Balancing budgets, Limiting Access: The Impact of State Appropriation Cut on Public University Decisions

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November 23, 2025

Abstract

State appropriations are a central source of funding for public higher education in the United States, and fluctuations in these transfers play a critical role in shaping universities' decisions. This paper examines how changes in state appropriations, in conjunction with economic downturns and booms, affect higher education outcomes. Exploiting cross-state variation in the stringency of balanced budget requirements, I implement an instrumental variables strategy using institution-level panel data from 2002 to 2019. I find that institutions in states with stricter balanced budget requirements experience a sharper cut in state appropriations during and immediately following the economic downturns, whereas institutions in states with weaker requirements can smooth adjustments over time. In response to these appropriation cuts, universities reduce undergraduate enrollment, raise tuition, and shift the composition of majors toward lower-cost fields.

JEL Codes:H72, I22, I23, E62.
Keywords: State appropriations; Balanced budget requirements; Higher education finance; Public universities; Fiscal constraints

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1 Introduction

For decades, state appropriations have been a key component of public higher education finance in the United States, accounting for roughly 60% % of public universities' core revenue between 2002 and 2019. Because public universities rely heavily on this non-tuition revenue, they respond to fluctuations in state appropriations by altering enrollment, raising tuition, or reallocating resources across academic programs (Deming and Walters 2017; Bound et al. 2019; Chakrabarti et al. 2020). Unlike K-12 education, appropriations for public higher education are largely discretionary. As a result, they often serve as a "balance wheel " in state budgets, with appropriations expanding in booms and contracting sharply during downturns (Delaney and Doyle 2011). This cyclical pattern exposes public universities to economic shocks, helping explain why universities' enrollment, pricing, and program allocation decisions closely track the business cycle. Understanding how fiscal institutions transmit economic shocks into higher education is therefore important for evaluating the resilience of public universities.

At the same time, state governments themselves face fiscal institutional constraints that shape the fluctuations in appropriations. Balanced budget requirements (BBRs), which prohibit deficit financing for operating expenses, induce substantial procyclicality in state spending, with the stringency of rules determining the magnitude of adjustment to shocks. These rules amplify the impact of revenue fluctuations on appropriations, particularly during downturns when states with stricter budget constraints enact deeper cuts to higher education, whereas states with weaker rules implemented less severe adjustments. Public universities, in turn, respond to these fiscal shocks, with significant implications for higher education access and quality.

This paper investigates how public higher educational institutions respond to state appropriations reductions in conjunction with economic shocks, focusing on the role of balanced budget rules (BBRs) of varying stringency. The key empirical challenge is that appropriations are endogenous to the business cycle: economic fluctuation, particular

downturns, simultaneously reduce state tax revenues, which drive cuts in appropriations, and directly influence students' enrollment decisions. As a result, since both state appropriations and educational outcomes respond endogenously business cycle shocks, naive estimates confound the causal effect of appropriations with the influence of unobserved cyclical factors. To address this, I exploit cross-state variation in the stringency of BBRs and their interaction with cyclical shocks to isolate plausibly exogenous variation in state funding. Using institution-level panel data from 2002 to 2019, I show that stricter balanced budget requirements lead to significantly larger cuts in state appropriations for higher education during downturns, with strict-rule states cutting roughly 4-5 percent more funding in response to rising unemployment. These fiscal shocks, in turn, lower new university undergraduate enrollment, raise tuition, and shift the composition of majors toward lower-cost fields, highlighting the supply-side consequences of fiscal institutions for higher education access and quality.

This paper contributes to several areas of literature. First, it adds to research on the cyclical behavior of higher education by shifting the focus from demand to supply. Much of existing literature emphasizes student responses to business cycle, showing that postsecondary enrollment is generally countercyclical. Students are more likely to enter or remain in school when the labor market conditions are weak, as the opportunity cost of schooling falls (Barr and Turner 2015; Dellas and Sakellaris 2003; Johnson 2013; Bedard and Herman 2008; Bogan and Wu 2018). In contrast, my paper highlights how fiscal institutions on the supply side shape the universities' ability to respond to cyclical shocks. By documenting how these institutions condition the timing and magnitude of funding cuts, this paper introduces an institutional perspective to the literature on higher education and the business cycle.

Second, this paper contributes methodologically by introducing a new instrumental variable to address the endogeneity of state appropriations. Prior research shows that declines in state appropriations lead public universities to reduce spending and enrollment, raise tuition, increase student debt, and lower faculty salaries (Deming and Walters

2017; Bound et al. 2019; Bound et al. 2020; Chakrabarti et al. 2020; Goodman and Volz 2020; Webber 2017; Cook and Turner 2022; Hinrichs 2022). To identify these effects, most studies employ Bartik-style instrument that interact institutions' historical reliance on state appropriations with aggregate changes in total state appropriations or use appropriations to other public institutions within a state as instrument . These approaches may still reflect institution-specific endogeneity tied to historical funding patterns.

My design instead interacts state-level unemployment rates with an indicator for strict BBRs, leveraging predetermined fiscal institutions that constrain the ability of states to smooth spending across the business cycle. This strategy provides plausibly exogenous variation in appropriations that is (i) orthogonal to both institution-specific demand shocks and endogenous adjustments in historical reliance on state funding. (ii) isolates the supply-side channel by exploiting the amplification of cyclical shocks under strict fiscal rules, and (iii) reflects real fiscal institutions rather than abstract statistical constructs, making the variation directly policy relevant.

Third, this paper contributes by examining how fiscal shocks reshape the composition of academic programs. While prior work such as (Bound et al. 2019) examines how funding shocks affect aggregate instructional expenditures at public universities, evidence on how these shocks reallocate resources across fields of study remains limited. I address this gap by constructing a new measure of per-student instructional cost per credit hour across major of fields and analyzing how changes in state appropriations alter the distribution of resources within universities. When appropriations declines, universities tend to preserve funding for high-prestige or resource-intensive fields (e.g., STEM) while cutting more heavily in lower-cost disciplines. This mechanism implies that observed changes in average instructional costs may reflect not only spending adjustments but also compositional shifts in majors.

Finally, this paper contributes to the literature on fiscal rules and macroeconomic volatility by showing how state-level Balanced Budget Requirements (BBRs) can shape fiscal outcomes in higher education. The most related study is (Clemens and Miran 2012), who

document that balanced budget rules increase the cyclicality of state fiscal policy by prohibiting operating deficits and tightening budget management. Their analysis, however, is conducted at the level of aggregate state budgets and focuses on the responsiveness of overall spending to cyclical shocks. My paper builds on this insight but shifts the focus to higher education, investigating how fiscal institutions mediate the transmission of business cycle shocks into a specific category of public spending. Taken together, these findings provide more evidence on how fiscal institutions can amplify the long-term consequences of economic downturns by constraining access to higher education, a central pathway to upward mobility and economic growth.

This paper is organized as follows. Section 2 provides a brief description of the data used for the analysis. Section 3 and Section 4 present the identification strategy and the empirical results. Section 5 concludes with a discussion of my findings.

2 Background and Data

2.1 State Balanced Budget Requirements

In the US, states vary substantially in the stringency of their balanced budget requirements (BBRs). Originally designed to limit deficit financing and prevent the accumulation of unsustainable debt, BBRs have become a key component of state-level budget governance. These rules constrain the ability of states to engage in deficit financing for routine operating expenses, typically prohibiting borrowing to cover non-capital spending and requiring that revenues and expenditures be aligned within a fiscal year (NASBO). While BBRs promote fiscal discipline, they may also amplify the negative effects of recessions by forcing abrupt cuts in essential public services. This tradeoff is particularly economically significant for higher education, where state appropriations cut during downturns—constrained by balanced budget rules—lead to increased tuition dependence and reduced access (Hou and Smith 2006, 2010; Rueben et al. 2018; Green and Loualiche 2021; Serna and Harris 2014).

To measure the variation in states' balanced budget requirements, I use the stringency

index framework developed by the Advisory Commission on Intergovernmental Relations (ACIR, 1992). Although states' BBRs have remained largely stable over the past several decades, minor adjustments have occurred. To capture the most up-to-date institutional settings, I apply the ACIR framework to the more recent information from the National Association of State Budget Officers (NASBO), which documents statutory and constitutional provisions in Budget Processes in the States report. In addition, since 1988, NASBO's semiannual Fiscal Survey of the States has reported state-level data on enacted budgets, mid-year enacted budget adjustments, and fiscal outcomes, showing that states frequently employ mid-year adjustment to maintain year-end balance when revenue shortfalls arise. Because NASBO's record of deficit carryover rules are not fully comprehensive, I additionally supplement this component using each state's statutory or constitutional Articles or Provisions. The ACIR index produces a 0-10 measure of BBR stringency, which offers several advantages for empirical analysis. First, a key benefit of this index is that it assigns a numerical score to each state, allowing for a straightforward comparison of the relative stringency of budget rules across states. Second, and most relevant to the present study, the ACIR index is the only classification that explicitly incorporates the timing of the annual budgetary and legislative cycles, making it well-suited for predicting states' mid-year adjustments, such as mid-year budget cuts or tax increases.

Table 1 summarizes the degree of stringency of balanced budget requirements (BBRs) across U.S. states from 2002 to 2019. The index ranges from 0 to 10, with higher values indicating stricter rules. The index of states remains highly stable over time, with limited changes in individual scores. Overall, the stringency of BBRs has remained relatively stable over the past two decades, with most states showing no change or only minor adjustments. For example, Colorado(CO), Florida (FL), and Georgia (GA) consistently maintained the maximum score of 10, indicating that these states have long operated under the strictest budget constraints, whereas Indiana (IN) and Vermont (VT) remained at 0 throughout, reflecting the absence of formal annual balanced budget requirements. In a small number of states, the degree of stringency experienced modest changes. For instance, Alabama (AL)

decreased from 10 in 2002–2008 to 9 after 2015; Iowa (IA) declined from 10 to 9 in 2015; and Arizona (AZ) shifted from 4 in 2002 to 0 in 2015, before slightly increasing to 2 in 2021. This variation provides a valuable source of identification for empirical analysis, as it generates systematic differences in the speed and magnitude of higher education appropriation cuts across states during economic downturns.

2.2 Data

This paper uses data primarily from the Integrated Postsecondary Education Data System (IPEDS) of the U.S. Department of Education. IPEDS is a comprehensive, institution-level dataset that collects detailed information on postsecondary institutions in the United States. I focus on four-year public universities from 2002 to 2019. This period covers a full economic cycle, including the Great Recession, allowing the analysis to capture how public universities respond to significant economic fluctuations.

The IPEDS data include information on student enrollment and admissions, attendance status (e.g., undergraduate vs. graduate), and degree completions by award level (certificate, associate's, bachelor's) and fall enrollment by major field of study. In IPEDS, fall enrollment data is available at the two-digit CIP code for even-numbered years. In addition, IPEDS provides institution-level financial data on revenues and expenditures by source.

To supplement the institutional finance data, I incorporate state legislative appropriations data from Grapevine, an annual survey of state support for higher education compiled by the State Higher Education Executive Officers (SHEEO). I further match the IPEDS data to publicly available information on state-level economic conditions, including state unemployment rates from the Bureau of Labor Statistics (BLS), as well as annual data on state tax revenues and other categories of state government spending. All nominal fiscal variables are converted into real terms using the Consumer Price Index for All Urban Consumers (CPI-U, U.S. city average, all items) from the Bureau of Labor Statistics. I construct a CPI adjustment factor with 2020 as the base year, so that all values are expressed in 2020 constant

dollars .

As control variables, I draw on annual state-level population estimates by single year of age from the U.S. Census Bureau. From these data, I construct measures of the college-age population (ages 19–23) as a proxy for the pool of potential undergraduates. In addition, I estimate each year's entering cohort size as the average of the populations aged 17 and 18, which provides a consistent measure of the flow of first-time college entrants.

Table 2 summarizes key fiscal and institutional characteristics of public higher education across business cycle phases (booms and downturns) and by the stringency of states' balanced budget requirements (BBRs). Panel A shows that, on average, state appropriations per young adult fall substantially during downturns relative to booms, reflecting the procyclicality of state funding. States with stricter BBRs experience slightly lower per-capita appropriations in downturns ($1,352 versus $1,392 during booms) and a somewhat higher share of state revenues devoted to higher education, suggesting that constrained states reallocate within fixed budgets rather than expanding total spending. Federal and local appropriations remain nearly constant across the cycle, consistent with their limited role in short-term stabilization.

Panel B documents how these funding changes translate into institutional outcomes. Undergraduate enrollment rates decline modestly during downturns, while tuition per pupil falls only slightly, indicating that universities absorb part of the fiscal stress through non-price adjustments such as enrollment management or expenditure cuts. Unemployment rates rise sharply during recessions, especially in weak-rule states, which supports the identification of downturns as periods of heightened fiscal stress.

Panel C presents additional state-level characteristics. Mid-year budget cuts increase markedly in downturns particularly in strict-rule states. Demographic composition remains stable, and median household income declines slightly, consistent with broader cyclical patterns. Overall, the descriptive statistics confirm that strict balanced budget requirements amplify the procyclicality of state appropriations and fiscal adjustments, setting the stage for the paper's subsequent causal analysis.

2.3 Budgetary Processes and Timing

Figure 2 illustrates the timeline of the fiscal-year budget cycle and the corresponding actions of public higher-education institutions. The state budget process begins in early fall of fiscal year t–1, when higher-education coordinating boards submit funding requests for FY t to the governor's office. Governors' budget offices draft proposals during the fall, and the executive budget is typically submitted to the legislature in January or February. Legislatures debate, amend, and pass the budget by late spring, with final approval and gubernatorial signature occurring around June—just before FY t begins. Once enacted, appropriations for FY t become available in July. Public universities then finalize internal allocations, adjust tuition rates, and plan enrollment for the following academic year (FY t+1) using the now-known appropriations as a key input. The admissions cycle proceeds through the fall and winter, with offers made in spring and students matriculating in summer or early fall.

While most fiscal decisions are completed before the next academic year, enrollment can also respond contemporaneously within the same fiscal year due to both realized and expected funding shocks. When appropriations are reduced, universities face immediate liquidity constraints that force cuts in course offerings, and limits on new admissions—causing measurable enrollment contractions even before the next cycle (Deming and Walters 2017). At the same time, institutions anticipate future fiscal conditions and act preemptively: during the budget-planning stage, signals of fiscal stress such as rising unemployment or legislative debates over deficit closure prompt administrators to adopt conservative strategies—postponing program expansion, restricting class sizes, or tightening admissions—to maintain balance. Consequently, enrollment reacts not only to realized funding cuts but also to anticipated fiscal tightening, reflecting universities' forward-looking behavior and strong supply-side sensitivity to fiscal conditions These mechanisms jointly explain why the impact of state appropriations on enrollment manifests both within and beyond the current fiscal year.

3 Empirical Analysis

3.1 Build the Instrument

Changes in state appropriations over the business cycle often coincide with changes in university outcomes, but these correlations do not by themselves reveal causal effects. Both appropriations and enrollment react to the same underlying cyclical forces, such as rising unemployment, making it difficult to distinguish the impact of state funding from the direct influence of economic conditions. To address this, I employ an instrumental variables approach. The strategy exploits the fact that, conditional on similar cyclical conditions as proxied by the state unemployment rate, institutions in states with stricter balanced budget rules are more likely to experience sharper cuts in appropriation. In this way, the instrument affects university outcomes only through its impact on state appropriations, rather than through underlying business cycle condition itself or other contemporaneous policy or demographic changes.

Formally, I use the interaction between a state's BBR stringency and lagged unemployment rate as an instrument:

$$Z_{st} = BBR_{st} \times Unemployment\ Rate_{s,t-1} \tag{1}$$

Where BBR_{st} represents the degree of stringency of balanced budget requirements on a scale from 0 to 10. This interaction captures the extent to which exogenous cyclical shocks are amplified by predetermined fiscal institutions. Because BBRs are set by state constitutions or statutes and remain stable over time, they can be regarded as plausibly exogenous to short-run fluctuations in higher education outcomes. A key identifying assumption is that this excluded instrument, affects university outcomes only through its impact on state appropriations. In other words, while the unemployment rate directly captures cyclical conditions that simultaneously influence student demand and state revenues, the addi-

tional variation induced by BBRs operates solely through states' fiscal adjustments. This interaction therefore provides plausibly exogenous variation in appropriations, isolating the causal effect of state support on university behavior.

A key threat arises from the possibility that other fiscal mechanisms or institutions correlate with balanced budget rules or independently respond to cyclical shocks. States with stricter rules may differ in their use of rainy-day funds, or in political characteristics such as partisan control. I mitigate these concerns by including institution and year fixed effects to absorb persistent institutional differences, year fixed effects to capture national shocks, and controls for observable fiscal and political characteristics. I also controlled for rainy-day balances and partisan controls as outcomes.[1]

Another potential threat to identification arises from the fact that business cycles themselves may affect university outcomes through demand-side channels that operate independently of state appropriations. Economic downturns can directly influence students' decisions to enroll in higher education by changing the opportunity cost of work or altering the perceived value of schooling, and they may also coincide with shifts in the size of the college-age population or changes in local labor-market conditions. These mechanisms could generate enrollment responses that are unrelated to state funding. The exclusion restriction remains plausible, however, because balanced budget rules are institutional features of the state budget process that operate primarily through fiscal adjustments. They do not directly affect student demand for higher education, nor do they change universities' internal costs except through their impact on appropriations. In practice, I mitigate this concern by conditioning on insitution and year fixed effects, as well as controls for state unemployment rate and the size of the university-aged population. Under this specification, the identifying variation reflects differences in how strict- and weak-rule states adjust appropriations in response to comparable cyclical shocks, rather than differences arising from the direct impact of the business cycle itself.

[1] I also estimate placebo first stages using mid-year cuts as outcomes. The interaction of BBR stringency and unemployment does not predict this alternative fiscal responses, supporting the view that the instrument operates primarily through the higher-education appropriation channel.

3.2 First stage

The first stage equation for log state appropriation is:

$$\log(\textit{state appropriation})_{ist} = \beta_1 BBR_{st} \times \textit{unemployment rate}_{s,t-1} + \beta_2 \textit{unemployment rate}_{s,t-1} + \gamma X_{st} + \delta_t + \eta_i + \nu_{ist} \tag{2}$$

Where $\log(\textit{state appropriation})_{ist}$ is log of the state appropriate received by public higher educational institution i in state s, year t. BBR_{st} represents the degree of stringency of balanced budget requirements on a scale from 0 to 10. $\textit{unemployment rate}_{s,t-1}$ is the unemployment rate in state s, year t-1, which is a proxy for business cycle. X_{st} is a vector of control variables in state s, year t, containing unemployment rate, population aged from 18-22 in the state s, year t. δ_t and η_i represent year and institution fixed effect respectively.

The interaction between the indicator for strict budget rules and unemployment rate is the budget policy instrument Z_{st}. while the main effect of unemployment rate is an essential element of vector of control variables $X_(s,t)$. This equation estimates the changes in universities' state appropriations relative to the changes in budget policy instrument. The coefficient β_1 represents when there is an economic downturn, how much more will state with stricter balanced budget rule cut their state appropriation for public universities than states with weaker balanced budget rule. The coefficient β_2 captures the baseline pro-cyclical effect of economic shocks on appropriations. Because the variation in β_1 derives from cross-state differences in fiscal institutions that are predetermined and relatively stable over time, it can be regarded as plausibly exogenous to contemporaneous shocks in higher education outcomes. The comparison between β_2 and β_1 therefore provides both substantive evidence on the amplifying role of BBRs and the basis for our identification strategy: while β_2 reflects cyclical conditions per se, the larger magnitude of β_1 reflects institutional constraints that generate quasi-experimental variation in the timing and intensity of budget adjustments.

3.3 The Second Stage

The second stage equation is:

$$Y_{i,s,t+1} = \alpha_0 + \alpha_1 \log(\widehat{state\ appropriation}_{i,s,t}) + \alpha_2 unemployment\ rate_t + \gamma X_{s,t} + \delta_t + \eta_i + \epsilon_{i,s,t} \quad (3)$$

$\log(\widehat{state\ appropriation}_{i,s,t})$ is predicted log state appropriation from the first stage. We focus on the impacts of sharp yearly changes in the instruments on the endogenous variables and outcomes. $Y_{i,s,t+1}$ are the key outcomes of interest for the universities' decisions. This paper tests the total undergraduate student enrollment, tuitions and cost by major.

4 Results

4.1 First Stage Results and Reduced Form

Table 3 reports the first-stage estimates linking the interaction between lagged unemployment rate and balanced budget rules (BBRs) stringency index to state appropriations for higher education.

Effect of Budget rules on State Appropriations – In column (1), the coefficient on $BBR_{st} \times \text{unemployment rate}_{s,t-1}$ is –0.005 ($p < 0.05$). That is, conditional on controls and fixed effects, a one-unit increase in the BBR stringency amplifies the effect of a one-percentage-point rise in the lagged unemployment rate by reducing log state appropriations by approximately 0.50 percent. This implies that during economic downturns, states with more stringent balanced budget requirements experience a stronger procyclical response of higher-education appropriations relative to states with weaker rules, making funding more sensitive to adverse economic conditions. The finding supports the interpretation that tighter BBRs constrain fiscal flexibility and thus amplify the procyclicality of state budgets in higher education.

The coefficient on the BBR index itself (0.06) is positive but statistically insignificant, suggesting no systematic difference in the level of appropriations across states with dif-

fering levels of fiscal rule stringency in normal years. The coefficient on unemployment (0.007) is also insignificant once fixed effects are included, consistent with the idea that the cyclical response of appropriations is primarily driven by fiscal rules rather than the business cycle alone. In other words, while β_2 captures the baseline effect of cyclical conditions on appropriations, the larger absolute magnitude of $\beta 1$ reflects the additional, fiscal institutional constraint imposed by stricter BBRs, which leads to more pronounced adjustments in higher-education appropriations when economic conditions deteriorate.

Table ?? reports the reduced form estimates for undergraduate enrollment, tuition and cost of major. The basic pattern of the change in trends in state appropriations are mirrored for enrollment. The enrollment declines are larger for the states that have strict balanced budget requirements. Relative to states with weak budget rules, during the economic downturn enrollment fell by roughly 1.28 percent per year in strict-rule states. The effect is strongest in the contemporaneous year and gradually diminishes over the next two years, though it remains statistically significant. This interaction term is negative and highly significant, whereas the unemployment rate itself is small and statistically insignificant, indicating that enrollment declines arise only when cyclical shocks interact with strict budget rules. The pattern of the change in trends in state appropriations are also mirrored for tuition. In the column (4) and (5), in strict-rule states, tuition growth is muted or even reduced in the year of an unemployment shock, but the effect does not persist beyond the immediate year. Finally, the pattern of the change in trends in spending are mirrored by students' distribution across majors. In the column (6), the average instructional cost per students declined are larger for the states with strict budget rules. Relative to states with weak budget rules, during the economic downturn the cost of major increased by roughly \$0.27 in instructional cost per student credit hour (significant at the 5 percent level) in strict-rule state. It is helpful to look to the instrument variable regression that relate the changes in outcomes (due to the instruments) to the induced changes in state appropriations.

4.2 Second Stage Results

The second stage estimates imply that how key outcomes in higher education institutions, such as enrollment, tuition and instructional costs respond to changes in state appropriations. When facing reductions in state appropriations public universities often increase revenues or reduce the cost to compensate for lost budget.

Enrollment – Table 4, Column (1) shows the effect of log state appropriations on current-year undergraduate enrollment. The coefficient is 0.572 ($p<0.01$) indicates that a 1 percent decline in state appropriations reduces total undergraduate enrollment in the current year by roughly 0.57%. This suggests that enrollment is highly sensitive to contemporaneous state funding, as universities immediately reduce admissions or fail to accommodate additional demand when resources decline. In column (2), the coefficient 0.621 ($p<0.01$) shows that a 1% decrease in state appropriations lowers undergraduate enrollment in the following year by about 0.62%, still significantly positive and slightly larger than in the current year, which is consistent with the idea that universities' enrollment adjustments occur with a natural one-year lag. Such timing likely reflects the admissions and budgeting cycle, where state funding cuts in year t constrain the subsequent year's admissions plans, financial aid availability, and student enrollment decisions. Together, these results indicate that fiscal contractions in higher education have both immediate and persistent effects on institutional capacity and access.

Sensitivity check (without year-fixed effect): To verify that the estimated effects are not solely driven by common time shocks, Columns (3) – (4) in Table 4 present regressions that exclude year fixed effects while controlling for state-level unemployment rates to capture part of the macroeconomic variation over time. The coefficients on log state appropriations remain positive and highly significant, indicating that the main relationship between state funding and undergraduate enrollment is robust to the exclusion of year dummies. This confirms that the baseline results are not mechanically driven by nationwide trends or common shocks affecting all states simultaneously.

When year fixed effects are omitted, the unemployment rate becomes statistically significant, suggesting that it partially absorbs aggregate business-cycle fluctuations that were previously captured by year dummies. Nevertheless, the persistence and significance of the funding coefficients indicate that macroeconomic conditions alone cannot account for the observed enrollment responses. Instead, the results emphasize that fiscal constraints—rather than aggregate demand or labor-market conditions—constitute the primary mechanism linking state budgets to enrollment outcomes.

Placebo Test: To further verify that the estimated effects are not driven by pre-existing enrollment trends or spurious correlations, Columns (5) and (6) of Table 4 present placebo tests using future and lagged specifications. Specifically, these regressions relate undergraduate enrollment in years $t-1$ and $t-2$ to contemporaneous state appropriations. The estimated coefficients on log state appropriations in Columns (5) and (6) are small in magnitude (0.138 and 0.204, respectively) and statistically insignificant, consistent with the absence of any pre-trend in enrollment prior to the appropriation changes.

These findings strengthen the causal interpretation of the main results by showing that changes in state appropriations affect enrollment contemporaneously and with a short lag, rather than reflecting endogenous adjustments or omitted cyclical factors. In other words, universities do not appear to alter enrollment decisions in advance of appropriation changes, reinforcing the view that fiscal shocks operate through direct revenue constraints rather than anticipatory behavior.

Tuition – In Table 5 Column (1) reports a coefficient of 0.206 on log state appropriations, which is economically small and statistically insignificant, indicating that changes in state funding do not immediately translate into tuition adjustments within the same fiscal year. Column (2) similarly shows an insignificant and near-zero estimate (–0.004) for the following year, suggesting that universities do not raise or lower tuition in response to short-term appropriation shocks even with a one-year lag. These results imply that tuition levels are largely insulated from contemporaneous fiscal fluctuations, likely reflecting the institutional rigidity of tuition-setting processes and the role of political oversight in

moderating year-to-year price changes.

By contrast, the coefficients on the Balanced Budget Rule (BBR) index are consistently negative and highly significant across all columns. In Columns (1)–(2), the BBR coefficients of –0.099 and –0.088 ($p < 0.01$) suggest that a one-unit increase in fiscal rule stringency is associated with roughly an 8 to 10 percent decrease in posted tuition, conditional on appropriations and other controls. When year fixed effects are omitted in Columns (3)–(4), the magnitude of these estimates increases further (–0.264 and –0.239, $p < 0.01$), implying that the relationship between fiscal discipline and lower tuition is not merely driven by common time shocks but reflects persistent cross-state differences in budget constraints.

Taken together, these results indicate that while state appropriations have little short-run impact on pricing decisions, fiscal institutions exert a strong and systematic influence on universities' tuition. States with stricter balanced-budget rules maintain lower tuition levels, potentially because their constrained fiscal environments limit universities' ability to offset funding volatility through tuition increases. Combined with the enrollment results, this pattern suggests that appropriations shocks primarily operate through the revenue channel—affecting enrollment and institutional scale—rather than through immediate changes in posted tuition.

Changes in Major Composition– To measure instructional costs by major, I follow the approach of (Altonji and Zimmerman 2018), who uses administrative student and expenditure data from the Florida Board of Governors (2000–2014) to estimate how the cost of producing graduates varies across fields. Specifically, I draw on estimates of per-credit direct expenditures by major from that study and combine them with IPEDS enrollment data by field. This allows me to construct a measure of the average per-student cost by major.

Table 6 reports the estimated effects of state appropriations on the cost of instruction per major, measured as the total educational expenditure per credit hour per enrolled student. Across specifications, the coefficient on log state appropriations is consistently negative, indicating that declines in state funding lead to higher per-student instructional

costs. In Column (1), the coefficient of –0.029 ($p < 0.10$) implies that a 1 percent reduction in state appropriations is associated with a roughly 0.03 percent increase in the average cost per major in the current year. This effect remains similar in magnitude and significance when the specification excludes year fixed effects or adjusts the sample in Column (2), and persists one year later in Column (3) (–0.029, $p < 0.10$).

A plausible explanation for the counterintuitive increase is reallocation across majors. As mentioned in Data section, the measure of average instructional cost per student in this paper is constructed as a weighted composite across major fields, rather than directly observed at the aggregate level. STEM fields typically require much higher per-student spending than humanities disciplines (Hemelt et al. 2021). Thus, the observed increase in average costs is not driven by uniform changes across all disciplines, but rather by a compositional shift: when state appropriations decline, universities strategically protect or even expand resources in STEM fields—particularly high-cost programs such as engineering—while cutting more heavily from lower-cost fields like business (Stange 2015). This reallocation raises the average "cost per student" as calculated across majors.

4.3 Robustness Check

5 Conclusions

The results draw three key conclusions. First, strict BBRs amplify the procyclicality of state budgets. When unemployment rises, states with strict rules cut higher education appropriations more sharply and are more likely to implement mid-year rescissions. This effect is large in magnitude and consistent across specifications, highlighting the role of institutional rules in accelerating fiscal contraction. Second, public universities respond to these cuts primarily through changes in enrollment rather than tuition. In strict-rule states, institutions reduced undergraduate enrollment contemporaneously with appropriation cuts, with the effects persisting into subsequent years. By contrast, tuition adjustments were limited and statistically insignificant, suggesting that institutions relied less on shifting costs

to students and more on restricting access as a adjustment mechanism. Third, spending reallocations across majors indicate that cuts also affected instructional resources, implying potential consequences for educational quality in addition to quantity.

These findings carry several implications. At a theoretical level, they demonstrate that fiscal rules are not simply background institutions, but active mediators of how economic shocks are transmitted into public services. The institutional design of state budget processes—whether deficits may be carried over, whether governors or legislatures are required to pass or sign balanced budgets—determines not only fiscal aggregates but also the educational opportunities available to students. At a policy level, the results raise concerns about equity and access. Because enrollment is the primary adjustment margin, students from disadvantaged backgrounds may bear the incidence of fiscal stress in strict-rule states, particularly during recessions when countercyclical demand for education is highest. The evidence thus highlights a tension: while BBRs promote fiscal stringency, they may do so at the cost of reducing access to higher education precisely when it is most needed.

The methodological contribution of the paper is to use the Interaction between cyclical shocks and institutional rules as an instrument for appropriations. This strategy improves on prior approaches that rely solely on spending reliance, by generating plausibly exogenous changes in funding that are both large and policy relevant. The empirical results suggest that institutions' responses differ sharply depending on whether appropriations fall through the ordinary budget cycle or through unanticipated mid-year adjustments, highlighting the importance of timing in fiscal policy transmission. Several avenues for future research remain. First, while this study focuses on enrollment and tuition, subsequent work could examine longer-run outcomes, such as degree completion, labor market returns, or migration patterns, to assess whether the immediate enrollment reductions translate into persistent effects. Second, the analysis could be extended to other public services—such as K–12 education or health care—to test whether the mechanism identified here generalizes beyond higher education. Finally, given the renewed fiscal stress experienced by states during the COVID-19 crisis, the interaction of BBRs with federal aid

provides a natural setting for examining whether intergovernmental transfers can offset the procyclical effects of fiscal rules.

6 Future work

Second, I will investigate how fiscal contractions influence the quality of higher education, beyond observable changes in scale. Budget cuts may lead not only to reduced access but also to degradation in instructional inputs, faculty composition, and learning environments. Using detailed data on faculty employment, instructional spending, and academic resources, I will assess whether universities in fiscally constrained states substitute away from tenure-track faculty, increase class sizes, or restructure curricula in ways that affect educational quality. This line of inquiry will clarify the mechanisms through which fiscal rules may generate long-term inequality in skill formation and academic outcomes.

Third, I aim to evaluate the effectiveness of alternative fiscal tools—such as rainy-day funds and stabilization reserves—in mitigating the rigidities imposed by balanced-budget rules. By examining how fiscal buffers interact with economic downturns, I will assess whether states with greater reserve capacity are able to sustain counter-cyclical investment in higher education despite formal budget constraints. This project will contribute to policy debates on optimal fiscal architecture by distinguishing between fiscal discipline that promotes stability and rigid rules that exacerbate cyclical volatility in essential public services.

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Figures

FIGURE 1: Stringency of Balanced Budget Requirements in the States

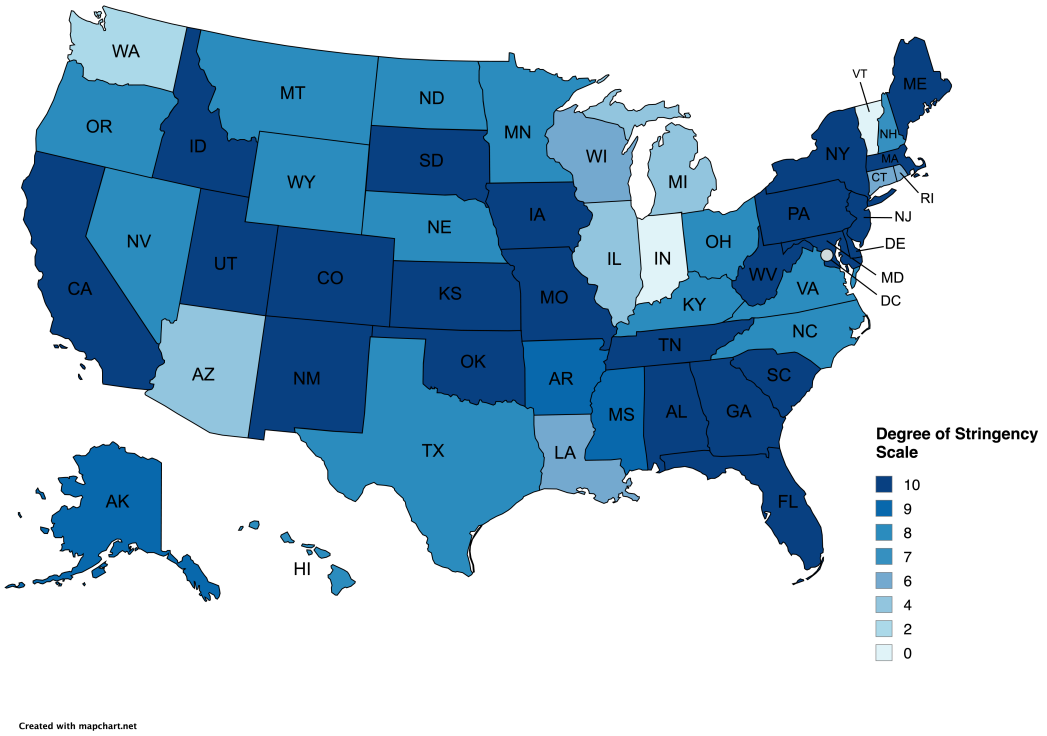
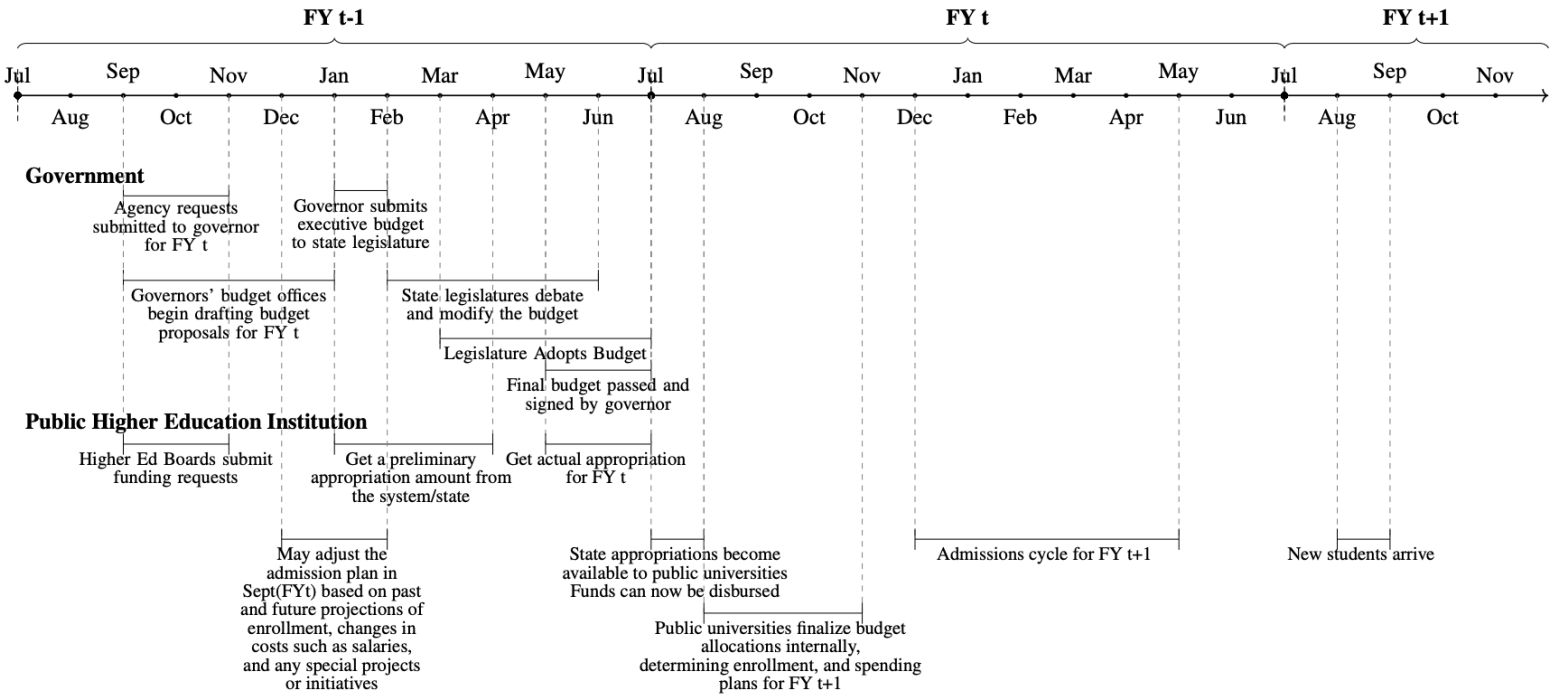


FIGURE 2: Timeline of the Fiscal Year Budget Cycle and Institutional Responses in Public Higher Education



Tables

TABLE 1: Stringency of Balanced Budget Requirements in the United States

State	2002	2008	2015	2021
AL	10	10	9	9
AK	9	9	9	9
AZ	4	4	0	2
AR	9	9	9	9
CA	10	10	10	10
CO	10	10	10	10
CT	6	6	6	6
DE	10	10	10	10
FL	10	10	10	10
GA	10	10	10	10
HI	8	8	8	8
ID	10	10	10	10
IL	4	4	4	4
IN	0	0	0	0
IA	10	10	9	9
KS	10	10	10	9
KY	8	8	8	8
LA	6	6	6	6
ME	10	10	10	10
MD	10	10	10	10
MA	10	10	9	9
MI	4	4	4	4
MN	8	8	8	8
MS	9	9	9	9
MO	10	10	10	10
MT	8	8	8	8
NE	8	8	8	8
NV	8	8	8	8
NH	7	7	7	7
NJ	10	10	10	10
NM	10	10	9	9
NY	10	10	10	10
NC	8	8	8	8
ND	8	8	8	8
OH	8	8	8	8
OK	10	10	10	10
OR	8	8	8	8
PA	10	10	10	10
RI	6	6	6	6
SC	10	10	10	10
SD	10	10	10	10
TN	10	10	10	10
TX	8	8	8	8
UT	10	10	10	10
VT	0	0	0	0
VA	8	8	8	8
WA	2	2	2	2
WV	10	10	10	10
WI	6	6	6	6
WY	8	8	8	8

Notes: Author documented from NASBO and ACIR, complemented by fiscal articles in each state; more details see Table A1 and Appendix: BBR note.

Table 2: Summary Statistics by Balanced Budget Requirements Stringency and Business Cycle (2002 -2019)

	All				Strict				Weak			
	Boom		Downturns		Boom		Downturns		Boom		Downturns	
	(1) Mean	(2) SE	(3) Mean	(4) SE	(5) Mean	(6) SE	(7) Mean	(8) SE	(9) Mean	(10) SE	(11) Mean	(12) SE
Panel A												
State Appropriations Per Young Adults	1381.54	2603.30	1363.91	2573.32	1391.75	2734.31	1352.11	2687.02	1331.36	1828.12	1421.86	1925.29
State Appropriations/Total Revenue	0.60	0.38	0.64	0.36	0.64	0.39	0.67	0.37	0.43	0.23	0.51	0.24
Federal Appropriations/Total Revenue	0.00	0.02	0.00	0.02	0.00	0.02	0.01	0.02	0.00	0.01	0.00	0.02
Local Appropriations/Total Revenue	0.00	0.05	0.00	0.06	0.01	0.06	0.01	0.06	0.00	0.01	0.00	0.00
Panel B												
Undergraduate Enrollment Rate	0.15	0.20	0.14	0.19	0.15	0.21	0.14	0.19	0.17	0.18	0.16	0.17
Tuition per pupil	5775.14	3361.79	5061.27	2480.53	5533.69	3117.28	4855.52	2298.63	6962.24	4172.26	6072.04	3040.79
Unemployment Rate	5.63	1.80	8.32	2.06	5.56	1.81	8.16	2.00	5.97	1.74	9.10	2.16
Panel C												
Mid-Year Budget cuts (2020 dollars)	129.63	355.69	811.42	2294.53	134.12	375.92	915.00	2501.41	107.62	230.82	302.57	292.71
Population Aged 19-23	737.77	697.68	741.58	704.15	785.30	750.14	790.68	756.84	504.25	219.27	500.38	220.02
Population Aged 18-19	146.50	139.37	154.93	147.77	155.97	149.78	164.74	158.82	99.95	45.21	106.70	49.33
Median Income(Thousand Dollars)	67.57	10.91	65.46	9.53	67.63	11.17	65.37	9.84	67.31	9.56	65.87	7.86
Number of Observations	8041				6,579				1,462			
Number of States	49				38				11			
Number of Institutions	473				387				86			

*Notes:*The table reports means and standard errors of key fiscal and higher education variables, separately for economic booms and downturns, and for states with strict an weak balanced budget rules.

TABLE 3: First Stage Results: Effect of Budget Rules on State Appropriations

	Log(state appropriations)			
	(1)	(2)	(3)	(4)
BBR index × unemployment	-0.005**	-0.005***	-0.005**	-0.005***
	[0.002]	[0.002]	[0.002]	[0.002]
BBR index	0.060	0.021	0.060	0.020
	[0.041]	[0.054]	[0.042]	[0.054]
Unemployment	0.007	0.001	0.012	0.004
	[0.017]	[0.015]	[0.017]	[0.014]
Rainy Day Funds			0.002***	0.004**
			[0.001]	[0.002]
F-statistics	6.093	7.403	6.276	8.016
Observations	8,041	8,041	8,027	8,027
R^2	0.977	0.973	0.977	0.974
Institution fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	No	Yes	No
Controls	Yes	Yes	Yes	Yes

Notes: The dependent variable is log(state appropriations). The coefficient on BBR index × Unemployment uses unemployment in fiscal year $t-1$; the main effects of the BBR index and unemployment (in FY T-1) are included. The "Rainy Day Funds" is the rainy day funds divided by total expenditure. All specifications include institution and year fixed effects. The vector of controls includes log of university-aged population (see Section 2 for definitions). Robust standard errors are clustered at the state level. Variables are scaled so that the BBR index ranges from 0 to 10. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.
note: party: democratic/pub;

TABLE 4: Second Stage Results: Enrollment

	Log(Total Undergraduate Enrollment)					
	(1) *T*	(2) *T+1*	(3) *T*	(4) *T+1*	(5) *T-2*	(6) *T-1*
Log State Appropriations	0.572***	0.621***	0.533***	0.604***	0.138	0.204*
	[0.185]	[0.231]	[0.169]	[0.205]	[0.120]	[0.111]
BBR index	-0.024	-0.026	-0.027	-0.017	-0.005	-0.010
	[0.032]	[0.040]	[0.025]	[0.037]	[0.011]	[0.014]
Unemployment	0.008	0.009	0.018***	0.023**	0.003	0.001
	[0.008]	[0.010]	[0.007]	[0.008]	[0.003]	[0.003]
Weak Identification F-stat	6.090	6.078	7.400	7.389	4.625	4.628
Observations	8,041	8,040	8,040	8,040	8,040	8,040
Institution Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	No	No	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is log of total undergraduate enrollment in four-year public universities. Coefficients are 2SLS second-stage estimates; brackets report robust standard errors clustered at the state level. All specifications include institution fixed effects and the stated controls (demographics and macro variables). Columns (1)–(2) use current- and next-year enrollment; Columns (3)–(4) drop year fixed effects to assess sensitivity; Columns (5)–(6) are *placebo* tests that regress enrollment in t–2 and t–1 on contemporaneous appropriations, and coefficients are small and/or imprecisely estimated, consistent with no anticipatory pre-trends. ***, **, * denote significance at 1%, 5%, and 10%.

TABLE 5: Second Stage Results: Tuition

	Log (Tuitions)			
	(1)	(2)	(3)	(4)
	T	*T+1*	*T*	*T+1*
Log State Appropriations	0.206	-0.004	0.191	0.054
	[0.199]	[0.241]	[0.364]	[0.375]
BBR index	-0.099***	-0.088***	-0.264***	-0.239***
	[0.024]	[0.020]	[0.085]	[0.084]
Unemployment	0.026***	0.021**	-0.004	0.006
	[0.010]	[0.009]	[0.011]	[0.010]
Weak Identification F-stat	6.094	5.096	7.403	6.198
Observations	8,041	8,040	8,040	8,040
Institution Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	No	No
Controls	Yes	Yes	Yes	Yes

Notes: The dependent variable is log(tuition) for four-year public universities. Brackets report robust standard errors clustered at the state level. All specifications include institution fixed effects and the stated controls (demographics and macro variables). Columns (1)–(2) use current- and next-year tuition with year fixed effects; Columns (3)–(4) drop year fixed effects as a robustness check while retaining controls. ***, **, * denote significance at 1%, 5%, and 10%.

TABLE 6: Second Stage Results: Cost of Major

	Log (Cost of Major)		
	(1)	(2)	(3)
	T	*T*	*T+1*
Log State Appropriations	-0.029*	-0.023	-0.029*
	[0.016]	[0.018]	[0.017]
BBR index	-0.003*	-0.003*	-0.002
	[0.002]	[0.001]	[0.002]
Unemployment	-0.002**	-0.001**	-0.002***
	[0.001]	[0.001]	[0.001]
Weak Identification F-stat	6.078	7.389	4.628
Observations	2,561	5,897	6,041
Institution Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	No	Yes
Controls	Yes	Yes	Yes

Notes: The dependent variable is log(cost per major), measured as the average educational cost per credit hour per enrolled student, calculated using major-level cost data. Brackets report robust standard errors clustered at the state level. All specifications include institution fixed effects and relevant controls. Columns (1) and (2) use current-year outcomes; Column (2) additionally excludes year fixed effects and drops observations in which more than 30 percent of enrollment data by major are missing. Column (3) reports results using next-year outcomes. ***, **, * denote significance at the 1

Table A1: Reduced Form Results

	Log(Enrollment)			**Log(Tuition)**		**Log(Cost of Major)**
	(1) (FY t)	(2) (FY t+1)	(3) (FY t+2)	(4) (FY t)	(5) (FY t+1)	(6) (FY T)
Strict Rules × Unemployment	−0.0128***	−0.0109***	−0.0082***	−0.0107***	−0.0013	0.272**
	[0.002]	[0.002]	[0.002]	[0.003]	[0.003]	[0.110]
Unemployment	−0.000516	−0.00341*	−0.00538**	0.0274***	0.0201***	−0.178
	[0.002]	[0.002]	[0.002]	[0.003]	[0.003]	[0.123]
F-stats	47.63	41.01	20.70	13.99	0.229	6.099
Observations	8,041	8,041	8,041	8,041	8,041	2,328
R-Squared	0.984	0.984	0.982	0.981	0.981	0.004
Institution Fixed Effects	X	X	X	X	X	X
Year Fixed Effects	X	X	X	X	X	X
Controls	X	X	X	X	X	X

Notes: Enrollment is undergraduate total enrollment. The cost-of-major measure is constructed on a biennial basis and is reported only for states with an annual budget cycle. Following (Clemens and Miran 2012), we exclude biennial budget states, as their timing introduces substantial measurement challenges. Brackets report robust standard errors (cluster level as stated in the paper). ***, **, * denote significance at the 1%, 5%, and 10% levels.