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Bachelor's Degree Completion Across State Contexts: Does the Distribution of Enrollments Make a Difference?

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Abstract Growing accountability pressures, accompanied by a lack of readily accessible measures of institutional performance, have led to an increasing focus on graduation rates. Although previous research has illuminated myriad factors influencing students' likelihood of educational success, it has not paid adequate attention to how state contexts may shape student outcomes. I build on the small but growing body of research exploring the role of state characteristics in facilitating student success in higher education. Controlling for a range of state and individual attributes, I examine how one aspect of the state context—the distribution of enrollments in 2 vs. 4-year public institutions—is related to bachelor's degree attainment of students attending public 4-year colleges and universities. The results suggest that the larger the proportion of students attending community colleges in a state, the higher the probability of bachelor's degree attainment at public 4-year institutions. This appears to be a product of student sorting: the presence of community colleges facilitates sorting of students into higher education in a way that is associated with higher degree completion at public 4-year institutions. These findings have important implications for research on student outcomes and policies aimed at evaluating the performance of public 4-year institutions.

Keywords Higher education · Educational attainment · Community college · State context

Completion rates in higher education have recently been deemed "unacceptable" by the Secretary of Education's Commission on the Future of Higher Education (2006). Although not surprising to keen observers of higher education, the relatively low graduation rates, especially within traditional time-frames, have received widespread attention in recent decades. Statistics showing that only slightly over 50% of students entering public 4-year institutions earn bachelor's degrees within 6 years have raised questions about the

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effectiveness of public higher education.[1] Individual institutions have also come under increasing scrutiny since the Federal Student Right-to-Know and Campus Security Act of 1991 mandated that institutions publish their graduation rates.

The fervor of public and policy makers' attention to graduation rates brings the question of student success to the fore: what facilitates degree attainment in higher education? An extensive body of literature provides a complex picture of the myriad factors influencing students' likelihood of degree completion (for a recent review, see Pascarella and Terenzini 2005; Perna and Thomas 2008). Most of the previous work has highlighted the importance of individual attributes, particularly academic preparation and attendance patterns, for student success. Some studies have also considered the role of institutional characteristics, such as selectivity and expenditures, in facilitating degree completion. Consequently, researchers have cautioned against using raw graduation rates as a measure of institutional performance and suggested different approaches for adjusting graduation rates to account for student body characteristics and institutional resources (e.g., Archibald and Feldman 2008; Astin 1993, 1997; Goenner and Snaith 2004; Scott et al. 2006).

However, previous literature and policy discussions regarding institutional accountability have paid less attention to how state contexts may shape student success. Students do not only bring individual attributes to higher education or enter specific institutions; they also pursue higher education within particular state contexts. In this study, I build on the small but growing body of literature focusing on how state characteristics and policies are associated with educational outcomes in higher education (for recent reviews see Perna 2006; Perna et al. 2008). While controlling for a range of state and individual attributes, I examine how one aspect of the state context—the reliance on community colleges vs. 4-year institutions to provide higher education—is related to bachelor's degree attainment of students attending public 4-year colleges and universities. The results indicate that the size of the community college sector facilitates sorting of students in public higher education, which in turn is associated with students' likelihood of bachelor's degree completion. Consequently, the larger the community college sector, the higher the bachelor's degree attainment of students attending public 4-year institutions. These findings highlight the importance of considering the distribution of enrollments in studies of student outcomes as well as in performance evaluations of public higher education institutions.

The Importance of State Contexts

Synthesizing recent research, Perna (2006) proposed a conceptual model for understanding college enrollment which consists of four levels of context: (1) individual's habitus, (2) school and community context, (3) the higher education context, and (4) the broader social, economic and policy context (see also Perna et al. 2008; Perna and Thomas 2008). While the last two layers in Perna's model have received relatively limited attention in previous research, a growing number of recent studies have started to explore how broader contexts, and particularly state characteristics and polices, are related to student outcomes in higher education.

[1] Different data sources produce similar six-year bachelor's degree completion rates, which at public 4-year institutions are estimated at approximately 53% (The Chronicle of Higher Education 2008; see also NCES 2003a). Considering more traditional students and longer time frames produces higher graduation rates; yet even then, many students leave higher education without a degree in hand.

Given rising tuition and strained state budgets, existing research on state contexts in higher education has often focused on tuition and financial aid policies. A range of studies have described state variation in these factors and their relationship to enrollment and degree completion (e.g., Berger and Kostal 2002; Heller 1999, 2006; Kane 1995; National Center for Public Policy and Higher Education 2002; Titus 2006). Using state-level data, Heller (1999) showed that tuition levels and financial aid spending are related to enrollment rates. Similarly, on the individual level, Titus (2006) reported that the state's financial context, operationalized by different measures of investment in financial aid, is associated with students' likelihood of degree completion. Several recent endeavors have broadened the analysis of the financial aspects of higher education to include other challenges faced by states in educating their citizens, particularly academic preparation. These studies show that fostering access to higher education requires a joint consideration of financial aid and academic preparation (e.g., Kipp et al. 2002; St. John 2003). Academic preparation in K-12, as well as financial aspects of higher education (state appropriations, financial aid, and tuition), are related to whether and how students enroll in postsecondary institutions (Perna and Titus 2004).

In this burgeoning research on state contexts, one dimension has yet to receive adequate attention: the distribution of enrollments in 2 vs. 4-year institutions. States vary dramatically in the extent to which they rely on 2 vs. 4-year institutions to provide access to higher education. While approximately 70% of students in California's public education system attend community colleges, less than 15% of public education students in Alaska and South Dakota are enrolled in these institutions (National Center for Education Statistics [NCES] 2007). Consequently, students entering higher education face a dramatically different set of options in public higher education, and colleges and universities operate in vastly different environments across states. In this study, I focus on understanding how the reliance on community colleges vs. 4-year institutions to provide higher education may be related to student outcomes.

One approach to considering potential consequences of these differences is to examine the relationship between community college enrollments and bachelor's degree production by state. Figure 1 reports the number of bachelor's degrees awarded by public 4-year institutions, adjusted for public 4-year enrollments, by the relative size of the community college sector (i.e., the percent of students in public higher education attending community colleges). This figure reflects bachelor's degrees awarded in 2005–2006, with enrollments lagged 6 years (i.e., enrollments are coded in the Fall of 1999).[2] Figure 1 shows a strong, positive correlation ($r = 0.738$, $p < 0.05$) between the relative size of the community college sector and bachelor's degree production of public 4-year institutions: the larger the community college sector, the more bachelor's degrees are produced by public 4-year institutions (adjusted for the number of students enrolled in 4-year colleges and universities).[3] This finding implies that, on the whole, public 4-year institutions would perform better (i.e., have higher graduation rates) in states with large community college sectors.

Extant critiques of community colleges often present a different figure, one showing a negative relationship between community college enrollments and bachelor's degree

[2] The results are not substantively altered if both enrollments and degrees are coded in the same year.

[3] Alaska is the outlier in the bottom left portion of the graph. If removed, the correlation still remains strong and significant, $r = 0.696$, $p < 0.05$. Moreover, a strong positive correlation between the size of the community college sector and 4-year retention and graduation is reported in *Measuring Up* (author's calculations). The correlations are slightly weaker in *Measuring Up* because their state estimates are based on aggregating institutional graduation rates which have more variability and because they include both public and private 4-year institutions.

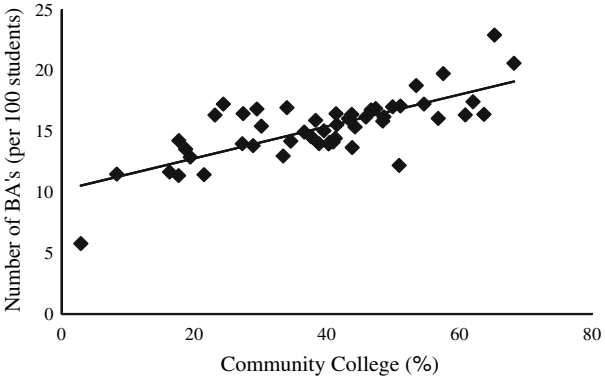

Fig. 1 Bachelor's degrees awarded by public 4-year institutions, by state. *Source*: *Digest of Education Statistics*. *Note*: Bachelor's degrees awarded are adjusted for the total enrollment in public 4-year institutions

production. The negative relationship is obtained by dividing bachelor's degrees awarded by the total enrollment in public higher education (as opposed to only enrollment in 4-year institutions, as is the case in Fig. 1). Including all students in the calculation assumes that all students who enter higher education, including those who enter community colleges, are candidates for a bachelor's degree. However, students generally cannot earn bachelor's degrees until they enter 4-year institutions, and thus become counted in 4-year enrollments. More importantly, considering total enrollments draws attention away from what happens in public 4-year institutions. Policy discussions regarding bachelor's degrees and the accountability for producing bachelor's degrees rest on the shoulders of 4-year institutions. Thus, understanding how the presence of community colleges may be related to the outcomes of 4-year colleges and universities is particularly relevant.

Community Colleges and Sorting in Higher Education

Since the seminal critiques of Clark (1960) and Brint and Karabel (1989), community colleges have been seen as both providers of opportunity and a hindrance to baccalaureate degree attainment. Researchers agree that community colleges have a democratizing influence in higher education—they provide greater opportunities for access. However, at the same time, community colleges have been criticized for diverting students from 4-year institutions, and consequently bachelor's degrees. Several recent studies have attempted to resolve this tension between democratization and diversion effects of community colleges (Leigh and Gill 2003; Rouse 1995, 1998). Rouse (1995) for example finds both processes at work with respect to the years of schooling completed but neither seems consequential for degree attainment. However, a number of other studies have suggested that starting in a community college as opposed to a 4-year institution hinders the likelihood of a bachelor's degree completion, even after adjusting for a range of individual characteristics and selection into higher education and 2 vs. 4-year institutions (e.g., Alfonso 2006; Dougherty 1992; Monk-Turner 1995; Whitaker and Pascarella 1994).

Although the literature on the role of community colleges in facilitating or hindering educational attainment is extensive, current debates seem to pay little attention to the consequences of community colleges for 4-year institutions. Previous studies focus on comparing outcomes of students who begin in 2 vs. 4-year institutions, but do not consider how the proportion of students attending community colleges in a state may be related to outcomes of public 4-year institutions. In their critique, Brint and Karabel (1989) argued that community colleges serve as a "safety valve" for 4-year institutions. They proposed

that community colleges help to alleviate enrollment pressures at public 4-year institutions, particularly by enrolling less privileged and less academically prepared students. This would suggest that the presence of community colleges would influence the sorting of students in higher education, and particularly the distribution of students in public 4-year colleges and universities.

More generally, the distribution of enrollments creates an opportunity structure for access to higher education, which can influence both actual possibilities for enrollment as well as student perceptions. If a state, such as California, provides the majority of public higher education in 2-year institutions, students entering higher education will be much more likely to begin their education in community colleges simply because of the spaces available in 2 vs. 4-year institutions. Moreover, students living in different state contexts may develop different ideas regarding possible pathways into higher education. It may be hypothesized that students in states with large community college sectors may have a less stigmatized perception of community colleges and believe that community colleges provide an effective pathway toward a bachelor's degree.[4] The empirical reality may not necessarily support this optimistic outlook as it is not clear that the likelihood of transfer from community colleges to 4-year institutions is higher in states with large community college systems.[5] However, students are not likely to know those statistics, but instead are more likely to rely on their everyday experience, which is that many of their fellow students, including those who aspire to earning bachelor's degrees, are enrolling in community colleges.

Although most studies of student entry into higher education focus on the role of individual attributes, researchers are increasingly considering how contextual factors, and particularly schools, influence students' decision-making process (see recent reviews in Perna 2006; Perna and Thomas 2008). McDonough (1997) for example explained how high school *habitus* can influence students' aspirations and college going behaviors. Students who attend high schools with "college going *habitus*" are much more likely to prepare for and attend higher education. Thus, based in part on the clues derived from their high school contexts, students develop aspirations based on "sensible or reasonable choices (p. 9)." Extending this reasoning to the state context, it could be hypothesized that statewide patterns of college entry may help students develop specific ideas about the possible and likely pathways into higher education. By shaping the number of available spaces as well as students' perceptions of different pathways, the distribution of enrollments may channel students' enrollment in higher education.

In addition, the size of the community college sector may lead to differential sorting of students into 2 vs. 4-year institutions. If, as Brint and Karabel (1989) suggested, community colleges serve as safety valves, different types of students are likely to enroll in 4-year institutions in states with large as opposed to small community college sectors. If the presence of community colleges is indeed related to the sorting of students in higher education, it may be expected that the outcomes of public 4-year institutions, including whether students earn bachelor's degrees, will in part reflect this sorting process. The present study assesses these propositions.

[4] I am not aware of any published work testing this hypothesis.

[5] Author's calculations based on data from California and Florida (both of which enroll a large proportion of public higher education students in community colleges) suggest that those states do not have notably higher transfer rates than the national average reported in the Transfer Assembly Project (see Cohen 1994,1996).

Data and Methods

Analyses in this study are based on the Postsecondary Education Transcript Study (PETS), a component of the National Education Longitudinal Study (NELS 1988–2000). NELS is a two-stage stratified sample which began with a nationally representative sample of eighth-graders first interviewed in 1988. The sample was drawn from 1,052 public, private, and parochial schools and included ~25,000 respondents. Most of the respondents were included in the follow-up studies in 1990 and 1992, and new students were added to the sample in each year to render the dataset representative of high school sophomores and seniors. A sub-sample of approximately 16,000 students was selected for interviews in 1994 and 2000. Students who reported enrollment in postsecondary institutions in one of the last two follow-ups were included in the PETS sample, and their postsecondary transcripts were requested from institutions they attended (close to 9,600 respondents). In addition to postsecondary transcript data, PETS includes a selected list of items from earlier survey years.[6]

The first set of analyses, examining the probability of entry into a 2 vs. a 4-year public institution, is based on a sample of students who entered public higher education by September 1994 (effectively within 2 years of high school graduation). The second set of analyses, estimating the likelihood of bachelor's degree completion, is based on a sample of students who entered public 4-year institutions by September 1994. These restrictions are necessary in order to define populations of interest and assess the propositions advanced in the literature review. Limiting students' time of entry up to 1994 allows adequate time for bachelor's degree completion. Models of bachelor's degree completion are also restricted to students who began and completed their bachelor's degrees in the same state due to the focus of this study on state contexts. Each set of analyses has a small number of missing cases, which are deleted using listwise deletion.[7] The final sample for entry into public 4 vs. 2-year institutions includes 5,217 students. Models of bachelor's degree completion are based on 2,789 students who entered public 4-year institutions.

State Context

The key aspect of the state context examined in this study is the relative size of the community college sector, defined as the proportion of students in public higher education attending community colleges. However, state policies do not occur in a vacuum. For example, Hearn et al. (1996) showed that state's tuition and financial aid policies are related to other state characteristics, such as region, social and economic resources, and postsecondary governance. Similarly, the distribution of enrollments is likely to be associated with other aspects of the state environment, which may mediate the relationship between the size of the community college sector and examined student outcomes. Presented analyses thus control for other aspects of the state context identified as relevant in the previous literature, including financial context, articulation policy, and governance.

[6] Detailed explanation of the NELS sample and procedures can be found in the *Base-Year to Fourth Follow-Up User's Manual* (NCES 2002). Also, for explanation and descriptive statistics of the PETS sample, see NCES (2003b) report titled *Postsecondary Attainment, Attendance, Curriculum, and Performance*.

[7] The loss of cases due to missing data on independent variables is small. Using mean substitution (e.g., Cohen and Cohen 1975) or multiple imputation procedures (e.g. Allison 2002) does not substantively alter the reported results.

Following Hauptman (2001), I distinguish between three different aspects of the state financial context: appropriations to higher education, tuition policy, and student financial aid. These three aspects are represented by the following variables: state appropriations for public higher education, per college-age population (i.e., adjusted by the total population 18–24 years old); tuition ratio between 4-year and 2-year public institutions; and the percentage of total state grant aid awarded based on need (i.e., need-based aid). Appendix Table 3 reports descriptive statistics and data sources for these variables.

The second aspect of the state policy that is relevant for the questions addressed in this study is articulation policy. All models include a dummy variable indicating whether a state has a state-wide articulation policy. This variable is based on the coding of state statutes (for details see Roksa and Keith 2008). While previous studies suggest that articulation policies are not associated with students' likelihood of transfer or bachelor's degree completion (Anderson et al. 2006; Roksa 2009; Roksa and Keith 2008), they may nonetheless be related to the distribution of enrollments and thus are important to include in the presented analyses.

Another important aspect of the state context considered is governance. Previous research in this area has focused mostly on examining the relationship between governance structures and other state-level policies, such as accountability (McLendon et al. 2006) and appropriations to research universities (Weerts and Ronca 2006). It is thus not clear whether and how governance structures may influence student outcomes. However, since governance structure is related to other aspects of the state environment, and thus may be associated with the distribution of enrollments, it is included in the presented models. I rely on McGinness' (1994) typology of governance and include a dummy variable indicating the presence of a consolidated governing board. Because of the focus of this study on the relationship between 2-year and 4-year public institutions, this dummy variable captures states in which community colleges are governed by a consolidated governing board responsible for both 2-year and 4-year institutions.[8]

In addition to financial context, articulation policy, and governance, which have emerged as key aspects of the state context in previous research, all models include several other state-level controls. Following previous studies (e.g., Perna and Titus 2004; Titus 2006), I include dummy variables for geographic region (West, Midwest, and Northeast, with South serving as the reference category). Moreover, I control for the size of the private sector (the proportion of the total number of students enrolled in higher education attending private institutions), as some studies have suggested that the private sector may be related to the characteristics and outcomes of the public sector (Arum 1996; Quigley and Rubinfeld 1993). Finally, although receiving mixed support in previous research, I control for unemployment and the size of the college educated population (proportion of the population above age 25 with a college degree or higher). All variables measuring state context are coded in 1992 (or as close as possible to that year) since that is when the majority of students in the sample entered higher education. Descriptive statistics, together with data sources, for all state-level variables are listed in the Appendix Table 3.

Analytic Strategy

Analyses in this study proceed in two stages. The first set of models estimates entry into public 4 vs. 2-year institutions using probit regression. Following this analysis, I estimate

[8] Using an alternative definition, one denoting a consolidated governing board without a distinction regarding 2 vs. 4-year institutions, does not substantively alter the reported results.

the predicted probability of entry into 4-year institutions (compared to 2-year institutions). Probability of selecting a 4-year institution over a 2-year institution is then used in the second stage of analysis, i.e., it is included as a term in the models examining the likelihood of a bachelor's degree completion. Estimates of bachelor's degree completion are specified as logistic regression models. All models are weighted using an appropriate panel weight, and estimates are corrected for NELS design effects using STATA survey commands (for a discussion of sampling design issues in national surveys and appropriate corrections, see Thomas and Heck 2001).

I present two models for each set of analyses: the first model includes only the key state-level variable of interest while the second model controls for other aspects of the state environment. Thus, the first model for entry into public 4 vs. 2-year institutions includes the relative size of the community college sector (i.e., the proportion of students in public higher education attending community colleges as opposed to 4-year institutions). The second model controls for other aspects of the state environment in order to examine whether they mediate the relationship between the relative size of the community college sector and entry into 4 vs. 2-year institutions. Similarly, for college completion, the first model includes only one state-level variable: sorting in higher education (i.e., probability of entry into public 4-year institutions compared to public 2-year institutions, based on Model 1 in Table 1). The second model considers whether this relationship may be mediated by other aspects of the state environment.

Table 1 Probit models predicting entry into 4 vs. 2-year public institutions

Independent variables	Model 1 b (s.e.)	Model 2 b (s.e.)
State context		
Community college sector	−3.229 (0.261)**	−3.372 (0.371)**
Tuition ratio (4 yr vs. 2 yr public)		0.018 (0.021)
Need based aid		0.161 (0.169)
State appropriations per 18–24 year old		−0.218 (0.189)
Articulation policy		0.118 (0.087)
Consolidated governing board		−0.066 (0.116)
Unemployment		−10.765 (4.176)*
College educated population		−1.388 (1.524)
Private sector		0.679 (0.764)
West		0.073 (0.166)
Midwest		0.000 (0.167)
Northeast		−0.218 (0.258)
Student characteristics		
Female	0.095 (0.066)	0.086 (0.066)
African American	0.735 (0.164)**	0.791 (0.161)**
Hispanic	0.445 (0.120)**	0.499 (0.123)**
Other non-white	0.331 (0.176)	0.333 (0.168)*
Test score	0.062 (0.005)**	0.062 (0.005)**
Socioeconomic background	0.272 (0.058)**	0.276 (0.058)**
Expect bachelor's degree	0.771 (0.066)**	0.774 (0.065)**
Intercept	−2.473 (0.279)**	−1.533 (0.623)*

* $p < 0.05$, ** $p < 0.01$ (two-tailed). $N = 5{,}217$

All models also control for a range of individual-level characteristics associated with educational success (for an extensive review, see Pascarella and Terenzini 2005). I begin with basic demographic characteristics (race and gender), followed by family's socio-economic background (a composite measure of parents' education, occupation, and income), academic ability (standardized composite test score in reading and math), and educational expectations (whether students expected to earn a bachelor's degree). Models of bachelor's degree completion also include personal characteristics which may influence students' ability to dedicate their time and resources to educational pursuits (marriage and children) as well as attendance patterns and early academic experiences in college. These variables measure whether students delayed entry into higher education, whether they were enrolled continuously and full-time, and whether they took any remedial courses. Descriptive statistics and definitions of the variables are provided in the Appendix Table 3.

Results

Sorting of Students in Higher Education

Table 1 presents probit models estimating entry into 4 vs. 2-year public institutions. The first model examines the relationship between the relative size of the community college sector and enrollment patterns, controlling for a range of individual-level characteristics. The results indicate that the larger the proportion of students in the state attending community colleges, the lower the individual's likelihood of attending public 4-year institutions.

This finding is to be expected as the relative sizes of the two sectors present differential opportunity structures. If there are more spaces available in community colleges, students will be more likely to follow this route on their journeys into higher education. While this finding is not surprising, implications of the sorting process are less intuitive. Figure 2 presents one illustration of potential consequences. This figure reports the proportion of students entering 4-year institutions, based on the relative size of the community college sector and students' educational expectations. These are descriptive results, based on sample statistics, with the sample restricted to students enrolled in public higher education. As would be expected, there is a negative relationship between the size of the community college sector and entry into 4-year institutions: in states with larger community college sectors, smaller proportions of students enter public 4-year institutions. Notably, this pattern holds for both students who do and do not expect to earn bachelor's degrees. Thus, even when students expect to earn bachelor's degrees, a smaller proportion of them enter 4-year institutions in states with large community college sectors. This suggests that students in states with large community college sectors may perceive these institutions as providing a viable path toward a bachelor's degree. Focusing on students who do not expect to earn bachelor's degrees presents perhaps the most notable finding: three and a half times as many students who do not expect to earn bachelor's degrees enter 4-year institutions in states with small community college sectors (less than a quarter of total public enrollments) than in states with large community college sectors (over three quarters of total public enrollments). Thus, when states do not provide community college alternatives, many students, including those who do not expect to earn bachelor's degrees, end up enrolling in 4-year institutions.

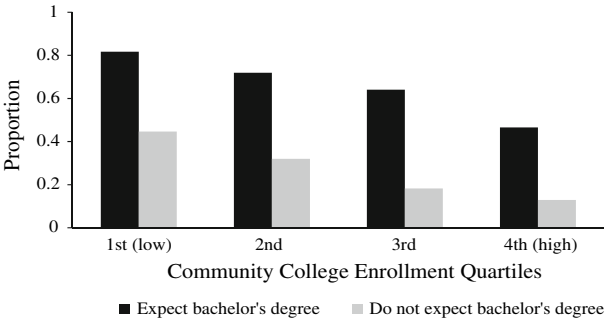

Fig. 2 Proportion of students entering public 4-year institutions, by bachelor's degree expectations and size of the community college sector. *Source*: NELS 1988–2000. *Note*: Sample restricted to students who entered public higher education

The second model in Table 1 considers whether the relationship between the relative size of the community college sector and enrollment in 4 vs. 2-year public institutions is mediated by other aspects of the state environment. The state context is assessed along multiple dimensions deemed relevant in the previous literature, including financial context, articulation policy, and governance, as well as unemployment, educational level of the population, size of the private sector, and region. After including other measures of the state context in the model, the magnitude and significance of the coefficient for the relative size of the community college sector remain unchanged. Although controlling for other aspects of the environment does not allow one to make causal statements, it increases one's confidence that the observed relationship between the size of the community college sector and enrollment patterns is not simply a product of the other aspects of the state environment.

With the exception of unemployment, none of the state-level controls have a statistically significant relationship to enrollment in 4 vs. 2-year public institutions. On the surface, this may appear to contradict previous findings. However, a more careful examination of the models and outcomes considered suggests that these findings are consistent with the extant literature. For example, while Perna and Titus (2004) show that the state financial context is related to specific enrollment patterns, the odds ratios for state appropriations to higher education and need-based financial aid are virtually identical for enrollment in 2-year and 4-year public institutions.[9] Similarly, while the tuition ratio (defined as a ratio of 4-year private and 2-year public tuitions) is significant for some of the outcomes, it shows no difference with respect to enrollment in 2 vs. 4-year public institutions. Thus, while state financial context may be important for whether students enroll in higher education, and for certain choices in higher education, the decision between enrolling in 2 vs. 4-year public institutions does not appear as susceptible to the influence of these state-level factors.

A lack of significance for other aspects of the state environment also corroborates previous findings. Several recent studies have suggested that articulation policies are not associated with students' likelihood of transfer or degree completion (Anderson et al. 2006; Roksa 2009; Roksa and Keith 2008). Moreover, studies of governance structures usually do not consider individual outcomes; instead, they explore relationships between

[9] Although the authors do not provide coefficients and standard errors to statistically test these differences, the odds ratios for entry into 4-year and 2-year public institutions are virtually identical. Odds ratios for state appropriations are 1.047 for entry into public 2-year and 1.046 for entry into public 4-year institutions. Similarly, odds ratios for need-based financial aid are 1.188 for entry into public 2-year and 1.162 for entry into public 4-year institutions (Perna and Titus 2004; Table 1; similar patterns are reported in Table 3).

governance and other aspects of the state environment. Thus, there is no clear expectation that governance structures would be related to student outcomes. Moreover, at least one study that examined the consequences of governance structures for student outcomes found no relationship between centralized governance and either entry or completion in higher education (Volkwein and Tandberg 2008).

In addition to the presented models, I conducted supplemental analyses to examine whether the sorting of students in higher education varies across different groups of students based on race/ethnicity, socioeconomic status, and academic ability. Several previous studies have suggested that state contexts may not have uniform consequences for all students: educational decisions reflect specific "situated contexts" which vary across racial/ethnic and socioeconomic groups (Paulsen and St. John 2002; St. John 2003). Moreover, in their critique of community colleges, Brint and Karabel (1989) proposed that community colleges would disproportionately divert less advantaged groups of students, including students who are less academically prepared. Supplemental analyses reveal no significant interactions between the size of the community college sector and race/ethnicity or socioeconomic status. The coefficient for academic ability (measured by a composite math/reading test score) was marginally significant at the $p < 0.10$ level, suggesting that students with higher test scores are more advantaged in access to 4-year institutions in states with higher proportions of community college enrollments. Thus, there is some, albeit limited, evidence that community colleges serves as "safety valves" allowing 4-year institutions to be more selective.

Bachelor's Degree Completion

While the relative size of the community college sector is related to the sorting of students in higher education, the crucial question is whether this sorting is associated with bachelor's degree completion. This question is important to address because it can offer insights into specific ways in which state contexts are related to degree completion, which has notable research and policy implications. Table 2 presents logistic regression models estimating the likelihood of bachelor's degree completion for students attending public 4-year institutions. The first model includes the measure of sorting into higher education (i.e., the probability of entry into public 4 vs. 2-year institutions calculated based on Model 1, Table 1) as well as a range of individual-level controls. The coefficient reflecting the sorting process is statistically significant, indicating that the sorting process is indeed related to students' likelihood of bachelor's degree attainment.[10]

The direction of the coefficient reflecting the sorting process may seem counterintuitive, as it suggests that the selection process has a negative relationship to the likelihood of graduation, and thus requires some elaboration. Focusing on the proportion of students attending community colleges, Model 1in Table 1 suggests that the *larger the relative size* of the community college sector, the *lower the probability* of entry into 4-year institutions. Moving to Model 1 in Table 2, the *higher the probability* of entry into 4-year institutions (which is represented by the sorting coefficient), the *lower the likelihood of degree completion*. Stating the second sentence in reverse, in order to focus on the low probability of

[10] Coefficients for individual-level factors are as expected. However, it is important to keep in mind that the first set of coefficients (from female to expecting a bachelor's degree) needs to be interpreted in combination with Table 1 because the sorting process was estimated with these individual-level characteristics in the model.

Table 2 Logistic regression models predicting bachelor's degree attainment

Independent Variables	Model 1 b (s.e.)	Model 2 b (s.e.)
Sorting in higher education		
Probability of entry into a 4 yr institution	−1.736 (0.799)*	−1.793 (0.844)*
State context		
Tuition ratio (4 yr vs. 2 yr public)		−0.001 (0.104)
Need based aid		−0.190 (0.419)
State appropriations per 18–24 year old		−0.153 (0.357)
Articulation policy		−0.206 (0.179)
Consolidated governing board		−0.033 (0.217)
Unemployment		−0.501 (7.689)
College educated population		0.824 (3.063)
Private sector		−2.314 (1.604)
West		−0.046 (0.387)
Midwest		0.102 (0.319)
Northeast		0.265 (0.596)
Student characteristics		
Female	0.871 (0.170)**	0.864 (0.169)**
African American	0.497 (0.293)	0.375 (0.311)
Hispanic	0.026 (0.428)	−0.005 (0.451)
Other non-white	0.213 (0.247)	0.192 (0.303)
Test score	0.065 (0.021)**	0.066 (0.019)**
Socioeconomic background	0.669 (0.134)**	0.658 (0.145)**
Expect bachelor's degree	0.818 (0.255)**	0.795 (0.279)**
Married	0.318 (0.194)	0.305(0.190)
Child	−1.441 (0.258)**	−1.439 (0.256)**
No delay in PSE	1.029 (0.393)**	1.042 (0.384)**
Enrolled continuously	2.857 (0.211)**	2.886 (0.204)**
Remedial courses	−0.659 (0.167)**	−0.651 (0.171)**
Enrolled full-time	0.901 (0.179)**	0.908 (0.170)**
Intercept	−6.508 (1.061)**	−5.861 (1.372)*

* $p < 0.05$, ** $p < 0.01$ (two-tailed). $N = 2{,}789$

Note: Analyses are restricted to students enrolled in public 4-year institutions

entry into 4-year institutions (which would be the case when the relative size of the community college sector is high), suggests that the lower the probability of entry into 4-year institutions, the higher the likelihood of degree completion. Combining the two sets of models thus implies that the larger the community college sector, the lower the probability of entry into 4-year institutions, and the higher the likelihood of bachelor's degree attainment.

Largely following the patterns revealed for entry into 4 vs. 2-year institutions, other aspects of the state environment do not appear related to the likelihood of bachelor's degree completion. As was the case for entry, these findings may reflect the specific outcome examined in this study (bachelor's degree completion of students attending public 4-year institutions). Most of the previous studies of state contexts have focused on entry

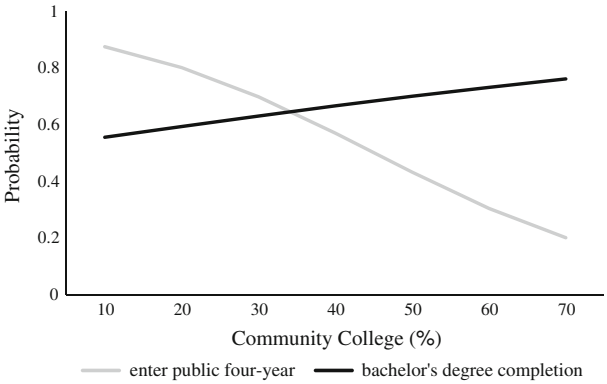

Fig. 3 Predicted probability of entry into public 4-year institutions and bachelor's degree completion, by the proportion of students attending community colleges in the state. *Source*: NELS 1988–2000

into higher education. When studying outcomes, previous studies have examined different student populations or used different definitions of student success (e.g., Titus (2006) considers bachelor's degree completion of students in all (not just public) 4-year institutions; and the sample includes only first-time, full-time, degree-seeking students).[11] Studies focusing on degree completion are relatively rare; thus, much more research is needed to understand whether and how different aspects of the state context may be related to degree completion across different institutions. This study suggests that one characteristic in particular, enrollment in 2 vs. 4-year institutions, deserves careful consideration in future research.

To facilitate the interpretation of results as well as to summarize the overall patterns revealed in this study, Fig. 3 reports predicted probabilities for entry into 4 vs. 2-year public institutions and bachelor's degree completion for states with varying sizes of the community college sector. Predicted probability of entry into 4 vs. 2-year public institutions is estimated based on a model including the size of the community college sector and individual-level controls reported in Table 1. Predicted probability of bachelor's degree completion for students attending public 4-year institutions is based on a model including the size of the community college sector and student attributes reported in Table 2. Both models are estimated as logistic regressions for ease of interpretation. All individual-level variables are centered at their means when calculating predicted probabilities.

Focusing on the gray line first, Fig. 3 illustrates that the probability of entry into public 4-year institutions declines as the proportion of students enrolled in community colleges in the state increases. The magnitude of this difference is notable. The predicted probability of entry into 4-year institutions in states with small community college systems (10% of enrollment) is almost 0.90 while that of entry into 4-year institutions in states with large community college sectors (70% of enrollment) is 0.20. The black line, representing the predicted probability of bachelor's degree completion shows the opposite pattern: the larger the community college sector, the greater the probability of bachelor's degree completion at public 4-year institutions. The probability of BA completion is 20% higher in states with large community college sectors (70% of enrollments) than in states with small community college sectors (10% of enrollments). The size of the community college

[11] Part of the explanation for a lack of significant findings in Model 2 may be attributed to relatively large standard errors resulting from a reduced sample size. However, even if variables are entered one at the time or in blocks (e.g., financial context, articulation, governance, other controls), none of the state-level characteristics are statistically significant.

sector is thus related to the sorting of students in higher education, which is in turn associated with the likelihood of bachelor's degree completion at public 4-year institutions.

Discussion

Research in recent decades has reflected a growing interest in the role of state contexts in facilitating enrollment and attainment in higher education (for recent reviews see Perna 2006; Perna et al. 2008). The present study contributes to this line of research by considering how the distribution of enrollments in public higher education is related to student outcomes. The results suggest that there is a positive relationship between the size of the community college sector and bachelor's degree attainment at public 4-year institutions: the larger the proportion of students attending community colleges in a state, the higher the probability of bachelor's degree attainment at public 4-year institutions. This appears to be a product of student sorting: the presence of community colleges facilitates sorting of students into higher education in a way that is associated with higher degree completion at public 4-year institutions. These findings highlight the importance of understanding how state contexts, and specifically the distribution of enrollments in public higher education, are related to student outcomes.

Reported analyses also included a range of state-level controls which did not have a significant relationship to examined outcomes. As discussed in the preceding pages, a lack of significant results is not surprising given the specific populations and outcomes examined in this study. However, these findings highlight the importance of examining how state contexts are related to a range of different outcomes: not just entry into higher education, but selection into specific types of institutions; and not just degree completion, but degree completion of students attending public vs. private 4-year colleges and universities. As St. John et al. (2004) showed, a particular set of policies may be related to some outcomes but not others: they found that educational reforms regarding high school preparation were related to SAT performance but not to postsecondary entry. Thus, studying the relationship between different state contexts and specific educational outcomes is crucial to developing more nuanced explanations of how state contexts shape the educational attainment process.

Moreover, future research is needed to replicate the patterns reported herein. The sample used in the study is not ideal for examining state-level contexts as it is not designed to be representative of students in each state. No nationally representative dataset is currently designed to have large and representative samples of students across all states.[12] Consequently, other studies examining the influence of state contexts on individual outcomes have relied on similarly less than ideal datasets: Perna and Titus (2004) used the same dataset employed in this study (NELS) while Anderson et al. (2006) and Titus (2006) used the Beginning Postsecondary Students (BPS) Longitudinal Study. Due to their reliance on nationally representative datasets, researchers do not attempt to estimate specific effects for each state, but only obtain a summary estimate capturing the relationship between different state characteristics and student outcomes. The accuracy of these

[12] The most recent version of the Beginning Postsecondary Students (BPS) dataset includes representative samples of students in 12 states, highlighting the potential and challenges associated with collecting state representative samples.

estimates will not be known until we have a dataset that includes nationally representative samples of students in many if not all states. Establishing such a dataset is vital to further development of knowledge in this area of research.[13]

In terms of policy implications, this study highlights yet another shortcoming in comparing raw graduation rates across public 4-year institutions. Growing accountability pressures, accompanied by a lack of readily accessible measures of institutional performance, have led to an increasing focus on graduation rates. Raw graduation rates have been criticized for not taking into account differential inputs (e.g., student characteristics and financial resources) across institutions. Consequently, most analysts today attempt to adjust graduation rates for some of those factors, such as students' SAT scores or institutional expenditures. Presented results suggest that those efforts need to be supplemented by a careful consideration of student sorting within specific state contexts. The sorting process is related to degree attainment above and beyond the individual characteristics commonly used to adjust graduation rates. This finding is particularly important to keep in mind when comparing graduation rates across states. Graduation rates of public 4-year institutions may be artificially inflated or deflated depending on the presence of community colleges. This is not to suggest that institutions should not be encouraged to do their best with the students they serve. As Carey (2004) pointed out, there is much variation across institutions in graduation rates, even after adjusting for some common input measures. However, it should be recognized that success partly reflects the state context in which institutions are embedded.

More than simply adjusting graduation rates, presented findings imply the need to think carefully and holistically about student success. If states wish to improve graduation rates, they need to consider how that is possible within the specific context in which their institutions are embedded. Presented results are not intended to suggest that there is a "perfect mix" of 2-year and 4-year institutions. The two sectors have different missions and produce distinct outcomes. Each state has tried to meet the challenge of providing higher education opportunities within the context of its political, social, and economic circumstances. The presented findings only aim to suggest that the performance of public 4-year institutions in part reflects those choices: decisions made about the structure of the higher education system, and in particular the distribution of students in 2 vs. 4-year institutions, can shape outcomes often assessed for accountability purposes.

Finally, as the federal government increasingly raises the possibility of nation-wide accountability measures, it is crucial to take into account the influence of state contexts. State contexts provide the contours of opportunities and shape student enrollment trajectories, which have consequences for student outcomes. Abstracting students and institutions from their state environments not only fails to appreciate the complexity of educational attainment, but may also misrepresent individual and institutional performance.

[13] In the meantime, careful studies of individual states over time can provide useful insights. However, individual state analyses cannot be generalized, as each state is characterized by a unique set of characteristics, necessitating the development of a national dataset including many if not all states.

Appendix

Table 3 Descriptive statistics (weighted) and definitions of variables used in bachelor's degree attainment analyses ($N = 2{,}789$)

Variables	Mean	SD	Definition
State context			
Community college sector	0.424	0.140	Proportion of students in public higher education attending community colleges (Digest of Education Statistics 1994)
Tuition ratio (4 yr vs. 2 yr public)	2.474	1.845	Ratio of 4-year public to 2-year public tuition (Digest of Education Statistics 1994)
Need based aid	0.661	0.314	Proportion of total state aid that is need based (National Association of State Scholarship and Grant Programs 1993)
State appropriations per 18–24 year old	1.312	0.297	State appropriations for public higher education, per 18–24 year old (in thousands) (State Higher Education Executive Officers (SHEEO), available at http://www.higheredinfo.org/)
Articulation policy	0.340	0.474	Dummy variable (coded 1) for states with statewide articulation policies (Roksa and Keith 2008)
Consolidated governing board	0.216	0.412	Dummy variable (coded 1) for states where community colleges are under consolidated governing board for both 2-year and 4-year institutions (McGuinness 1994)
Unemployment	0.055	0.010	Unemployment rate (Statistical Abstract of the US 1994)
College educated population	0.194	0.033	Proportion of population over 25 with a college degree (Digest of Education Statistics 1994)
Private sector	0.202	0.107	Proportion of students attending private institutions (Digest of Education Statistics 1994)
West	0.162	0.369	Dummy variable (coded 1) for Western region
Midwest	0.297	0.457	Dummy variable (coded 1) for Midwestern region
Northeast	0.152	0.359	Dummy variable (coded 1) for Northeastern region
Student characteristics (NELS 1988–2000)			
Female	0.534	0.499	Dummy variable (coded 1) for females
African American	0.099	0.298	Dummy variable (coded 1) for African Americans
Hispanic	0.065	0.247	Dummy variable (coded 1) for Hispanics
Other non-white	0.051	0.220	Dummy variable (coded 1) for other non-white racial/ethnic groups
Test score	56.772	7.641	Standardized composite test score (reading and math)

Table 3 continued

Variables	Mean	SD	Definition
Socioeconomic background	0.329	0.707	Socioeconomic background (a composite measure of parents' education, occupation, and income)
Expect bachelor's degree	0.770	0.421	Dummy variable (coded 1) if expected to earn a bachelor's degree
Married	0.383	0.487	Dummy variable (coded 1) if married
Child	0.204	0.403	Dummy variable (coded 1) if had a child
No delay in PSE	0.921	0.271	Dummy variable (coded 1) if entered postsecondary education within six months of high school graduation
Enrolled continuously	0.756	0.430	Dummy variable (coded 1) if enrolled in higher education continuously
Remedial courses	0.266	0.442	Dummy variable (coded 1) if enrolled in any remedial courses
Enrolled full-time	0.687	0.464	Dummy variable (coded 1) if enrolled in higher education full-time

Note: Selected individual-level variables are used in predicting entry into 4 vs. 2-year public institutions. The sample for entry models includes 5,217 respondents

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