Community College Student Success:

What Institutional Characteristics Make a Difference?

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Abstract

The goal of this study is to determine the institutional characteristics that affect the success of community college students as measured by the *individual* student probability of completing a certificate or degree or transferring to a baccalaureate institution. While there is extensive research on the institutional determinants of educational outcomes for K-12 education and a growing literature on this topic for baccalaureate institutions, few researchers have attempted to address the issue for community colleges. Using individual level data from the National Education Longitudinal Study of 1988 (NELS:88) and institutional level data from the Integrated Postsecondary Education Data System (IPEDS), we address two methodological challenges associated with research on community college students: unobserved institutional effects and attendance at multiple institutions. The most consistent results across specifications are the negative relationship between individual success and larger institutional size, and the proportion of part-time faculty and minority students.

JEL Classification: I21, I28

Keywords: input output analysis; resources allocation; expenditures

1. Introduction

Community colleges are a crucial point of access to higher education for low-income and minority students. Many of these students would not be in college if community colleges—or similar institutions—were not available (Alfonso, 2004; Rouse, 1995). The community college access mission is built on low tuition, convenient location, flexible scheduling, an open-door admissions policy, and programs and services designed to support at-risk students with a variety of social and academic barriers to postsecondary success (Cohen & Brawer, 1996).

While community colleges have played a crucial role in opening access to higher education to a wide variety of students, access alone is not sufficient. In recent years, policy makers, educators, accreditors, and scholars have increasingly turned their attention to student persistence and completion, but most of the research and attention has focused on the educational outcomes of baccalaureate students and not those who begin at a community college.

Many community college students never finish a degree. Indeed, for students who enrolled in a community college as their first postsecondary enrollment in the 1995-96 academic year, only 36 percent had completed either a certificate, associate, or bachelor's degree within six years. Another 22 percent were still enrolled in college (about three-fifths of those were enrolled in a four-year institution). Therefore, 42 percent of students who started college in a two-year public institution left college within six years after initial enrollment without a degree or certificate. Low-income, minority, and first-generation college students all have even lower six-year completion rates. And those who do complete among these populations tend to earn lower-level credentials—for example, a certificate rather than an associate or bachelor's degree.[1]

[1] Authors' calculations from the Beginning Postsecondary Student Longitudinal Study of 1995-96.

How can community colleges improve their graduation rates? Certainly one strategy would be to be more selective. Extensive research has shown that students who have stronger high school records, who come from higher income families, whose parents also went to college, who do not delay college entry after high school, who attend full time, and who do not interrupt their college studies are more likely to graduate (Adelman, 1999; 2003; Bailey, Alfonso, Scott, & Leinbach., in press; Cabrera, Burkum, & La Nasa, in press). But such a strategy would defeat the purpose of the open-door community college institution. Community colleges are committed to providing a place in higher education for all students who meet minimum criteria. In many states, students can attend community college even if they do not have a high school diploma or equivalent and in many colleges, a majority of students, after being assessed, are determined not to be prepared for college level coursework. The question facing community colleges, then, is not how to attract better students (although surely many would like to do that), but rather how to do a better job with the types of students they already have. Indeed, there is some evidence that colleges differ in their effectiveness in helping students to graduate since community college graduation rates vary significantly, even after controlling for characteristics of the student body (Bailey, Calcagno, Jenkins, Leinbach, & Kienzl, in press).

The goal of the study presented here is to identify institutional characteristics that affect the success of community college students. In this article, we examine several characteristics that are under the control of either the colleges or state policy makers. They include the size of the college; tuition levels; the use of part-time faculty; overall expenditures per student; the distribution of those expenditures among possible functions such as instruction, administration, and student services; the extent to which the college focuses on certificates as opposed to associate degrees; and the level of financial aid.

While there is extensive research on the determinants of educational outcomes for K-12 education (Hanushek, 1986; 2003) and a growing literature on this topic for baccalaureate institutions, few researchers have attempted to address the issue for community colleges. In this study we measure the probability that a student will have a successful educational outcome, controlling for both their individual characteristics and the characteristics of the institutions that they attend. Our sample is drawn from the National Education Longitudinal Study of 1988 (NELS:88), which also provides our detailed individual level characteristics. Our institutional variables are drawn from the Integrated Postsecondary Education Data System (IPEDS).

The structure of this article is as follows. Section 2 reviews the existing literature addressing the factors that affect student success rates at both baccalaureate institutions and community colleges. In Section 3 we introduce the empirical model using NELS and IPEDS data to measure the institutional effects on community college graduation rates. Section 4 presents the findings from this analysis, and in Section 5 we explore some of these findings in more detail and test the robustness of our analysis. Finally, we summarize and discuss our findings in Section 6.

2. Existing Research

Education economists have studied educational production functions for more than 30 years. Also called an input-output approach, the method allows researchers to understand the effect of *student* and *institutional* characteristics on educational outcomes such as student achievement. In widely-cited articles, Hanushek (1986; 2003) summarized the existing literature

where questions like “Do schools make a difference?” or “Does money matter?” are repeatedly addressed.

Research by economists on community college outcomes has focused on the economic payoff of enrolling in a two-year program and receiving a degree (Grubb, 2002; Kane & Rouse, 1995; 1999) or on the effectiveness of transferring to a four-year institution (Ehrenberg & Smith, 2004; Leigh & Gill, 2003; Rouse, 1995). As a result, production functions are not widely used to estimate the effect of *student* and *institutional* characteristics on higher education outcomes like completion for community college students.

The most widely used conceptual frameworks of persistence and completion developed by education researchers are based on Tinto’s *Student Integration Model* (1993) and Bean’s *Student Attrition Model* (1985). These models have generated an immense amount of research and conceptual development. The central institutional implication of the models is that administrators and faculty should try to foster the academic and social engagement of their students in and with the colleges. The large majority of the research inspired by these models has consisted of single institution studies which do not allow an analysis of the influence of differences in institutional characteristics (Bailey & Alfonso, 2005). Drawing on the various theories that have emerged from the engagement models, Titus (2004; in press) developed a list of institutional characteristics that might influence student persistence, including control (public or private), whether the college is residential, college size, sources of revenue, and patterns of expenditure. Other than those variables, all of the other institutional variables concern the characteristics of the institution’s students. The hypothesis is that the goals, characteristics, academic performance, and behavior of a student’s peers have an influence on that student’s persistence.

There has also been extensive research on individual postsecondary educational outcomes using nationally representative samples such as the Beginning Postsecondary Student Longitudinal Study (BPS) and NELS, and this research has shown that students who have stronger high school records, who come from higher income families, whose parents went also went to college, who do not delay college entry after high school, who attend full time, and who do not interrupt their college studies are more likely to graduate (Adelman, 1999; 2003; Bailey et al., in press; Cabrera et al., in press). However, the models in these studies do not account for variation among institutions and their effects on student outcomes. That is, they do not consider that the characteristics of the institution that a student attends might influence his or her outcome.

In contrast, the growing production function research on colleges takes the institution as the unit of analysis and estimates the influence of institutional characteristics (including average student characteristics) on college graduation rates (Astin, Tsui, & Avalos, 1996; Mortenson, 1997; Porter, 2000; Ryan, 2004; Scott, Bailey, & Kienzl, in press). Almost all of this work has concerned four-year colleges and the research generally concludes that colleges serving students with higher SAT scores and from higher income families, with higher proportions of full-time and female students, and higher instructional and academic support expenditures per full-time equivalent (FTE) student, have higher graduation rates. Only one study has conducted this analysis for community colleges (Bailey et. al., in press), and it concluded that institutions with a larger enrollment and a high share of minority students, part-time students, and women have lower graduation rates. In addition, their results confirm that greater instructional expenditures are related to a greater likelihood of graduation.

Titus (2004; in press) has recently published research on persistence in four-year colleges that includes both institutional and individual characteristics. He merged two nationally

representative datasets (BPS:96/98 and IPEDS 1995) to consolidate individual student data with the institutional information from the college where each student enrolled. He concluded that persistence is higher at more selective, residential, and larger institutions (Titus, 2004). In a subsequent paper he analyzed the effects of financial variables and found that a higher expenditure per full-time equivalent student is associated with greater persistence, although within expenditures, colleges with relatively higher administrative expenditures tended to have lower persistence. Graduation rates were also higher at colleges in which a larger share of revenue came from tuition.

Therefore, over the last two decades, researchers have developed an extensive empirical literature on college persistence. Our research contributes to this literature in three ways. First, we use a production function framework with both college-level and individual variables to analyze the institutional correlates of persistence, completion, and transfer in community colleges. Little of the existing research explicitly analyzes the influence of institutional characteristics, and those researchers who have done so, with one exception, studied four-year colleges. Further, with the exception of Titus, even those studying institutional factors in four-year colleges have not controlled for individual level variables, as we have done.

Second, many students now attend more than one postsecondary institution (Adelman, 1999; 2003; Burd; 2004). Given the growth of multi-institutional attendance, particularly among students who enter higher education through community colleges, our study incorporates the effect on a student's educational outcome of *every* institution attended. We thereby account for the entire undergraduate experience of a student. The graduation rates used in most of the research on institutional determinants of persistence (the research that uses the institution as the unit of analysis), do not include students who transfer to another institution; students who

transfer are counted as dropouts rather than as potentially successful transferees. By using individual data we were able to track students as they move among institutions, keeping in mind that each institution contributes to the intellectual and social development of the student and affects his or her educational outcome.

Third, unobserved institutional factors like leadership, faculty relations, and local political environment may have a bearing on students' outcomes. We therefore used a technique that takes account of unobserved institutional characteristics to compute consistent coefficients for the observable variables.

3. Empirical Model and Data

3.1 Econometric Models

In this paper we define a community college student as successful if he or she attains any degree (certificate, associate, or bachelors) or transfers to a four-year institution. Therefore, we coded the dependent variable as a binary one with a value of unity if we observed any of the mentioned successful outcomes, and zero otherwise. Following the discussion in the last section, we used both *students* and *institutional* characteristics to explain community college student success. By restricting our analysis to students whose initial postsecondary institution was a community college, we could model the probability that a student will succeed as follows:

$$y^{*}_{ic} = X'_{ic}\beta + v_{ic} \qquad i = 1, 2, \ldots, N \text{ and } c = 1, 2, \ldots, C \qquad (1)$$

and $y_{ic} = 1$ if $y^{*}_{ic} > 0$ and = 0 otherwise

where i denotes each student and c is the cluster, in this case, the community college, y^{*}, is the unobservable individual propensity to graduate, y is the observed outcome, X is a vector of

exogenous *students* and *institutional* characteristics that affect the outcome and v_{it} is the unobserved component. Under usual assumptions for the error component (mean zero, normalized variance σ_v^2 equal to one), we could pool the data and use a standard Probit model (henceforth, Model 1):

$$\text{Prob}\left[y_{ic} = 1 \mid X_{ic}\right] = \Phi\left(X'_{ic}\beta\right) \qquad (2)$$

where Φ (.) denotes the standard normal cumulative density function. Maximum Likelihood estimation guarantees asymptotically unbiased estimates. However, standard errors will be misleading and need a robust variance-covariance matrix to account for serial correlation within institutions (Guilkey & Murphy, 1993; Wooldridge, 2002).

Our Model 1 assumes that heterogeneity in students' probability to graduate is only affected by observable characteristics of the institution. However, other unobserved institutional factors like leadership, faculty relations, and the local political environment may have a bearing on students' outcomes. Moreover, research on graduation rates at baccalaureate institutions often finds that more selective institutions have higher graduation rates than those enrolling less academically ready students (Astin et al., 1996; Pascarella & Terenzini, 1991; 2005). Nevertheless, there is not a widely used and available measure of the academic preparedness of community college students. Our Model 2 is designed to account for the institution-level unobserved factors that may affect the individual's propensity to graduate. We decompose the error term in equation (1) as follows:

$$v_{ic} = \alpha_c + u_{ic} \qquad (3)$$

where α_c is the unobserved institution specific effect and u_{ic} is the usual idiosyncratic error term. The unobserved part can be treated as fixed or random. Unfortunately, fixed effect regression with binary outcomes do not provide consistent estimates of either the β or the α_i. Unlike in the

linear case, the incidental parameter problem (Neyman & Scott, 1948) contaminates the estimation of β.[2] In the case of random effects, standard practice assumes that α_c and u_{ic} are independent and identically distributed random variables with mean zero and variance σ_c^2 and 1, respectively. The assumptions imply that *Var* $(v_{ic}) = \sigma_\alpha^2 + 1$ and $\rho = \text{corr}(v_{ic}, v_{is}) = \sigma_\alpha^2 / (\sigma_\alpha^2 + 1)$, interpretable as the proportion of the total error variance contributed by the unobserved heterogeneity. Further, if error terms are independent of the vector of covariates X and we assume a standard normal distribution for u_{ic}, we obtain a random effect Probit model[3] for the outcome:

$$\text{Prob}\left[y_{ic} = 1 \mid X_{ic}, \alpha_c\right] = \Phi\left(X_{ic}'\beta + \alpha_c\right) \qquad (4)$$

However, α_c is unobservable and cannot be part of the likelihood function. Heckman (1981) noted that since the dependence in the error term v_{ic} is completely due to the common variation in the α_c, the distribution of y_{ic}^* conditional on α_c is independent normal and, therefore, the problem can be solved by integration of the likelihood function with respect to α_c. The individual contribution to the likelihood is:

$$\text{Prob}(Y_i) = \int_{-\infty}^{\infty} \prod_{i=1}^{N} \left[\Phi\left(X_{ic}'\beta + \sigma_\alpha \alpha_c\right)\right]^{y_{ic}} \left[1 - \Phi\left(X_{ic}'\beta + \sigma_\alpha \alpha_c\right)\right]^{1-y_{ic}} \phi(\alpha_c) d\alpha \qquad (5)$$

and the likelihood function for the observed sample:

$$L = \prod_{i=1}^{C} \text{Prob}(Y_i) \qquad (6)$$

[2] Solutions are available for logistic regression using conditional maximum likelihood model (Chamberlain, 1980). However, institutional observed characteristics, our central covariates, will be dropped in the same process that eliminates the fixed unobserved factors.

[3] Wooldridge (2002) and Hsiao (2003) provide excellent reviews of the model.

maximization of eq. (6) with respect to β/σ_u^2 and ρ provide asymptotically unbiased estimates.[4] In practice, estimation by maximum likelihood can be automatically implemented using, for example, the Stata xtprobit command.[5]

For Models 1 and 2, we used institutional data from the first year of a student's enrollment in a community college. In so doing, we ignored the characteristics of other institutions in which a student may enroll. Based on the NELS:88 survey, we found that over 40 percent of community college students enroll in more than one institution during their postsecondary education. We would expect that their enrollment at any particular institution has an impact on their outcome at all succeeding institutions in which they enroll. Therefore, as an extension of Model 1, in Model 3 we created an index value for each institutional characteristic as a weighted average of all the institutions attended. The weight in each case is proportional to the full-time equivalent (FTE) months enrolled in each institution relative to the FTE months enrolled at all institutions, prior to the student outcome event (certificate; degree; transfer; or last enrolled, if no outcome).[6]

3.2 Dataset and Variables

To obtain student characteristic and enrollment information, we used data from the National Education Longitudinal Study of 1988 (NELS:88). NELS:88 follows a nationally representative sample of individuals who were eighth graders in the spring of 1988.[7] They began

[4] Arulampalam (1999) showed that the coefficients from the pooled and random effect models and subsequent marginal effects are not directly comparable due to differences in the normalizations.
[5] Although integration in equation (5) requires Gauss-Hermite quadrature formula to approximate the integral (Butler & Moffit, 1982).The accuracy of the estimation decrease as the cluster size or Rho increase, and the number of points at which the integrand must be evaluated becomes an important factor to achieve convergence.
[6] Model 3 allows students to change institution; hence we expect the effect of the unobserved heterogeneity to be small. Nonetheless, results should be compared with Model 1.
[7] The NELS:88 sample contains mostly students who entered college soon after high school graduation, following the traditional pattern of postsecondary enrollment. Therefore, the sample is not a representative cross-section of all

enrolling in postsecondary education in fall 1992. Follow-up interviews were conducted in 1990, 1992, 1994, and 2000, and the dataset contains rich demographic, standardized high school test scores, and socioeconomic measures of the respondents.[8] The NELS:88 database includes college transcripts of all individuals in the sample who enrolled in postsecondary education by 2000. With the NELS:88 data, the enrollment patterns of college students, including the number and type of institutions attended and the attendance intensity at each institution, can be observed along with any educational outcomes through 2000.

The NELS:88 data provide complete information on the type of credential earned (certificate, associate degree, bachelor's degree, and post-baccalaureate degree) as well as the date earned. For purposes of this analysis any certificate or degree earned was considered a positive outcome or an indication of success. In addition to credentials, the transcript data for students allowed us to observe whether a student transferred from a community college to a baccalaureate institution within the eight-year window. Such a transfer, regardless of whether it was accompanied by a degree at either the transfer-out or transfer-in institution, was also included as a positive outcome for community college students.[9]

Institutional Variables: The relationships between persistence and institutional characteristics and practices are the central issues addressed in this article. We drew these explanatory institutional variables from the Integrated Postsecondary Education Data System (IPEDS), which contains information on aggregate student characteristics, faculty, enrollment, and finances reported by institutions to the National Center for Education Statistics. From these

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community college students, but by design (of the survey) includes only cohorts of younger beginning postsecondary students.

[8] The NELS:88 sample design involved stratification and clustered probability sampling. We used the survey design correction included with Stata statistical software for estimating the models. However, we were not able to account for stratification of the survey in our Model 2. Although we obtained the proper design-based point estimates, our standard errors might be misleading.

data, we created a file of each institution's characteristics for every school year of NELS:88. We merged the institutional characteristics file with the student characteristics file by institution identifier and school year of enrollment to assign the appropriate institutional characteristics.[10]

The set of institutional characteristics can be divided in four groups: *general institutional characteristics* which are under the control of the colleges or state policy makers; *compositional characteristics* of the student body; *financial variables* relating to revenue and expenditures; and *fixed locational characteristics*.

The general institutional characteristics that are (at least in principal) under the control of the college or state policy makers include institution size, the proportion of the faculty working part time, and the balance between certificates and associate degrees awarded. Of these variables, institution size has been the most studied and there have been mixed conclusions. In a study of baccalaureate institutions, Titus (2004) found that larger four-year institutions have significant positive impacts on persistence, explained by the belief that larger institutions have stronger institutional socialization capabilities and offer degrees possessing higher status. It would seem easier, however, to create a socially and academically engaged environment in a small institution, so a negative relationship between size and persistence would also be consistent with the engagement model. Indeed, Pascarella and Terenzini (1991; 2005), Bailey et al. (in press), and Toutkoushian and Smart (2001) found that size is negatively related to measures of success and student gains in baccalaureate institutions. Moreover, Alfonso (2004) found that institutional characteristic variables have differential effects on degree attainment depending on the race/ethnicity of the student. She found that Hispanics who enroll in large community colleges

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[9] In the discussion that follows, we use the terms *graduate*, *complete*, and *succeed* interchangeably for readability—in this context they all refer to earning a certificate or degree or transferring to a baccalaureate institution.

[10] NELS reports students' colleges by IPEDS ID number, so we were able to associate the characteristics of the college, reported in IPEDS, with the individuals in the NELS sample.

are less likely to earn an associate degree than are those who attend smaller two-year colleges, while the educational attainment of blacks is higher when they attend private two-year colleges. We used a step function based on intervals of full-time-equivalent enrollments to measure institutional size which allowed us to capture nonlinear effects on size (Titus, in press).

The use of part-time faculty is a key cost saving strategy for community colleges, and indeed most four-year colleges. The use of many adjuncts is generally considered a poor educational practice, however, and accreditors set minimum percentages for full timers. Many part-time professors probably make it difficult for colleges to develop the type of environment envisioned by the engagement model. Conversely, especially in occupational fields, which are more important for community colleges than four-year institutions, part-time practitioners may be particularly effective. Empirical evidence on the effectiveness of adjunct faculty is mixed. Jacoby (in press) found a negative effect while Ehrenberg and Zhang (2004) found no effect.[11] We used the percentage of the faculty accounted for by part timers as our variable for this feature.

Community colleges have many missions, including preparing students to transfer to baccalaureate institutions and training them in occupational fields where they can work immediately after college. Colleges that confer relatively more certificates tend to put a greater emphasis on the short-term workforce development function than on the more academic transfer-oriented function. Research on institutional graduation rates, using completion of any degree or certificate as a successful outcome, has shown that that the colleges emphasizing certificates have higher graduation rates (Alfonso, Bailey, & Scott, 2005; Bailey et al., in press). This may be true simply because it is easier to complete a one-year certificate than a two-year associate

degree. From this perspective, the ratio of associate to certificate degrees conferred is an important control variable. But some researchers have argued that these missions can conflict and that graduation and transfer rates would be lower in colleges emphasizing direct occupational preparation (Brint & Karabel, 1989; Dougherty, 1994). We tested this hypothesis by including the certificate/associate variable in an analysis limited to students in associate degree programs. Since these students were not seeking certificates, then the fact that certificates are easier to complete will not be a factor in the analysis. If a workforce preparation emphasis weakens the transfer and associate degree function, then we would expect that the coefficient for this variable would be negative in the model with only associate degree students.

Student Compositional Characteristics: Most of the studies of institutional effects on graduation rates have used the college as the unit of analysis and therefore they have not controlled for individual characteristics. Thus the direct effect of a variable—say, attending part time—is captured in a variable measuring the percent of part timers among all enrolled students. If part-time students graduate at a lower rate, then a college with more part timers would have a lower institutional graduation rate. In our analysis, though, we controlled for these individual characteristics; therefore, the institutional compositional variables (i.e., the percent part-time students) captured the indirect or peer effects—i.e., a full-time student would be less likely to persist if he or she attends a college dominated by part timers. Our analysis included measures of overall household income levels and the percent of part-time, female, and minority (comprising African American, Hispanic, and Native American) students. What effect would we expect these variables to have?

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[11] Ehrenberg and Zhang (2004) found no evidence that increasing the percentage of part-time faculty members at two-year colleges adversely influence institutional graduation rates. However, the authors used College Board data and included only those community colleges that report average SAT scores.

Research on peer effects suggests that college students benefit when they take classes with or study with high-performing students (Winston & Zimmerman, 2004). But most of this work has focused on four-year colleges and, even among such studies, on selective four-year colleges. Assuming that this conclusion holds for community colleges, we would expect that colleges with high proportions of women, higher income students, and full-time students would have higher graduation rates, even after controlling for individual characteristics, since members all of these groups tend to be more successful students (Toutkoushian & Smart, 2001). Research on four-year colleges that does not control for individual characteristics tends to confirm these relationships, although Titus (2004), who did control for individual characteristics, found no effect.

The engagement model would also predict that a prevalence of part-time students would weaken persistence, since many part-time students make it more difficult to develop the socially and academically engaged environment called for by this perspective. On campuses with a highly heterogeneous population it might also be more difficult to establish an environment conducive to engagement. Titus (2004) tested the effect of a measure of racial diversity and found no effect for four-year colleges.

Financial Characteristics: These characteristics include federal student aid per FTE; average undergraduate in-state tuition; and average expenditures per FTE in instruction, academic support,[12] student services,[13] and administration.[14] The federal aid measure, which is primarily comprised of Pell Grants awarded to low- and middle-income students, also acts as a

[12] Academic support includes expenses for activities and services that support the institution's primary mission of instruction, research and public service, like for example, display of educational materials in libraries, museums, or galleries.

[13] Student services include expenses for admissions, registrar activities, and activities whose primary purpose is to contribute to students' emotional and physical well-being and to their intellectual, cultural, and social development outside the context of the formal instructional program.

proxy for the relative income level of the student body.[15] Given that we were controlling for student socio-economic status and receipt of financial aid, we expected that tuition levels would be negatively associated with persistence—the greater the financial burden of attendance, the more difficulty students would have in staying in college.

Based on the findings of previous research, we expected expenditures in instruction and academic support to have a positive effect on the probability of success of community college students. Titus (2004) and Ryan (2004) found negative effects for this variable in four-year institutions and argued that, although these expenses are necessary for day-to-day work, they might divert funds from more effective expenditures like instruction. Finally, we expected important effects if institutions spending large amounts on student services succeeded in compensating for the deficiencies that their students face (Astin, 1993). However, it is possible that colleges may spend more on student services and still not be able to help their students overcome the multiple barriers to success that they face (Ryan, 2004).

Fixed Location Characteristics: Our fourth category consists of just one variable: the college's location in an urban, suburban, or rural area. There is no strong argument for expecting any particular effect here. Perhaps suburban colleges might be expected to have more resources, especially in states where colleges collect revenue from local taxes, but this possibility ought to be accounted for by our expenditure variables. We included this variable to control for any factors that might be captured by a college's location[16].

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[14] Administration includes expenses for the day-to-day operational support of the institution, like general administrative service or logistic services.

[15] Ehrenberg and Zhang (2004) also used the proportion of undergraduate students receiving a Pell Grant at the institution. However, Romano and Millard (2005) questioned its use as a proxy for relative income level of the community college student body.

[16] We also estimated our models with state dummies to capture any unobserved factor shared by institutions in the same state. However, results did not change after controlling for state fixed effects.

Individual Variables: Our primary interest in this paper is in the effect of institutional factors, but we included individual characteristics as controls. We selected the individual characteristics for equation (1) for the model based on factors that previous studies have indicated are related to degree completion. Adelman (1999; 2003), Bailey et al. (in press), and Cabrera et al. (in press) found that students who have stronger high school records, who come from higher income families, and whose parents went also went to college are more likely to graduate. To measure socioeconomic status (SES) we used a composite variable in NELS:88 that included parental education, parental occupation, and total household income. Academic readiness was approximated using tenth grade composite test scores. We also included fixed controls for gender, race/ethnicity, and declared major. Findings from previous research indicate that we should expect full-time enrollment to increase the probability to graduate, while delaying college entry after high school and interruptions while enrolled predict lower levels of integration with the institution and, as a result, decrease the probability to graduate (Pascarella & Terenzini, 1991; 2005; Tinto, 1993). We therefore added dummies for students who took remediation courses in the first year of enrollment (Adelman, 1999), while full-time intensity and interruptions were measured throughout the entire period of enrollment.

Sample: Our initial NELS:88 sample contained 2,438 students whose initial postsecondary education was in one of 686 community colleges. However, regressions with full information included only 2,196 students in 536 community colleges. Missing values corresponded mainly to high school tracking variables like test scores (173 observations), but

also resulted from missing values in institutional variables merged from IPEDS (69 observations). [17]

We estimated our models for two different samples. The first comprised all students whose initial postsecondary education was at a community college. The second was a subset containing community college students enrolled initially in an associate degree program. In the latter case, we excluded a certificate as a successful outcome since students in an associate degree program generally do not have earning a certificate as their goal. Although the main interest of the research is to understand the effect of institutional characteristics on community college student outcomes, we recognize that community college students are quite heterogeneous, especially in terms of their educational goals.[18] Conducting a separate analysis for associate degree program students is a way to circumvent the problem.

Descriptive statistics for each sample group are provided in Tables 1 to 3. Table 1 shows that, overall, 54.6 percent of all community college students attained some outcome between 1992 and 2000. Interestingly, barely 6 percent received a certificate degree as *highest* outcome, 15 received percent an associate degree, 15 percent transferred to a four-year institution, and 17 percent received a bachelor or post-baccalaureate degree before 2000. Recall that the NELS:88 sample contains mostly students who entered college soon after high school graduation, following the traditional pattern of postsecondary enrollment. Therefore, the sample is not a representative cross-section of all community college students, but by design is representative of a cohort of young adults.

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[17] Compared with the final sample presented on Table 2, students with missing data are, on average, more likely to be Hispanic (22 percent), low SES (24 percent) and to delay enrollment after high school (45 percent). They are less likely to be white (59 percent).

[18] A survey question asking first-time beginning community college students their primary reason for enrolling produced the following response distribution: job skills: 23 percent; degree or certificate: 21 percent; transfer: 39 percent; personal enrichment: 17 percent. (Source: Beginning Postsecondary Students Longitudinal Study 1996-2001; authors' calculations.)

Table 2 shows the descriptive statistics for the institutions in which students in the NELS :88 sampled enrolled. Community college students in the NELS:88 sample tended to be enrolled in large urban institutions. The student body in the average institution was composed of 21 percent minority students (black, Hispanic, and Native American), 56 percent female students, and 37 percent part-time students. The average student enrolled at an institution where, overall, students received on average of $1,073 dollars in Pell Grants and paid $1,327 in tuition. Similarly, the average institution spent $2,925 on instruction, $472 on academic support, $608 on student services, and $1,329 on administrative expenses per FTE student. Note also that the variable means are reasonably similar for the associate degree sample.

Finally, Table 3 shows the descriptive statistics of the students in our sample. NELS students whose initial enrollment was a community college are characterized by a larger number of minorities and historically underrepresented students, and they come from relatively disadvantaged backgrounds as measured by SES and academic readiness. Fifty-three percent of these students took remedial education in their first community college, 41 percent interrupted enrollment, and only 17 percent attended full time. The subset of associate degree students show similar statistics.

4. Findings

The regressions effects of institutional characteristics for the whole sample of community college students and the subset of associate degree students are shown in Tables 4 and 5, respectively.[19] The second column of Table 4 presents results of Model 1, the pooled Probit

[19] Individual level characteristics were included as covariates. Results are not show here, but are available upon request from authors.

regression (eq. 1). We used a robust variance covariance matrix to account for serial correlation within clusters. Consistent with previous research (Bailey et al., in press; Pascarella & Terenzini, 1991; 2005), we found that students enrolled in medium-size community colleges (1,001-5,000 FTE undergraduates) are between 13 and 15 percent less likely to have a successful outcome than the reference students in small institutions (fewer than 1,000 FTE undergraduates). Similarly, students enrolled in institutions with large proportions of part-time faculty and minority populations are less likely to attain a degree. A $1,000 increase in in-state tuition decreases the probability of graduating by 4 percent among NELS students, although the result is statistically weak.

When we accounted for possible unobservable institution-specific effects in Model 2, the coefficients on medium-size institutions, percentage of part-time faculty and minority students remained as statistically important negative factors associated with the probability of graduation, although the size effect is smaller than before. Students enrolled in medium-size institutions are 10 percent less likely to have a successful outcome that than are the reference students in small institutions. Similarly, students enrolled in an institution with student body comprised of 75 percent minority students are 9 percent less likely to succeed than are students enrolled in institutions only with 25 percent minority students.[20] Finally, the last column presents results for Model 3. After accounting for multiple institutions attended by the students, the pattern for the significant institutional covariates remained. Across specifications, size and the proportions of part-time faculty and minority students are important negative factors associated with our measure of success. However, the statistical association between in-state tuition and the probability of graduating found in Model 1 vanished.

[20] For variables originally expressed as a proportion, like part-time faculty, and minority, female, part-time students, the marginal effects represent a unit change from 0 to 1.

We now focus our attention on a more homogeneous population: students initially enrolled in an associate degree program, as shown in Table 5. Examining the effects of the first institution only, the results echo the patterns for the whole set of community college's students. Model 1 shows that size, part-time faculty, and minority student population are also negative factors associated with the probability of graduation for associate degree students. Interestingly, relatively large expenditures on academic support by community colleges is negatively associated with the probability to complete. Perhaps academic support at community colleges is not effective, or this result may reflect added effort by colleges to address academic deficiencies, not captured by our test score variable, of their students.

The third column on Table 5 controls for unobservable institution-specific effects. Results support the evidence found for the whole group of community college students. Increases in the size of the institution have a strong negative effect on the probability of student success. For example, students enrolled in institutions with 2,501 to 5,000 FTE undergraduates are 17 percent less likely to graduate than the reference group: those enrolled in community colleges with 1,000 FTE students or less. Note also that having more part-time faculty is a negative factor affecting the probability of success of a student enrolled in an associate degree program (Jacoby, in press), although the result is statistically weak.

The fourth column on Table 5 shows the effects of multiple institutions on student completion. Here, the statistical significance of institution size remains strong. The outcomes for associate degree program students are affected negatively by increases in the proportion of part-time faculty. Similarly, a larger percentage of minority students is associated with a lower likelihood of graduation. For example, students enrolled in an institution with a student body that

is 75 percent minority are almost 28 percent less likely to succeed than are students enrolled in an institution with only 25 percent minority students (see footnote 15).

Finally, we tested the relative effect of individual student characteristics compared with institutional characteristics. Although measures of fit in limited dependent variable models do not have the same interpretation as with a linear regression model, they do provide some indication about the accuracy with which the model fits the data (Maddala, 1983). We first fitted each model with a constant term, and then added sequentially the individual characteristics (block 1) and the institutional variables (block 2) to compute Pseudo-R^2 using the log-likelihood values in each model. The analysis of measures of fit is presented on Table 6. Results suggest that the addition of 16 institutional covariates improves the fit of the model, although the impact is relatively small. This finding indicates that individual student characteristics have a greater bearing on individual graduation rates than do institutional characteristics, or at least the institutional characteristics that are measured by IPEDS. Data on more specific institutional policies, practices, and programs may show these to be more influential than the more macro characteristics such as size, student composition and overall expenditures that we use in this study.

5. Robustness and Limitations of the Results

The first robustness test examines whether the pooled Probit or the random effect Probit models is a more appropriate specification based on the assumptions each model imposes. For this test, rho, ρ, was first estimated via a random effect Probit model in equation (4).[21] The rho

[21] Our standard estimation of the Gauss-Hermite quadrature formula to approximate the integral used 12 points and we also test sensibility of the results with 8 and 16 points as provided by Stata command quadchk. Results show that

term refers to the proportion of the total variance contributed by the unobserved heterogeneity at the institution level and is reported in last row on Tables 4 and 5 for Model 2. Eleven percent of the variance in the unexplained outcome of all community college students can be explained by the unobserved institution-specific effect. Similarly, 13 percent of the unexplained variance in the outcomes of students in the associate degree student sample can be attributed to unobserved institutional level effects.

After estimating rho, we compared the pooled Probit and the random effect Probit models using a likelihood ratio test for rho. More specifically, we tested whether $\rho = 0$, the null hypothesis. The likelihood ratio test was distributed Chi-square with one degree of freedom and assumed values of 16.43 for all the community college students and 7.11 for the associate degree sample. These results provide strong statistical evidence at a 1 percent level against the null hypothesis. We conclude, therefore, that the random effect Probit model is the most appropriate specification.

Finally, we conducted a parallel analysis using a different dependent variable. A dummy variable as a measure of success of community college student outcomes can hide important information and, therefore, we used the cumulative number of credits earned. This alternative measure of success has the important advantage of being a continuous variable and consequently, common linear regression tools can be used. At the same time, a cumulative credit earned has a highly non-normal distribution since community college students have a high propensity to drop out after earning fewer than 10 credits.[22] After accounting for the non-normality with a

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the quadrature technique is stable as expected since our sample contains around 400 community colleges and Rho has low values in both samples. In addition, we also followed Rabe-Hesketh et al. (in press) and estimated the same models using GLLAMM and an adaptive quadrature as recommended by the authors. The results are similar to those discussed in the paper and are available from authors upon request.

[22] Excellent examples of these distributions and a detailed analysis can be found in Kane and Rouse (1995).

logarithmic transformation, we re-estimated Models 1, 2, and 3 for both samples of students and found results statistically consistent with the estimates presented here.[23]

Some analytic problems remain. For example, we still must rely on the crude institutional measures available in IPEDS. So, while we may know that an individual is from a low-income family, we have no reliable information on the economic background of the typical student at that individual's college. In addition, we do not have measures of specific institutional policies, such as the types of student services or pedagogic strategies used to improve retention and completion. Finally, the NELS:88 sample is made up almost entirely of traditional-age college students, and therefore provides no information on older students, who comprise an important part of community college enrollments.

6. Discussion

The overarching goal of this study is to measure the institutional characteristics that affect the success of individual community college students. While there is extensive research on the institutional determinants of educational outcomes for K-12 education and a growing literature on this topic for baccalaureate institutions, few researchers have attempted to address the issue for community colleges. We carried out an analysis using individual data from the National Education Longitudinal Study of 1988 (NELS:88) and institutional information from the Integrated Postsecondary Education Data System (IPEDS) to analyze a student's probability of completing a certificate or associate degree, or of transferring to a baccalaureate institution. This approach enabled us to estimate the institutional effect on a student's likelihood of completing a postsecondary credential or transferring to a four-year college while controlling for

[23] Results are available upon request from the authors.

individual characteristics such as a student's socioeconomic background and scores on standardized tests administered in high school. We assessed the effects of linking institutional variables from IPEDS to the individual student records from NELS:88. Our estimation strategy addressed two methodological challenges: unobserved institutional effects and multiple institution attendance.

A summary of our results is displayed in Table 7. The table also compares our results to findings from research on community colleges that uses the college as the unit of analysis and does not control for individual characteristics and to research on four-year colleges that does and does not control for individual characteristics.

Our results are reasonably consistent across both population and specifications. What do these findings imply about the policy, compositional, and financial variables that we analyzed?

First, graduation rates go down as school size increases. This finding contrasts to some findings about four-year colleges, but it is consistent with other institutional analyses of two-year colleges. Our finding is also consistent with the notion that the more personalized atmosphere and services that would seem to be likely at a smaller institution may benefit at least the traditional-age student population in the NELS sample.

Second, students in colleges with more part-time faculty also have lower graduation rates. This result agrees with community college studies that do not control for individual characteristics. Our results provide strong support for the conclusion that a greater emphasis on occupational training or workforce development (as indicated by a larger share of certificates among credentials conferred) lowers graduation rates.

Compositional factors have some effects as well. Our research provides some support for the hypothesis that colleges with a larger share of minority students have a lower graduation rate,

a result that is consistent with research using institutional data at both community colleges and four-year colleges. Given that we are controlling for race, test scores, and SES, this is a result certainly worth further study.

In general, financial factors do not have strong effects. Expenditure patterns and tuition levels, at least within the ranges present in this sample, are not related to differences in the graduation probabilities. It is interesting that these variables appear to have a stronger influence on graduation from four-year colleges.

Further, we found that individual characteristics are more strongly related to the completion probabilities than are institutional factors. There may be several explanations for the apparent greater importance of individual characteristics. First, the findings suggest that well-prepared students with economic resources are likely to survive and do well in a variety of institutions. Likewise, students with many challenges, including personal and financial responsibilities, may have trouble even in strong colleges.

Alternatively, the magnitude of some variables may reflect a response to perceived student need as well as to some exogenously determined institutional policy. For example, colleges whose students face multiple barriers may spend more on student services. While we have tried to control for student characteristics, there may be important factors that are not measured in our datasets. In this case, even if student services are effective in increasing retention, the negative effect of the initial student characteristics may offset the positive program effect resulting in a coefficient that suggests no effect.

Third, individual variables are measured with much more precision than institutional variables, especially with respect to the influence of factors on individuals. Students' individual characteristics obviously influence their experience, but colleges are often comprised of sub-

cultures or sub-communities. The characteristics of these groups are probably much more important to individual students than average characteristics of the whole institution.

Finally, we may simply not have data on the most effective institutional policies. Pedagogic strategies, different guidance and academic counseling models, faculty culture, organizational characteristics, and many other factors are probably more influential than the broad characteristics measured by IPEDS.

Research on the relationship between institutional characteristics and institutional effectiveness is crucial to understanding how community colleges can increase their very low completion and transfer rates. There are several possible directions for future research. Certainly additional refinements of the type of analysis presented here using IPEDS and national longitudinal data, such as NELS or the BPS, will be important. State unit record data systems can provide much larger samples, including significant samples within individual institutions, although clearly the number of institutions will be much smaller. But within states it will be easier to have more comprehensive measures of institutional features. Evaluations of individual programs, such as particular strategies for remediation, can also play a role. Finally, additional insights can be gained by conducting qualitative research that searches for institutional features and policies that seem to be related to differences in institutional effectiveness.

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Table 1. Degree Completion of Community College Students by Highest Outcome

Variable	Percentage by Student Type	
	All	**Associate Degree**
Certificate	6.53	-
Associate	15.42	18.22
Transfer	15.17	15.46
Bachelor or post-baccalaureate	17.45	17.5
Overall outcome	54.57	51.18
Observations	**2,196**	**1,188**

Source: Estimates based on NELS:88.

Table 2. Descriptive Statistics for Institutional Characteristics

Variable	Mean by Student Type	
	All	**Associate Degree**
General Institutional Characteristics		
1,001-2,500 FTE undergraduates	25.73%	25.04%
2,501-5,000 FTE undergraduates	24.96%	24.93%
More than 5,000 FTE undergraduates	42.80%	42.79%
Proportion part-time faculty	51.55%	52.61%
Institution awards more certificates than associate degrees	10.59%	9.67%
Student Compositional Characteristics		
Proportion FTE minority	21.24%	21.63%
Proportion FTE female	56.25%	56.43%
Proportion FTE part-time	37.14%	36.42%
Financial Characteristics		
Federal aid (Pell Grants) [b]	1.073	1.085
In-state tuition[a]	1.327	1.371
Instructional expenditures[b]	2.925	2.840
Academic support[b]	0.472	0.466
Student services[b]	0.608	0.609
Administrative expenditures[b]	1.329	1.328
Fixed Locational Characteristics		
College is located in urban area	51.35%	47.67%
College is located in suburban area	45.89%	49.53%
College is located in rural area	2.76%	2.80%
Observations	**2,196**	**1,188**

Source: Estimates based on NELS:88 and IPEDS. Notes: [a] in $1,000s. [b] in $1,000s per FTE undergraduate.

Table 3: Descriptive Statistics for Community College Students

Variable	Mean by Student Type	
	All	**Associate Degree**
Student Characteristics		
Female	49.66%	50.36%
White	71.71%	68.44%
Black	8.63%	10.61%
Hispanic	15.66%	17.92%
Asian	3.17%	2.40%
SES: lowest quartile	17.24%	20.10%
SES: second quartile	28.97%	30.29%
SES: third quartile	32.55%	27.59%
SES: highest quartile	21.25%	22.01%
Test scores: lowest quartile	19.20%	18.38%
Test scores: second quartile	31.03%	31.78%
Test scores: third quartile	32.47%	34.68%
Test scores: highest quartile	17.30%	15.16%
Student Enrollment Characteristics		
Academic major	34.77%	38.83%
Occupational major	46.55%	54.32%
No major	8.50%	6.68%
Took remediation in first PSE	53.02%	56.46%
Delayed Enrollment	32.20%	23.93%
Interrupted enrollment	41.22%	38.92%
Full-time enrollment	16.96%	18.32%
Observations	**2,196**	**1,188**

Source: Estimates based on NELS:88.

Table 4. Institutional Level Effect on Community College Student Outcomes

	Model 1 Pooled Probit		Model 2 Random Effect Probit		Model 3 Pooled Probit Multiple institution	
Variable	Coeff	dy/dx	Coeff	dy/dx	Coeff	dy/dx
1,001-2,500 FTE undergraduates	-0.328**	-0.130	-0.222	-0.089	-0.389**	-0.152
	(0.165)		(0.144)		(0.174)	
2,501-5,000 FTE undergraduates	-0.374**	-0.148	-0.262*	-0.104	-0.445**	-0.175
	(0.171)		(0.147)		(0.174)	
More than 5,000 FTE undergraduates	-0.281*	-0.111	-0.264*	-0.105	-0.373**	-0.146
	(0.164)		(0.147)		(0.165)	
Proportion part-time faculty	-0.562**	-0.219	-0.374**	-0.149	-0.620**	-0.233
	(0.234)		(0.149)		(0.257)	
Certificate degree oriented	0.013	0.005	-0.129	-0.051	0.009	0.003
	(0.145)		(0.119)		(0.149)	
Proportion FTE minority undergraduates	-0.690**	-0.268	-0.467**	-0.186	-0.733**	-0.275
	(0.327)		(0.225)		(0.373)	
Proportion FTE female undergraduates	1.095	0.425	0.294	0.117	-0.507	-0.191
	(0.705)		(0.658)		(0.663)	
Proportion FTE part-time undergraduates	-0.416	-0.162	0.142	0.056	-0.129	-0.049
	(0.555)		(0.317)		(0.636)	
Federal aid (Pell Grants)[a]	0.114	0.044	0.067	0.027	0.219	0.082
	(0.175)		(0.128)		(0.215)	
In-state tuition[b]	-0.095*	-0.037	-0.040	-0.016	-0.059	-0.022
	(0.049)		(0.043)		(0.045)	
Instructional expenditures[a]	0.009	0.004	0.002	0.001	-0.014	-0.005
	(0.050)		(0.040)		(0.050)	
Academic support[a]	-0.232	-0.090	0.151	0.060	-0.254	-0.096
	(0.174)		(0.147)		(0.174)	
Student services[a]	-0.155	-0.060	-0.126	-0.050	-0.031	-0.012
	(0.174)		(0.125)		(0.130)	
Administrative expenditures[a]	0.035	0.013	-0.095	-0.038	-0.003	-0.001
	(0.087)		(0.073)		(0.116)	
College is located in urban area	-0.058	-0.023	-0.092	-0.037	-0.084	-0.032
	(0.105)		(0.075)		(0.106)	
College is located in rural area	0.052	0.020	0.091	0.036	-0.010	-0.004
	(0.171)		(0.214)		(0.200)	
Constant	0.339		0.527		1.290***	
	(0.547)		(0.462)		(0.492)	
Unweighted observations	2196		2196		2117	
Number of institutions			536			
Log-Likelihood	-1310.20		-1331.55		-1266.44	
Pseudo R^2	0.137		0.139		0.139	
Estimated rho			0.117			

Source: Authors' estimates based on NELS:88 and IPEDS, various years.
Notes: [a] in $1,000s per FTE undergraduate. [b] in $1,000s. Standard errors are in parenthesis. **, *, indicates statistically significance at 5 and 10 percent level. All models include individual level controls for gender, race, SES, ability, major, remedial courses, delay enrollment, interruptions, and intensity patterns.

Table 5. Institutional Level Effect on Associate Degree Student Outcomes

	Model 1 Pooled Probit		Model 2 Random Effect Probit		Model 3 Pooled Probit Multiple institution	
Variable	Coeff	dy/dx	Coeff	dy/dx	Coeff	dy/dx
1,001-2,500 FTE undergraduates	-0.321	-0.123	-0.281	-0.112	-0.154	-0.055
	(0.213)		(0.194)		(0.243)	
2,501-5,000 FTE undergraduates	-0.536**	-0.208	-0.447**	-0.177	-0.444*	-0.152
	(0.220)		(0.197)		(0.252)	
More than 5,000 FTE undergraduates	-0.440**	-0.170	-0.332*	-0.132	-0.554**	-0.195
	(0.209)		(0.195)		(0.257)	
Proportion part-time faculty	-0.563*	-0.205	-0.423*	-0.169	-0.687**	-0.248
	(0.310)		(0.220)		(0.339)	
Certificate degree oriented	0.028	0.010	0.032	0.013	0.048	0.018
	(0.211)		(0.174)		(0.204)	
Proportion FTE minority undergraduates	-0.747*	-0.272	-0.712**	-0.284	-1.540**	-0.556
	(0.411)		(0.298)		(0.633)	
Proportion FTE female undergraduates	1.062	0.386	1.082	0.431	-0.912	-0.329
	(0.941)		(0.911)		(1.023)	
Proportion FTE part-time undergraduates	-0.636	-0.231	-0.476	-0.190	-0.752	-0.272
	(0.602)		(0.445)		(0.711)	
Federal aid (Pell Grants)[a]	-0.071	-0.026	-0.070	-0.028	-0.156	-0.056
	(0.200)		(0.183)		(0.260)	
In-state tuition[b]	-0.072	-0.026	-0.057	-0.023	-0.006	-0.002
	(0.071)		(0.058)		(0.065)	
Instructional expenditures[a]	0.060	0.022	-0.055	-0.022	0.074	0.027
	(0.075)		(0.063)		(0.077)	
Academic support[a]	-0.478**	-0.174	-0.156	-0.062	-0.523**	-0.189
	(0.233)		(0.196)		(0.250)	
Student services[a]	-0.106	-0.039	0.082	0.033	-0.031	-0.011
	(0.208)		(0.176)		(0.218)	
Administrative expenditures[a]	-0.003	-0.001	-0.098	-0.039	-0.140	-0.051
	(0.110)		(0.099)		(0.160)	
College is located in urban area	0.027	0.010	0.037	0.015	0.043	0.016
	(0.135)		(0.100)		(0.145)	
College is located in rural area	0.275	0.093	0.425	0.163	0.235	0.089
	(0.216)		(0.296)		(0.242)	
Constant	0.817		0.860		1.814**	
	(0.675)		(0.626)		(0.713)	
Unweighted observations	1188		1188		1114	
Number of institutions			423			
Log-Likelihood	-682.75		-692.03		-625.36	
Pseudo R^2	0.171		0.173		0.191	
Estimated rho			0.134			

Source: Authors' estimates based on NELS:88 and IPEDS, various years.
Notes: [a] in $1,000s per FTE undergraduate. [b] in $1,000s. Standard errors are in parenthesis. **, *, indicates statistically significance at 5 and 10 percent level. All models include individual level controls for gender, race, SES, ability, major, remedial courses, delay enrollment, interruptions, and intensity patterns.

Table 6. Measures of Fit Analysis, Individual versus Institutional Characteristics[a]

Model	Community College Students		Associate Degree Students	
	Block 1[b]	Block 2[c]	Block 1[b]	Block 2[c]
Model 1	0.113	0.139	0.129	0.171
Model 2	0.121	0.132	0.148	0.173
Model 3	0.115	0.139	0.141	0.191

Source: Authors' estimates based on NELS:88 and IPEDS, various years. Notes: [a] Fit of the model is measures as Pseudo-R^2. [b] Block 1 corresponds to models only with individual level characteristics. [c] Block 2 adds to Block 1 the institutional level variables.

Table 7. Institutional Characteristics Associated with Degree Completion: Comparison of Findings from Research on Baccalaureate Institutions and Community Colleges

Institutional Characteristics	Studies of Baccalaureate Institutions		Studies of Community Colleges	
	Without Individual Controls (several papers)	With Individual Controls (Titus)	Without Individual Controls (IPEDS)	With Individual Controls (NELS + IPEDS)
General Characteristics				
Size (enrollment)	+/-	0/+	-	-
Percent part-time faculty	Nm	nm	0/-	-
Grants more certificates than associate degrees	Na	na	+	0
Compositional Characteristics				
Residential (vs. commuter) college	+	+	na	na
Selectivity (SAT/ACT)	+	+	nm	nm
Undergraduate student body composition				
• Average student household income (measured by federal aid per FTE in CC studies)	+	0	0	0
• Percent part-time students	-	nm	-	0
• Percent female	+	0	-	0
• Percent minority (black, Hispanic, and Native American)	-	0	-	-
• Percent older	-	nm	nm	nm
Financial Characteristics				
In-state tuition	+	+	0	0
Total expenditures	+	+	0	0
Instructional expenditures	+	0	+	0
Academic support expenditures	+	0	0	-
Student support expenditures	0	0	0	0
Administrative expenditures	0	-	0	0
Federal aid (Pell Grants)	Nm	nm	0	0
Fixed Characteristics				
Urban (vs. suburban or rural) location	-	nm	0	0
State where located	Nm	nm	+/-/0	nm
Historically black college or university	+	0	+	nm
Private college	+	0	na	na
Engineering school	-	0	na	na

Key: + = statistically significant positive effect on completion. - = statistically significant negative effect on completion. 0 = no statistically significant effect. +/- = research findings are contradictory. +/-/0 = state effects are statistically significant; the size and direction of the effects depend on the state. na = not applicable to institution type. nm = no measure for the given characteristic.