

An Examination of the Relationship Between Various Socioeconomic Conditions, Distance Education, and Capital Appropriations for Public Higher Education Capital Improvements

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ABSTRACT

State appropriations for public higher education are dependent upon several factors and involve many revenue and expenditure categories. Among the appropriations critical for higher education are capital improvement projects, such as new construction and campus renovations. However, given the increasing demand for distance education, physical campus infrastructure may not be as critical for online student populations. This paper asked the primary question: “What factors influence state capital appropriations for public four-year higher education institutions?” In addition to testing the relationship between distance education and capital budgets, this project also examined several socio-economic and political variables. Using data gathered from the Integrated Postsecondary Education Data System (IPEDS), the Bureau of Economic Analysis, and the U.S. Census Bureau for all 50 states from 2012 to 2020, an OLS regression was used for analysis. The study found that distance education is positively associated with capital appropriations. Poverty and change in GDP were the most statistically significant variables tested in this analysis with a p -value ≤ 0.01 . Additionally, state credit ratings were statistically significant with a p -value ≤ 0.05 . The study’s results imply policymakers and educators have a complicated landscape to navigate as colleges and universities adopt distance education modalities.

Keywords: campus infrastructure; public budgeting; state credit ratings

With the increased cost-effectiveness of distance education, more students are straying from brick-and-mortar campuses and completing degree programs through distance education platforms. (Springer 2016). The adoption of distance education could reduce the need for in-person lecture spaces on campuses, reducing the need for capital improvement projects (Baker 2021). . Given the increased use of distance education, state budgeting priorities for capital appropriations at public four-year higher education institutions may change significantly, however there is little scholarly research on the topic to study

these changes. This project seeks to address the literature gap regarding higher education capital appropriations by asking the following primary research question: what factors influence state capital appropriations for public four-year higher education institutions?

TRENDS IN HIGHER EDUCATION FUNDING

Historically, state governments provided substantial funding to public four-year higher education institutions, but in recent years higher education appropriations have steadily declined. In

2014, 48 states, except Alaska and North Dakota, spent less per student than they did before the recession in 2009. In addition, the average state spent \$2,026 or 23 percent less per student than before the Great Recession. Public colleges and universities across the country have increased tuition to compensate for rising costs and a decline in state funding. Annual published tuition at four-year public colleges has risen by \$1,936 or 28 percent since the 2007-08 school year, adjusting for inflation (Mitchell et al. 2014).

Although state allocations for public higher education have decreased, they still represent one of the largest categories of discretionary spending, and are thus vulnerable to budget cuts (Luskin and Small 2004). However, state governments faced increased pressure to fund competing programs, some of which are federally mandated (e.g., Medicaid); therefore, placing increased pressure on state revenues allocated to public higher education institutions (Conner et al. 2011). To further compound this trend, during periods of economic recession, higher education institutions face disproportionate budget cuts as financial resources are limited (Delaney and Doyle, 2011). As such, observing economic trends is important to fully understand the depth of higher education fiscal conflicts.

HIGHER EDUCATION FUNDING FORMULAS

Whereas economic conditions may aid in explaining higher education funding, there are other internal factors that dictate state appropriations for higher education institutions such as funding formulas. "The term 'funding formulas' or 'guidelines' refer to a mathematical basis for allocating dollars to institutions of higher education using a set of rates, ratios, and/or percentages derived from cost studies and analyses" (McKeown 1994, p. 320). In recent years, concern has centered around

the use of funding formulas due to the viability and increasing financial difficulties of higher education (Noe 1986). Although, higher education funding formulas vary by state and are developed based on a wide variety of metrics including student performance, student enrollment, and financial need, most states use a performance-based funding formula. The metrics for performance-based funding formulas may include degrees award with an incentive for certain high-demand degrees, student credit hours completed, and external research and public service dollars brought into the university system (Community College League of California n.d.).

CAPITAL BUDGETING

The National Association of State Budget Officers (2014) defines state higher education capital expenditures as funds provided by the state to higher education institutions for campus improvement projects for physical infrastructure, repairs, and the acquisition of land. Capital expenditures also cover qualified equipment purchases such as information technology equipment (Consortium for School Networking, n.d). Capital budgets differ from state to state, yet, they tend to share one essential characteristic in that a state's general expenditures for "capital" items are segregated and presented in a special budget separate from the general operations budget (McKinney 2015).

Capital projects are expected to produce benefits for a considerable amount of time and, therefore, require extensive planning. The high cost of these capital projects makes debt financing appealing to most jurisdictions (Nice and Fisher 2016). While the capital budgeting process may involve different steps depending on the government or project in question, there are various commonly accepted stages including (1) assessing existing infrastructure and services, (2) identifying

environmental trends and future service requirements, (3) developing service objectives, (4) developing preliminary cost estimates, (5) identifying financial resources, (6) selecting projects for inclusion in a multi-year capital investment plan, (7) identifying implications for reoccurring costs, and (8) including the first year of the capital investment plan in the capital budget (Lee et.al 2021)..

Revenue sources vary by capital improvement project. Some projects, such as highway construction, have their own revenues from highway tolls and/or state and federal gas taxes (Gramlich, 1994). However, it is not always possible to find sufficient revenues to accommodate capital needs. In terms of public higher education, cutbacks/retrenchment, revenue-raising limitations, and a drop in enrollment are all fiscal constraints that make obtaining funds difficult (McKinney 2015). As discussed above, a critical part of the capital improvement project process is the development of a financing plan (McKinney 2015). The institution planning the project must determine how much money can be spent, the sources of revenue for the project, and relevant stakeholders. An analysis of revenue collection and expenditures for the past five years is an important first step in the financing plan as it provides a benchmark for spending on the project. The resources to fund most capital improvement projects in the public sector are obtained mainly through state and federal appropriations and the issuance of long-term debt. More popular are revenue bonds, which permit the debt service to be paid from the revenue produced by the capital improvement project in the future (McKinney 2015)

When examining capital appropriations for public higher education institutions, states appropriated roughly \$118,670,000 in 2020. However, the overall funding trends for state capital

appropriations for higher education do not significantly vary year-to-year. For example, appropriations for 2012 averaged \$110,369,000. The relative stability in funding is to be expected given the incremental nature of how public funding is approved each fiscal year (McKinney 2015; IPEDS 2023).

ECONOMIC CONDITIONS IN HIGHER EDUCATION FUNDING

Due to the complex nature of debt financing and multi-year projections (Lee et al. 2021), it is crucial to examine economic conditions that could impact higher education capital appropriations. Much of the early literature examining higher education appropriations attempted to link various socioeconomic variables with the “supply and demand” nature of higher education (Delaney and Doyle 2011). Clotfelter (1976) was the first to address this relationship by testing the effect of personal income and wages on enrollment and expenditures of higher education institutions. Clotfelter (1976) found a significant positive relationship between per capita income and enrollment in higher education.

Gross Domestic Product (GDP)

Just as per capita income is related to higher education enrollment, so too may other national economic variables. While there are different ways to measure overall economic health, the most frequently tracked and reported measure is gross domestic product (GDP) (International Monetary Fund n.d.) U Hauptman (1997) conducted a notable study demonstrating the relationship between overall economic growth and higher education appropriations. Strong economic growth in the range of two to three percent real growth per year is likely to produce substantial increases in resources for higher education. Hauptman’s (1997) simulations indicate that growth in higher education

resources will occur even if the proportion of federal and state taxpayer dollars devoted to higher education declines, and the public loses confidence in the future of higher education. On the other hand, low or negative rates of economic growth will most likely result in declining resources per student even if public confidence is high and a larger share of public dollars goes towards higher education.

Poverty and Unemployment

In addition to GDP, research indicates that students in high-poverty high schools are less likely to attend college and more likely to encounter greater challenges in accessing higher education than those in low-poverty schools (Reddick et al. 2011). Similarly, Letseka et al. (2009) found a high proportion of students living below poverty to fall in the “non-completer” category rather than “graduate” in terms of degree completion. It is fair to assume that, as poverty increases higher education enrollment decreases, thus minimizing the need for physical campus infrastructure. In the same fashion, unemployment is likely to shape state investment in higher education. McLendon et.al. (2009) found strong empirical connections between state appropriations for higher education and unemployment rates indicating that as unemployment increases state appropriations decrease.

State Credit Ratings

Correspondingly, credit ratings are another indicator of a state’s economic health and may be related to capital appropriations for higher education. “Credit ratings are an agency’s opinion about the ability and willingness of an issuer, such as a state or local government, to meet its financial obligations in full and on time” (Standard and Poor’s Global Ratings 2019). Credit ratings are useful tools in enabling governments to raise money for various expenditures. Rather

than taking out a loan, governments may borrow money from investors through the issuance of bonds. Investors expect to receive interest plus the return of their principal when the bond matures or through periodic payments. Credit ratings provide an efficient measure that allows investors to screen an issuer for credit risk before investing (Standard and Poor’s Global Ratings 2019). According to Standard and Poor’s Global Ratings, “the more creditworthy an issuer, the lower the interest rate the issuer would have to pay the investor. The reverse is also true; an issuer with a low credit rating will have to pay a higher interest rate to offset the credit risk assumed by investors” (Standard and Poor’s Global Ratings 2019). While state credit ratings are vital in reflecting a state’s ability to honor its financial obligations without default or loss, credit ratings directly impact the cost of repaying bonds the state sells to investors. For state governments, less spending on interest means more available for other priorities such as education and infrastructure (Daly 2021).

DISTANCE EDUCATION

Apart from economic considerations, distance education may be a significant predictor of higher education capital appropriations, given the lack of need for physical campus infrastructure in an online educational setting. Although distance education has garnered much attention since the COVID-19 pandemic, it is not a new instructional delivery method. Forms of distance education have existed since the 1800s when Anna Eliot Ticknor organized a correspondence distance education program through mail in Boston, Massachusetts, entitled “Society to Encourage Studies at Home.” Ticknor offered instruction in 24 subjects in history, science, art literature, French, and German (Harting and Erthal 2005). By 1922, radio broadcasting became a viable way of

dispersing information and was adopted by the Pennsylvania State College, later renamed the Pennsylvania State University in 1953.

Subsequently, in 1965, the University of Wisconsin created a statewide education program for physicians using a phone-based format. Likewise, as early as 1976, Coastline Community College (CCC) was the first “virtual college” with no physical campus in operation (WorldWideLearn). CCC has been a model for the community-based “college beyond walls” movement. CCC claims the reduction in high construction costs is one of their most prominent reasons for using existing facilities for CCC to reach students who cannot come to campus (Luskin and Small 1980).

Based on these earlier experiences, the widespread adoption of contemporary distance education includes email, discussion forums, chat rooms, synchronous technologies, and test-taking functionality in virtual classrooms). Thanks to technological advancements, many higher education institutions utilize learning management systems (LMS), which are software applications or web-based technologies used to plan, implement, and assess a specific learning process (Gecer et.al 2023).

POLITICAL CONSIDERATIONS

Recent studies indicate a clear ideological difference in legislators’ views on higher education funding. Archibald and Feldman (2006) found Democratic control of the lower chambers of state houses and governors’ offices are associated with an increase in higher education appropriations. Similarly, Rizzo (2004) found states with Republican control of government are negatively associated with state appropriations to higher education institutions. On the other hand, community colleges tend to receive bipartisan support

for spending due to their perceived collective economic benefits to their perspective states. Republicans consider community colleges cost-effective alternatives to four-year institutions (Dowd and Shieh 2013). The number of empirical analyses of political factors contributing to the decline in higher education funding is limited (McLendon et.al., 2009). However, Dar and Lee (2014) argue that when there is low political polarization in the state legislature, the collective-benefit dimension of higher education will take precedence. Both Democrats and Republicans will be more likely to support higher education spending.

METHODS

To address the relationship between capital appropriations, distance education, and economic conditions, this research employs an Ordinary Least Squares (OLS) regression analysis using capital appropriations as the dependent variable. OLS is an appropriate modeling technique given the variables’ linear relationship and the continuous nature of the dependent variable (see Stevens 1996; Tabachnick and Fidell 2013)

H1: A state’s economic conditions are positively related to a state’s appropriations for higher education capital improvement expenditures

H2: As the percentage of students enrolled in distance education at public higher education institutions increases, state appropriations for higher education capital improvement projects decrease.

Dependent Variable

The dependent variable tested is state capital appropriations, as a source of revenue, for public, 4-year higher education institutions, per capita. Data for capital appropriation revenues were obtained from the Integrated Postsecondary

Education System (IPEDS) for 2012, 2014, 2016, 2018, and 2020. The raw data collected from IPEDS was measured in thousands of US dollars using Governmental Accounting Standards Board (GASB) standards. For this study, the raw data was transformed to capital appropriations ‘per capita’ Based on state population data for the respective years.

Independent Variables

As previous literature demonstrates a relationship between economic conditions and higher education expenditures (see Hauptman 1997), this research controls for GDP, poverty, unemployment, and state credit ratings. GDP is measured as change in GDP per capita by state. Data for GDP was obtained from the U.S Bureau of Economic Analysis and is calculated by the percentage change from the preceding period.

In addition, Conner et al. 2011 suggested that higher education funding faces competition from other programs for limited funding. One of the largest expenditure categories for many states is related to social service programs, which face increased demands as a state’s poverty level increases (Trisi et al. 2021). As such, this paper controls for the poverty rate by measuring the percentage of a state’s population living below poverty, based on data collected from the U.S. Census Bureau for the years in the study.

Likewise, unemployment may be a predictor of capital appropriations given prior findings demonstrating a strong relationship between overall higher education funding and a state’s unemployment rate (McLendon et al. 2009). For this project, unemployment is measured as the total number of unemployed people expressed as a percentage of the civilian labor force. Unemployment is calculated as $(\text{Total Unemployed} \div \text{Labor Force}) \times 100$ per the

Bureau of Labor Statistics, from which the unemployment data was gathered.

Poverty and unemployment are likely not the only economic predictors of capital appropriations. State credit ratings may also help predict capital appropriations and reflect a state’s fiscal management practices (Standard and Poor’s Global Ratings 2019). Given the relationship between economic health and government expenditures (Daly 2021), this study includes an independent variable measuring state credit ratings based on Standard and Poor’s Global Ratings from 2012 to 2020. A ‘AAA’ rating is the highest credit rating that indicates an extremely strong capacity to meet financial commitments. A ‘D’ is the lowest credit rating and is used when there is a payment default on a financial commitment or breach of an imputed promise (Standard and Poor’s Global Credit Ratings, 2019). A state can receive a rating of D, C, CC, CCC, B, BB, BBB, A, AA, and AAA. For this study, states with a credit rating of AAA are coded as “4”, states with a rating of AA are coded as “3”, states with a rating of A are coded as “2”, states with a rating of BBB are coded as “1.” No states in the analysis had credit ratings below BBB for the years under study.

Finally, given the primary focus of this research concerns distance education, an independent variable measuring distance education is included in the regression model. Data for distance education enrollment and total enrollment for 2012, 2014, 2016, 2018, and 2020 was collected from IPEDS. Distance education controls for students who are enrolled exclusively in this modality per capita by state.

RESULTS

This study asked, “What factors influence state capital appropriations for public four-year higher education

institutions?” The results offer a complex answer to this question. Before exploring the regression model results, the mean values for each variable are reported in Table 1. States appropriated an average of \$25.93 of capital appropriations per capita. In addition, GDP change averaged 2.31%.

Table 1: Mean Values of Variables

Variable	Mean
Capital Appropriations Per Capita	\$25.93
GDP Change	2.31%
Poverty	12.61%
Unemployment	5.77%
Distance Education	15.47%
Valid N	250

The average percentage of those unemployed totaled 5.77% while 12.61% of a state’s population was living below poverty. On average, 15.47% of students enrolled at public, 4-year institutions were enrolled exclusively in distance education courses.

Figure 1 illustrates an overlay of the trends in both distance education enrollment and capital appropriations at public higher education institutions. As highlighted in the illustration, the trends

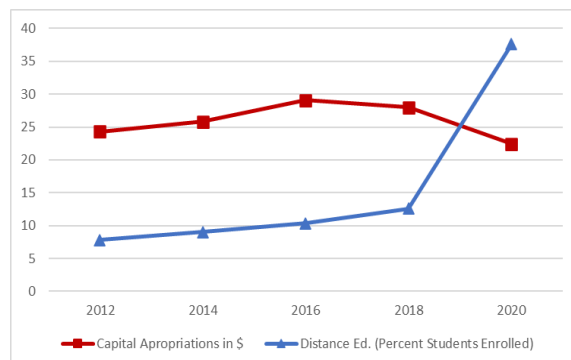


Figure 1: Public Higher Ed. Distance Education & Capital Appropriations Trends (2012-2020)

diverge after 2018 indicating that as distance education enrollment increases, capital appropriations decrease.

While Figure 1 includes two different units of measurement, it illustrates the inverse relationship between capital appropriations and distance education. Should these trends continue, there may be significant implications for capital appropriations amidst increased demand for distance education.

Additionally, results from the regression analysis of the various socioeconomic and distance education enrollment variables tested in this study are illustrated in Table 2. Change in GDP and poverty were the most statistically significant variables tested in this analysis with a p -value ≤ 0.01 . The results indicate that as GDP improves capital appropriations decrease. Likewise, as poverty increases capital appropriations decrease. Additionally, state credit ratings are significantly, positively associated with capital appropriations, reporting a p -value ≤ 0.05 . Unemployment and distance education enrollment are statistically insignificant based on this regression model.

DISCUSSION

The findings in this analysis suggest the factors influencing higher education capital expenditures are more complex and nuanced than just a single explanation. First, of the economic variables included in the analysis, GDP change and poverty were negatively associated with capital appropriations. These findings are contrary to the first hypothesis, expecting a state’s economic conditions to be positively related to capital appropriations. The negative association between change in GDP and capital appropriations is also contrary to the findings in Hauptman’s (1997) simulations, indicating that low or

Table 2: OLS Regression- Socioeconomic Correlates

	<i>B</i>	Std. Error	Beta	t	Sig.
(Constant)	26.553	14.529		1.828	0.069
<i>GDP Change</i>	-3.899	0.999	-0.273	-3.904	0.001***
<i>Poverty</i>	-2.516	0.656	-0.267	-3.838	0.001***
<i>Unemployment</i>	1.893	1.212	0.115	1.562	0.120
<i>State Credit Ratings</i>	7.889	3.306	0.147	2.386	0.018**
<i>Distance Education</i>	0.255	0.165	0.114	1.542	0.124

$p \leq 0.10$ * $p \leq 0.05$ ** $p \leq 0.01$ ***

negative rates of economic growth will result in declining resources per student even if public confidence is high and a large share of public dollars goes towards higher education.

However, state credit ratings had a positive association with capital appropriations. The results indicate that states with higher credit ratings allocate more capital appropriations per capita. This result conforms with Daly’s (2021) findings suggesting that states with higher credit ratings can allocate more funds to other education priorities, because less funding is needed to service debt payments due to more favorable interest rates.

Unfortunately, distance education enrollment and unemployment do not have a statistically significant relationship with capital appropriations, contrary to what was expected in the hypotheses. However, the lack of a significant finding for distance education enrollment may possibly be attributed to the novelty of widely adopted distance education modalities since the COVID-19 pandemic. Furthermore, the initial adoption of distance education may coincide with some increased capital appropriations for IT infrastructure, thus potentially influencing this analysis’s

results (see Alsabawy et al. 2013). Likewise, due to data limitations, this analysis was not able to differentiate between IT infrastructure appropriations and other capital appropriations, such as buildings and improvements.

Although the regression analysis did not produce the anticipated results, the overall trend in capital appropriations is a good indicator that the

need for traditional campus improvements will continue to decrease over time. As was illustrated in Figure 1, the trend line for distance education enrollment increases while capital appropriations decrease beginning in 2018. These findings are compounded by the steady decline in enrollment, which will constrain higher education funding in the future (Wu et.al 2019). As the world emerges from the COVID-19 pandemic, the demand for distance education may remain high, thus compelling higher education institutions to adopt digital modes of instruction. As distance education enrollment grows, higher education institutions face the challenge of paying off existing debt (Zusman 2005).

Due to data limitations, enrollment data for distance education and capital appropriations was only available starting in 2012 from the Integrated Postsecondary Education System. This analysis was also limited in the variables tested, making it critical to investigate possible relationships with other variables in the future, such as the relationship between higher education capital appropriations and the ratio of higher education interest groups, the total number of interest groups, and legislative composition, which are beyond the scope

of this study. Prior research has hypothesized that higher education will receive more appropriations for capital improvement projects in states with more higher education lobbyists than in states with a small number of higher education interest groups (Tandberg 2013).

Much of the discussions around distance education focuses on its perceived benefits and disadvantages. Critics point to a lack of in-person contact with instructors, access to in-person resources such as libraries and tutors, and structured schedules. Advocates contend distance education has many perceived benefits, including cost-effectiveness, a wide variety of accelerated programs, schedule flexibility, and independence (Arkoful and Abaidoo 2015). However, this study goes beyond those debates and addresses a much-overlooked area regarding the transition to distance education. The study's results imply policymakers and educators have a complicated landscape to navigate as colleges and universities adopt distance education modalities.

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