10-10-2006

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Keywords
higher education, public universities, public funding, graduation rates

October 10, 2006
Comments solicited

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Abstract

This study uses panel data to examine the direct link between state funding and graduation rates at four-year public institutions. When other factors are held constant, a $1,000 increase in state appropriations per FTE student at four-year public institutions is associated with about a one percentage point increase in graduation rates. This positive link appears to hold for all research/doctoral, masters, and baccalaureate institutions. In addition, there is evidence that modest increases (or a decrease) in state funding are associated with rapid increases in tuition rates charged at four-year public institutions, which likely result in an additional negative impact on graduation rates. Simply put, there is no such a thing as free lunch when it comes to graduation rates at public higher education institutions.

Does State Funding for Higher Education Matter?

I. Introduction

It is no longer a secret that higher education is often regarded as a discretionary item in many state budgets. At a time of favorable state fiscal environments, Hovey (1999) predicted that many states would experience significant difficulties in maintaining their levels of public service over the following decade. Unfortunately, that forecast has been especially true for public colleges and universities. Rizzo (2006) documented three major changes in state funding of education that occurred during the last quarter of the 20th century: the decline in education's share of state budgets, the decline in higher education's share of state educational funding, and the decline in the share of higher education funding that goes to public higher education institutions. Although for most years during the last quarter of century the absolute level of state funding was not reduced, the *share* of public institutions' revenues from state appropriations decreased from about 44% in early 1980s to about 32% due to increases in college costs and in college enrollments (National Center for Educational Statistics 2005, Table 171 and 329). Faced by relative reductions in state funding and limits in their ability to raise other revenues, public higher education institutions often had to do more with less.

Part of the current dilemma facing public higher education is a lack of evidence to show the harmful impacts of reduced state funding. Skolnick (1986) wrote succinctly: "If the cut is so deep, where is the blood?" If higher education institutions have been as severely hurt by financial limitations as they claim, why have researchers not uncovered that damage? Analysis of the influence of inadequate public funding is essential if public institutions are to make the case to legislatures and governors that improved funding will enable them to better serve the public. Without such evidence, the structural deficits faced by many states (Hovey 1999), coupled with

the growing competition for public funding, will likely result in a continuation of Rizzo's declines (2006).

Somewhat surprisingly, very few studies have addressed whether reduced state funding for public higher education has impacted public higher education, resulting, for example, in less learning, longer time-to-degree, and lower graduation rates. Recent studies by Ehrenberg and Zhang (2005a, 2005b), however, suggested a possible link between state funding and institutional performance. They (2005a) showed that the growing financial pressures faced by public higher education institutions have led to increases in the utilization of contingent faculty and reductions in tenured and tenure-track. In a second study, they found that the increased usage of contingent faculty adversely affected graduation rates at four-year institutions, with the largest impact on students being at public master's-level institutions (Ehrenberg & Zhang 2005b). Together, these two studies suggest promising areas for investigating whether reduced state funding adversely affects such key institutional performance indicators as graduation rates.

An examination of the direct link between state funding and institutional performance seems in order. Several studies have addressed this issue partially. Ryan (2004) used a cross-section sample of baccalaureate colleges (both private and public) to examine the impact of institutional expenditures on six-year cohort graduation rates. The results suggested a positive and significant relationship between instructional and academic support expenditures and cohort graduation rates. A more recent study by Blose, Porter, and Kokkelenberg (2006) used a similar approach to examine the effect of institutional expenditures on graduation rates at public institutions and similar results were reported. The evidence of the link between expenditures and graduation rates is important not only because political leaders consider these outcomes to be

very important, but also because institutions may wish, accordingly, to redirect financial resources *internally.*

Of course, it could be argued that a direct link between state funding and institutional performance should to be established to hold states accountable for the education of their citizens. In a recent report by the National Center for Higher Education Management Systems, Kelly and Jones (2005) used state-level data to examine the relationship between state funding and performance in a variety of areas, including graduation rates and participation rates. Their study concluded that "not all institutions need more resources, some can perform better with what they have, and some can maintain or improve performance with few resources" (p. 37). Such conclusions could be harmful, of course, if policy makers believe erroneously that higher education can improve performance even when state support declines. What is needed is a careful examination of the issues.

This study is the first to use panel data to address whether reduced state funding adversely influences the graduation rates of students enrolled at public four-year institutions. We use eight cohorts of undergraduate students enrolled at four-year public higher education institutions in the United States to analyze this issue. The data come from various components of the *Integrated Postsecondary Education Data System* (IPEDS) and *The College Entrance Examination Board's Annual Survey of College Standard Research Compilation* data files (henceforth College Board data). In previous *cross-sectional* studies (e.g., Blose, Porter, & Kokkelenberg 2006; Ryan 2004), the estimated effects of instructional expenditures on graduation rates may have been confounded by unobserved institutional characteristics, that is due to the omission of important variables. The panel data model used in this paper overcomes this problem. The next section briefly describes the data and our analytical framework, which

addresses several important issues brought up in previous studies. Section III presents our empirical results, while Section IV discusses empirical extensions of our model, and we spell out some of our conclusions in Section V.

II. The Data

Graduation rates of undergraduate cohorts were first added to IPEDS *Graduate Rates Survey* in 1997 when four-year institutions reported six-year cohort graduation rates (i.e., 150% of normal time-to-degree). In other words, the six-year graduation rates reported in 1997 (as of August 31, 1997) were for the entering freshman cohort in the fall of 1991. For the present study the year for which the most recent graduation rate data were available was 2004—for the entering freshman cohort in the fall of 1998. For each entering cohort from 1991 to 1998, we extracted data on graduation rates for each four-year institution from IPEDS. While *College Board* data provided similar information on the cohort graduate rates, the data reported by IPEDS had been adjusted for various exclusions (such as students who died or became permanently disabled and who left school to serve military, foreign aid, or church missions).

Detailed characteristics of each entering cohort between 1991 and 1998 were available in *College Board* data. Cohort characteristics included the average age of the entering freshman cohort, number of students by gender and attendance status (i.e., full-time vs. part-time), proportion of students who were minority, proportion of students from in-state, and 25^{th} and 75^{th} percentile math and verbal SAT scores. We then merged this detailed cohort-specific information by cohort and institution with the data on cohort graduation rates from IPEDS.

We measured the level of state funding at public institutions by state appropriation per FTE student. Data on state appropriation were available from IPEDS *Finance Survey*. We

computed the number of FTE students at an institution by adding the number of full-time students and one-third of the number of part-time students at that institution. The number of students by attendance status was reported in IPEDS *Enrollment Survey*. We then calculated state appropriation per FTE by dividing the total amount of state appropriation at an institution by the FTE enrollment.

In estimating the impacts of state funding on cohort graduation rates, it was important to "match up" the cohort with financial variables. Previous studies either used the financial variables in the year freshman cohort started their colleges (e.g., Blose, Porter, & Kokkelenberg 2006; Ryan 2004) or in the year the data on six-year graduation rates were collected (Kelly & Jones 2005). Because college education is a multi-year experience, neither of these measures characterized the financial environment to which a particular cohort was exposed. We assumed that the relevant financial variables were those during the first four years that a particular cohort was enrolled in college. So, for example, the six-year graduation rates reported by IPEDS *Graduation Rates Survey* in 2004 were for students who first enrolled as freshmen in the fall of 1998. Hence, we computed the relevant financial environment that this cohort of students experienced by averaging the financial variables their institutions reported in the FY 1999, 2000, 2001, and 2002 IPEDS *Finance Survey*.

Finally, tuition was another important financial variable that could have influenced graduation rates. The financial pressure caused by high tuition could have led to high rates of drop-out or stop-out, both resulting in low graduation rates. Because of state funding at public institutions, their tuition rates were kept relatively low. For example, the average tuition charged at 4-year public institutions was about $3,400 in the year 2000. However, as state funding waned, public higher education institutions might have used tuition as a buffer. As a result, the

impact of tuition increase on graduation rates could have been regarded as an indirect effect of reduced state funding; thus, estimating the impact of tuition on cohort graduation rates could have been tricky because the level of tuition was not only a financial burden for students, but also indicated educational quality to a significant extent. For example, Zhang (2005) showed that students with higher test scores, among other academic and non-academic factors, are more likely to attend better institutions that charge higher tuition. Consequently, the estimated effect of tuition on graduation rates, which picks up the impact of students characteristics and institutional quality when they are not adequately measured and controlled, is likely to be upward biased when a cross-section sample of institutions is used in regression analyses.

The same logic applies to the estimation of other variables. For example, because the proportion of nonresident students is probably higher at better institutions than others, the effect of non-resident enrollment could be confounded by the impact of institutional quality when the latter is not adequately controlled. Similarly, a cross-section estimate of the impact of state funding on graduation rates is likely to be biased when institutional characteristics (such as college quality) are absent from the empirical model.

The panel data available to us provide a way to control for unobserved institutional characteristics. Our analytical approach is to use our panel data to estimate models in which the six-year graduation rate of students that entered institution *i* in year *t* (G_{it}) is specified to be a function of the state appropriation per FTE at institution *i* averaged over the first four years (i.e., year *t*, *t+1*, *t+2*, and *t+3*) that the cohort is enrolled at the institution (S_{it}), the in-state undergraduate tuition and fees changed at institution *i* in year *t* (T_{it}), characteristics of the cohort students and of the institution (X_{it}), institutional fixed effects (η_i), and a random error term (ε_{it}).

(1) $G_{it} = \alpha_0 + \alpha_1 S_{it} + +\alpha_2 T_{it} + \alpha_3 X_{it} + \eta_i + \varepsilon_{it}$

where the α_k are parameters to be estimated. Clearly, in a cross-section regression where the institutional dummies are omitted from Equation (1), the estimates for α_k are biased if these independent variables are correlated with institutional dummies. In empirical analyses, Equation (1) needs to be tested against the cross-section model where η_i is assumed to be zero.

The characteristics of the students included in the model are the average age of the entering cohort, the proportion of entering freshmen who are from in-state, the share of underrepresented minority students in the entering class, the proportion of the entering freshmen who are full-time students, the share of male students, and the midpoint of the 25th and 75th percentile SAT scores of the entering class. State appropriation per FTE is deflated by the Consumer Price Index to 2000 constant dollars. We included institutional dummies to control for other institutional characteristics that are not captured by the two financial variables in the model. We further allow the estimated coefficients to vary across different Carnegie categories of institutions by estimating the model separately for each type of institution.

III. Econometric Results

Table 1 presents the estimates from a cross-section model, which has the same model specifications as in Equation (1) except that institutional fixed effects are assumed to be zero. Table 2 reports the estimates from a panel data fixed-effects model where institutions are allowed to have their own intercepts. A comparison between these two models makes it clear that different model specifications lead to quite different estimates and interpretations and, hence, to different policy implications. In Tables 1 and 2, the two financial variables, state

funding per FTE and tuition, are deflated by the Consumer Price Index. A separate set of regressions using Higher Education Price Index are also included in Appendix Tables A and B.

Table 1 reports our estimates of a cross-section model for our sample as a whole and for subsamples of doctoral/research, master's, and liberal arts institutions. Remember that these are cross-section estimates. The estimated coefficients should therefore be interpreted across institutions. Turning first to the control variables of cohort characteristics, we see that institutions with younger freshman students have higher graduation rates, other factors included in the model being held constant. On average, an institution with its entering cohort one year younger than others would have a graduation rate 2.5 percentage points higher. The estimated effect of age is quite stable for different types of institutions. Other cohort characteristics can be interpreted similarly. For example, institutions whose freshman cohort has higher SAT scores, a higher proportion of non-resident students, a lower proportion of minority students, a higher proportion of full-time students, and a lower proportion of male students, have higher graduation rates on average.

Turning to the two financial variables, institutions with better state funding have higher graduation rates. On average, a $1,000 difference in state funding per FTE is associated with a gap of 1.182 percentage points in graduation rates, other factors being held constant. This positive relationship between state funding and graduate rates is strong for all types of institutions. Not surprisingly, institutions charging higher tuition and fees have better graduation rates. On average, a $1,000 difference in tuition and fees charged to in-state students is associated with about a gap of 2 percentage points in graduation rates, with the largest difference appearing for liberal arts colleges.

Results in Table 1 are important because they explain the variation of graduation rates across institutions. For example, why does Institution A have better graduation rates than Institution B? It may be because Institution A has better state funding, higher tuition and fees, an entering cohort with higher SAT scores, more non-resident students, fewer minority students, more full-time students, and fewer male students. Important as they are, these results have less value in policy making if, let us say, Institution B wants to increase its graduation rates. For example, an increase in tuition and fees in the hope of improving graduation rates would not typically be a good strategy.

To obtain "within" estimates that give the impact of the change in dependent variables on the change in dependent variables, we present fixed-effect panel data models. Table 2 presents our estimates of a fixed-effect panel data model for our sample as a whole and for subsamples of doctoral/research, master's, and liberal arts institutions. Results in this table are quite different from those in Table 1. Turning first to the control variables of cohort characteristics, we see that a decrease in the average age of the entering cohort does not seem to increase graduation rates significantly, holding constant other factors in the model including institutional dummies. Taken together with the result in Table 1, it suggests that the relationship between the average age of a cohort and its graduation rates is primarily a cross-institution phenomenon. It could simply reflect the fact that younger students are more likely to attend better institutions (e.g., Zhang 2005). From an institutional point of view, enrolling younger students alone would not be effective in improving graduation rates. A couple of other cohort variables including the proportion of resident students and minority students do not appear to have significant influence on graduation rates in the fixed-effect model.

The other three cohort characteristics, including the mean SAT scores, the proportion of full-time students, and the proportion of male students, remain their significant impact on graduation rates in the fixed-effect model, although the magnitude of their influence has been reduced greatly. For example, Table 1 indicates that an institution whose entering freshman class has mean SAT scores 100 points higher than the classes of other institutions would have more than a 7% advantage in graduation rates. In contrast, Table 2 suggests that an increase of 100 points in mean SAT scores at a particular institution would result in about a 2% increase in graduation rates in that institution. Similarly, an increase of full-time students by 1 percentage point is associated with a 0.065 percentage point increase in graduation rate. Because the graduation rate is measured only for full-time first-time students, the significant influence of the share of students that are part time suggests that more part-time students might create an academic environment that may adversely affects full-time students. Finally, results indicate that an increase of male students by 1 percentage point is related to a 0.111 percentage point decrease in graduation rates.

Although the effects of most variables have been reduced greatly in the fixed-effect model, the impact of state appropriation per FTE remains strong and significant. On average, a $1,000 increase in state funding per FTE student is associated with a 0.922 percentage point increase in graduation rates, only slightly lower than the cross-section result of 1.182 in Table 1. In fact, for research/doctoral institutions, the estimated effect of state funding is slightly larger in the fixed-effect model than in the cross-section model. Results in Tables 1 and 2 indicate that the positive relationship between state funding and graduation rates not only exists across institutions, but also holds for any particular institution, suggesting that increasing state funding is a good strategy to improve graduation rates at four-year public institutions.

While there is a positive association between tuition and graduation rates across institutions, increasing tuition alone is not a feasible strategy for improving graduation rates. On average, an increase in tuition at an institution would result in lower graduation rates, although the effect is not statistically significant. (In Appendix Table 2 where the Higher Education Price Index is used to deflate financial variables, the estimated effect of tuition is significant.)

We carried out two of model specification tests to determine the model of best fit. The test of the null hypothesis that all institutional fixed effects η_i are zero is rejected with an F statistic of 43.32, which was significant at the 0.001 level. Furthermore, we tested a random-effect panel data model against the fixed-effect model using the standard Hausman procedure and subsequently rejected it with a Chi-square statistic of 632.87, which was significant at 0.001 level. These tests indicated that the fixed-effect model as presented in Table 2 yield consistent estimates and thus are preferred.

IV. Empirical Extensions

Several extensions of our analyses warrant being briefly reported here. First, one might argue that the collection of goods and services purchased by colleges and universities is different from that used in calculating the Consumer Price Index. Consequently, to determine increases in funding necessary to maintain real purchasing power for colleges and universities, the Higher Education Price Index should be used according to this perspective. Appendix Tables A and B report a parallel set of regression as in Tables 1 and 2, but using HEPI. The qualitative results are similar, although the estimated effect of state funding per FTE on graduation rates in Appendix Table B is about half of the size as in Table 1.

Second, besides state governments, federal and local governments also fund public higher education, especially to special institutions such as tribal colleges. For the three types of institutions included in this analysis (i.e., research/doctoral, master's, and liberal arts institutions), federal and local appropriations are minimal relative to state appropriations. For example, in 2000, federal and local appropriations account for less than 2% of total government appropriations. Consequently, when total public funding (appropriations from all levels of governments) per FTE is used in the analysis, we obtain virtually identical results as when we use state funding per FTE. One might suggest that total revenues per FTE be used because other sources of revenue might also contribute to student success in college. When we do so, the estimated effect of total revenues per FTE on graduation rates is about one third of the magnitude as in the case of state funding per FTE. Not surprisingly, when state appropriations are excluded from the total revenues in the empirical model, the estimated effect is even lower. These results suggest that, although our analysis does not reject the idea that other sources of revenues than state funding also influence student graduation rates, the dominant factor still appears to be state appropriations.

Third, other variations of model specifications have also been considered. It is possible that part of the relationship uncovered in this study is due to the time trend in the graduation rate. When our panel data models are estimated with time trend removed, the estimated effect of state appropriation on graduate rate remains significant, but its magnitude is reduced to about half of the effect as before. In addition, our models use the tuition level at an institution in the year when a cohort enters colleges; alternatively, we could use the tuition averaged over the first four years when the cohort stays in college. When we do so, there is a positive but insignificant relationship between tuition and graduate rate. However, when we re-estimate the model with

time trend in graduate rate removed, the relationship between tuition and graduate rate is again negative and insignificant as in Table 1. In light of these results, caution must be given when one interprets the relationship between tuition and graduate rate, although the majority indicates a negative association between these two variables.

Finally, a topic of interest may be the dynamics between state funding and tuition charged at public institutions. One hypothesis is that a decrease in state funding could lead to an increase in tuition, which would further depress graduation rates. However, for most of the years of our analysis, the absolute dollar value of state funding per FTE has not decreased; as a result, a negative association between state funding and tuition is not detected using their absolute values. Alternatively, one could show the relationship between the relative changes in both variables by removing their time trends. When we do, a negative correlation between these two variables emerges. That is, when state funding per FTE increases slowly (or decreases), tuition charged by institutions increases fast. In contrast, a relatively fast increase in state funding is associated with a relatively slow increase of tuition. Taken together, a decrease or a slow growth in state funding appears to push tuition up quickly, possibly resulting in a negative impact on student graduation rates.

V. Conclusion

This study is the first to use panel data to examine the direct link between state funding and graduation rates at four-year public institutions. When other factors are held constant, a $1,000 increase in state appropriations per FTE student at four-year public institutions is associated with about a one percentage point increase in graduation rates. This positive link appears to hold for all research/doctoral, master's, and baccalaureate institutions. In addition,

there is evidence that modest increases (or a decrease) in state funding are associated with rapid increases in tuition rates charged at four-year public institutions, which likely result in an additional negative impact on graduation rates. Simply put, there is no such a thing as free lunch when it comes to graduation rates at public higher education institutions.

Our results are largely consistent with recent studies on similar topics (e.g., Blose, Porter, & Kokkelenberg 2006; Ryan 2004). While these recent studies showed the positive link between instructional expenditures and graduation rates, our study makes it clear that it is mainly the state appropriations that have a positive impact on graduation rates. These results are consistent with the perspective of resource dependency, which holds that internal organizational activities are influenced primarily through the actions of external resource providers. For example, Hasbrouck (1997) found that instructional expenditures were consistently and strongly predicted by state appropriation and tuition and fees, as would have been expected from resource dependency point of view, and only modestly by gift, grants, and contract revenues. In short, a decline in state appropriation, when other factors are held constant, would most likely lead to a reduction in instructional expenditures. In other words, it is unlikely that public institutions can compensate for the reduction in state appropriation through internal resource reallocation other than by raising tuition and fees.

Our results appear to counter those of Kelly and Jones (2005) who found no correlation between state funding and institutional performance. The time-mismatch between the state funding and performance variables could be one explanation and the one-shot cross-section nature of their study could be another. Further, the positive relationship between state funding and graduation rates at institutional level as shown in our study could be mitigated by

inefficiency in state resource allocation among public institutions when these variables are aggregated to a state level.

More research on the relationship between financial resources and institutional performance is necessary before we can determine the adequacy of public funding at public institutions. Ehrenberg and Zhang (2005a, 2005b) provided a possible through which inadequate public support at public institutions might adversely affect student outcomes. Studies along this line would collectively improve our understanding about the impact of financial resources on institutional performance. Further, measures of institutional performance should go beyond graduation rates to include other outcomes such as student learning and research productivity. Given the shrinking public funding for higher education in recent decades, it is imperative for the higher education research community to study the impact of financial resources, especially public funding, on the quality of the service that public higher education institutions are able to offer.

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Table 1: Cross-section Estimates for Six-Year Graduation Rates at Four-Year Public Higher Education Institutions (t-statistics)

	All Institutions	Research /Doctoral Institutions	Master's Institutions	Liberal Arts Colleges
State Appropriation per FTE ($1,000)	1.182 (14.74)	0.880 (9.49)	1.070 (4.88)	1.241 (4.83)
Undergraduate Tuition and Fees ($1,000)	2.141 (12.62)	1.823 (8.92)	2.631 (8.35)	2.817 (5.63)
Average Age of the Entering Cohort	-2.496 (-13.03)	-2.497 (-8.24)	-2.263 (-8.28)	-2.628 (-5.53)
Mean SAT Scores of the Entering Cohort (100)	7.137 (31.44)	7.916 (25.08)	6.397 (17.14)	5.252 (7.55)
Proportion of Resident Students	-0.128 (-8.75)	-0.095 (-4.65)	-0.106 (-4.44)	-0.146 (-2.82)
Proportion of Minority Students	-0.035 (-3.44)	-0.055 (-3.07)	-0.052 (-3.52)	0.018 (0.54)
Proportion of Full-time Students	0.254 (17.95)	0.375 (19.46)	0.201 (9.20)	0.017 (0.41)
Proportion of Male Students	-0.312 (-13.99)	-0.454 (-15.85)	-0.212 (-5.60)	-0.113 (-1.74)
# Observations	1794	751	823	220
R-Squared	0.7121	0.7780	0.5853	0.6152

Note: State Appropriations per FTE and Undergraduate Tuition and Fees are deflated by the Consumer Price Index

Table 2: Panel Data Estimates for Six-Year Graduation Rates at Four-Year Public Higher Education Institutions (t-statistics)

	All Institutions	Research /Doctoral Institutions	Master's Institutions	Liberal Arts Colleges
State Appropriation per FTE ($1,000)	0.922 (5.51)	1.055 (4.93)	1.115 (3.76)	0.506 (1.07)
Undergraduate Tuition and Fees ($1,000)	-0.259 (-1.26)	0.010 (0.04)	-0.391 (-1.02)	-0.337 (-0.57)
Average Age of the Entering Cohort	-0.084 (-0.72)	0.266 (1.62)	-0.273 (-1.60)	-0.146 (-0.34)
Mean SAT Scores of the Entering Cohort (100)	1.967 (12.59)	1.876 (8.02)	1.635 (7.00)	2.428 (4.58)
Proportion of Resident Students	0.023 (1.48)	0.028 (1.48)	0.018 (0.72)	-0.018 (-0.21)
Proportion of Minority Students	-0.018 (-0.73)	0.058 (1.62)	-0.025 (-0.73)	-0.323 (-2.98)
Proportion of Full-time Students	0.065 (5.08)	0.155 (6.47)	0.025 (1.34)	0.079 (2.46)
Proportion of Male Students	-0.111 (-4.90)	-0.257 (-6.38)	-0.035 (-1.09)	-0.145 (-2.43)
# Observations	1794	751	823	220
R-Squared	0.9703	0.9764	0.9527	0.9505

Note: State appropriations per FTE and undergraduate tuition and fees are deflated by the Consumer Price Index.

Appendix Table A: Cross-section Estimates for Six-Year Graduation Rates at Four-Year Public Higher Education Institutions (t-statistics)

	All Institutions	Research /Doctoral Institutions	Master's Institutions	Liberal Arts Colleges
State Appropriation per FTE ($1,000)	1.185 (15.25)	0.891 (9.95)	1.169 (5.44)	1.224 (4.86)
Undergraduate Tuition and Fees ($1,000)	2.111 (12.96)	1.806 (9.23)	2.636 (8.70)	2.730 (5.62)
Average Age of the Entering Cohort	-2.480 (-13.02)	-2.499 (-8.31)	-2.249 (-8.28)	-2.614 (-5.50)
Mean SAT Scores of the Entering Cohort (100)	7.177 (32.13)	7.978 (25.68)	6.464 (17.55)	5.328 (7.72)
Proportion of Resident Students	-0.126 (-8.69)	-0.093 (-4.62)	-0.109 (-4.57)	-0.146 (-2.80)
Proportion of Minority Students	-0.034 (-3.42)	-0.057 (-3.17)	-0.052 (-3.59)	0.021 (0.62)
Proportion of Full-time Students	0.256 (18.22)	0.376 (19.64)	0.202 (9.29)	0.021 (0.50)
Proportion of Male Students	-0.318 (-14.28)	-0.458 (-16.12)	-0.213 (-5.65)	-0.117 (-1.80)
# Observations	1794	751	823	220
R-Squared	0.7089	0.7747	0.5809	0.6149

Note: State appropriations per FTE and undergraduate tuition and fees are deflated by the Higher Education Price Index.

Appendix Table B: Panel Data Estimates for Six-Year Graduation Rates at Four-Year Public Higher Education Institutions (t-statistics)

	All Institutions	Research /Doctoral Institutions	Master's Institutions	Liberal Arts Colleges
State Appropriation per FTE ($1,000)	0.546 (3.16)	0.682 (3.02)	0.774 (2.53)	0.325 (0.68)
Undergraduate Tuition and Fees ($1,000)	-0.474 (-2.38)	-0.212 (-0.86)	-0.590 (-1.58)	-0.530 (-0.90)
Average Age of the Entering Cohort	-0.082 (-0.70)	0.279 (1.69)	-0.277 (-1.61)	-0.144 (-0.34)
Mean SAT Scores of the Entering Cohort (100)	2.147 (14.23)	2.140 (9.50)	1.815 (8.09)	2.458 (4.66)
Proportion of Resident Students	0.026 (1.66)	0.035 (1.81)	0.019 (0.76)	-0.026 (-0.30)
Proportion of Minority Students	-0.010 (-0.41)	0.062 (1.72)	-0.017 (-0.48)	-0.318 (-2.91)
Proportion of Full-time Students	0.069 (5.31)	0.158 (6.46)	0.029 (1.58)	0.080 (2.49)
Proportion of Male Students	-0.116 (-5.09)	-0.262 (-6.38)	-0.042 (-1.29)	-0.145 (-2.43)
# Observations	1794	751	823	220
R-Squared	0.9706	0.9769	0.9532	0.95054

Note: State appropriations per FTE and undergraduate tuition and fees are deflated by the Higher Education Price Index.