment of an associate's degree to enrollment in four-year college (5 -> 3)																
Intercept	-2.76	0.12	***	0.06	-2.76	0.12	***	0.06	-2.76	0.12	***	0.06	-2.76	0.12	***	0.06
Slope	-0.59	0.07	***	0.56	-0.59	0.07	***	0.56	-0.59	0.08	***	0.56	-0.59	0.08	***	0.56
Log-likelihood				-25,389				-24,865				-24,474				-24,403
N				3,350				3,350				3,350				3,350
number of parameters				22				50				66				79
BIC				50,956				50,137				49,483				49,446

* p < .05   ** p < .01   *** p < .001

Table 4: Estimates from multi-state hazard model under different scenarios of state-specific heterogeneity or p-heterogeneity

Full model: controls for sociodemographic characteristics, cognitive and non-cognitive skills, and educational trajectory

	from table 2, model 4				p-heterog. in State 1				p-heterog. in State 4				p-heterog. in State 5			
	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)
Transition from high school graduation to enrollment in two-year college (1 -> 2)																
Baseline hazard																
Intercept	-0.07	0.26		0.93	0.01	0.26		1.01	-0.07	0.26		0.93	-0.07	0.26		0.93
Slope	-0.43	0.03	***	0.65	-0.40	0.04	***	0.67	-0.43	0.03	***	0.65	-0.43	0.03	***	0.65
Demographic and socioeconomic characteristics																
Age	-0.13	0.01	***	0.88	-0.13	0.01	***	0.88	-0.13	0.01	***	0.88	-0.13	0.01	***	0.88
Black	0.11	0.09		1.12	0.13	0.09		1.14	0.11	0.09		1.12	0.11	0.09		1.12
Hispanic	0.42	0.09	***	1.53	0.46	0.09	***	1.58	0.42	0.09	***	1.53	0.42	0.09	***	1.53
Female	0.29	0.06	***	1.34	0.29	0.07	***	1.33	0.29	0.06	***	1.34	0.29	0.06	***	1.34
Parental education: 12 or less years	-0.40	0.08	***	0.67	-0.43	0.08	***	0.65	-0.40	0.08	***	0.67	-0.40	0.08	***	0.67
Family below poverty threshold in 1979/80 interview	-0.18	0.08	*	0.84	-0.19	0.08	*	0.83	-0.18	0.08	*	0.84	-0.18	0.08	*	0.84
Two-parent household at age 14	-0.14	0.07	*	0.87	-0.14	0.07	*	0.87	-0.14	0.07	*	0.87	-0.14	0.07	*	0.87
Cognitive skills and academic preparation																
High school curriculum: College preparatory	0.28	0.07	***	1.33	0.34	0.08	***	1.41	0.28	0.07	***	1.33	0.28	0.07	***	1.33
Test scores: Top quartile	0.43	0.09	***	1.54	0.48	0.10	***	1.62	0.43	0.09	***	1.54	0.43	0.09	***	1.54
Non-cognitive traits																
Self-esteem: Above median	0.17	0.06	**	1.18	0.17	0.06	**	1.18	0.17	0.06	**	1.18	0.17	0.06	**	1.18
% of time spent in with a health limitation	0.00	0.13		1.00	-0.02	0.13		0.98	0.00	0.13		1.00	0.00	0.13		1.00
Educational trajectories																
High school completion via GED	-0.22	0.11	*	0.80	-0.26	0.11	*	0.77	-0.22	0.11	*	0.80	-0.22	0.11	*	0.80

Table 4: Estimates from multi-state hazard model under different scenarios of state-specific heterogeneity or p-heterogeneity (cont.)

	from table 2, model 4				p-heterog. in State 1				p-heterog. in State 4				p-heterog. in State 5			
	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)
Transition from high school graduation to enrollment in four-year college (1 -> 3)																
Baseline hazard																
Intercept	2.91	0.36	***	18.41	2.88	0.36	***	17.87	2.91	0.36	***	18.41	2.91	0.36	***	18.41
Slope	-0.31	0.04	***	0.74	-0.27	0.04	***	0.77	-0.31	0.04	***	0.74	-0.31	0.04	***	0.74
Demographic and socioeconomic characteristics																
Age	-0.31	0.02	***	0.73	-0.31	0.02	***	0.74	-0.31	0.02	***	0.73	-0.31	0.02	***	0.73
Black	0.29	0.09	***	1.34	0.31	0.09	***	1.36	0.29	0.09	***	1.34	0.29	0.09	***	1.34
Hispanic	0.17	0.09		1.19	0.22	0.09	*	1.25	0.17	0.09		1.19	0.17	0.09		1.19
Female	0.12	0.06	*	1.13	0.09	0.06		1.10	0.12	0.06	*	1.13	0.12	0.06	*	1.13
Parental education: 12 or less years	-0.54	0.09	***	0.58	-0.58	0.09	***	0.56	-0.54	0.09	***	0.58	-0.54	0.09	***	0.58
Family below poverty threshold in 1979/80 interview	-0.20	0.09	*	0.82	-0.21	0.09	*	0.81	-0.20	0.09	*	0.82	-0.20	0.09	*	0.82
Two-parent household at age 14	0.25	0.08	**	1.28	0.25	0.08	**	1.28	0.25	0.08	**	1.28	0.25	0.08	**	1.28
Cognitive skills and academic preparation																
High school curriculum: College preparatory	1.02	0.06	***	2.78	1.08	0.07	***	2.95	1.02	0.06	***	2.78	1.02	0.06	***	2.78
Test scores: Top quartile	1.18	0.07	***	3.25	1.22	0.07	***	3.39	1.18	0.07	***	3.25	1.18	0.07	***	3.25
Non-cognitive traits																
Self-esteem: Above median	0.22	0.06	***	1.24	0.21	0.06	***	1.24	0.22	0.06	***	1.24	0.22	0.06	***	1.24
% of time spent in with a health limitation	-0.38	0.14	**	0.69	-0.40	0.14	**	0.67	-0.38	0.14	**	0.69	-0.38	0.14	**	0.69
Educational trajectories																
High school completion via GED	-0.55	0.17	**	0.58	-0.60	0.17	***	0.55	-0.55	0.17	**	0.58	-0.55	0.17	**	0.58

Table 4: Estimates from multi-state hazard model under different scenarios of state-specific heterogeneity or p-heterogeneity (cont.)																
	from table 2, model 4				p-heterog. in State 1				p-heterog. in State 4				p-heterog. in State 5			
	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)
Transition from enrollment in two-year college to attainment of an associate's degree (2 -> 5)																
Baseline hazard																
Intercept	-3.79	0.43	***	0.02	-3.79	0.43	***	0.02	-3.79	0.43	***	0.02	-3.79	0.43	***	0.02
Slope	1.13	0.08	***	3.09	1.13	0.08	***	3.09	1.13	0.08	***	3.09	1.13	0.08	***	3.09
Demographic and socioeconomic characteristics																
Age	0.03	0.02	*	1.03	0.03	0.02	*	1.03	0.03	0.02	*	1.03	0.03	0.02	*	1.03
Black	-0.48	0.22	*	0.62	-0.48	0.22	*	0.62	-0.48	0.22	*	0.62	-0.48	0.22	*	0.62
Hispanic	-0.38	0.23		0.68	-0.38	0.23		0.68	-0.38	0.23		0.68	-0.38	0.23		0.68
Female	0.26	0.17		1.29	0.26	0.17		1.29	0.26	0.17		1.29	0.26	0.17		1.29
Parental education: 12 or less years	0.17	0.19		1.18	0.17	0.19		1.18	0.17	0.19		1.18	0.17	0.19		1.18
Family below poverty threshold in 1979/80 interview	0.29	0.19		1.33	0.29	0.19		1.33	0.29	0.19		1.33	0.29	0.19		1.33
Two-parent household at age 14	0.22	0.17		1.25	0.22	0.17		1.25	0.22	0.17		1.25	0.22	0.17		1.25
Cognitive skills and academic preparation																
High school curriculum: College preparatory	0.03	0.17		1.03	0.03	0.17		1.03	0.03	0.17		1.03	0.03	0.17		1.03
Test scores: Top quartile	0.18	0.19		1.20	0.18	0.19		1.20	0.18	0.19		1.20	0.18	0.19		1.20
Non-cognitive traits																
Self-esteem: Above median	0.04	0.15		1.04	0.04	0.15		1.04	0.04	0.15		1.04	0.04	0.15		1.04
Cumulative % of time spent in with a health limitation	-0.21	0.30		0.81	-0.21	0.30		0.81	-0.21	0.30		0.81	-0.21	0.30		0.81
Educational trajectories																
High school completion via GED	-0.05	0.32		0.95	-0.05	0.32		0.95	-0.05	0.32		0.95	-0.05	0.32		0.95
First college attended is four-year college	0.08	0.22		1.08	0.08	0.22		1.08	0.08	0.22		1.08	0.08	0.22		1.08
Cumulative % of part-time enrollment in 2-yr col.	-1.10	0.20	***	0.33	-1.10	0.20	***	0.33	-1.10	0.20	***	0.33	-1.10	0.20	***	0.33
Running # months enrolled in 4-year college X 10	0.20	0.09	*	1.22	0.20	0.09	*	1.22	0.20	0.09	*	1.22	0.20	0.09	*	1.22
Running # of months not enrolled in any college X 10	-0.03	0.04		0.97	-0.03	0.04		0.97	-0.03	0.04		0.97	-0.03	0.04		0.97

Table 4: Estimates from multi-state hazard model under different scenarios of state-specific heterogeneity or p-heterogeneity (cont.)																
	from table 2, model 4				p-heterog. in State 1				p-heterog. in State 4				p-heterog. in State 5			
	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)
Transition from enrollment in four-year college to attainment of a bachelor's degree (3 -> 6)																
Baseline hazard																
Intercept	-6.40	0.36	***	0.00	-6.40	0.36	***	0.00	-6.40	0.36	***	0.00	-6.40	0.36	***	0.00
Slope	1.81	0.06	***	6.10	1.81	0.06	***	6.10	1.81	0.06	***	6.10	1.81	0.06	***	6.10
Demographic and socioeconomic characteristics																
Age	0.09	0.01	***	1.09	0.09	0.01	***	1.09	0.09	0.01	***	1.09	0.09	0.01	***	1.09
Black	-0.28	0.12	*	0.75	-0.28	0.12	*	0.75	-0.28	0.12	*	0.75	-0.28	0.12	*	0.75
Hispanic	-0.40	0.16	*	0.67	-0.40	0.16	*	0.67	-0.40	0.16	*	0.67	-0.40	0.16	*	0.67
Female	0.20	0.10	*	1.22	0.20	0.10	*	1.22	0.20	0.10	*	1.22	0.20	0.10	*	1.22
Parental education: 12 or less years	-0.31	0.16		0.73	-0.31	0.16		0.73	-0.31	0.16		0.73	-0.31	0.16		0.73
Family below poverty threshold in 1979/80 interview	-0.01	0.16		0.99	-0.01	0.16		0.99	-0.01	0.16		0.99	-0.01	0.16		0.99
Two-parent household at age 14	0.04	0.11		1.04	0.04	0.11		1.04	0.04	0.11		1.04	0.04	0.11		1.04
Cognitive skills and academic preparation																
High school curriculum: College preparatory	0.27	0.10	**	1.31	0.27	0.10	**	1.31	0.27	0.10	**	1.31	0.27	0.10	**	1.31
Test scores: Top quartile	0.20	0.11		1.22	0.20	0.11		1.22	0.20	0.11		1.22	0.20	0.11		1.22
Non-cognitive traits																
Self-esteem: Above median	0.00	0.09		1.00	0.00	0.09		1.00	0.00	0.09		1.00	0.00	0.09		1.00
Cumulative % of time spent in with a health limitation	-0.14	0.19		0.87	-0.14	0.19		0.87	-0.14	0.19		0.87	-0.14	0.19		0.87
Educational trajectories																
High school completion via GED	-1.10	1.39		0.33	-1.10	1.39		0.33	-1.10	1.40		0.33	-1.10	1.39		0.33
Completed AA degree only or before bachelor's	-0.55	0.15	***	0.58	-0.55	0.15	***	0.58	-0.55	0.15	***	0.58	-0.55	0.15	***	0.58
First college attended is two-year college	0.23	0.15		1.26	0.23	0.15		1.26	0.23	0.15		1.26	0.23	0.15		1.26
Cumulative % of part-time enrollment in 4-yr col.	-0.93	0.16	***	0.39	-0.93	0.16	***	0.39	-0.93	0.16	***	0.39	-0.93	0.16	***	0.39
Running # months enrolled in 2-year college X 10	0.19	0.03	***	1.21	0.19	0.03	***	1.21	0.19	0.03	***	1.21	0.19	0.03	***	1.21
Running # of months not enrolled in any college X 10	0.00	0.02		1.00	0.00	0.02		1.00	0.00	0.02		1.00	0.00	0.02		1.00

Table 4: Estimates from multi-state hazard model under different scenarios of state-specific heterogeneity or p-heterogeneity (cont.)

	from table 2, model 4				p-heterog. in State 1				p-heterog. in State 4				p-heterog. in State 5			
	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)
Transition from enrollment in two-year college to enrollment in four-year college (2 -> 3)																
Intercept	-2.80	0.09	***	0.06	-2.80	0.09	***	0.06	-2.80	0.09	***	0.06	-2.80	0.09	***	0.06
Slope	0.59	0.08	***	1.81	0.59	0.08	***	1.81	0.59	0.08	***	1.81	0.59	0.08	***	1.81
Transition from enrollment in two-year college to enrollment in no college (2 -> 4)																
Intercept	-0.55	0.02	***	0.58	-0.55	0.02	***	0.58	-0.55	0.02	***	0.58	-0.55	0.02	***	0.58
Slope	-0.04	0.02		0.96	-0.04	0.02		0.96	-0.04	0.02		0.96	-0.04	0.02		0.96
Transition from enrollment in four-year college to enrollment in two-year college (3 -> 2)																
Intercept	-4.05	0.11	***	0.02	-4.05	0.11	***	0.02	-4.05	0.11	***	0.02	-4.05	0.11	***	0.02
Slope	-0.16	0.12		0.85	-0.16	0.12		0.85	-0.16	0.12		0.85	-0.16	0.12		0.85
Transition from enrollment in four-year college to enrollment in no college (3 -> 4)																
Intercept	-1.31	0.03	***	0.27	-1.31	0.03	***	0.27	-1.31	0.03	***	0.27	-1.31	0.03	***	0.27
Slope	-0.25	0.02	***	0.78	-0.25	0.02	***	0.78	-0.25	0.02	***	0.78	-0.25	0.02	***	0.78
Transition from enrollment in no college to enrollment in two-year college (4 -> 2)																
Intercept	-2.67	0.03	***	0.07	-2.67	0.03	***	0.07	-1.98	0.04	***	0.14	-2.67	0.03	***	0.07
Slope	-0.44	0.03	***	0.64	-0.44	0.03	***	0.64	-0.15	0.03	***	0.86	-0.44	0.03	***	0.64
Transition from enrollment in no college to enrollment in four-year college (4 -> 3)																
Intercept	-2.73	0.03	***	0.07	-2.73	0.03	***	0.07	-2.03	0.03	***	0.13	-2.73	0.03	***	0.07
Slope	-0.54	0.03	***	0.58	-0.54	0.03	***	0.58	-0.28	0.03	***	0.76	-0.54	0.03	***	0.58
Transition from attainment of an associate's degree to enrollment in four-year college (5 -> 3)																
Intercept	-2.76	0.12	***	0.06	-2.76	0.12	***	0.06	-2.76	0.12	***	0.06	-1.70	0.24	***	0.18
Slope	-0.59	0.08	***	0.56	-0.59	0.08	***	0.56	-0.59	0.08	***	0.56	-0.40	0.12	**	0.67
Constant of p-heterogeneity																
State 1		--			-3.05	0.29	***	0.05		--				--		
State 4		--				--			-0.83	0.05	***	0.43		--		
State 5		--				--				--			0.11	0.28		1.12
Log-likelihood				-24,403				-24,394				-24,222				-24,401
N				3,350				3,350				3,350				3,350
number of parameters				79				80				80				80
BIC				49,446				49,437				49,093				49,451

* p < .05 ** p < .01 *** p < .001

Table 5: Estimates from multi-state hazard model with individual heterogeneity

Full model: controls for sociodemographic characteristics, cognitive and non-cognitive skills, and educational trajectory

	from table 2, model 4				Model with non-parametric heterogeneity -- 2 points of support			
	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)
Transition from high school graduation to enrollment in two-year college (1 -> 2)								
Baseline hazard								
Intercept	-0.07	0.26		0.93	1.90	0.27	***	6.67
Slope	-0.43	0.03	***	0.65	0.77	0.07	***	2.17
Demographic and socioeconomic characteristics								
Age	-0.13	0.01	***	0.88	-0.30	0.01	***	0.74
Black	0.11	0.09		1.12	0.02	0.09		1.02
Hispanic	0.42	0.09	***	1.53	0.26	0.10	**	1.30
Female	0.29	0.06	***	1.34	0.26	0.07	***	1.30
Parental education: 12 or less years	-0.40	0.08	***	0.67	-0.30	0.09	***	0.74
Family below poverty threshold in 1979/80 interview	-0.18	0.08	*	0.84	-0.10	0.09		0.90
Two-parent household at age 14	-0.14	0.07	*	0.87	-0.22	0.08	**	0.80
Cognitive skills and academic preparation								
High school curriculum: College preparatory	0.28	0.07	***	1.33	-0.06	0.08		0.94
Test scores: Top quartile	0.43	0.09	***	1.54	-0.10	0.10		0.90
Non-cognitive traits								
Self-esteem: Above median	0.17	0.06	**	1.18	0.09	0.07		1.09
% of time spent in with a health limitation	0.00	0.13		1.00	0.08	0.13		1.08
Educational trajectories								
High school completion via GED	-0.22	0.11	*	0.80	0.01	0.12		1.01
Factor loading for unobserved heterogeneity	--				4.98	0.16	***	146

Table 5: Estimates from multi-state hazard model with individual heterogeneity (cont.)

	from table 2, model 4				Model with non-parametric heterogeneity -- 2 points of support			
	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)
Transition from high school graduation to enrollment in four-year college (1 -> 3)								
Baseline hazard								
Intercept	2.91	0.36	***	18.41	4.27	0.38	***	71.22
Slope	-0.31	0.04	***	0.74	1.66	0.07	***	5.28
Demographic and socioeconomic characteristics								
Age	-0.31	0.02	***	0.73	-0.52	0.02	***	0.60
Black	0.29	0.09	***	1.34	0.12	0.10		1.13
Hispanic	0.17	0.09		1.19	-0.01	0.11		0.99
Female	0.12	0.06	*	1.13	0.18	0.07	*	1.19
Parental education: 12 or less years	-0.54	0.09	***	0.58	-0.38	0.10	***	0.69
Family below poverty threshold in 1979/80 interview	-0.20	0.09	*	0.82	-0.08	0.10		0.92
Two-parent household at age 14	0.25	0.08	**	1.28	0.04	0.09		1.04
Cognitive skills and academic preparation								
High school curriculum: College preparatory	1.02	0.06	***	2.78	0.66	0.08	***	1.93
Test scores: Top quartile	1.18	0.07	***	3.25	0.69	0.09	***	2.00
Non-cognitive traits								
Self-esteem: Above median	0.22	0.06	***	1.24	0.12	0.07		1.12
% of time spent in with a health limitation	-0.38	0.14	**	0.69	-0.33	0.18		0.72
Educational trajectories								
High school completion via GED	-0.55	0.17	**	0.58	-0.29	0.16		0.75
Factor loading for unobserved heterogeneity	--				7.27	0.16	***	1,442

Table 5: Estimates from multi-state hazard model with individual heterogeneity (cont.)								
	from table 2, model 4				Model with non-parametric heterogeneity -- 2 points of support			
	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)
Transition from enrollment in two-year college to attainment of an associate's degree (2 -> 5)								
Baseline hazard								
Intercept	-3.79	0.43	***	0.02	-3.97	0.54	***	0.02
Slope	1.13	0.08	***	3.09	1.12	0.08	***	3.08
Demographic and socioeconomic characteristics								
Age	0.03	0.02	*	1.03	0.04	0.02	*	1.04
Black	-0.48	0.22	*	0.62	-0.49	0.22	*	0.61
Hispanic	-0.38	0.23		0.68	-0.39	0.23		0.68
Female	0.26	0.17		1.29	0.26	0.17		1.30
Parental education: 12 or less years	0.17	0.19		1.18	0.17	0.19		1.18
Family below poverty threshold in 1979/80 interview	0.29	0.19		1.33	0.29	0.19		1.34
Two-parent household at age 14	0.22	0.17		1.25	0.23	0.18		1.26
Cognitive skills and academic preparation								
High school curriculum: College preparatory	0.03	0.17		1.03	0.03	0.17		1.03
Test scores: Top quartile	0.18	0.19		1.20	0.17	0.19		1.19
Non-cognitive traits								
Self-esteem: Above median	0.04	0.15		1.04	0.04	0.15		1.04
Cumulative % of time spent in with a health limitation	-0.21	0.30		0.81	-0.20	0.31		0.82
Educational trajectories								
High school completion via GED	-0.05	0.32		0.95	-0.05	0.32		0.95
First college attended is four-year college	0.08	0.22		1.08	0.08	0.23		1.08
Cumulative % of part-time enrollment in 2-yr col.	-1.10	0.20	***	0.33	-1.09	0.21	***	0.34
Running # months enrolled in 4-year college X 10	0.20	0.09	*	1.22	0.20	0.09	*	1.22
Running # of months not enrolled in any college X 10	-0.03	0.04		0.97	-0.03	0.04		0.97
Factor loading for unobserved heterogeneity	--				0.10	0.19		1.11

Table 5: Estimates from multi-state hazard model with individual heterogeneity (cont.)

	from table 2, model 4				Model with non-parametric heterogeneity -- 2 points of support			
	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)
Transition from enrollment in four-year college to attainment of a bachelor's degree (3 -> 6)								
Baseline hazard								
Intercept	-6.40	0.36	***	0.00	-7.06	0.48	***	0.00
Slope	1.81	0.06	***	6.10	1.76	0.07	***	5.79
Demographic and socioeconomic characteristics								
Age	0.09	0.01	***	1.09	0.11	0.02	***	1.12
Black	-0.28	0.12	*	0.75	-0.32	0.12	*	0.73
Hispanic	-0.40	0.16	*	0.67	-0.42	0.16	**	0.66
Female	0.20	0.10	*	1.22	0.21	0.10	*	1.24
Parental education: 12 or less years	-0.31	0.16		0.73	-0.29	0.16		0.75
Family below poverty threshold in 1979/80 interview	-0.01	0.16		0.99	0.01	0.16		1.01
Two-parent household at age 14	0.04	0.11		1.04	0.02	0.11		1.02
Cognitive skills and academic preparation								
High school curriculum: College preparatory	0.27	0.10	**	1.31	0.26	0.10	**	1.30
Test scores: Top quartile	0.20	0.11		1.22	0.19	0.11		1.21
Non-cognitive traits								
Self-esteem: Above median	0.00	0.09		1.00	-0.01	0.10		0.99
Cumulative % of time spent in with a health limitation	-0.14	0.19		0.87	-0.12	0.19		0.89
Educational trajectories								
High school completion via GED	-1.10	1.39		0.33	-1.13	1.19		0.32
Completed AA degree only or before bachelor's	-0.55	0.15	***	0.58	-0.56	0.15	***	0.57
First college attended is two-year college	0.23	0.15		1.26	0.24	0.15		1.27
Cumulative % of part-time enrollment in 4-yr col.	-0.93	0.16	***	0.39	-0.92	0.16	***	0.40
Running # months enrolled in 2-year college X 10	0.19	0.03	***	1.21	0.17	0.04	***	1.19
Running # of months not enrolled in any college X 10	0.00	0.02		1.00	-0.02	0.02		0.98
Factor loading for unobserved heterogeneity		--			0.34	0.16	*	1.40

Table 5: Estimates from multi-state hazard model with individual heterogeneity (cont.)

	from table 2, model 4				Model with non-parametric heterogeneity -- 2 points of support			
	Est.	S.E.		exp(Est)	Est.	S.E.		exp(Est)
Transition from enrollment in two-year college to enrollment in four-year college (2 -> 3)								
Intercept	-2.80	0.09	***	0.06	-2.80	0.09	***	0.06
Slope	0.59	0.08	***	1.81	0.59	0.08	***	1.81
Transition from enrollment in two-year college to enrollment in no college (2 -> 4)								
Intercept	-0.55	0.02	***	0.06	-0.36	0.03	***	0.70
Slope	-0.04	0.02		1.81	-0.04	0.02		0.96
Factor loading for unobserved heterogeneity		--			-0.36	0.05	***	0.70
Transition from enrollment in four-year college to enrollment in two-year college (3 -> 2)								
Intercept	-4.05	0.11	***	0.06	-4.05	0.11	***	0.02
Slope	-0.16	0.12		1.81	-0.16	0.12		0.85
Transition from enrollment in four-year college to enrollment in no college (3 -> 4)								
Intercept	-1.31	0.03	***	0.06	-0.57	0.04	***	0.57
Slope	-0.25	0.02	***	1.81	-0.19	0.03	***	0.83
Factor loading for unobserved heterogeneity		--			-0.97	0.05	***	0.38
Transition from enrollment in no college to enrollment in two-year college (4 -> 2)								
Intercept	-2.67	0.03	***	0.06	-2.60	0.04	***	0.07
Slope	-0.44	0.03	***	1.81	-0.44	0.03	***	0.64
Factor loading for unobserved heterogeneity		--			-0.13	0.06	*	0.88
Transition from enrollment in no college to enrollment in four-year college (4 -> 3)								
Intercept	-2.73	0.03	***	0.06	-3.11	0.05	***	0.04
Slope	-0.54	0.03	***	1.81	-0.54	0.03	***	0.58
Factor loading for unobserved heterogeneity		--			0.60	0.06	***	1.82
Transition from attainment of an associate's degree to enrollment in four-year college (5 -> 3)								
Intercept	-2.76	0.12	***	0.06	-2.76	0.13	***	0.06
Slope	-0.59	0.08	***	1.81	-0.59	0.08	***	0.56
Log-likelihood				-24,403				-23,938
N				3,350				3,350
number of parameters				79				88
BIC				49,446				48,590

* p < .05   ** p < .01   *** p < .001

Figure 1: Definition of state space