Peer-Reviewed Article

OJED
OPEN JOURNALS IN EDUCATION

© *Higher Education Politics & Economics*
Volume 8, Issue 1 (2022), pp. 2-23
ISSN: 2162-3104 (Print), 2166-3750 (Online)
doi: 10.32674/hepe.v8i1.4497
ojed.org/hepe

Relationship Between Alternative Revenue Strategies and Graduation Rates for U.S. Public Higher Education

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ABSTRACT

State support for higher education has been volatile, prompting public universities to pursue alternative revenue sources to supplement state support. While dependence on alternative revenue sources has been raising, the relationship between these revenue sources and graduation rates has not been examined in depth. This study used panel data from 2012-2018 to examine how alternative revenue sources related to graduation rates by institution type and student race. The results show that the associations among alternative revenue sources and graduation rates varied by institution type and racial group. The results also showed that relying on alternative revenue other than state funding may negatively influence graduation rates for all student racial groups. The discussion and implications for practice are presented.

Keywords: higher education, graduation rates, strategies of revenue sources, state funding, students' racial groups

For many reasons, improving completion rates at U.S. public institutions of higher education has become a focus of the government. These reasons range from social and economic benefits to the importance of a highly educated population (Bailey & Xu, 2012; Carnevale et al., 2016; Deming, 2017; Pike & Robbins, 2020). However, despite increasing levels of enrollment, completion rates have remained low across the country (Matthew & Powell, 2016). Factors such as students' level of college readiness, individual ability, and socio-economic background, as well as institutional characteristics and the cost of higher education, have all been found to contribute to students' level of persistence and rate of completion (Morrison, 2012; Pike & Robbins, 2020; Titus, 2009; Zhang, 2009). Research has shown that state funding is a crucial determinant of graduation rate (Chen, 2020; Zhang, 2009). However, trends in state support for higher education show it to be unpredictable and generally in decline (Delaney & Doyle, 2018; Long, 2016; Noll, 2010; State Higher Education Executive Officers Association [SHEEO], 2017; Tandberg, 2008; Zumeta, 2004, 2018). Moreover, with the advent of the COVID-19 pandemic, higher education institutions (HEIs) are likely to experience more precarious financial situations than at any time in history due to the decline in their other primary revenue sources and net tuition revenue (Laderman, & Heckert, 2021).

Studies of future trends in state support for higher education have indicated that state funding is unlikely to normalize any time soon, especially with increasing competition from Medicare, corrections [prisons], and K-12 education (The Pew Charitable Trusts, 2019; Zumeta, 2010, 2018). In times of financial difficulty, higher education is used as a balance wheel for state budgets. Research has shown that in good times, however, states do not fund institutions back to the level they were before cuts were made, or if they do, it is at a slower pace (Doyle & Delaney, 2009, 2011; Laderman, & Heckert, 2021; SHEEO, 2018; Zumeta, 2018). This lack of stability in financial support makes planning difficult, as HEIs cannot know what funds to expect from the state. This uncertainty in state support may also have significant implications for institutional planning, and consequently, negatively affect students' completion rates. HEIs often struggle to implement long-term plans (Delaney & Doyle, 2018; Doyle et al., 2018; Laderman & Heckert, 2021; Tandberg, 2008) and meet the public's demand for productivity (Delaney & Doyle, 2011; Lacy et al., 2017). As a result, some public HEIs have resorted to cost-saving and efficiency measures such as reducing administrative layers, sharing faculty and services, embracing system-wide collaboration, and increasing tuition and

fees to garner more financial support (American Academy of Arts and Sciences [AAAS], 2016; Hanover Research, 2020; Weerts & Ronca, 2016; Wekullo & Musoba, 2020).

Since state funding alone cannot generate adequate sums, public universities have actively begun pursuing alternative revenue sources to supplement state support (Cheslock & Gianneschi, 2008; Navas, 2020; Noll, 2010). These revenue sources include commercializing intellectual property, pricing services, soliciting endowments and charitable giving, and collaborating with other research organizations (AAAS, 2015; Hanover Research, 2020; Hearn, 2003, 2006; Wekullo & Musoba, 2020). It is unclear, however, the extent to which these revenue sources contribute to institutions' graduation rates. In addition, there are increasing concerns that depending on revenues from private partnerships may drive the institutional expenditure away from their core mandate of teaching, research, and community service towards contractual obligations (Fowles, 2014). Moreover, the change in revenue pattern is not only likely to cause changes in the expenditure pattern, but it can cause changes to student cohort, as well. Furthermore, studies examining the nexus between revenue sources and graduation rates are limited, especially those analyzing the issue by institution type and racial group. Thus, the present research examines whether different revenue sources are associated with graduation rates and if there is a relationship, whether it varies by institution type and student race.

SIGNIFICANCE OF THE STUDY

This research contributes to the growing body of literature on the relationship between revenue sources for public higher education and student outcomes. Studies have demonstrated the need to increase college graduation rates at a national level. As graduation rates hold a critical place in institutional research and public policy discussions and decision making (Pike & Robbins, 2020). However, this goal cannot be achieved without increasing the rate at which racial minority students obtain postsecondary degrees. Moreover, improving graduation rates can be especially challenging in a financial environment in which state appropriations are at best uncertain. Given the decline in state funding and the various revenue strategies institutions have begun to implement, it is important to examine the relationships among particular strategies for increasing revenue and students' graduation rates by racial group, as well as the extent to which revenue sources affect graduation rates at different institutions. This is because of the fears that depending more on revenue from alternative sources and mainly that from private partnerships may change institutions' expenditures, which can further change the focus of institutional activities towards private obligations.

RELATED LITERATURE

Uncertainty in state support for public higher education coupled with spiraling costs for equipment and resources have resulted in the need to identify, enhance, and manage revenue sources serving as alternatives to government appropriations. Earlier studies have shown that public universities have begun to actively seek alternative sources of revenue (AAAS, 2015; Cheslock & Gianneschi, 2008; Lynch, 2018; Navas, 2020). These include commercializing research activities (Hanover Research, 2020; Hearn, 2003; Minh & Van, 2022; Navas, 2020; Page & John, 2019; Slaughter & Rhodes, 2004), expanding the pool of donor funding (Hanover Research, 2020), and increasing net tuition and fees (Delaney & Doyle, 2011; Desrochers &Wellman, 2011; Ehrenberg, 2012; Mitchell et al., 2019). Increasing the number of out-of-state students allowed to enroll (Hearn & Warshaw, 2015; Navas, 2020) and changing the mode of instruction delivery (Deming et al., 2015; Dietrich, 2015; Navas, 2020; Paddick, 2017) are other alternative revenue streams higher education institutions have turned to in times of financial difficulty. However, how these alternative revenue sources relate to the graduation rate has been a concern of many stakeholders. Because some of these revenue sources are restricted and can neither directly be used to fund student services nor be tied to a specific racial group. Thus, this research explores the relationship between revenue sources and graduation rates and how the relationships vary by institution type and student racial groups.

One of the alternative sources of income for universities is research funds. While there may not be a direct relationship between research revenue and completion rates, research funds provide an opportunity for students to engage socially and academically, which is vital for their staying to completion. For instance, Gregerman et al. (1998) used a sample of 1,280 freshman and sophomore minority students to examine the relationship between research revenue and student outcomes and found that engaging students in research increased completion rates among Hispanic and White students. Gregerman et al.'s (1998) study also found that engaging students in research activities improved retention for below-average Black students who took part in the program. Similarly, Hathaway et al. (2002), Lopatto (2004), and Rodenbusch et al. (2016) found that engaging undergraduate students in funded research projects and research-based courses improved completion rates and enrollment in postgraduate programs. Although Hearn (2003) noted that revenue from research was neither cost-effective nor predictable, other studies suggest that involving students in research activities meant to generate revenue could improve graduation rates (Gregerman et al.,1998;

Hathaway et al., 2002; Lopatto, 2004; Tinto, 1987). Further, Tinto (1987) explained that while the research grand may not directly cause an increase in students' graduation rate, it is that ability of the research projects to integrate students socially, academically, and to keep them engaged, that is more likely to retain the students to completion. The current study hypothesizes that revenue from research is likely to increase the graduation rate and the effect may vary by institution type and student racial group.

A considerable body of research has found that whenever state appropriations are lower, then the higher the tuition and fees the students will pay (Gordon & Hedlund, 2017; Laderman & Heckert, 2021; SHEEO, 2016). Further, research has shown that tuition and fees has consistently served as a fallback when institutions face financial constraints (Desrochers & Hurlburt, 2016; Leslie et al., 2012; Navas, 2020; SHEEO, 2016; Teixeira & Koryakina, 2013; Webb, 2015; Zumeta, 2018). This suggests that net tuition and fees, especially from international students, graduate, and out-of-state students (Paddick, 2017; Navas, 2020), have become significant sources of revenue for most public institutions. A report by SHEEO (2017) indicated that in 2017 more than 28 states primarily relied on tuition revenue to fund higher education, despite there being an increase in state support. According to SHEEO (2017), net tuition comprised over 50% of these 28 states' educational revenue. That year was the first in which more than half of the states relied on tuition rather than state funding (SHEEO, 2017).

Earlier research on the effects of raising net tuition on student outcomes has been inconsistent. Some studies have found that increasing net tuition and fees increased students' unmet financial needs, negatively influencing graduation rates, especially for lower-income students (Delaney & Doyle, 2014; Long, 2016; Mitchell et al., 2019; Tandberg, 2008; Titus, 2006). Conversely, Titus (2006) found that an increase in tuition was positively associated with an increase in the graduation rate. This finding suggests that institutions are either strategizing to offer efficient and high-quality services and thus are retaining students, or students are motivating themselves to persist throughout their education (Heck et al., 2014). The current study hypothesizes that an increase in tuition and fees is likely to hurt students' graduation rate and the effect may vary by institution type and racial groups.

In times of crisis, universities use revenue from auxiliary services such as vending, dining amenities, and facilities to supplement their income. However, most of these are greatly affected by social, economic, political, and educational matters, and it is infrequent that they generate any significant income (Rullman et al., 2008). While research has examined the relationship between auxiliary services and graduation rates, such studies are few. Hamrick et al. (2004) used a combination of multiple regression, bivariate regression, and a hierarchical model to analyze data from four-year public institutions across the 50 states, testing the effects of various institutional characteristics on graduation rates and finding that institutions with engaging programs (i.e., medical, dental, and veterinary programs) had higher rates of completion, after controlling for predictors such as the institution's classification, location, and level of selectivity. While having programs, such as medical, dental, and veterinary alone may not directly improve student completion, it is the aspect of these programs to integrate students socially and academically in their institutions that is more likely to retain the students to completion (Tinto, 1987). The current study hypothesizes that institutions with activities related to generating revenue are more likely to increase their students' graduation rates. The effects may vary by institution type and by racial group.

Regarding endowments, Titus (2006) found that college completion was positively associated with the wealth of the institution. Wealthy institutions with high institutional expenditures per FTE have the ability to invest more in education-related activities that foster increased access and persistence in all students, including those from low-income backgrounds. Titus suggested a future study examining the "extent to which changes over time in the distribution of institutional wealth and expenditures per FTE … influence … college completion rates by social class" (p. 395). Among other variables, the current study examines the relationship between institutional wealth as measured by endowments and other revenue sources and completion rates. The hypothesis is that endowment would positively influence graduation rates and the effect may vary by institution type and racial groups.

State Environmental Context

According to Heck et al. (2014), the environmental context of the state includes factors related to trends in state support for higher education, their economic context, certain political factors, and state demographics. Earlier studies have shown that the level of state support for higher education depends on the economic situation of that state, such as the per capita income, gross state product, and changes in business cycles (Delaney & Doyle, 2007, 2011, 2018; Doyle et al., 2018; Hovey, 1999; Lacy et al., 2017; Tandberg & Ness, 2011; Zumeta, 2004, 2017, 2018). Historically, state appropriations have comprised the largest portion of the operating budgets of state institutions of higher education (Laderman & Heckert, 2021; Zumeta, 2004).

Several studies have explored the relationship between changes in funding and completion rates, reporting a significant positive correlation between state appropriations and schools' rates of graduation (Heck et al., 2014;

Shin, 2010; Titus, 2009; Zhang, 2009). For instance, Zhang (2009) used the Integrated Post-secondary Education Data System (IPEDS) panel data from 1997 to 2004 to analyze the relationship between state appropriations and graduation rates at four-year public institutions, finding that a 10% increase in state appropriations per full-time equivalent student in a public university was associated with a 0.64% increase in graduation rate, after controlling for other predictors. Similarly, Titus (2009) showed that changes in state funding positively influenced bachelor's degree attainment, after controlling for state- and institution-level factors. The latter study, however, did not include data on individual institutional characteristics, which may uniquely contribute to the graduation rate. The current study, also, considered state appropriation as one of the independent variables in the model and examined how state appropriation together with other variables influence the graduation rates.

The state's economic condition, such as the per capita personal income, unemployment rate, and percentage of the population of college age (i.e., 18 to 24 years) were all found to likely influence the level of state funding (Lowry, 2001; McLendon et al., 2014). As Lowry (2001), McLendon et al. (2014), and Tandberg (2010) all noted, a weaker economy is associated with higher unemployment rates and may incentivize legislators to allocate less funding to public higher education. Regarding the proportion of the population of college age, research has found that both increases and decreases can influence the level of state funding. Toutkoushian and Hollis (1998) determined that an increase in this population may trigger more state support. Conversely, a decrease could cause a decline.

Institutional Characteristics

Researchers have found institutions of higher education to differ in terms of variables such as mission, level of selectivity, amount of financial aid, composition of the student body, number of faculty, amounts of expenditures, and size and setting (Chen, 2013; Crisp et al., 2018; Heck et al., 2014; Morrison, 2012; Pike & Robbins, 2020; Titus, 2006). The impacts of these features on graduation outcomes also differ. For instance, Morrison (2012) used logistic regression on a 2003 to 2004 sample of 661,485 full-time equivalent students establishing that institutional characteristics have a positive significant effect on graduation outcomes. Further, Morrison (2006) also found that the percentage of students receiving Pell grants and average SAT scores positively influenced graduation outcomes, while college size (i.e., the number of students enrolled) and expenditures per FTE were only moderately correlated to graduation outcomes, as the effect size was medium. Likewise, these variables are included in the model examining the relationship between the revenue sources and graduation rates at public 4-year institutions.

Earlier studies have been inconsistent regarding the relationship between graduation rates and institutional expenditures on academic activities, student support, and services. For instance, Webber and Ehrenberg (2010) found that allocating funding to non-educational expenditures enhanced persistence and graduation rates. The effect was greater in institutions with lower graduation rates than in those with already high graduation and persistence rates. The authors also found that increased instructional and research expenditures led to lower graduation rates. Conversely, Gansemer-Topf and Schuh (2006) argued that institutional expenditures related to students' academic integration, such as those for instruction, academic support, student services, facilities, institutional support, and grants were positively associated with increased graduation rates. However, Gansemer-Topf and Schuh's (2006) study focused on private institutions which do not receive state appropriations. In different studies, Pike and Robbins (2020) and Crisp et al. (2018) found that investing revenue in institutional expenditures for instruction, academic support, student services, and institutional revenue positively increased graduation rates. Similarly, the current study included these institutional variables in the model to examine whether the change in revenue pattern changes the expenditure and graduation rates and whether the effect varies by institution type and students by racial groups.

Research has also shown that a high level of selectivity is positively related to the graduation rate (Gansemer-Topf & Schuh, 2006; Heck et al., 2014). Heck et al. (2014) found that institutional variables such as being highly ranked according to the Carnegie classification and high percentage of full-time faculty affect student academic experiences, and together with other variables, such as tuition and fees and high first-year retention rate all influenced the rate at which students graduated. Schools with higher enrollment also had higher retention and graduation rates (Pike, 2013; Ryan, 2004).

Student body characteristics, such as the percentage of minority students, percentage of in-state students, and SAT scores at the 25^{th} and 75^{th} percentiles were all found to be strongly associated with completion rate (Gansemer-Topf & Schuh, 2005, 2006; Millea et al., 2018; Zhang, 2009). Specifically, students with higher admissions test scores or students who were academically prepared were more likely to persist to completion, as compared to those with lower scores (Gansemer-Topf & Schuh, 2005). Moreover, students who received grants or scholarships had higher retention and graduation rates (Millea et al., 2018). Likewise, this study included these factors as they had shown to have the potential to influence the graduation rate. This study also examined whether the effect of student body

characteristics: the percentage of minority students, percentage of in-state students, and mean SAT Composite score, would vary by institution type and by student racial group.

CONCEPTUAL MODEL

The conceptual framework for this study drew from two bodies: resource dependence theory and prior research. First, resource dependence theory, proposed by Pfeffer and Salancik (1978), has long been a premier framework for understanding the relationship between an organization and its environment. The theory has three key aspects that relate to higher education institutions: the environment in which the organizations operate, power, and strategy. The theory postulates that the environment provides critical resources the organization needs to continue functioning. When resources are not provided, the ability of the organization to function may be endangered. Within the environment, there is *power and control* within and outside the organization. In this case, *power and control* refer to factors that have the ability to force numerous policies and decisions upon universities. The strategy refers to the actions and structures institutions put in place to survive in the existing environment and the power and control within and outside the organization which influences the outcomes. In this case, higher education institutions depend on state financial support for operations. When the state support declines or becomes uncertain, public higher education institutions may experience difficulties achieving their functions. As a result, institutions of higher learning may opt for alternative sources of revenue to continue with their operations, which is the case in the current study. There is no doubt that revenue from private partnerships may change the institutional expenditures as well drift their core function towards private obligations. The theory guides the choice of key variables in the study and grounds the institutions' decisions to seek for alternative sources of funding.

Second, two bodies of research have been used in framing the conceptual framework: (a) literature on strategies that institutions of higher education employ to obtain revenue in times of financial difficulty and how those sources relate to graduation rate, and (b) the factors contributing to graduation rate. From these strands of literature, three core factors appeared to account for variations in the level of state support for higher education institutions: 1) economic context of the state (i.e., state appropriations, net tuition and fees, research funding, endowment income, and income from private auxiliary services), 2) state demography (i.e., per capita personal income, percentage unemployment in state, and the percentage of the population that is college going age), and 3) institutional and student characteristics (i.e. type of institution, selectivity, enrollment scaled by FTE, expenditure on academic and student services, and full-time employee – 100FTE). The model is an appropriate fit for the study as it summarizes the focal variables in the study, the control variables and how they related with the dependent variable- graduation rate. This current study tests the framework that posits a relationship between graduation rates and revenue sources, controlling for economic, demographic, and institutional factors, as shown in Figure 1.

METHOD

The data for this study were drawn from several sources: the Delta Cost Project Dataset, IPEDS, US Census Bureau, and US Bureau of Economic Analysis. The researcher used a panel dataset of 2012 to 2018 data for 476 public four-year public institutions consisting of eight cohorts (a total of 4,284 observations) in the analysis. Except for percentage and categorical variables, the researcher computed a natural logarithm for each variable to model the linear relationship, reduce sensitivity to institutional type, and simplify the interpretation. Table 1 presents a detailed summary of the variables.

Description of the Variables

The researcher used the six-year cohort graduation rate for a bachelor's degree (within 150% of the normal time of completion) as the dependent variable. To examine the relationships among race and strategies for obtaining revenue, the researcher included the race-specific graduation rates for minority students (i.e., Black, Hispanic, and Native American) in the analysis as dependent variables. Graduation rate is an accountability measure (Titus, 2009) mainly used as an indicator of performance and productivity (Titus, 2006; Zhang, 2009), as well as a measure of institutional quality (Mitchell et al., 2017). Although the measure has been criticized for not reflecting the quality of graduates, it is still considered the most relevant measure, as data are readily available and easily understood by stakeholders, especially policymakers (Heck et al., 2014).

The primary independent variables include the following strategies for obtaining revenue: (a) net tuition, or revenue received from students after excluding institutional student aid; (b) research, or funding received from private and corporate sources and state, local, and federal funding in the form of grants and contracts specifically meant for research; (c) endowment income, or investment income from trusts held by others on behalf of the university and

funds related to endowments; and (d) private and auxiliary income, or income received from auxiliary enterprise operations such as residence halls, food services, athletics, hospitals, and revenue from private or public sources for non-research services (adjusted from Desrochers & Hurlburt, 2014). The researcher also included total revenue from state and local appropriations variables in the model.

As Scott et al. (2006) and Bailey and Xu (2012) suggested, several control variables related to the state economic context (i.e., per capita personal income, unemployment rate, and percentage of the population of college age) and institutional characteristics (i.e., selectivity as measured by SAT score percentiles, financial aid, student body composition, number of part-time faculty, expenditures, and size as measured by enrollment) were also included in the model. The state economic variables were included to capture the state economic factors that influence changes in state funding as well as funding to higher education institutions. In addition, control variables relating to institutional and student service characteristics were included in the analysis. These variables were included to capture other financial pressures that may influence student retention and graduation. It was assumed that a percentage increase in income from revenue sources would be associated with an increase in graduation rate by institution type and racial groups.

To capture differences in graduation rates by institution type, the researcher categorized public four-year institutions into three groups, according to the Carnegie 2010 classification: research/doctorate-, master's degree-, and bachelor's degree-awarding institutions. Previous studies have found different types of institutions to have unique features that could either positively or negatively be associated with graduation rates. Data on these variables were extracted from the Delta Cost Project Database. Table 2 presents a summary of the descriptive statistics for the variables in this study.

Analytical Model

A fixed effects model was used to determine the relationships among revenue strategies and graduation rates. This technique allowed the researcher to estimate the variations within an institution over time, control for unobserved variables, and approximate time-invariant variables. Closely related studies examining the effects of changes in state appropriations on either alternative revenue sources (Cheslock & Gianneschi, 2008; Jasquette & Curs, 2015) or student outcomes (Heck et al., 2014; Sanford & Hunter, 2011; Zhang, 2009) have also used fixed effects regression. A time lag of six years was factored into the model to allow for the effects of variations in the predictor and control variables.

To estimate the relationships among revenue strategies and graduation rates, a fixed effects model was specified:

$$Y_{it} = \beta_{0i} + \beta_{01}X_{it1} + \beta_{02}\,X_{it2} \ldots\ldots\ldots + \beta_{0k}\,X_{itk} + \varepsilon_{it} \quad (1)$$

where Y_{it} is the dependent variable, *i* represents the institutions and *t* is the time, β_{0i} is the intercept, X_{it1} is one independent variable (e.g., net tuition and fees) and X_{it2} is the second control variable in the model. The β_{01} variable indicates the coefficients for the first independent variable (i.e., net tuition and fees), β_{02} indicates the coefficients for the second control variable in the model, similarly, β_{0k} indicates a vector of variables up to k number of variables and X_{itk} indicates the coefficients up to k. The variable ε_{it} is the error term.

The researcher estimated several fixed effects models. For instance, to examine the relationships between revenue strategies and graduation rates by racial group, the researcher ran four models. Model 1 tested the relationship between revenue sources and all student racial groups, Model 2 tested the relationship between revenue sources and the graduation rate of Hispanic students, Model 3 tested the relationship between revenue sources and the graduation rate of Black students, and Model 4 tested the relationship between revenue sources and the graduation rate of Native American students. Table 3 presents the analysis.

To determine the influence of various revenue sources on graduation rates by institution type, the researcher ran three models. Model 5 tested the fixed effects for doctoral institutions only, Model 6 tested the fixed effects for master's institutions, and Model 7 for baccalaureate institutions (see Table 3). It was hypothesized that revenue strategies would be negatively associated with graduation rates.

Several diagnostic tests related to the fixed effects models were conducted. The result of the Hausman test for whether to use fixed or random effects was statistically significant, indicating that using fixed effects was the most preferable [$\chi 2$ (22) = 265.54, p = 0.0017] (Torres-Reyna, 2007). The Breusch-Pagan test for heteroskedasticity assumption was violated [$\chi 2$ (384) = 8.6e + 33, $p < 0.001$]. The robust option was used in the analysis to obtain heteroskedasticity-robust standard errors. Also, a Lagrangian multiplier test for random effects was run to determine whether group effects were present in the data (Breusch & Pagan, 1980). The results showed that residuals were highly correlated over time, indicating that the fixed effects model was better for obtaining unbiased estimates.

RESULTS

The results of the findings are presented in two sections: the relationships among funding strategies and graduation rates by racial group and the relationships among revenue strategies and graduation rate by institution type.

The Relationships Between Funding Strategies and Graduation Rates by Racial Group

Table 4 presents the results of the relationships among funding strategies and graduation rates by racial group. Model 1 examined the effect of funding strategies on all racial groups. The fixed effects results show that revenue from state and local appropriations was significant and positively associated with an increase in graduation rate, all other factors in the model being held constant. A one-point percent increase in state and local appropriations was associated with a 2.6% higher graduation rate. The results also show that state and local appropriations were positively and significantly associated with the graduation rates of Hispanic, Black, and Native American students (Models 2, 3, and 4, respectively). A one-point percent increase in state and local appropriations was associated with a 6.8% higher graduation rate for Hispanic students, 6.5% higher graduation rate for Native American students, and 12.3% higher graduation rate for Black students, all other factors in the model being held constant.

Regarding net tuition and fees, the results of the fixed effects analysis in Model 1 show that net tuition and fees were significantly negatively associated with the graduation rates of all racial groups (see Model 1), all other factors in the model being held constant. A one-point percent increase in net tuition was associated with a 0.9% decrease in graduation rate. Similarly, net tuition and fees was significantly negatively associated with the graduation rates for Native American (see Model 3) and Black students (see Model 4); A one-point percent increase in net tuition and fees was associated with 24.7% and 22.6% decreases in graduation rates for each group, respectively, all other factors in the model held constant. Conversely, the results show that the net tuition and fees strategy was not significantly associated with the graduation rate of Hispanic students (see Model 2).

The fixed effects results indicate that revenue from research funding was significant and negatively associated with the graduation rates of all racial groups (see Model 1), Hispanic students (see Model 2), and Black students (see Model 4). A one-point percent increase in research funding was associated with a 1.6% decrease in graduation rate for all racial groups, 1.8% decrease for Hispanic students, and 2.3% decrease for Black students, all other factors in the model being held constant. Conversely, an increase in the dependence on revenue from research was significant and positively associated with the graduation rate of Native American students (see Model 3). A one-point percent increase in research funding was associated with a 3.7% higher graduation rate, after controlling for other predictors in the model.

The results of the fixed effects analysis show that revenue from endowments was significant and negatively associated with the graduation rates for all students (see Model 1) and Native American students (see Model 3). Specifically, a one-point percent increase in endowment expenditures was associated with a 0.2% decrease in the overall graduation rates and a 0.7% decrease in the graduation rates for Native American students, all other factors in the model being held constant. Conversely, Model 2 showed that a one-point percent increase in endowment expenditures at any type of institution caused a 0.7% increase in the graduation rate for Hispanic students. Surprisingly, endowments were not significantly associated with the graduation rate for Black students.

The results of the fixed effects analysis show a varying relationship between income from private and auxiliary services and graduation rate, other factors in the model being held constant. A one-point percent increase in revenue from private and auxiliary services was associated with a 1.1% decrease in the graduation rates for all racial groups (see Model 1). Similarly, Models 2 and 3 showed that a one-point percent increase in private and auxiliary services revenue led to 4.1% and 8% decreases in the graduation rates of Hispanic and Native American students, respectively, other factors in the model being held constant. Conversely, Model 4 showed that an average increase in revenue from private and auxiliary services was associated with an 11.2% increase in the graduation rate for Black students.

Turning to the control variables in Model 1 showed that after controlling for other factors, higher average institutional grant aid, average loan amount, Pell Grant aid, mean SAT composite score, full-time employees per 100 FTE, the average expenditure on student academic support, and per capita personal income were all significant and positively associated with higher graduation rates. Conversely, factors such as higher in-state tuition and fees, FTE enrollment, percentage of minority students, unemployment rate, and percentage of the population of college age were all significant and negatively associated with graduation rate. The control variables in Models 2, 3, and 4 can be interpreted similarly.

The Relationships Between Revenue Strategies and Graduation Rate by Institution Type

Table 3 presents the fixed effects results regarding the relationships among revenue strategies and graduation rate by institution type. In Model 5, the results show that state and local appropriations were significantly and positively associated with the graduation rate for doctoral institutions, other factors in the model being held constant. A one-point percent increase in state and local appropriations led to a 0.9% increase in the graduation rate for doctoral institutions. Similarly, the results show that an average increase in state and local appropriations was associated with a 2.9% increase in the graduation rate for master's institutions, other factors in the model being held constant. Surprisingly, *state and local appropriations* were not statistically significantly associated with the graduation rate of bachelor's institutions.

The results indicate that while depending on net tuition and fees was significant and negatively related to the graduation rate for doctoral institutions, it was not statistically and significantly associated with the graduation rates for master's and bachelor's institutions, other factors in the model being held constant. A one-point percent increase in net tuition led to a 1.3% decrease in the graduation rate for doctoral institutions.

Regarding research revenue, the results from Model 6 show that a one-point percent increase in revenue from research led to a 2.6% decrease in the graduation rate for master's institutions, holding all other factors in the model constant. Conversely, research revenue was not statistically significantly associated with the graduation rates for doctoral and bachelor's institutions (see Models 5 and 7, respectively).

The fixed effects results show that revenue from endowments was significant and negatively associated with graduation rates for doctoral and master's institutions. A one-point percent increase in endowment revenue was associated with a 0.3% decrease in the graduation rates for both institutions, other factors in the model being held constant. Endowment revenue was not significant and positively associated with the graduation rate for bachelor's institutions.

Finally, Table 4 shows that while revenue from private and auxiliary services was significantly and positively associated with the graduation rates for doctoral and master's institutions, the relationship was negative for bachelor's institutions. A one-point percent increase in revenue from private and auxiliary services led to a 2% increase in the graduation rate for doctoral institutions and a 0.6% increase for master's institutions. However, an increase in revenue from private and auxiliary services led to a 6% decrease in the graduation rate for bachelor's institutions, after controlling for other predictors (see Models 5, 6, and 7).

With regards to the control variables in Model 5, the results show that a one-point percent variation in total revenue led to a 6% increase in the graduation rate for doctoral institutions. Other control factors in the model can be interpreted similarly. The effects of the control variables on the model differed. For example, while factors such as variations in in-state tuition, Pell Grant aid, mean SAT scores, per capita personal income, and expenditures on instructional, academic, and student services were, on average, significant and positively associated with the graduation rate, other factors such as average loan amount and percentage of minority students were significantly and negatively associated with the graduation rate. The control variables in Models 6 and 7 can be interpreted similarly. It is important to note that the relationship between each control variable and the graduation rate was inconsistent across institution types. For instance, while an increase in total revenue was significantly and positively associated with graduation rates for doctoral and master's institutions, the relationship was not significant and was negatively associated with graduation rates for institutions offering bachelor's degrees.

DISCUSSION AND IMPLICATIONS

Funding Strategies and Graduation Rates by Racial Group

These results suggest that a positive relationship between state and local appropriations and a six-year graduation period exists not only overall but also for different racial groups. The significance also varies by racial group. The greatest increase in graduation rate was with Black students, followed by Hispanic and then Native American students. Similar to earlier studies, the results of this study confirm the crucial effect that state and local appropriations have on graduation rates (Titus, 2006; Zhang, 2009). Moreover, these findings are like what Fowles (2014) found – an increasing dependency on revenues from private partnerships can drive institutional expenditures away from instructional activities towards contractual obligations.

Similar to previous studies, the results of this current research demonstrate that increases in the dependence on net tuition and fees have a negative effect on the overall graduation rate. More so, such increases may significantly harm graduation rates for minority students, specifically those who are Native American or Black. These findings

have significant implications for policymakers and institutional leaders seeking to improve completion rates and reduce the gap not only in enrollment but also in the graduation rates of racial minority groups.

The finding that revenue from research was negatively associated with the overall six-year graduation rate and graduation rates for Hispanic and Black students was surprising. The explanation is likely multidimensional and reflects both institutional and academic factors. In most cases, research funding is competitive and restricted to specific research. Diverting revenue meant for research to instructional purposes may be challenging for most institutions. Partly, like Tinto (1987) found, research grants may not directly cause an increase in students' graduation rate, it is that ability of the research projects to integrate and engage the students socially and academically that is more likely to retain the students to completion. These findings have significant implications for policymakers, demonstrating that though revenue from research may seem significant, it is meant to serve a specific function (i.e., research) and indirectly research funds are likely to assist institutions to achieve their goal of increasing graduation rates by incorporating and engaging students socially and academically. Further, the finding that revenue from research was positively associated with the six-year graduation rate for Native American students was interesting and suggests the need to examine the patterns of enrollment by racial group, and in particular, whether Native Americans participate in funded research or course-based research programs. While the results of this study contribute to the existing literature on undergraduate students and funded research, the findings suggest that more work is needed to explore the relationship between research revenue and undergraduate students' completion by racial group.

The results regarding the relationship between endowment revenue and graduation rate were not consistently significant. While the association between endowments and the graduation rate for Hispanic students was significant and positive, the relationships between endowments and the graduation rates for all Native American students were significant and negative. It is assumed that wealthy institutions with large endowments are more likely to offer financial support to their racial minority and low-income students to facilitate completion (Gershenfeld et al., 2019; Hamilton & Darity, 2017; Taylor et al., 2013; Titus, 2006; Weisbard & Ash, 2010). Thus, the findings of this study suggest that endowment revenue is not significantly associated with the overall graduation rate or those of certain racial groups such as Black and Native American students. Similar to the findings of previous studies, this present research confirms that though endowment revenue may seem substantial, it makes only a minimal contribution to an institution's operational budget (Steward, 2008). More importantly, the findings of this current study suggest the need for institutions to grow their endowment funds as worthy institutions are likely to offer financial support to their students to persist to completion.

The results also seem to indicate that private and auxiliary services, like other strategies institutions, use to garner additional revenue, have a positive influence on the graduation rate for Black students but a negative influence on the overall graduation rate and those of Hispanic and Native American students. Although the findings of this study differ slightly from those of Hamrick et al. (2004), which focused on the association between the availability of auxiliary services and graduation rates, the present work suggests the need for further examination of the connection between private and auxiliary services revenue and graduation rates by racial group.

The result that revenue from auxiliary services is significantly and positively related to the graduation rate of Black students was unexpected. The literature has shown that most Black students are associated with auxiliary services, which tends to be the largest employer of students on campus (Bundrick & Pruett, 2017). As highlighted by a national survey conducted by the National Association for Campus Activities in partnership with Riddle and Bloom (Bundrick & Pruett, 2017), auxiliary services are responsible for contributing to students' success (i.e., mentorship, employment, academic retention, and attainment) beyond what is evidenced by the revenue and budget. Their findings suggest that increasing revenue from auxiliary services has a positive relationship with the graduation rates of some students' racial groups.

The results of the fixed effects analysis suggest that except for revenue from state and local funding and auxiliary and private services (in some institutions), other revenue sources relied upon in times of financial difficulty may be negatively associated with graduation rates. The results also show that the magnitude of the relationship between each revenue strategy and graduation rate varied by the type of institution. The higher 2.9% graduation rate increase in master's institutions as compared to 0.9% in doctoral institutions in response to an average increase in state and local appropriation could indicate a difference in state support for research-intensive public universities (AAAS, 2015; SHEEO, 2014; Taylor et al., 2013). As McLendon et al. (2014) noted, the differences in state support for research and non-research universities are likely to have negative effects on both students and the education system, in the long run. Like previous studies, the findings of this study emphasize how much the availability of financial resources matters in improving graduation rates for all students.

Revenue Strategies and Graduation Rate by Institution Type

These results show that depending on revenue from private and auxiliary services may increase graduation rates for doctoral and master's institutions but not for bachelor's institutions. More importantly, the results demonstrate that the return on investment from auxiliary services may depend on the institution's investment level, which could be lower in bachelor's institutions as compared to doctoral and master's institutions. Moreover, not all sources of revenue can help schools achieve their mission. Thus, there is a need for consistent support for universities seeking to attain a 65% postsecondary completion rate.

Like other previous studies, this study has certain limitations, such as using the graduation rate as an outcome. Graduation rate is a function of many predictors, not limited to those included in the current model. Other elements, such as political and institutional policies have been shown to positively correlate with student outcomes.

CONCLUSION

This study examined the relationships among different revenue strategies public institutions rely upon in times of financial difficulty, and how they might influence student outcomes. The results show that five revenue strategies have varying relationships with graduation rates when examined by institution type and student racial group. The findings support the claim that relying on revenue strategies other than state funding could negatively impact the graduation rates of all students. Except for the relationships between research revenue and Native American students' graduation rate, endowments and Hispanic students' graduation rate, and private and auxiliary services and Black students' graduation rate, all of which were significantly positive, revenue strategies were significantly and negatively associated with graduation rates, though the extent differed by group.

The relationships between revenue strategies and graduation rate by institution type also varied. Except for state and local appropriations and private and auxiliary services (for doctoral and master's institutions), revenue strategies were either significantly and negatively associated or not significantly associated with graduation rates. This suggests the need for consistency in state funding and investment in racial minority students to reduce disparities in degree completion. In addition, helping institutions create reserves for financially difficult times would improve institutional outcomes, including the rates of graduation.

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FIGURES AND TABLES

Figure 1

The Conceptual Framework: The Variables and the Relationship Identified from Theory and Literature.

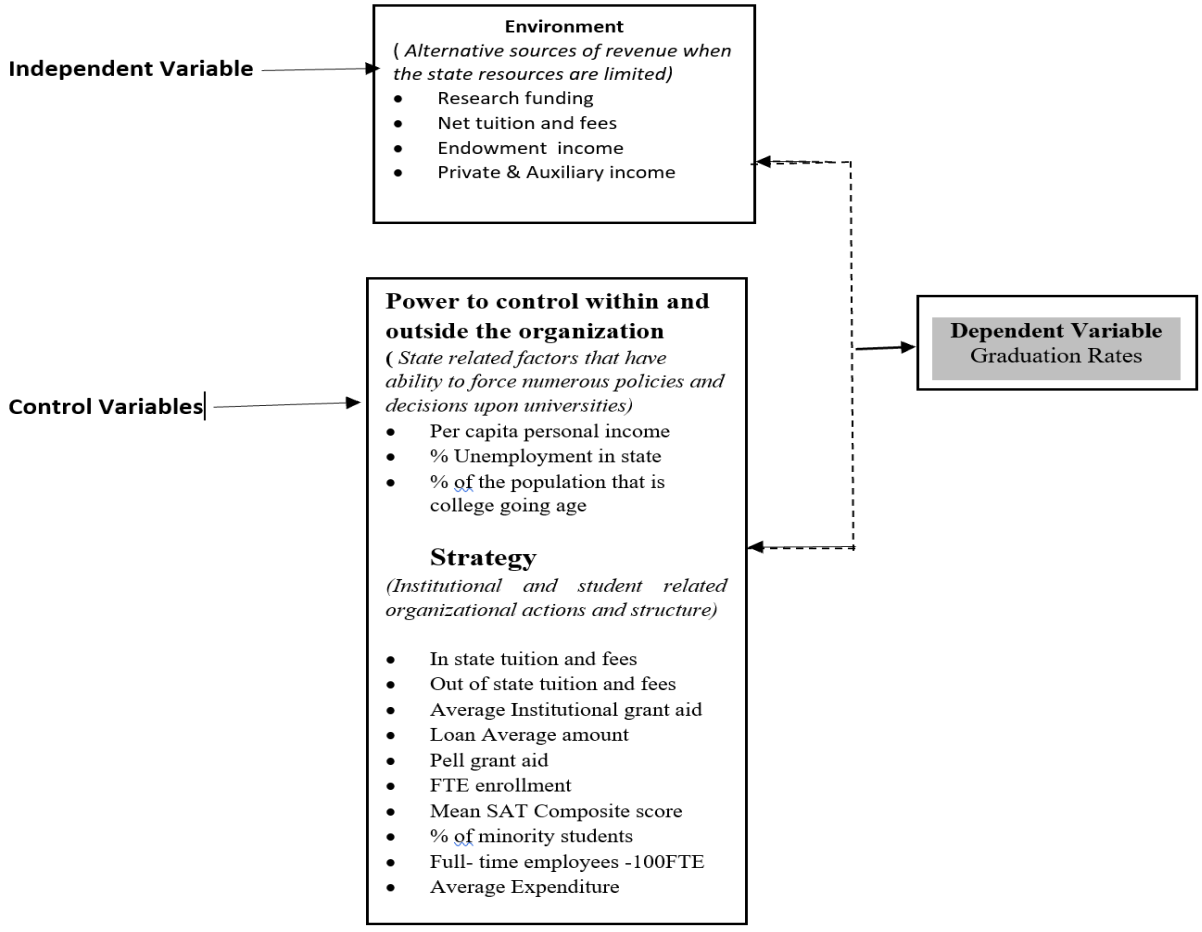

Table 1: Variables and Sources in the Study

Variables	Description	Source
6 Year Graduation rate (All)	6-year cohort graduation rates for bachelor's degree (within 150% of normal time (All)	Delta Cost Project Database https://www.deltacostproject.org/delta-cost-project-database
Hispanic student graduation rate	6-year cohort graduation rates for Hispanic (within 150% of normal time	IPEDS
Black student graduation rate	6-year cohort graduation rates for Black (within 150% of normal time	IPEDS
Native American graduation rate	6-year cohort graduation rates for American Indians (within 150% of normal time	IPEDS
Revenue (Lagged)		***Delta Cost Project (used for all revenue variables)*** https://www.deltacostproject.org/delta-cost-project-database
State and local appropriation Per FTE	Revenue from state and local appropriation	
Net tuition and fees	Revenue from net tuition and fees	
Research funding	Revenue from federal, grants and contracts and state and local grants and contracts	
Endowment income	Revenue from private gifts, return from investment and income from endowment	
Private and auxiliary income	Revenue from sales of education activities, auxiliary enterprises, and others (i.e., hospitals, independent operations, and other sources)	
In-state tuition and fees	The tuition charged by institutions to full-time undergraduate students who meet the state's or institution's residency requirements.	
Out of state tuition and fees	Amount of money charged to an out-of-state full-time undergraduate student by an institution that covers tuition and required fees.	
Institutional grant aid	institutional grant spent on student grants	
State/local grant aid	Expenditures for scholarships and fellowships funded by the state and local governments.	
Loan average amount	Average amount of student loans received by first-time, full-time degree/certificate-seeking undergraduates	

Variables	Description	Source
State Factors		
Pell Grant aid (log)	Amount of Pell grant to students in form of Finance-scholarships & fellowships	
FTE Enrollment	Total Full Tine enrollment	
Mean SAT composite score	Scholastic assessment test (SAT) Composite percentile score	
% minority students***	Percentage sum of (Native American, Black, and Hispanic) to the total enrollment	Calculated based on Delta Cost Database
Full-time Employees-100 FTE	The number of all full-time employees per 100 FTE students.	
Carnegie Classification	4 Year institution Type. Doctoral= 1; Masters =2; Bachelor =3	
Expenditure	Expenditures for academic and instructional support and student services	
Per capita personal income	Per capita personal income by state by year U.S.	Bureau of Economic Analysis. State annual personal income. Regional Economic Information System http://www.bea.gov/regional/spi/default.cfm?satable
% Unemployment in state	State Unemployment rate by the year	Bureau of Labor Statistics. Local area unemployment
% of the population that is college going age	Percentage of the population that is College going age (18 to 24-year-old)	U.S. Census Bureau. Selected age groups by states archives http://www.census.gov/popest/archives

Table 2: Descriptive Statistics

Variables	Mean	SD	Min	Max
6 Year Graduation rate (All)	0.48	0.17	0.03	100
Hispanic student graduation rate	0.09	0.187	0.00	100
Black student graduation rate	0.09	0.197	0.00	100
Native American graduation rate	0.07	0.16	0.00	100
Primary predictors -Revenue (Lagged)				
State and local appropriations FTE	7286.82	3488.9	32.87	27003.08
Net tuition and fees	6267.75	2539.7	323.61	20447.11
Research funding	8250	18800	316986.6	249000
Endowment income	2110	6900	-6626459	124000
Private and auxiliary income	11600	32200	29943.26	332000
Control Variables: Institution and Student Factors - (Lagged)				
In-state tuition and fees	4692.85	2147.54	70.57	18628.62
Out of state tuition and fees	12958.87	4859.90	70.57	37747.12
Average Institutional grant aid	3080.34	1629.21	85.57	13878.73
Loan Average amount	4364.98	1035.22	677.68	11251.92
Pell grant aid	1182.83	678.56	68.00	8792.25
FTE enrollment	1591.79	5455.27	263.57	101282.4
Mean SAT Composite score	487.14	114.6	94.38	675.63
% of minority students	21.93	22.81	1.21	96.11
Full-time employees – 100 FTE	13.44	7.38	1.54	66.14
Average Expenditure	7540	11100	1411620	141000
State Factors				
Per capita personal income	34480.68	12760.78	8093.03	67588.55
% Unemployment rate	5.60	3.17	0.6	21.83
% of the population that is college going age	15.13	4.46	4.63	25.7

Note: The variables are inflated into 2013 dollars using the CPI-U Scala. The units for Net tuition and fees, Research funding, Endowment income, Private and auxiliary income, Average Expenditure, and Total revenue are in 10,000s.

Table 3: Diversifying and Graduation Rates by Type of Institution

Parameter	Doctoral Model 5		Masters Model 6		Bachelor's Model 7	
Primary predictors -Revenue(lagged)	Coef	(S.E)	Coef	(S.E)	Coef	(S.E)
State and local appropriations FTE (log)	.901***	(.26)	2.86 ***	(.40)	.91	(.68)
Net tuition and fees(log)	-1.28*	(.55)	-.16	(.42)	-.98	(1.01)
Research funding(log)	-1.08	(.56)	-2.58***	(.25)	-.22	(.55)
Endowment income(log)	-.34 **	(.12)	-.28*	(.08)	-.01	(.22)
Private and auxiliary income(log)	1.75 ***	(.45)	.55 *	(.22)	-4.93 ***	(.47)
Control Variables: Institution and Student Factors (Lagged)						
In-state tuition and fees (log)	2.49***	(.35)	-1.71**	(.5)	-7.58***	(.98)
Out-of-state tuition and fees(log)	-.28	(.36)	-.86**	(.31)	6.53 ***	(1.06)
Average Institutional grant aid (log)	-.38	(.25)	.69***	(.16)	-.80	(.54)
Loan Average amount (log)	-.98**	(.35)	1.94***	(.3)	2.77***	(.7)
Pell grant aid (log)	1.55***	(.34)	-.58*	(.27)	2.99 ***	(.67)
FTE enrollment	2.74e-06	(7.41e-06)	2.81e-05**	(1.05e-05)	1.10e-05	(2.49e-05)
Mean SAT Composite score	.32***	(4.23e-04)	.01***	(4.05e-04)	.02 ***	(1.01)
% of minority students	-.18***	(.04)	-.04	(.02)	-.05	(.05)
Full-time employees - 100FTE	-.02	(.02)	.08***	(.02)	26.11***	(.04)
Average Expenditure (log)	3.92***	(.58)	-.15	(.61)	3.03*	(1.40)

Parameter	Doctoral Model 5	Masters Model 6	Bachelor's Model 7	Parameter	Doctoral Model 5	Masters Model 6
Primary predictors -Revenue(lagged)	Coef	(S.E)	Coef	(S.E)	Coef	(S.E)
State factors						
Per capita personal income(log)	.31*	(.12)	.72***	(.12)	.54	(.31)
% Unemployment rate	-.02	(.02)	-6.45**	(.02)	-.21 ***	(.06)
% of the population that is college going age	-.04*	(.02)	-.15 ***	(.14)	-9 *	(.04)
Constant	-144.59***	(13.29)	-112.49***	(11.20)	74.41 *	(22.28)
R-squared(within)	19.80		7.17		11.66	
rho	96.38		91.70		86.52	
Number of Observations	1429		2122		733	

Note: Monetary values are CPI-adjusted and expressed in 2013 dollars; Standard errors in parentheses.
Within R-square is reported in the table because in a fixed-effects model, within *r* squared is the most reliable and comparative measure. *p = 0.05. **p = 0.010. ***p = 0.001. Average expenditure means average expenditure on student academic support.

Table 4: Strategies of Revenue Sources and Graduation Rate by Race

Parameter	All students		Hispanic		Native American		Black	
	Model 1		Model 2		Model 3		Model 4	
Primary Predictors – Revenue (Lagged)	**Coef**	**(S.E)**	**Coef**	**(S.E)**	**Coef**	**(S.E)**	**Coef**	**(S.E)**
State and local appropriations FTE (log)	2.06***	(.26)	6.84***	(1.05)	6.51***	(.85)	2.29 ***	(.98)
Net tuition and fees(log)	-.0.87*	(.35)	2.53	(1.44)	-24.70***	(1.19)	-22.64***	(1.34)
Research funding(log)	-1.63***	(.22)	-1.80*	(.88)	3.68***	(.73)	-.2.27*	(.82)
Endowment income(log)	-0.19**	(.07)	.69*	(.29)	-.65 **	(.24)	.08	(.27)
Private and auxiliary income(log)	-.1.05***	(.18)	-4.05***	(.74)	-7.96***	(.61)	11.19***	(.70)
Control Variables: Institution and Student Factors (Lagged)								
In-state tuition and fees (log)	-.0.55*	(.32)	-1.57	(1.29)	3.23 **	(1.06)	-2.86*	(1.21)
Out-of-state tuition and fees (log)	-.002	(.28)	-4.67***	(1.13)	.77	(.93)	4.55***	(1.06)
Average Institutional grant aid (log)	.54***	(.15)	2.80***	(.61)	4.23***	(.50)	-1.59**	(.57)
Loan Average amount (log)	1.10***	(.24)	7.77 ***	(.99)	-4.39***	(.79)	-4.65***	(.89)
Pell grant aid (log)	1.39***	(.23)	-16.53 ***	(.93)	9.76 ***	(.74)	7.90 ***	(.84)
FTE enrollment	-3.91e-06	7.77e-06	-2.89e-04 ***	(3.16e-05)	-9.28e-05***	(2.62e-05)	3.87e-04 ***	(2.95e-05)
Mean SAT Composite score	.07***	(3.39e-04)	-.02	(.04)	.03**	(.01)	.03 *	(.01)
% of minority students	-.05**	(.02)	1.22***	(.07)	.29***	(.06)	-.42***	(.07)
Full- time employees - 100FTE	.07***	(.01)	.31***	(.06)	-.06	(.05)	-.23***	(.05)
Average Expenditure (log)	2.03 ***	(.48)	1.18	(1.93)	8.46***	(1.59)	-10.31 ***	(1.8)

Parameter	All students		Hispanic		Native American		Black	
	Model 1		Model 2		Model 3		Model 4	
Primary Predictors – Revenue (Lagged)	**Coef**	**(S.E)**	**Coef**	**(S.E)**	**Coef**	**(S.E)**	**Coef**	**(S.E)**
State Factors								
Per capita personal income(log)	.59 ***	(.10)	7.48 ***	(.42)	-.95**	(.34)	6.39***	(.39)
% Unemployment rate	-.07***	(.02)	-.93***	(.074)	-.19**	(.06)	-1.03***	(.07)
% of the population that is college going age	-.11***	(.01)	-.07	(.05)	-.94***	(.04)	1.05***	(.05)
Constant	-54.62***	(8.91)	-37655 ***	(3617)	16105***	(2978)	208.82 ***	(33.92)
rho	91.49		77.35		53.94		.7929	
n	476		476		476		476	
Number of observations	4284		4284		4284		4284	

Note: Monetary values are CPI-adjusted and expressed in 2015 dollars; Standard errors instate parentheses. "Within *r*-square" is reported in the table because in a fixed-effects model, "within *r* squared" is the most reliable and comparative measure. *$p = 0.05$. **$p = 0.010$. ***$p = 0.001$. Average expenditure means average expenditure on student academic support.

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