Research in Higher Education, Vol. 48, No. 7, November 2007 (© 2007)
DOI: 10.1007/s11162-007-9050-y

THE EFFECT OF LOCAL LABOR MARKET CONDITIONS IN THE 1990S ON THE LIKELIHOOD OF COMMUNITY COLLEGE STUDENTS' PERSISTENCE AND ATTAINMENT

Gregory S. Kienzl,*,† Mariana Alfonso,** and Tatiana Melguizo***

This study analyzes the influence of local labor market conditions on the year-to-year persistence and attainment decisions of a sample of traditional-aged students who attended community colleges during the 1990s. The findings suggest that the enrollment and attainment decisions of these first-time community college students were not made purely as a response to changes in tuition costs, but rather the result of a more interconnected process whereby changes in tuition, local labor market conditions, and the relative change in both are considered. For those who are sensitive to these relative costs, the likelihood of dropping out is increased. Of those who remained enrolled, the evidence suggests that an increase in tuition appears to provide an incentive or extra motivation to finish a degree, especially an associate's degree. This finding does not support the raising of in-state tuition to improve student outcomes; rather it draws attention to the complexity involved in student persistence and attainment decision-making.

KEY WORDS: community colleges; local labor markets; persistence; attainment; commuting zones.

INTRODUCTION

Often neglected in studies that examine persistence and attainment in postsecondary education are the economic realities faced by students while they are enrolled. For example, a sudden boost in the local economy may raise wages, providing enough incentive for students to continue their enrollment and eventually complete a degree. However, for

*American Institutes for Research, Washington, DC, 20006 USA.
**Research Department, Inter-American Development Bank, Washington, DC, USA.
***Rossier School of Education, University of Southern California, Los Angeles, CA, USA.
†Address correspondence to: Gregory S. Kienzl, American Institutes for Research, 1990 K St, NW, Fifth Floor, Washington, DC, 20006 USA. E-mail: gkienzl@air.org.

some individuals, this tangible gain to a college education must be weighed against an increase in the indirect (or opportunity) costs associated with rising wages. The opportunity costs of postsecondary education are primarily the wages that students would have earned had they chose not to enroll in college. For students who are uncertain about their attainment prospects, this cost can increase the likelihood that they will temporarily stop out or drop out entirely from postsecondary education. Unfortunately, the empirical research trails these theoretical inferences, especially when dealing with students who are enrolled at a community college.[1]

Community college students tend to be more sensitive to changing local labor market conditions than 4-year college students. They are more likely to seek a credential in an occupational field, view themselves as employees rather than students, and work while enrolled (Bailey et al., 2004). Moreover, in a widely cited review of the research on the economic benefits of sub-baccalaureate education, Grubb (2002, p. 302) contends that "the pre-baccalaureate labor market appears to be quite local" in that employers needing workers with a sub-baccalaureate credential search locally and that students with a sub-baccalaureate education look to local industries for employment. Even with such strong ties to the local labor market, are community college students making enrollment and attainment decisions largely in response to year-to-year shifts in the local economy?

In this study, the traditional views of persistence and attainment in postsecondary education are expanded so that the relationships between local labor market conditions, state-level tuition costs, and the relative change of both can be examined. A single-event behavioral model for both processes—persistence and attainment—is developed and applied on a sample of first-time community college students in fall 1992. The analysis focuses on community college students because they are most likely to be at the margin between college and work (Kane and Rouse, 1999) and, thus, expected to be the most affected by changing labor market conditions.

The unique influences of these direct and opportunity costs on educational outcomes are estimated after controlling for a comprehensive set of student demographic and socio-economic characteristics, as well as measures of college preparedness and degree aspirations. The inclusion of these economic determinants is the main contribution of this analysis to the extensive literature on postsecondary students' persistence and attainment. Additional contributions to the economics literature are made by using local labor market characteristics rather than aggregate state-level measures, as well as modeling the extent to which students

respond to relative changes in local labor market conditions and in-state tuition costs. Ultimately, the proposed models account for the continuous reevaluation of the costs and benefits faced by students prior to enrolling for another year of postsecondary education.

The study develops as follows. In the next section, the relevant literature regarding the economic factors that influence postsecondary enrollment decision-making is reviewed. In section three, the datasets and variables used in the empirical estimations are explained along with the empirical strategy. Findings are discussed in section four, and the study concludes with a summary of main results and areas of future research.

LITERATURE REVIEW

A major tenet of human capital theory states that direct and opportunity costs of college affect an individual's decision to, first, enroll in college and then remain enrolled until completion or when economic conditions favor work rather than schooling (Becker, 1967; Mincer, 1974; Stratton, O'Toole, and Wetzel, 2005). Yet many of the models developed to explain student persistence and attainment in postsecondary education posit that high school academic preparation (Adelman, 1999); psychosocial readiness and motivation (Allen, 1999; Napoli and Wortman, 1998); academic and social integration opportunities while enrolled in postsecondary education (Pascarella and Terenzini, 2005; Tinto, 1993); sufficient guidance and counseling (Grubb and associates, 1999); alignment of educational and occupational expectations (Schneider and Stevenson, 1999); and financial aid (Cabrera, Nora, and Castaneda, 1992; Cofer and Somers, 2000a; DesJardins, Ahlburg, and McCall, 2002; Dowd and Coury, 2006) all have significant effects on the probability of staying in college and, ultimately, attaining a degree. With few exceptions, these models have been designed with the traditional[2] 4-year college student in mind and, as such, perform rather poorly when used to explain the transitional behavior of community college students.[3] More critically, none of them take into account how year-to-year changes in the local labor market affect students' persistence and attainment.

At best, previous research has found a countercyclical relationship between enrollments in community colleges and local economic conditions (Betts and McFarland, 1995; Grubb, 2002). Simply stated, the former increases when the latter worsens. The next step in this strand of research—linking local labor market conditions, state-level tuition, and students' enrollment and attainment decision-making—deserves some renewed attention.

Of the few studies that have examined this issue—although without focusing particularly on community college students—their findings underscore the key role of labor market conditions on students' enrollment decision-making. In an earlier work, Gustman and Steinmeier (1981) use the 1976 Survey of Income and Education dataset to find that enrollment probabilities of individuals aged 21–22 years old and with more than a high school education are very sensitive to variations in the wage offers; more sensitive than for individuals who stop their education at high school. Their results suggest that wage offers have a larger impact on postsecondary re-enrollment decisions than on initial college enrollment.

Using National Longitudinal Study of Youth data to assess the impact of wages, work effort and schooling cost on the waiting time to re-enroll among individuals not enrolled in college, Light (1996) finds that higher wages, working more hours a week, and increased school costs significantly reduce the probability of re-enrollment. Her results highlight the close inter-relationship between the job market and schooling decisions, and suggest that enrollment and persistence should be affected by unemployment rates and college costs.

More recently, Arkes (2005), in an attempt to introduce a new instrumental variable to estimate the effect of years of schooling on earnings, uses the 1980 Census microsample and finds that higher unemployment rates lead to increased educational attainment. His finding suggests that unemployment affects educational attainment through a substitution effect—a higher unemployment rate lowers the opportunity cost of schooling—rather than through an income effect—which posits that a higher unemployment rate leads individuals to drop out to help supplement family income. Lastly, using the 1989/1994 Beginning Postsecondary Longitudinal Survey, Stratton et al. (2005) find that a higher unemployment rate increases the probability of remaining continuously enrolled in college, although it does not affect the probability of dropping out or that of stopping out.

A key limitation of the aforementioned studies is that their measures of labor market conditions are taken either from the national or state level. Labor market conditions vary considerably within and across states and, thus, national or state unemployment rates cannot fully capture the true opportunity costs of college. Another important limitation of the previous studies is that they do not distinguish between enrollment at 2-year and 4-year colleges, although college choice studies suggest that students who enroll in community colleges are more sensitive to college costs than those who choose a 4-year college (Alfonso, 2005; Manski and Wise, 1983; Ordovensky, 1995; Rouse, 1994).

DESCRIPTION OF THE DATA AND METHODOLOGY

Datasets and sample

This study combines a number of different national datasets over a 9 year period. The main dataset is the postsecondary transcript file of the National Education Longitudinal Survey (NELS:88/2000). NELS:88/2000 allows student transitions in and out of postsecondary education and the labor market to be observed for 8 years after high school graduation in 1992, which is deemed to be sufficient length of time for the students in the sample to attain a postsecondary credential. Conversely, it is also enough time for these students to leave postsecondary education, with some returning and others not.

Transcript data reduce the likelihood of measurement or recall errors inherent in self-reported enrollment information, but the most tangible advantage of using them for this analysis is the precise documentation of when and where students attended college (Adelman, 2004; Adelman, Daniel, and Berkovits, 2003). All postsecondary institutions attended by students are identified in the transcript datafile, which allows secondary information, such as in-state tuition, to be merged in from the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS) surveys. Of particular interest for this study is the location of each postsecondary institution. Using zip codes from the IPEDS Institutional Characteristics survey, institutions (and by extension students) were placed within a local labor market, which is defined in the next section.

Individual-level information from NELS:88/2000 is further complemented with economic data for each year from 1991 to 2000 provided by the U.S. Department of Labor's Current Employment Survey (CES). Whereas average in-state tuition is calculated to measure the direct costs of college, CES data allow county-level employment and wage data to be aggregated in order to measure the opportunity costs of college. All in-state tuition and wage amounts are expressed in constant 2000 dollars.

The sample consists of students who started postsecondary education at a community college.[4] Of the more than 12,100 students in NELS:88/2000 who were interviewed in the 12th grade, 3278 observations remained after a number of restrictions. They included limiting the sample to high school graduates or those with a high school equivalency diploma, such as a general educational development (GED) credential, who enrolled directly into postsecondary education the fall following high

school graduation, and were located 8 years later.[5] Only students for which there is complete information in each of the variables described in the next three sections are included in the sample. Thus, the final sample contains 1425 community college students. However, the persistence and attainment models require the data to be structured in a person-period format. Table 1 presents a depiction of the person-period structure using variables that are described in more detail below. Under this data structure, each enrollment period, defined as an academic year starting on July 1st of a year and ending on June 30th of the following year, represents an observation. As a result, the sample size increases to 5321 observations.

Definition of "local"

Given that local economic conditions are central to the analysis, units of geography that are large enough to encompass employment opportunities within a reasonable distance are needed. Such units are shown in Fig. 1. They were developed by Tolbert and Sizer (1996), who analyzed 1990 Census data on county-to-county flows of commuters to and from work using a hierarchical clustering framework. Their analysis resulted in 741 unique geographic areas in the United States, which the authors termed *commuting zones*.

There are several aspects of commuting zones that make them highly desirable for this type of analysis. Like labor markets, commuting zones are not necessarily bound by single county or state borders. Relying on commuting patterns, not imposed boundaries, allows for more realistic representation of a local labor market. In addition, they lie between counties and metropolitan statistical areas (MSAs) in size, but unlike MSAs, commuting zones cover every area of the country. As a result, non-metro labor markets can be examined.

Commuting zones are also large enough to capture variations in economic activity in these non-metro markets (Tolbert and Sizer, 1996). Lastly, since they are based on a contiguous cluster of counties, county-level employment and wage information can be aggregated and, in this analysis, weighted based on county-level population figures from the 2000 Census. The specific measures of local economic conditions used in this study are the average annual wage in the commuting zone from 1992 to 2000 and, for each year that a student is enrolled, the change in average annual wages from the previous year to the current.

TABLE 1. Example of Person-Period Data Structure, Time-Variant Characteristics, and Education Outcomes

		Time-variant characteristics			Outcomes		
ID	Period enrolled	In-state tuition (×1000 in 2000 dollars)	Average wage in commuting zone (×1000 in 2000 dollars)	Rate of tuition increase greater than commuting zone wage	Dropped out of post -secondary education	Attained a degree at any point	Attained an associate's degree
1	1	1.253	34.453	0	0	0	0
1	2	1.322	34.304	1	0	0	0
1	3	1.331	34.372	1	0	0	0
1	6	2.514	24.966	0	0	0	0
1	7	2.224	30.814	0	0	1	0
2	1	1.709	28.563	0	0	0	0
2	2	1.814	28.665	1	0	0	0
2	3	1.876	28.987	1	0	0	0
2	4	2.004	29.397	1	0	1	1
3	1	2.333	23.914	1	0	0	0
3	2	2.419	23.597	1	0	0	0
3	3	2.416	24.056	0	0	1	0
4	1	1.477	19.571	1	0	0	0
4	2	1.582	19.586	1	0	0	0
4	3	1.602	19.597	1	0	0	0
4	4	1.667	29.026	1	0	0	0
4	7	1.750	30.805	1	0	0	0
4	8	1.784	31.927	0	0	0	0
4	9	1.739	32.293	0	1	0	0
5	1	2.027	30.757	0	0	0	0
5	2	2.165	30.580	1	0	0	0
5	3	2.192	30.821	1	0	0	0
5	4	2.238	31.227	1	1	0	0
6	1	0.975	22.572	0	0	0	0
6	2	1.121	22.245	1	0	0	0
6	3	1.214	20.198	1	0	0	0
6	4	1.228	20.334	1	0	0	0
6	5	1.295	20.632	1	0	0	0
6	7	1.277	23.762	0	0	1	1

Source: National Education Longitudinal Survey:88/2000, Integrated Postsecondary Education Data System, and Current Employment Survey, various years.

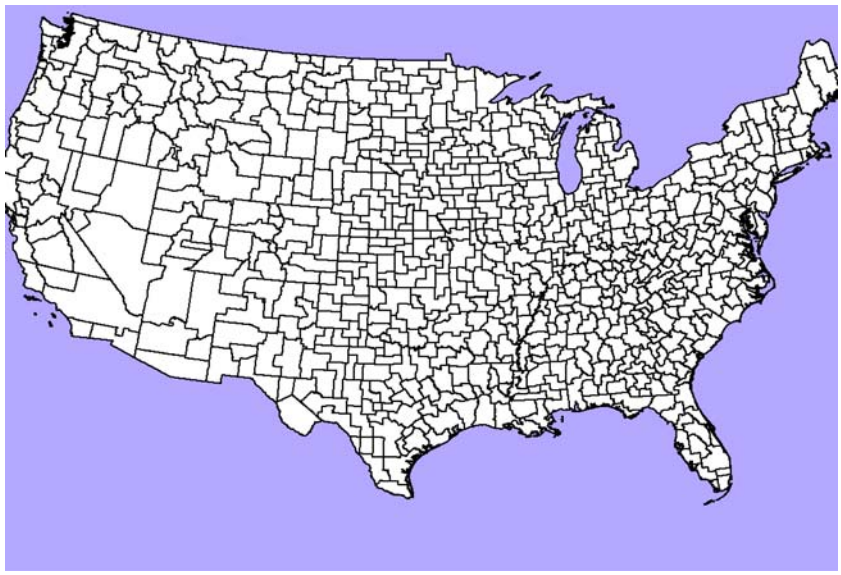

FIG. 1. Depiction of commuting zones in the United States, 1990.

Dependent variables

Three educational outcomes of community college students are examined in this study. First, the persistence process is modeled by observing if (and when) students drop out and do not return to postsecondary education. If students have not attained a postsecondary credential and are no longer enrolled (earning at least one credit in the academic year) within the 8 years, they are assigned a value of 1; otherwise a value of 0 is given for each period enrolled. The second and third outcomes involve the attainment process.[6] Conceptually speaking, degree attainment is counter-related to persistence in postsecondary education. Earning any credential is first used to model the overall attainment process, and then associate's degree attainment is examined separately as a special case. An associate's degree continues to be a central outcome for community college students and college administrators and, therefore, is worth additional inspection. More formally, a value of 0 is assigned if students complete at least one credit during the enrollment period but do not attain a degree during that year and 1 if attainment of any degree (or an associate's degree) during the period under consideration is observed.

Students are "at risk" of dropping out or earning a credential during each enrollment period. If students do not enroll or earn a single credit during the enrollment period, a missing value is assigned to all three dependent variables. This is because students who are not enrolled or earn any credit are not at risk of dropping out or attaining a degree during that period. In effect, the "clock" stops during these breaks in the enrollment spell. Also, if students attain a degree during period t, missing values are assigned to the outcome variable for all subsequent periods because they are no longer at risk for attaining that degree or dropping out.

Independent variables—time-invariant

A common set of student background characteristics are assumed to be constant across enrollment periods. They include students' race/ethnicity, sex, math and reading test scores from the 12th grade, GED receipt, and bachelor's degree expectation (a dummy variable indicating whether students in grade 12 expected to earn a bachelor's degree). The socioeconomic status of students, as measured in 1992, was divided into quartiles and also used as an explanatory variable. The variable was developed by the National Center for Education Statistics (NCES) from a composite of parental education, parental occupation and household income and has been adjusted to reflect the backgrounds of the community college sub-sample.

Independent variables—time-variant

Whereas time-invariant variables remain constant for each person in each period, time-varying variables can take on different values in different time periods. The time-varying explanatory variables used in the model include the annual in-state tuition at public 2-year colleges in the state where the student first attended college,[7] as well as local labor market conditions. The direct effects of both in-state tuition and average annual wage at each commuting zone are estimated, but given that the sample is based on students who have presumably already decided that the benefits of acquiring additional education outweigh the costs, it is necessary to capture the *relative* change in costs and benefits.

To accomplish this, the ratio between the in-state tuition of public 2-year colleges and the average annual wages in the commuting zone in the state where the student first attended a postsecondary institution is calculated. Instances where increases in in-state tuition are greater than increases in average wage are indicated with a binary variable. For

example, if in-state tuition at public 2-year institutions increases, say, 5% in a given year, but average wages in the commuting zone increases only 3%, then this event is indicated in the model with a binary variable. As mentioned earlier, Table 1 presents examples from actual data to assist in the conceptualization of the time-varying measures used in the analysis.[8]

The rationale behind the inclusion of the relative change variable in the models is that, at the margin, if increases in in-state tuition outpace increases in the average wage in the commuting zone, then students are likely to leave postsecondary education—either permanently or return when conditions improve. Therefore, it is expected that after controlling for in-state tuition and average wage, this comparison of the rates of change will have an additional negative effect on education outcomes.

Estimation strategy

A reduced-form model of both processes can be expressed in a multilevel cost-benefit (or utility maximization) equation below.

$$y^*_{it} = \beta_0 + X'_i\beta_1 + X'_{it}\beta_2(\mathrm{i} = 1,\ldots,\mathrm{N};\ \mathrm{t} = 1,\ldots,\mathrm{j},\ldots,\mathrm{T}) \qquad (1)$$

$$y_{it} = 1 \text{ if } y^*_{it};\ \text{otherwise } y_{it} = 0$$

where y^* is the unobservable propensity to drop out or complete a college degree, y is the observed binary outcome, i denote the student population of interest and t is the time period, which is an academic year. The complete set of covariates should include X_i, a vector of individual characteristics, fixed (or assumed fixed) over time, like gender, race, parental background, or educational expectation; and X_{it} a vector of direct and indirect college costs that vary over time, such as in-state tuition, average annual wage in the local labor market, and the relative change of both tuition and wages.

Typically, researchers interested in persistence and attainment chose two points in time to examine the evolution of the process. In the first period, when students start their postsecondary education, a set of relevant variables are observed. Most are assumed to be related to the outcome(s) of interest, such as graduation, drop out, still enrolled, or transfer, and constant over time. After a data-determined period of time, the direct effect of these factors is estimated on the educational outcome(s) or some combination of policy-relevant education outcomes.

However, this type of estimation approach fails to account for the longitudinal process involved. Time-varying covariates cannot be modeled and censored cases cannot be handled.

Discrete-time event history analysis provides a natural approach to model the occurrence of an event and its timing while controlling for time-varying covariates. The statistical method used in this study to model the educational outcomes of community college students is an extension of the single-event, discrete-time hazard model (Allison, 1984; Singer and Willett, 2003). The discrete-time hazard function is the conditional probability that student i will drop out or earn a degree in time period j given that either event had not occurred in an earlier time period. The basic discrete-time hazard function can be written as:

$$h_{ij} = \Pr[y_i = j | y_i \geq j, X_i, X_{it}] \tag{2}$$

where h_{ij} is the hazard function given that student i has not dropped out or attained a degree before j, and observable heterogeneity is measured by the set of time-invariant and -variant individual, institutional, and local labor market factors. Algebraically, assuming a logit link, the relationship in (2) can be written as:

$$\log_{it}(h_{it}) = \beta_0 + X_i'\beta_i + X_{it}'\beta_{it} \tag{3}$$

In Eq. (3), by taking the log of the hazard, a linear relationship between the conditioning data and logit hazard has now been defined. The Xs have been defined above and βs are parameters to be estimated. Taking an inverse transformation of both sides, the following equation is derived:

$$\log_{it}^{-1}(h_{it}) = \frac{1}{1 + e^{-\left(\beta_0 + X_i'\beta_i + X_{it}'\beta_{it}\right)}} \tag{4}$$

The relationship between the predictors and the hazard are now nonlinear and analogous to the usual logistic regression model (Singer and Willett, 2003).

Using a person-period data structure, the log-likelihood function can be computed using a standard logistic regression routine. Maximizing this function with respect to βs will provide consistent parameter estimates for whether and when an event occurs, as well as the effect of time-invariant and varying predictors.

The analysis was conducted without population weights as recommended by Winship and Radbill (1994) and Muthén and Satorra (1995). In general, there were four compelling reasons not to weight the data. First, sample selection was based on exogenous criteria—initial enroll-

ment in a community college. Second, variables that corresponded to oversampled sub-populations in NELS:88/2000, such as Black and Hispanic students, were included in the model to reduce the possibility of bias. Third, with the data reconfigured into a panel structure, using a weight would have resulted in a representational population more than 3 times larger than the true population of first-time community college students (1.4 million compared to 550,000). Lastly, all of the weights provided in the NELS:88/2000 file would be constant for each individual—now represented by a unique observation for each period of enrollment—over time. Longitudinal weights, the type most suited for an analysis of one observation per individual over time, are larger than cross-sectional weights to adjust for sample attrition. Using a longitudinal weight would bias the estimates associated with the earlier periods of enrollment, leading to inflated standard errors (a loss of efficiency) and, likely, Type I errors. Nevertheless, to alleviate any concerns regarding blatant differences between the weighted and unweighted samples, the means were compared using a one-way *t*-test and the estimates of the unweighted time-invariant predictors were, with the exception of the Other race/ethnicity variable,[9] statistically similar to the weighted estimates.[10] Although the data are not weighted, the standard errors of the estimates are calculated using the Huber/White sandwich method; otherwise known as ''robust'' standard errors.[11]

The persistence and attainment models are estimated using a method called *generalized estimating equations* (GEE). GEE can estimate the marginal expectation of a set of outcomes as a function of a set of explanatory variables.[12] Before proceeding, two features of the GEE estimation procedure warrant further explanation: how to interpret GEE estimates and the treatment of time. Unlike fixed or random-effects models, the GEE estimates represent the *average* effect of a unit shift in a predictor on a particular outcome across the entire population holding all other predictors constant. In other words, the parameter is the population-averaged effect rather than the usual interpretation for a specific individual (Lipsitz, Laird, and Harrington, 1991; Zeger, Liang, and Albert, 1988). For example, the odds ratio reported for females in the persistence model should be interpreted as the odds of dropping out for an average female compared with the odds of dropping out for an average male. Besides of this slightly different interpretation, the evidence suggests that population-averaged coefficients are smaller than for conditional models, although significance levels and inferences are generally similar (Neuhaus, Kalbfleisch, and Hauck, 1991).

The treatment of time is another feature worth explaining in greater detail. A fully flexible construction of time within the hazard function

framework would include dummy variables for each period a student is enrolled and, hence, "at risk." This may be the ideal, but alternative and more parsimonious constructs are acceptable if they closely mirror the shape of the fitted hazard probabilities. Figures 2 and 3 show the best comparable alternatives to the full flexible approach. For both the persistence and attainment (and degree) models, expressing time with a constant and a quadratic term largely captures the shape of the fully flexible construct.[13]

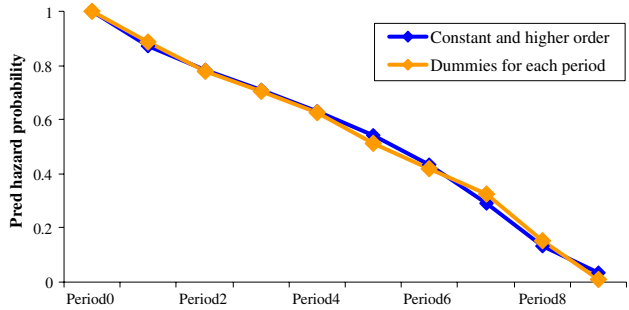

FIG. 2. Comparison of fitted hazard probabilities of dropping out of postsecondary education with constant and higher order versus dummies for each period time trends. Source: National Education Longitudinal Survey:88/2000. Authors' calculations.

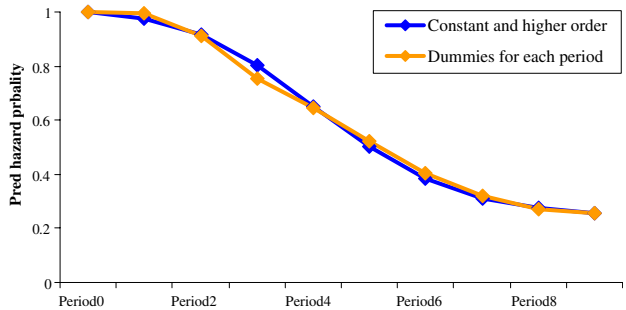

FIG. 3. Comparison of fitted hazard probabilities of attaining any postsecondary credential with constant and higher order versus dummies for each period time trends. Source: National Education Longitudinal Survey:88/2000. Authors' calculations.

DISCUSSION OF FINDINGS

Descriptive characteristics of sample

The descriptive characteristics of the sample of first-time community college students in 1992 are shown in Table 2. A majority of the sample, 51%, is female, and 70% are White, non-Hispanic. There is an under-representation of Black, non-Hispanic students among those who dropped out without attaining a credential. These findings are consistent with previous research (Bailey et al., 2004), and provide some insights into the type of students who are most affected by changing in-state tuition costs and labor market conditions. Additionally, over 71% of the students who initially enrolled in a community college expect to earn a bachelor's degree at some point and, not surprisingly, a greater proportion of degree-attainers in the sample reported having this educational expectation compared to drop outs, 74% versus 69%, respectively.

The overall attainment rate of these students is 48%, which means that 52% dropped out and did not return to postsecondary education at some point during the 8 years. This finding lies near the upper end of the estimates previously reported by Horn and Berger (2004), who reported that 37% of first-time, community college students in the early 1990s completed any degree, and Adelman et al. (2003), who found that 54% of students who took more than 10 credits at a community college did not attain a degree.[14] Of those who attained any postsecondary credential, over half earned an associate's degree. Of the remaining degree attainers, 41% earned a bachelor's degree as their highest award and 8% earned a certificate, but unfortunately there are insufficient sample sizes to apply the attainment model to these two potential outcomes.

The conditional likelihood of community college students dropping out of postsecondary education is greatest in the first 2 years; nearly one-fifth of the sample did not return to postsecondary education after the first period (see Table 3). However, for all but the last two periods, the probability that community college students attained a postsecondary credential—conditional on making it to that particular period—is greater than the probability of dropping out. The expectation is of a degree "spike" in the second period, but with many students attending part-time or transferring to other institutions (mainly 4-year colleges), the conditional probability is largely the same from the second to the sixth period while peaking in the third period. This trend reverses in the last two periods as the conditional likelihood of

TABLE 2. Descriptive Statistics of Community College Students and Local Labor Market Characteristics by Drop Out or Degree Attainment

	Overall		Dropped out		Attained degree	
Outcome	Mean	Std dev	Mean	Std dev	Mean	Std dev
Dropped out of postsecondary education	51.7%					
Attained a degree at any point	48.3%					
Associate's degree as highest attainment	24.7%				51.1%	
Background characteristics						
Female	51.2%		47.1%		55.7%	
White, non-Hispanic [*ref*]	69.9%		63.7%		76.5%	
Black, non-Hispanic	5.5%		7.0%		3.7%	
Hispanic	15.3%		18.6%		11.6%	
Other[a]	9.4%		10.6%		8.1%	
12th grade reading test score	0.51	0.08	0.50	0.08	0.51	0.08
12th grade math test score	0.51	0.08	0.50	0.08	0.52	0.08
Lowest SES quartile	23.8%		26.4%		21.0%	
Middle SES quartile [*ref*]	50.6%		48.7%		52.5%	
Highest SES quartile	25.6%		24.9%		26.5%	
Expects to earn a BA	71.2%		68.5%		74.2%	
Obtained a GED	0.6%		1.0%		0.2%	
Time-varying labor market characteristics						
In-state tuition (×1000 in 2000 dollars)	1.222	0.671	1.176	0.664	1.272	0.676
Average wage in commuting zone (×1000 in 2000 dollars)	28.49	5.34	28.90	5.48	28.06	5.14
Rate of tuition increase greater than commuting zone wage	51.0%		48.0%		54.3%	
Number of observations	5321		2752		2569	
Number of individuals	1425		781		644	

[a]Other includes individuals from Asian/Pacific Islander and Native American backgrounds.
Note: Data are unweighted.
Source: National Education Longitudinal Survey:88/2000, Integrated Postsecondary Education Data System, and Current Employment Survey, various years.

attaining a degree after the sixth period of enrollment decreases to a negligible amount compared to the conditional likelihood of dropping out.

TABLE 3. Distribution of Events by Period

Period when event occurred	Enrolled (%)	Dropped out (%)	Attained degree (%)
Period 1	100.0	16.0	1.4
Period 2	76.8	17.0	17.3
Period 3	58.3	10.3	24.4
Period 4	43.1	9.4	14.1
Period 5	33.5	10.3	14.7
Period 6	24.7	8.6	13.3
Period 7	18.3	5.9	9.3
Period 8	14.8	14.2	5.0
Period 9	5.2	8.3	0.5

Source: National Education Longitudinal Survey:88/2000, Integrated Postsecondary Education Data System, and Current Employment Survey, various years.

Results from GEE estimation

The findings discussed in the remainder of this section focus specifically on the time-variant measures of in-state tuition (direct costs), average wage in the commuting zone (opportunity costs), and instances when the former outpaces the latter (relative costs). As shown in Table 4, comparisons across the persistence and attainment processes reveal quite distinct relationships. According to the results of the persistence model, neither in-state tuition nor average wage in the commuting zone are significant predictors of dropping out of postsecondary education. Presumably, community college students are willing to accept the year-to-year costs and trade-offs of remaining enrolled in postsecondary education.

Recall the description of community college students from the first section and earlier in this section. They tend to be from lower socioeconomic backgrounds, have family and other responsibilities outside of school, and work while enrolled—all of which makes them particularly sensitive to changing costs. The effect of the last time-variant variable, an indicator for each period where in-state tuition increases at a rate greater than the average wage in the commuting zone, supports this claim. In each period where this condition occurs, the estimated odds of a community college student dropping out of postsecondary education is nearly 30% higher than during periods where changes in in-state tuition are less than or equal to changes in average wage in the commuting zone. These students are not making enrollment decisions purely in

TABLE 4. Generalized Estimating Equation Results of Persistence and Attainment Processes with Time-Invariant and -Variant Characteristics

	Models of persistence and attainment process					
	Persistence process		Attainment process			
	Dropped out		Attained degree		Associate's degree	
Time-invariant and -variant variables	Coef. (se)	Odds ratio (se)	Coef. (se)	Odds ratio (se)	Coef. (se)	Odds ratio (se)
Period enrolled	−0.362*** (0.07)	0.696 (0.05)	1.358*** (0.08)	3.888 (0.33)	1.316*** (0.13)	3.729 (0.48)
Period enrolled^2	0.080*** (0.01)	1.083 (0.01)	−0.120*** (0.01)	0.887 (0.01)	−0.142*** (0.02)	0.868 (0.02)
Female	−0.083 (0.09)	0.921 (0.08)	0.357*** (0.09)	1.429 (0.13)	0.418*** (0.12)	1.518 (0.18)
Black, non-Hispanic	0.039 (0.18)	1.039 (0.18)	−0.498** (0.22)	0.608 (0.14)	−0.175 (0.26)	0.839 (0.22)
Hispanic	0.025 (0.13)	1.025 (0.13)	−0.425*** (0.14)	0.654 (0.09)	−0.35 (0.19)	0.705 (0.13)
Other[a]	−0.176 (0.17)	0.838 (0.14)	−0.226 (0.17)	0.798 (0.14)	−0.234 (0.23)	0.791 (0.18)
12th grade reading test score	0.423 (0.66)	1.526 (1.01)	−0.91 (0.64)	0.403 (0.26)	−0.492 (0.83)	0.612 (0.51)
12th grade math test score	−2.901*** (0.69)	0.055 (0.04)	2.554*** (0.7)	12.860 (9.00)	3.155*** (0.92)	23.460 (21.66)
Lowest SES quartile	−0.016 (0.11)	0.984 (0.11)	−0.098 (0.11)	0.907 (0.10)	−0.153 (0.14)	0.858 (0.12)
Highest SES quartile	−0.347*** (0.11)	0.707 (0.08)	−0.124 (0.10)	0.884 (0.09)	−0.287** (0.14)	0.751 (0.11)
Expects to earn a BA	−0.534*** (0.10)	0.586 (0.06)	−0.126 (0.10)	0.881 (0.09)	−0.273** (0.12)	0.761 (0.09)
Obtained a GED	0.342 (0.62)	1.407 (0.88)	−1.632 (0.86)	0.195 (0.17)	−0.656 (0.82)	0.519 (0.43)
In-state tuition (×1,000 in 2000 dollars)	0.107 (0.07)	1.112 (0.08)	0.367*** (0.07)	1.444 (0.10)	0.449*** (0.09)	1.567 (0.14)
Average wage in commuting zone (×1,000 in 2000 dollars)	−0.011 (0.01)	0.989 (0.01)	−0.031*** (0.01)	0.969 (0.01)	−0.023 (0.01)	0.978 (0.01)
Rate of tuition increase greater than commuting zone wage	0.260*** (0.09)	1.297 (0.12)	0.048 (0.10)	1.049 (0.10)	0.107 (0.12)	1.113 (0.13)
Constant	−0.207 (0.44)	0.813 (0.36)	−5.330*** (0.48)	0.005 (0.00)	−6.182*** (0.60)	0.002 (0.00)

TABLE 4. (*Continued*)

Time-invariant and -variant variables	Models of persistence and attainment process					
	Persistence process		Attainment process			
	Dropped out		Attained degree		Associate's degree	
	Coef. (se)	Odds ratio (se)	Coef. (se)	Odds ratio (se)	Coef. (se)	Odds ratio (se)
Concordance correlation coefficient	0.221 (0.01)		0.130 (0.01)		0.074 (0.01)	
Number of observations	5321		5321		5321	
Number of individuals	1425		1425		1425	

[a]Other includes individuals from Asian/Pacific Islander and Native American backgrounds.

Note: Data are unweighted, but standard errors are robust (Huber/White method). $^{**}p < 0.05$, $^{***}p < 0.01$.

Source: National Education Longitudinal Survey:88/2000, Integrated Postsecondary Education Data System, and Current Employment Survey, various years.

response to either in-state tuition increases or wage changes in isolation, but rather are weighing one relative to the other. So what are the consequences of these findings on the results from the attainment models?

Remaining enrolled in a community college has positive, although modest, benefits on the economic well-being of students (Kane and Rouse, 1999; Marcotte et al., 2005). The greatest economic gains are experienced by students who attain degrees. However, the findings from the persistence model indicate that with each passing period, students who are most sensitive to costs are dropping out of the postsecondary education at greater rates than other students. Therefore, they are no longer "at risk" of attaining a degree and the results from the attainment model bear this out. The factors that affect community college students who remain on the path toward a postsecondary credential are quite different than those that explain the drop out process.

Unlike the persistence model, in-state tuition and average wage in the commuting zone affects community college students' attainment over time, but the direction of the effect runs counter to the prevailing wisdom (Cofer and Somers, 2000b; Hippensteel, St. John, and Starkey, 1996; St. John and Starkey, 1994).[15] The evidence suggests that students who enrolled in an area located in a high tuition state are much more likely than those who attended in a lower cost state to complete a postsecondary credential. Specifically, the estimated increase in odds is nearly 45% and improves to 57% in the associate's degree model. This seemingly contrary finding actually has a theoretically grounded explanation. In-state tuition may be viewed by students as a proxy for the expected economic payoff of earning a postsecondary credential. Notice the effect is larger in the associate's degree model than the overall attainment model. Plus, students who pay more than the average cost to attend a community college have an incentive to complete. Another explanation is related to institutional quality. Community colleges that charge relatively higher in-state tuition presumably have greater resources to provide a wider range of programs and support services, such as academic and career counseling. This finding, however, should not be misconstrued as justification for raising tuition at community colleges because doing so will price out certain students, particularly those from lower socio-economic backgrounds.

CONCLUDING REMARKS

Accounting for variations in the local economy is a crucial factor that can explain student persistence and attainment in higher education, but as the previous section showed, it is rarely examined. With constantly

changing economic incentives, it is entirely conceivable that students are reevaluating their costs relative to the benefits after each year and some may even do so after each semester (Light, 1996; Stratton et al., 2005). The economic climate is especially important for community college students because such institutions are uniquely tied to local business and industry. Thus, time-dependent models of postsecondary enrollment and attainment with information on local labor market conditions that vary over time are necessary.

In this study, single-event behavioral models are developed and applied separately to explain the persistence and attainment processes of a cohort of first-time community college students. The economic conditions faced by community college students are measured using an innovative unit of geography, called commuting zones, in order to better understand how local labor characteristics influence the persistence and attainment processes of these students. The results confirm previous findings and call others into question.

The analysis suggests that community college students are not looking at in-state tuition or wages in the local labor market independently when making re-enrollment decisions. Rather the relative change in these costs has a greater influence on their enrollment behavior, which is the very definition of making decisions "at the margin." However, students who are making decisions at the margin are also more likely to modify their behavior once new information about costs becomes available. Unfortunately for these students, the tendency is to drop out of postsecondary education. Such students may return when economic conditions are more favorable, but this cannot be observed with the current data.

In order to accumulate enough credits to earn a degree, students need to stay enrolled. Of those who remained enrolled, the evidence suggests that an increase in tuition appears to provide an incentive or extra motivation to finish a degree, especially an associate's degree. Nevertheless, while increases in in-state tuition itself has a positive effect on degree completion, in general, and associate's degree attainment, more specifically, such increases may adversely affect students from low socio-economic backgrounds who are less likely to persist and, thus, not attain a postsecondary credential.

ACKNOWLEDGEMENTS

The authors wish to thank Tom Bailey, Juan Carlos Calcagno, Tim Leinbach, Lisa Hudson, participants of the Society for Economics and Education meeting, and two anonymous reviewers. The views expressed

herein are those of the authors and do not necessarily represent the official position of the American Institutes for Research, Inter-American Development Bank, and the University of Southern California, respectively.

ENDNOTES

1. Community colleges are defined exclusively as public 2-year postsecondary institutions. The two terms are used interchangeably.
2. The term "traditional" defines students who do not delay enrollment from high school, attend full time while living on campus, and do not interrupt enrollment.
3. For a review of how well these models apply to community college research, see Bailey and Alfonso (2005).
4. Initial attendance was determined from the variable, REFINST, which identifies the true first institution based on students' postsecondary transcripts.
5. The college delayers are expected—if they ever enroll in postsecondary education—to be even more adversely affected by changes in direct and indirect costs. Thus, the estimates reported in this study, which are based on a more traditional-aged college student, are likely to be lower than if the entire NELS:88/2000 sample was used. In other words, the true impact of direct and indirect costs on the sample of first-time community college students is underestimated.
6. Another possible outcome—still enrolled in 2000 without attaining a degree—was considered. However, only a few students fell into this category and, thus, for the sake of simplicity, they were treated as drop outs. A censored term was added to the two models, but its inclusion does not change the overall findings and thus was omitted.
7. Average in-state tuition was chosen as a measure of direct costs rather than the actual tuition charged by institutions due to the likelihood of multi-institutional enrollment patterns of community college students (Adelman, 2005). If community college students change institutions, however, they are likely to remain in-state. Therefore using the average public 2-year tuition addresses this point (Rouse, 1995). Nevertheless, switching institutions can be considered a distinct process, but it is not the focus of this analysis.
8. For additional examples of person-period data, see Singer and Willett (2003) and Scott and Kennedy (2005).
9. The other race/ethnicity combines Asian/Pacific Islanders, Native Americans, and those of multiple or other racial/ethnic backgrounds.
10. The results from this test are available from the authors upon request.
11. See Zeger and Liang (1986) for a thorough discussion of how to derive robust standard errors and Winship and Radbill (1994), Thomas and Heck (2001), and Thomas, Heck, and Bauer (2005) for discussions of their importance.
12. Liang and Zeger (1986), Zeger and Liang (1986) and Zeger et al. (1988) offer a detailed explanation of GEE models and some applications.
13. Higher order terms were examined, such as cubic and quartic, but the models with only a constant and quartic term fit the data best as determined by a Wald chi-squared test. The results from this test are available from the authors upon request.
14. Adelman et al. (2003) and the current analysis both used NELS:88/2000. However, this study did not place a similar restriction of earning more than 10 credits on the data, which explains why the estimates of the former are higher than those of the latter.

15. Unlike the studies cited above, Dowd and Coury (2006) finds that tuition has a positive impact on persistence to the second year and associate's degree attainment over 5 years. However, it should be noted that none of the studies cited used in-state tuition in the same manner as the current analysis nor examined the same educational outcomes, which may partially explain the divergence from most of the findings in the literature.

REFERENCES

Adelman, C. (1999). *Answers in the Tool Box: Academic Intensity, Attendance Patterns, and Bachelor's Degree Attainment*, Office of Educational Research and Improvement, U.S. Department of Education, Washington, DC.

Adelman, C. (2004). *Principal Indicators of Student Academic Histories in Postsecondary Education, 1972–2000*, Institute of Education Sciences, U.S. Department of Education, Washington, DC.

Adelman, C. (2005). *Moving into Town-and Moving On: The Community College in the Lives of Traditional-Age Students*, Office of Vocational and Adult Education, U.S. Department of Education, Washington, DC.

Adelman, C., Daniel, B., and Berkovits, I. (2003). *Postsecondary Attainment, Attendance, Curriculum, and Performance: Selected Results from the NELS:88/2000 Postsecondary Education Transcript Study (PETS)*, National Center for Education Statistics, U.S. Department of Education, Washington, DC.

Alfonso, M. (2005). *What Students of Different Racial/Ethnic Groups do after High School: An Empirical Analysis with Focus on why Students Attend 2-year Colleges*. Paper presented at the Annual Meeting of the American Educational Research Association, Montreal, Quebec.

Allen, D. (1999). Desire to finish college: An empirical link between motivation and persistence. *Research in Higher Education* 40(4): 461–485.

Allison, P. D. (1984). *Event History Analysis: Regression for Longitudinal Event Data*. (Quantitative Applications in the Social Sciences Series paper 46). Thousand Oaks, CA: Sage University Publications.

Arkes, J. (2005). *Using Unemployment Rates as Instruments to Estimate Returns to Schooling*, Rand Corporation, Unpublished manuscript, Santa Monica, CA.

Bailey, T. R., and Alfonso, M. (2005). Paths to persistence: An analysis of research on program effectiveness at community colleges. *Lumina Foundation for Education New Agenda Series*, 6(1).

Bailey, T. R., Leinbach, D. T., Scott, M., Alfonso, M., Kienzl, G.S., and Kennedy, B. (2004). *The Characteristics of Occupational Sub-Baccalaureate Students Entering the New Millennium*, Community College Research Center, Teachers College, Columbia University, New York, NY.

Becker, G. (1967). *Human Capital and the Personal Distribution of Income: An Analytical Approach*, University of Michigan Press, Ann Arbor, MI.

Betts, J. R., and McFarland, L. L. (1995). Safe port in a storm: The impact of labor market conditions on community college enrollments. *Journal of Human Resources* 30(4): 741–765.

Cabrera, A. F., Nora, A., and Castaneda, M. B. (1992). The role of finances in the persistence process: A structural model. *Research in Higher Education* 33(5): 571–593.

Cofer, J., and Somers, P. (2000a). A comparison of the influence of debtload on the persistence of students at public and private colleges. *Journal of Student Financial Aid* 30(2): 39–58.

Cofer, J., and Somers, P. (2000b). Within-year persistence of students at 2-year colleges. *Community College Journal of Research and Practice* 24(10): 785–807.

DesJardins, S. L., Ahlburg, D. A., and McCall, B. P. (2002). Simulating the longitudinal effects of changes in financial aid on student departure from college. *The Journal of Human Resources* 37(3): 653–679.

Dowd, A. C., and Coury, T. (2006). The effect of loans on the persistence and attainment of community college students. *Research in Higher Education* 47(1): 33–62.

Grubb, W. N. (2002). Learning and earning in the middle, part I: National studies of pre-baccalaureate education. *Economics of Education Review* 21(4): 299–321.

Grubb, W.N., and associates (1999). *Honored but Invisible: An Inside Look at Teaching in Community Colleges*. New York, NY: Routledge.

Gustman, A. L., and Steinmeier, T. L. (1981). The impact of wages and unemployment on youth enrollment and labor supply. *The Review of Economics and Statistics* 63(4): 553–560.

Hippensteel, D. G., St. John, E. P., and Starkey, J. B. (1996). Influence of tuition and student aid on within-year persistence by adults in 2-year colleges. *Community College Journal of Research and Practice* 20(3): 233–242.

Horn, L., and Berger, R. (2004). *College Persistence on the Rise? Changes in 5-year Degree Completion and Postsecondary Persistence Rates between 1994 and 2000. (NCES 2005–156)*, National Center for Education Statistics, U.S. Department of Education, Washington, DC.

Kane, T. J., and Rouse, C. E. (1999). The community college: Educating students at the margin between college and work. *Journal of Economic Perspectives* 13(1): 63–84.

Liang, K.-Y., and Zeger, S. L. (1986). Longitudinal data analysis using generalized linear methods. *Biometrika* 73(1): 13–22.

Light, A. (1996). Hazard model estimates of the decision to reenroll in school. *Labour Economics* 2(4): 381–406.

Lipsitz, S. R., Laird, N. M., and Harrington, D. P. (1991). Generalized estimating equations for correlated binary data: Using the odds ratio as a measure of association. *Biometrika* 78(1): 153–160.

Manski, C. F., and Wise, D. A. (1983). *College Choice in America*, Harvard University Press, Cambridge, MA.

Marcotte, D., Bailey, T. R., Borkoski, C., and Kienzl, G. S. (2005). The returns to education at community colleges: Evidence from the National Education Longitudinal Survey. *Education Evaluation and Policy Analysis* 27(2): 157–175.

Mincer, J. (1974). *Schooling, Experience and Earnings*, Columbia University Press, New York, NY.

Muthén, B. O., and Satorra, A. (1995). Complex sample data in structural equation modeling. *Sociological Methodology* 25: 267–316.

Napoli, A. R., and Wortman, P. M. (1998). Psychosocial factors related to retention and early departure of 2-year community college students. *Research in Higher Education* 39(4): 419–455.

Neuhaus, J. M., Kalbfleisch, J. D., and Hauck, W. W. (1991). A comparison of cluster-specific and population-averaged approaches for analyzing correlated binary data. *International Statistical Review / Revue Internationale de Statistique* 59(1): 25–35.

Ordovensky, J. F. (1995). Effects of institutional attributes on enrollment choice: Implications for postsecondary vocational education. *Economics of Education Review* 14(4): 335–350.

Pascarella, E. T., and Terenzini, P. T. (2005). *How College Affects Students: Volume 2: A Third Decade of Research*, Jossey-Bass, San Francisco, CA.

Rouse, C. E. (1994). What to do after high school: The 2-year versus 4-year college enrollment decision. In: Ehrenberg, R. G. (ed.), *Choices and Consequences: Contemporary Policy Issues in Education*, ILR Press, Ithaca, NY, pp. 59–88.

Rouse, C. E. (1995). Democratization or diversion? The effect of community colleges on educational attainment. *Journal of Business and Economic Statistics* 13(2): 217–224.

Schneider, B., and Stevenson, D. (1999). *The Ambitious Generation: America's Teenagers, Motivated but Directionless*, Yale University Press, New Haven, CT.

Scott, M., and Kennedy, B. (2005). Pitfalls in pathways: Some perspectives on competing risks event history analysis in education research. *Journal of Educational and Behavioral Statistics*, 30(4).

Singer, J. D., and Willett, J. B. (2003). *Applied Longitudinal Data Analysis: Modeling Change and Event Occurrence*, Oxford University Press, New York, NY.

St.John, E. P., and Starkey, J. B. (1994). The influence of costs on persistence by traditional college-age students in community colleges. *Community College Journal of Research and Practice* 18(2): 201–213.

Stratton, L., O'Toole, D., and Wetzel, J. (2005). *A Multinomial Logit Model of College Stopout and Dropout Behavior* (Discussion paper 1634). Bonn, Germany, IZA.

Thomas, S. L., and Heck, R. H. (2001). Analysis of large-scale secondary data in higher education research: Potential perils associated with complex sampling designs. *Research in Higher Education* 42(5): 517–540.

Thomas, S. L., Heck, R. H., and Bauer, K. W. (2005). Weighting and adjusting for design effects in secondary data analyses. *New Directions for Institutional Research* 127: 51–72.

Tinto, V. (1993). *Leaving College: Rethinking the Causes and Cures of Student Attrition*, University of Chicago Press, Chicago, IL.

Tolbert, C. M., and Sizer, M. (1996). *U.S. Commuting Zones and Labor Market Areas: A 1990 Update*, Economic Research Service, U.S. Department of Agriculture, Washington, DC.

Winship, C., and Radbill, L. (1994). Sampling weights and regression analysis. *Sociological Methods and Research* 23(2): 230–257.

Zeger, S. L., and Liang, K.-Y. (1986). Longitudinal data analysis for discrete and continuous outcomes. *Biometrics* 42(1): 121–130.

Zeger, S. L., Liang, K-Y., and Albert, P. S. (1988). Models for longitudinal data: A generalized estimating equation approach. *Biometrics* 44(4): 1049–1060.

Received June 7, 2006