Considering a Standard Approach to Determining Institutional Funding Adequacy

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by Brian Prescott, Zac Koch, and Dennis Jones

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Over the last few decades, public institutions have had to make do with decreasing levels of state funding support per student. Policymakers looking for a way to balance state budgets during economic recessions have required higher education institutions to absorb a disproportionate share of cuts, largely because they know the institutions can offset the impact of those cuts with revenues from tuition. Increased tuition prices and growth associated with the counter-cyclical enrollment effects of recessions have helped cushion the impact of reduced state appropriations. But each of the last two recessions has accelerated an inexorable shift in the financing of public institutions, with the burden increasingly being borne by students and their families. Whereas public institutions derived 71 percent of their total educational revenue from the state in 2000, just prior to the recession of 2001, in 2019 only 64 percent of their revenue came from the state, according to the State Higher Education Executive Officers. In a majority of states, the state provided less than half of public institutions' overall funding support.

The impacts of this shift have not been evenly felt. States vary in their generosity to public higher education—ranging from Vermont, which in 2019 was the least generous state in providing only 13 percent of total educational revenue, to Wyoming where public funding state accounted for over 82 percent. Moreover, different sectors within states face starkly different realities in terms of how much state support they receive, how much they can raise tuition, and how wide and deep their market for prospective students is. State budget cuts are a more immediate challenge for those institutions least able to obtain additional tuition revenue from a shallower pool of prospective students and are especially threatening to the long-term fiscal health of the subset of those institutions in states that provide less generous institutional subsidies.

As the nation grapples with a new recessionary period brought about by the COVID-19 pandemic, state institutions are bracing for another round of cuts to state appropriations. Those cuts will combine with the unprecedented impact of COVID-19 on institutional finances—massive unbudgeted expenses for safety protocols, an abrupt and expensive switch to online programming, and major revenue losses in auxiliary services such as housing. The bills for these expenses and losses are still coming due. Add to this set of complications for institutional finances is the fact that the pandemic has scrambled typical enrollment patterns, with enrollment drops being steepest at community colleges and among racial/ethnic minorities (National Student Clearinghouse Research Center, 2020). The resulting uncertainty has left many institutions on edge.

The coming recession will also look different than economic downturns of the recent past since many states are simultaneously facing demographic conditions that may make it harder for institutions to cushion the impact of a loss of state funding support with growth-fueled tuition revenues. This is especially true for states in the Northeast and Midwest where the number of high school graduates have been declining and where the declines are likely to accelerate over the next several years (WICHE, 2020). These regions are home to many of the states in which tuition revenue accounts for the greatest proportions of total educational revenue collected by public institutions. Broadly accessible institutions without significant financial reserves, especially those that are located in rural areas and serve as anchor institutions and employers in their communities, will be particularly vulnerable (McClure, Orphan, Fryar, & Koricich, 2021; Prescott, 2019).

As policymakers work to plug holes in state budgets, they are likely to once again ask higher education institutions to take disproportionately large cuts, just as they have during past recessions (Delaney & Doyle, 2011). Unfortunately, policymakers have grown so accustomed to seeing public institutions make up reductions in state funding with tuition revenue—and not seeing (or ignoring) obvious impacts on performance—that they may not recognize the point beyond which budget cuts irreparably damage critical state assets.

Public institutions will mount a vigorous effort to preserve their state funding levels with pleas to policymakers likely to be grounded in references to prior years' funding levels. Such requests are often couched in terms of "base budget adequacy" with a baseline linked to a recent high point in state funding levels. Many policymakers will recognize that additional proposed cuts will be genuinely painful for these institutions and might worsen affordability challenges for students. Others, more concerned about perceptions of excessive spending at institutions, may view cuts as a necessary evil to inspire greater efficiency. But incremental approaches to budgets based on prior years' levels do not help policymakers understand how much funding an institution **really** needs to support core operating functions such as administration and to fund instruction and essential student services. Such approaches obviate the need to address the fundamental question—"What is the minimum level of funding necessary for an institution to fulfill its mission at a high level of quality?"

The current set of fiscal challenges, while uncomfortably familiar, may have a deeper and more transformative effect on the landscape of postsecondary education providers than previous economic downturns. The combination of declining demographic trends, the sudden and sweeping fiscal impacts caused by COVID (which has coupled unbudgeted costs with enrollment declines and associated losses in tuition revenues), and a looming recession raises questions of fiscal viability for the most impacted institutions. In cases where public institutions face serious questions about their solvency, the reality is that institutions have limited degrees of freedom to respond to fiscal crises, and their options dwindle further in unfavorable demographic conditions. Their attempts to respond effectively run into twin challenges that can hem them in—the higher education industry has great difficulty in creating productivity gains because they are traditionally so reliant on expensive staffing resources, and institutions usually operate with fairly inflexible personnel policies. These most particularly include tenure and, in some states, collective bargaining agreements that tightly define the terms and conditions of faculty and staff employment but extend as well to rising health care costs for all employees.

Such constraints do not let institutions off the hook for failing to anticipate at least some of the challenges they are encountering now and for making the hard and unpopular choices that might have better insulated them from present and future difficulties. Yet those constraints are important factors in the difficulty institutions have in mounting effective responses to deeply challenging fiscal conditions. Even prior to the pandemic there were a number of high-profile closures among institutions in the private sector. Public institutions may be less likely to close, due to resistance from policymakers with threatened institutions in their districts and from their colleagues and stakeholders who may be more broadly concerned with abandoning a state asset, steep costs of closure, and fears that institutions in their districts may be next. But proposals to shutter academic programs in some institutions or merge institutions in an attempt to shore up weakened financial conditions (in one or both affected institutions)

are evident signs that some public institutions face threats to their continued existence as independent institutions in the coming years. Alaska, Connecticut, Pennsylvania, Vermont, New Hampshire, and Wisconsin are among those states that have looked at, or are looking to, consolidation as one possible path out of fiscal crisis, oftentimes looking to Georgia's wave of mergers over the last decade for inspiration and models. [1]

It is certain is that institutional closures or mergers will have wide-ranging impacts on the communities and students they serve, with the most affected students likely to be those from the most vulnerable populations—low-income and first-generation students, under-represented minorities, and rural residents. Weakened or closed institutions will also have downstream fiscal effects on other institutions in the system or the state (Whitford, 2020). Moreover, merging institutions, while often preserving a campus in the short term, provides no certainty of its long-term presence. Mergers are also inevitably disruptive over the short term, and the institutions' concentration shifts away from students' needs toward merger-related activities and concerns (Seltzer, 2018). Affected communities and regions may be among those least capable of bouncing back from the loss of a critical anchor institution and employer, a point of access to educational opportunity, and a critical engine for economic development.

These conditions give rise to a concern that, in a triage environment, policymakers may adopt resource allocation approaches, such as across-the-board cuts, that disproportionately impact the most vulnerable institutions and the disadvantaged students they serve. These conditions introduce the very real possibility that policymakers may inadvertently make cuts that go beyond painful and actually trigger existential crises for these institutions.

Prior research and analysis provide insight into institutional funding requirements and spending patterns. This paper relies on theories concerning costs in higher education and on econometric analyses that have sought to identify the efficient frontier in institutional expenditure levels. Drawing an analogy from prior efforts to define a standard for affordability, and building from the economic concepts of fixed and variable costs, this paper proposes a conceptual framework to describe the various categories of funding support that public institutions require. Accompanying this framework is a brief examination of the variation in expenditures on administrative functions as reported by institutions, in order to assess the minimum level of fixed cost (foundational) support required for institutional viability. Such knowledge is intended to help policymakers better understand the point beyond which a public institution's future viability may be compromised by additional cuts.

Review of the Literature

Spending levels at higher education institutions have been the subject of considerable research over the years. Among the most enduring theories is Baumol's Cost Disease (Baumol & Bowen, 1966), which holds

[1] It is worth noting how different Georgia's experience was in terms of context and intent. Georgia's demographic future is quite different from these more northern states; its mergers were motivated primarily by a desire to improve student success and quality. Savings created were generally redirected into new strategic initiatives, new programs, and investments to bolster student outcomes (University System of Georgia, 2020), rather than into reducing costs as a necessary step in rescuing fiscally imperiled institutions.

that costs borne by higher education institutions, like those in other "handicraft" industries, is bound to rise at a rate faster than inflation due to its heavy emphasis on highly compensated human resources for which effective substitutes that could improve productivity are limited. Resource dependency theory (best articulated by Howard Bowen) is another major conceptual framework for understanding costs; it holds that institutions will raise as much revenue as they possibly can, and then spend it all on worthy activities. According to some analyses, these factors combine to create significant operational inefficiencies in higher education. Whether these inefficiencies take the form of an amenities "arms race" (Fischer & Ellis, 2021; McClure, 2019), cause "administrative bloat" (Simon, 2017), insulate institutions from making needed changes, or create other sources of perceived waste, growing concerns about affordability and inequitable access and success for students from different backgrounds have contributed to a lack of credibility in institutional statements regarding minimally required spending levels. Although there is some evidence to suggest that many of the additional costs are driven in part by added regulatory burden and growth in professional positions (Desrochers & Kirshstein, 2014), which may be attributable in part to the assumption of duties by administrators that were previously undertaken by faculty (e.g., student advising), such explanations are rarely given much weight. The responses to such concerns become especially divisive in postsecondary settings where the prospects of cuts to employee numbers or compensation are under consideration. The size of the administration relative to the number of faculty becomes a common point of contention in such cases.

Given recent patterns of funding cuts, the impact of changes in state appropriations on institutional spending has received new attention within the research literature. As described in SHEEO's overview of this paper series on public higher education finance (Cummings, Laderman, Lee, Tandberg, & Weeden, forthcoming), the findings suggest that the effects are unlikely to be the same across different institutional types. Public research universities are more likely to respond to state funding cuts by raising tuition revenue, in part through increased outreach to nonresidents. Among more broadly accessible public four-year and two-year institutions, however, reductions in state appropriations appear to prompt cuts to institutional budgets. Moreover, those cuts tend to be focused on expenditure categories most closely associated with serving students—instruction, student services, and academic support—while they are less likely to result in reductions in general administration expenses.

These theoretical underpinnings and the evidence about institutional responses to state budget cuts provide impetus to take a closer look at categories of institutional expenditures, not just total expenditures. Some basic economic concepts are also immediately germane to this review. Production theory in economics posits that there are two types of costs to producing output: fixed costs and variable costs. Fixed costs are costs incurred regardless of the level of output being produced. A fixed cost is the same at one unit of output as it is at 100 units. Renting a building is an example of a fixed cost. Variable costs have a positive relationship with total cost; they rise as production increases require a growing volume of input, a larger complement of workers, etc. The combination of fixed and variable costs leads directly to the concept of scale economies. Typically, if production costs are relatively more concentrated in fixed costs than variable costs, a producer will see average total costs decline as production increases. This is called economies of scale. The opposite can also be true, as when average total costs rise as more output is produced, it is called diseconomies of scale. When both economies and diseconomies of scale

are possible for a producer, there exists a point of cost minimizing output at the intersection where economies of scale yield to diseconomies of scale.

Research has attempted to specify the economies or diseconomies of scale in the production of higher education's "output." Typically, the output being measured is a student-focused one, such as enrollments or awards. Toutkoushian (2016) identified the presence of economies of scale in higher education institutions, especially when treating institutions as single-product firms producing undergraduate education. Vamosiu, McClure, and Titus (2018) found economies of scale and scope (efficiencies created by offering a combination of outputs like undergraduate and graduate education together) in a study of public master's institutions. When both economies and diseconomies of scale exist in a market of producers, it implies the existence of a cost-minimizing output level. For example, Toutkoushian (2016) found that the cost-minimizing enrollment level to be 25,446 students for associates institutions, 22,116 for master's institutions, and 9,894 for bachelor's institutions.

Much of the research on cost efficiencies in higher education has relied either on total expenditures or "education and general" expenditures, which exclude expenditures on research and public service, as the dependent variable of interest. Although related research focusing on other expenditure categories has tended to not address cost efficiency, there have been studies of the relationship between measures of student success or retention and spending levels on specific expenditure categories. These serve to reinforce the evidence that how institutions spend scarce resources will affect desirable outcomes. For example, Webber and Ehrenberg (2010) demonstrated that retention and graduation improved when institutions devote more of their institutional budgets to academic support, student services, and research. Ryan (2004) has documented a linkage between instructional expenditures and better graduation rates at baccalaureate-granting institutions, and separately found a negative relationship between administrative expenses and measures of student engagement (Ryan, 2005).

These three strands of research—theoretical frameworks that suggest that costs are difficult to control in higher education, evidence of disproportionate growth (or retrenchment) in administrative expenses, and indicators of economies of scale—come together to inform a proposed conceptual framework for thinking about institutional budgets in the context of falling state support levels.

A Proposed Framework

Missing in this discussion is a conceptual framework that describes the components of an institution's cost structure and empirical evidence that will guide policymakers in determining the point at which cuts to institutional funding really do imperil the ability of an institution to fulfill its mission at high levels of quality. This paper puts forward a framework that addresses this deficiency.

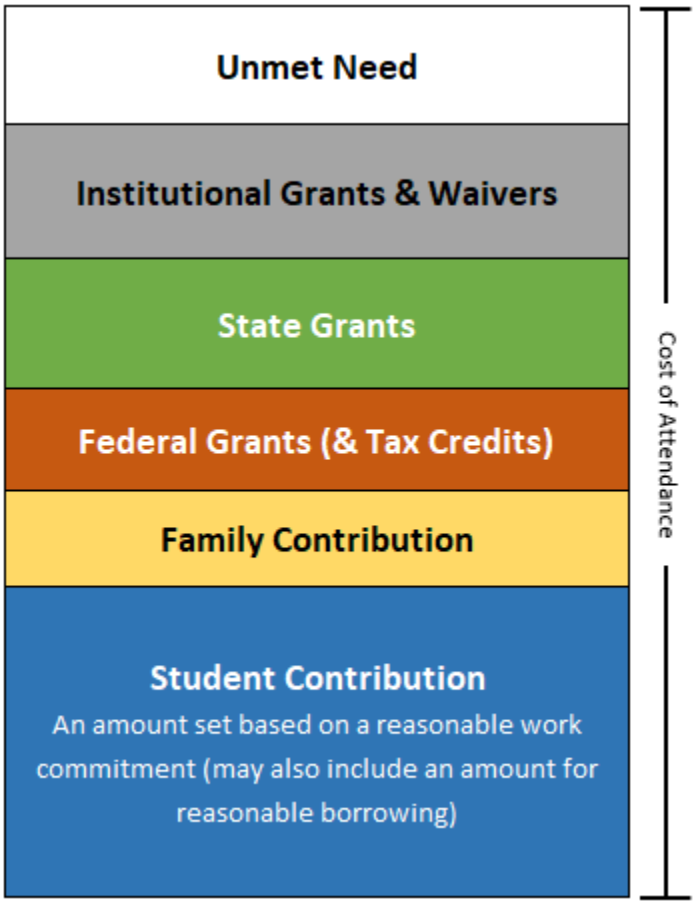
To introduce the benefits of a proposed framework for institutional spending, we take a brief detour to consider the role of conceptual frameworks in guiding approaches to student affordability policy. Affordability is possibly an even more ambiguous idea than is the notion of operational funding adequacy within institutions; often the only consensus that it inspires is that colleges are unaffordable and becoming less so every year. It also makes sense to look at affordability because policymakers ultimately need to simultaneously consider the effect of their resource allocation decisions on the financial

conditions of both institutions and students. That is, being informed about the degree to which prospective students from different income backgrounds can afford the costs of attendance is as important as being informed about the degree to which the array of postsecondary institutions can afford to deliver a quality education to those students. While only a minority of states have adopted a standard definition of affordability, there are at least a few models that can help inform policymakers in this regard.

Recognizing that the absence of a clear and measurable standard for affordability has not served policymakers well, there have been several attempts to define one. Perhaps most prominent among them, the "Rule of 10," was advanced by the Lumina Foundation in 2015. This standard has not been formally adopted by any state, although an important part of its intent was to establish a benchmark for the level of college-related saving required of parents. Another approach to defining affordability, developed by SHEEO as a central component of a proposed federal/state partnership, specified that college graduates should not be required to devote more than 10 percent of their discretionary revenue toward student loan repayment (Tandberg, Laderman, & Carlson, 2017). Similar in concept to SHEEO's approach, if not in actual construction, Texas has adopted a metric comparing graduates' debt and earnings and embedded it in its statewide strategic plan to use as a target for preserving affordability.

Several states rely on a standard definition of affordability that has been labeled the Shared Responsibility Model to determine eligibility for, or to distribute, state grant aid awards. This model borrows concepts from policy and practice in place in several states for allocating state financial aid funds to students. As depicted in Figure 1, the Shared Responsibility Model provides a definition for affordability that can be measured and used as a standard. This approach measures the difference between the cost of attendance and the sum of financial supports to which students have access. These include all grant aid available from government sources (plus institutional aid), as well as the funds a student's family is able to contribute. The critical element of the definition of the standard is the way it links affordability to an amount that a student can pay toward her total costs of attendance based on a working commitment that is not so onerous that it interferes with her pursuit of her educational goals (Prescott and Longanecker, 2014). Including a student financial commitment linked to working recognizes the fact that most students already hold down jobs while being enrolled, and many are doing so at an intensity level exceeding 15-20 hours per week, the level beyond which educational progress is impacted (Hood, Craig, & Ferguson, 1992; Ehrenberg & Sherman, 1987). But its more fundamental purpose is to set an evidence-based expectation for what a student can reasonably contribute financially to her costs of attendance by working and attending college simultaneously. Some states have also extended this concept to include a reasonable borrowing expectation that would result in a total debt level that is not overly burdensome for graduates who subsequently work in fields such teaching or social work that are not highly compensated but have considerable worth to society.

Figure 1. Shared Responsibility Model



These standards have one thing in common: they were created as a response to the need for applying some consistency to the development and execution of finance policies that affect students' ability to pay. And because a standard can be measured, it provides policymakers and executive agencies with direction and guidance about how to make resource allocation decisions mindful of the target embedded in the standard.

As they prepare to make difficult resource allocation decisions that are likely to result in cuts to higher education, a framework that serves a similar purpose, helping to orient policymakers about the levels of funding needed by public institutions to sustain their operations, will serve a similarly useful function. Rather than vague references to budget adequacy that is tied to prior years' funding levels and presented in the aggregate, a framework for strategic finance of public institutions (individually and collectively) will help policymakers better recognize the level of public support that is needed to:

1. Preserve the value of public institutions as state assets,
2. Adequately support improvement in student outcomes, and
3. Achieve reductions in equity gaps.

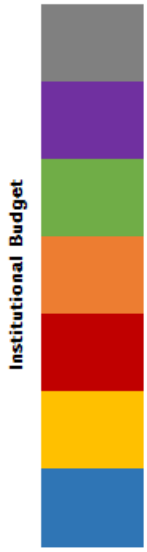
While these are not the only worthwhile reasons to support institutions with public funding, they are at least tightly linked to state goals for improving educational attainment. Ensuring that sufficient funding is provided to support pursuit of these goals requires deliberate and strategic resource allocation policies. Given the different circumstances that public institutions face in their respective markets, it is conceivable that funding cuts to some public institutions in some states could lead funding levels to dip below the minimum level required to ensure that basic institutional needs are met. At some point, the affected institution will be limping along on tuition revenue from populations increasingly unable to pay the price, all but ensuring that the state will be faced with an inevitable decision about how to cope with a bankrupt institution.

This paper proposes a framework that groups institutional funding needs into the following categories:

- Foundational – expenses that are associated with employing senior institutional leaders and with performing core functions related to governance, information technology, audit/accounting and other compliance-related activities, human resources, etc.
- Maintenance/renewal – expenses necessary to ensure that institutional assets are appropriately tended, including physical facilities, equipment needs, curricular relevancy, and human resources, as well as necessary planning activities to ensure the institution maintains its ability to serve its mission.
- Scope – expenses related to the breadth of the array of academic programs, recognizing differences in funding levels required for programs with different costs of delivery.
- Scale – expenses related to the size of the enterprise. More students require more classes, faculty/staff, support services, equipment, etc.
- Investments in innovation and performance – expenses that address the need to build capacity, implement new delivery models, scale effective best practices, etc.
- Distinctive mission-specific costs – expenses incurred for the pursuit of activities related to unique statewide academic programs, research, Land Grant and other public service activities, etc.

These groupings might align themselves into a framework for segmenting institutional operating needs as depicted in Figure 2.

Figure 2. Conceptual Categories of Institutional Funding Needs



Category	Functions and Roles	Funding Responsibility
Other	Advancement, auxiliaries, athletics, etc.	Self-support
Research and Public Service	Grants management, community engagement, museums, arts, extension services	Self-support
Innovation/Performance Enhancement & Equity	Investments in continuous improvement in all areas	Mix
Scale	Course sections, academic support, student services (tutoring, student health, organizations and activities, etc.)	Mix
Scope	Breadth of academic programming offered, variation in costs of delivering different programs	Mix
Maintenance/Renewal	Strategy and planning, deferred maintenance, program/curriculum renewal and relevancy, personnel and professional development	State
Foundational	Senior leadership, governance, compliance, debt obligations, foundational systems (LMS, public safety infrastructure, etc.)	State

At the most basic level, it may be said that some of the foundational expenditure needs are largely agnostic to the institution's mission, or even its place as a part of the higher education industry. That is, one can imagine that organizations across a wide range of the economy incur expenses for leadership, financial services and accounting, human resource management, regulatory compliance, and other essential costs. For example, a non-profit hospital will face a basket of core costs that are similar to those facing a postsecondary institution, even though the "product" is quite different. Some of the foundational costs will be more typical of the postsecondary education industry—leaders' compensation varies by industry and organizational complexity, and a learning management system represents a cost specific to postsecondary education institutions. Likewise, organizations in other industries will have expenses that may be industry-specific but are otherwise just as core to the enterprise.

The same might be said for the maintenance/renewal category, a category that encapsulates expenses associated with ensuring that a postsecondary institution's assets are not depreciated. Such assets include campus property, of course, but also the intellectual property of the institution that represents its real "products"—the curriculum, patents, and the like. The curriculum is an institutional asset in need of consistent maintenance and renewal, and resources must be put in place for that purpose. Accreditation cycles and related requirements are perhaps the most obvious manifestation of this set of activities, but resources are also needed in this context to tune the curriculum to the needs of students, employers, and the community; review existing programs and develop new ones; and provide for regular assessment. Given the prevalence of tenure, academic shared governance, and related policies and customs, the faculty are deeply ingrained into the institutional core, and should be considered assets of the organization as well. Costs associated with ensuring that these non-capital assets remain fresh and relevant through planning, managing the characteristics and capacities of the employee complement, and professional development are costs that fall into this maintenance/renewal category.

The foundational and maintenance/renewal costs are unavoidable—they can be considered as constituting the minimum expenditure requirements an institution has for "opening the doors." As basic

and essential costs, this hypothetical minimum level of expenses might be conceptualized as impervious to enrollment levels.

Next in the concept of institutional funding needs come the costs associated with its educational offerings—what is the breadth and depth of the institution's academic program array? This concept of scope addresses the particular mission of the institution and refers to both the levels and the fields of study. Institutions with graduate programs and programming that span a wide cross section of the universe of human knowledge and experience will have scope costs that exceed those of institutions more narrowly focused on delivering baccalaureate degrees in a limited number of fields. It is hard to draw a bright line between scope and the foundational costs described above. The program array determines the size and value of the curriculum as an asset needing maintenance and care, as well as requires more faculty to develop and tend it. It will also drive organizational changes: the creation of recognizable groupings of programs into departments or colleges—and the administrators to lead them, the addition of functions related to addressing the needs of faculty and students in different programs, etc. But the scope component in the framework conceptually differentiates what the institution teaches from the institutional foundation on which all academic programming rests. The difficulty of segmenting these costs argues for looking at costs on a sector-by-sector basis, recognizing that research universities have a generally similar scope of offerings, one that is very different from that of a regional, comprehensive university or a community college.

The next conceptual component of institutional budgets is scale, which in this construction is expressed principally in terms of enrollments. As enrollment levels rise, the institution will need to grow to accommodate more students. Additional faculty and space will be needed, as will more staff to provide student services and academic supports. This growth will come with associated non-personnel costs to pay for equipment, technology licenses, and an extensive array of other needs.

Of course, institutions exist to do more than provide instruction; they also conduct research and engage in public service, with considerable variations in these functions according to the emphasis put on each of these elements in their respective missions. These and other activities that are appropriate to the institution's mission require dedicated expenditures and are conceptually depicted as the next element in the framework diagram. These factors argue for addressing the topic of funding adequacy on a sector-by-sector basis.

Finally, the framework above calls out other costs that may be somewhat more difficult to categorize. Among these are programs that are expected to be revenue positive or at least neutral, such as housing and related auxiliaries, athletics, and alumni relations and fundraising. Of course, experience shows that these assumptions about revenue neutrality are often misplaced, and the current pandemic may have blown the lid off our collective complacency in this regard (Fischer & Ellis, 2021). Furthermore, some might reasonably argue that at least some of these elements are indispensable characteristics of the institutional mission; the role that residential facilities play in creating cocurricular experiences and related learning opportunities is an obvious example. Moreover, this presentation acknowledges that the framework serves to draw distinctions between related and complementary elements of an institution's budget. In basic economic terms, the framework understates the complementarity of outcomes of a multi-product firm—research activity complements graduate-level programs, which in turn may be complementary to undergraduate education, for example. But given that the framework's emphasis is on trying to conceptually pinpoint the elements of an institutional budget that represents the minimum fixed

costs of operating a state asset, which is put forward as being mission-agnostic, it is reasonable to allow for flexibility in how the upper portion of the framework diagram is specifically defined.

The framework described above can be connected to sources of funding support in ways that further inform policymakers about the investments they are asked to make in public institutions. For example, among the prospective categories as described above, some may more properly fall under the responsibility of the state and require general fund support, while tuition revenue may more reasonably be expected to help support the costs of other categories. If the core costs associated with foundational and maintenance/renewal needs of a public institution are the essential and unavoidable costs necessary to sustain an important state asset, that suggests those costs represent the absolute bare minimum of the state's funding responsibility. If that level could be identified and empirically measured, it would provide state policymakers with a standard minimum level of funding that remains exclusively the state's responsibility. While that level would fall well short of meeting institutional needs to effectively carry out their missions, it would provide a warning that state budget cuts below such a level would put the affected public institution on a potentially irreversible path to insolvency. In the absence of such a framework and standard, and confronted with the fiscal wreckage created by the pandemic, policymakers may be contemplating cuts of a magnitude that exceeds such a limit. And they are doing so at a time when the prospects for tuition revenue to cover scale and other costs are bleaker than ever.

Simply maintaining state assets is not the same as ensuring that institutions can fulfill their missions. But the framework suggests a way of thinking about the appropriate sharing of public institutions' costs between the state's responsibility as owner of an asset and its responsibilities to provide funding to support identifiable state needs that are addressed through the institution's mission, as contrasted with students' responsibilities to invest appropriately in pursuit of their own personal and professional goals. Such a framework also complements perspectives on how to appropriately align public versus private benefits with the respective costs of producing them (IHEP, 1998)

This framework for organizing institutional costs has at least two drawbacks that may limit its utility. The first potential problem relates to the fact that states take quite different approaches to postsecondary finance; they vary considerably in the degree to which history and political culture have led them to share the burden of financing higher education with students and families. How states decide to allocate their scarce resources to different institutions, particularly those that serve the poorest students, will have lasting consequences for student outcomes, institutional productivity, and ultimately the achievement of state economic goals that are tied to educational attainment (Gansemer-Topf, Downey, Thompson, & Genschel, 2018; Wright, 2016). By advancing a standard minimum state investment, there is a possibility that policymakers in states that provide comparatively generous institutional appropriations may feel justified in reducing those levels.

Furthermore, since public institutions within states enroll starkly different student bodies and often serve very different markets, their ability to generate tuition revenue to make up for funding gaps is highly variable. Policymakers' appreciation for these different circumstances is uneven at best, and the more that institutions are expected to fund their operations through tuition revenue the less transparent their business models will be. This framework is aimed at helping policymakers conceptually recognize some reasonable limits of institutional efficiency among different institutional types. It is nevertheless the case that they should wield this concept with caution and sensitivity to different institutional contexts.

A second problem is the extent to which the framework draws relatively bright lines between institutional budget categories that get muddied in practice and are inevitably linked to expenditure accounting standards that are defined and organized for different purposes. These data issues can be amplified by policymakers' interventions that create higher costs at affected institutions leading to the appearance of inefficiencies based on a data-informed application of the framework. For example, policymakers (and others) are known to intervene in decisions affecting institutional athletic programs. Such interventions may lead to added expenses in the foundational category (e.g., compliance-related expenses) that make an institution appear inefficient.

In spite of these caveats, if this framework provides a useful structure to identify a standard for the minimum level of support needed to fund the core part of a public institution, then an exploration of the available data on institutional expenditures might provide an empirical basis for that standard. The paper now turns to an analysis of expenditure data.

An Empirical Basis for the Framework

In order to examine the extent to which it may be possible to isolate fixed costs from variable costs in public institutions, we compiled expenditure and enrollment data from IPEDS for the 2018 fiscal year. Data collected covered all public, degree-granting, Title IV institutions. Those with hospitals were omitted from the analysis given the unusually high costs associated with that part of their mission. Tribal colleges and special-purpose institutions were also omitted.

Expenditure data in IPEDS are reported in total and by functional categories according to standards published by the Governmental Accounting Standards Board (GASB) standards. Functional categories include: Instruction, Research, Public Service, Academic Support, Institutional Support, Scholarships and Fellowships, Auxiliary Enterprises, Hospital Services, Independent Operations, Other Expenses and Deductions, and Total Expenses and Deductions. In general, the costs associated with administration are reported as institutional support expenditures, which is defined to include "the sum of all operating expenses associated with the day-to-day operational support of the institution." It "includes expenses for general administrative services, central executive-level activities associated with management and long-range planning, legal and fiscal operations, space management, employee personnel and records, logistical services such as purchasing and printing, and public relations and development." (IPEDS). Included among the functional expenses are costs associated with maintaining and operating buildings, or portions of buildings, that are devoted to housing administrative service activities.

Unfortunately, the expenditures data are not collected and reported in alignment with the concepts in the framework. That is, while it may be the case that the institutional support expenditures account for an important core of the fixed costs of operating a campus, the accounting standard for institutional support expenditures also includes spending that is sure to rise with enrollment (scale) and with the complexity that comes with a wider curriculum (scope) and a more expansive mission (research administration, for example). Furthermore, there are costs baked into expenditure categories other than institutional support that would meet our conceptual definition of foundational costs. These include the costs of maintaining physical facilities that are essential to a college or university as well as the costs of providing institutional level oversight of key functions. The library is a suitable example for both cases: it is a building that must be maintained and it requires qualified librarians to lead and manage the activities that are conducted within it. Disentangling the portion of such costs that fall within the framework's

definition of foundational funding needs is not straightforward. In order to capture at least some of those components of the institutional budget that are sunk costs, we developed a second measure of foundational expenses that approximates the costs of maintaining and operating physical facilities that are most closely aligned with the production of postsecondary awards.

As with the institutional support expenditure category, the costs associated with maintaining the physical facilities needed to deliver instruction or provide student support services and academic supports (like the library) are reported within those corresponding functional expenditure categories. As a proxy for capturing these costs in our supplemental measure of the expenditures required to support the institution's foundational core costs, we first distributed the expenses for plant operations and maintenance (which are reported as a separate total in IPEDS) in proportion to the institution's expenditures on instruction, student services, and academic support. In this calculation, we reduced total expenditures by the amount reported as expenses for scholarships and fellowships. This is surely an imperfect measure of the budgetary burden of maintaining the physical facilities of a campus. But in the absence of more comprehensive data, it serves as a rough approximation of the facilities costs related to producing degrees and credentials, separated as much as possible from costs associated with campus facilities devoted to other purposes such as research, student housing, or athletics.

A second issue concerns the influence of system offices on institutional expenses, especially those for institutional support. System offices often provide services to institutions that the institution would incur in the absence of the system. Information technology, procurement, and legal services are common functions performed by system offices wholly or in part on behalf of constituent institutions. Not including the expenses of system offices understates the true funding needs of institutions for foundational functions.

Naturally, the application of an accounting standard is subject to the judgment of those with responsibility for reporting the data, in this case to IPEDS, and the fidelity with which it is done from one year to the next is likely to vary somewhat, even though IPEDS has safeguards to ensure the data are high quality (Kolbe & Kelchen, 2017). Nevertheless, these separate and independent judgments made by personnel at each institution are a potential source of inconsistency in the data. This may be all the more true for the assignment of physical plant-related expenses to the functional categories discussed above; not all institutions will have the same level of sophistication in assigning square feet to those categories. Generally speaking, use of the conceptual framework would be enhanced by the adoption of recommendations made by Kolbe and Kelchen in their 2017 paper prepared for the National Postsecondary Education Cooperative, an advisory body to IPEDS.

Discussion

To look for signs that institutional support costs may be fixed relative to enrollment levels, we plotted the two variables against each other, by sector (Figure 3 – Figure 5). If institutional support expenditures data are fixed relative to enrollment, we would expect to see a horizontal boundary at some level that would signal the necessary level of administrative costs for institutions of that type. But these plots actually show that institutional support costs rising with enrollment.

Figure 3. Institutional Support Expenditures and Total FTE, Public Research Universities

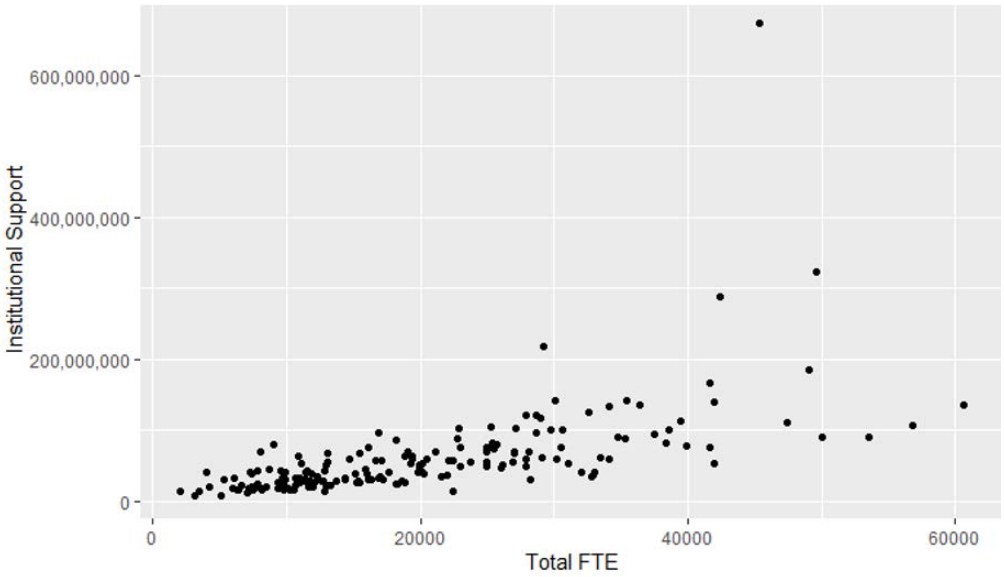


Figure 4. Institutional Support Expenditures and Total FTE, Public Comprehensive Institutions

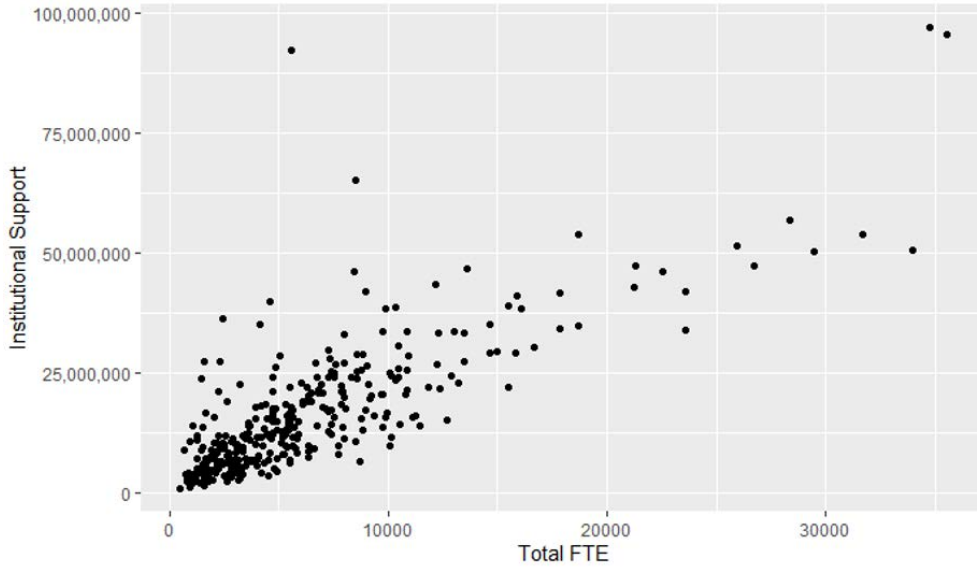
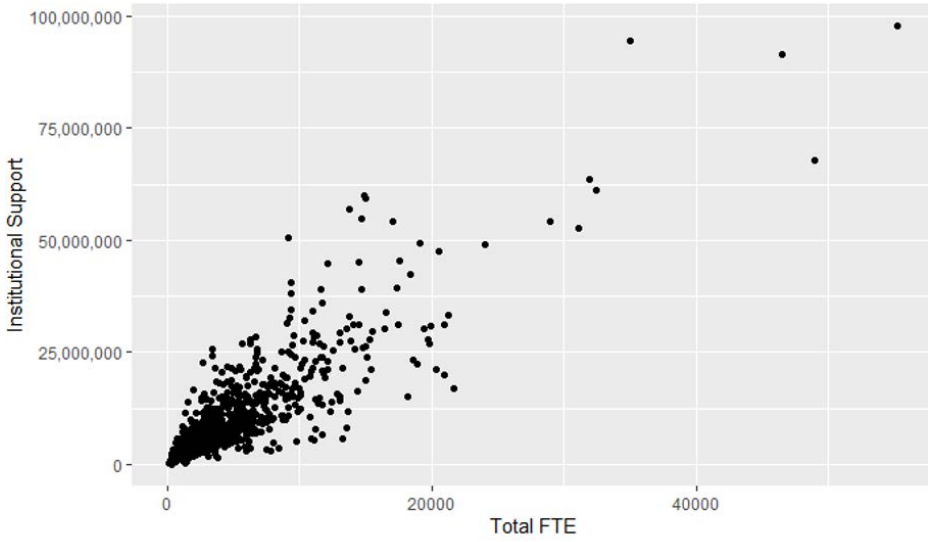


Figure 5. Institutional Support Expenditures and Total FTE, Public Two-Year Institutions



A regression of institutional support expenditures on FTE students produced a statistically significant result for the coefficient on enrollment for all three sectors, though it statistically weakest for research universities. These graphs and the regressions confirm that that institutional support expenditure data as captured in IPEDS cannot be disentangled from enrollment levels. Still, the conceptual framework suggests that institutional support expenditures consist of more of the institution's fixed costs, while instructional expenditures likely are more heavily influenced by scale. To investigate whether the data support that hypothesis, we ran an identical regression as before, using instructional expenditures as the dependent variable. Results suggested that the conceptual framework is on solid ground in this respect: the coefficients on the FTE student variable for all three sectors were significant and of much greater magnitude than the corresponding coefficients in the regression on institutional support expenditures. (These regression results can be found in Appendix A.)

Such results are consistent with existing research finding economies of scale present in postsecondary institutions. The patterns showing institutional support rising with enrollment likely mean that institutional support expenditure data in IPEDS are not precisely enough specified to isolate the fixed costs proportion of those expenses. This would comport with assessments of the applicability (and related limitations) of IPEDS Finance data for addressing questions related to productivity (Kolbe & Kelchen, 2017). It complicates the attempt to develop a sector-wide estimate for efficient "opening the doors" costs, by requiring us to examine such costs in relationship to enrollment. Therefore, we repeated the scatterplots as before but showing institutional support expenditures per FTE student compared to FTE students (Figure 6 – Figure 8). The plots show that, for public comprehensive four-year institutions and public two-year institutions, there appears to be a minimum level of per-FTE institutional support spending for public research universities and public comprehensive four-year institutions—no matter how large the institution gets, institutional support per FTE rarely dips below an "efficient floor" of about $1,500. That level falls at about the 10th percentile for public comprehensive institutions. For research universities, it is a little higher at about $1,700. The picture is muddier for public two-year institutions,

with much greater variation at lower enrollment levels, though that sector also has very few institutions at any enrollment level that reported institutional support expenditures per FTE lower than $900 per student.

Figure 6. Institutional Support Expenditures per FTE and Total FTE, Public Research Universities

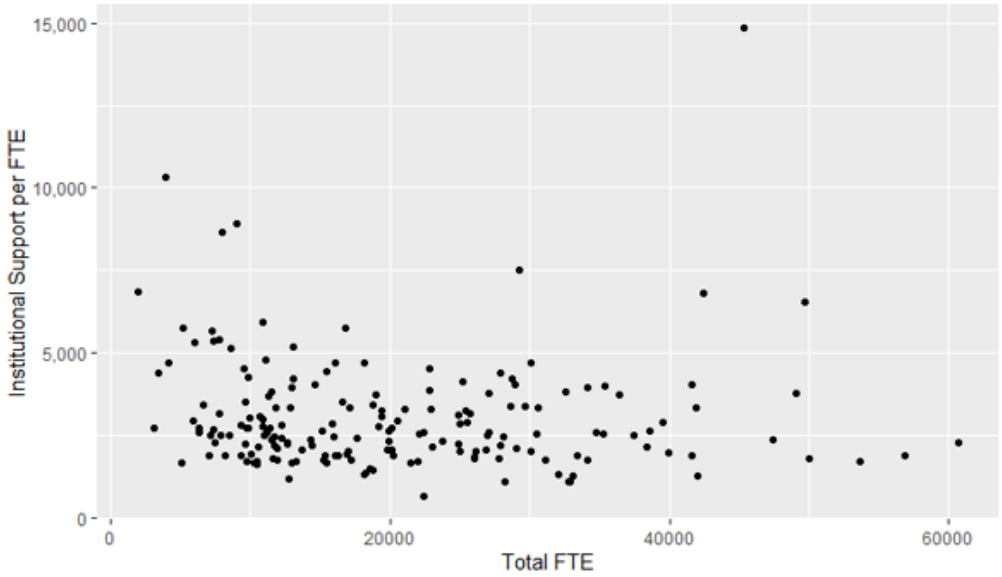


Figure 7. Institutional Support Expenditures per FTE and Total FTE, Public Comprehensive Institutions

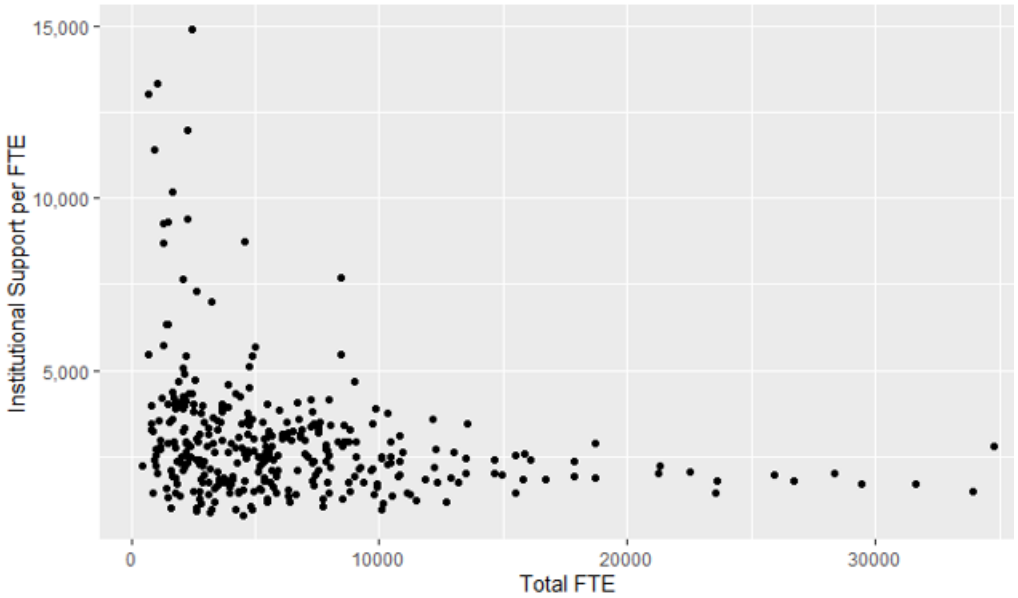
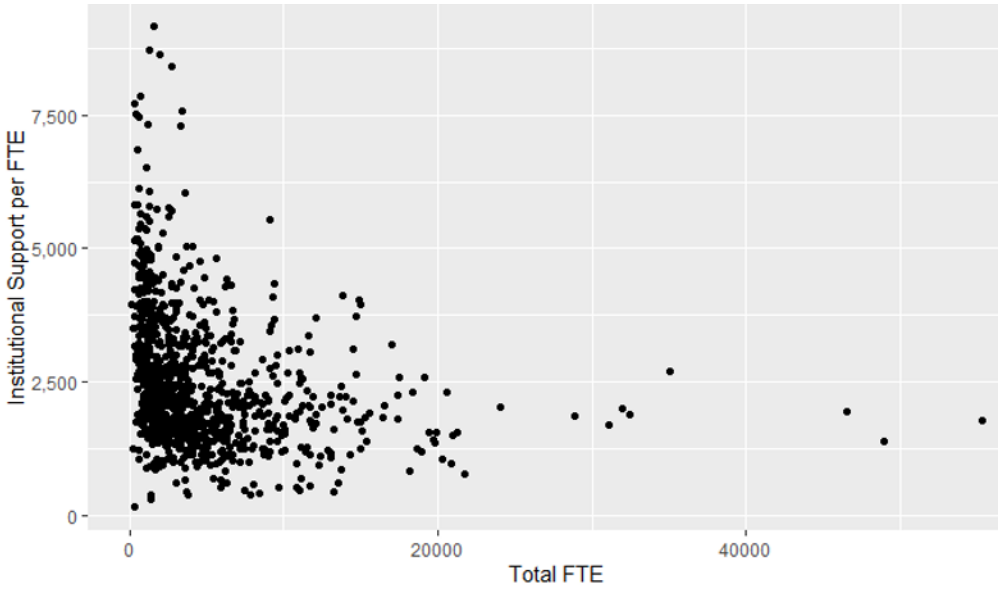


Figure 8. Institutional Support Expenditures per FTE and Total FTE, Public Two-Year Institutions



Of greater interest is that the scatterplots reveal wide variation at every enrollment level, suggesting that there are institutions that are less efficient than others in their spending on administration costs, given their enrollment levels. For all institution types, that variation is larger at lower enrollment levels; the variation decreases as enrollment increases. This pattern of diminishing variation is less obvious within the public research sector, which may be due to costs not caused by enrollment levels but to the costs of related functions that get reported as institutional support expenditures (such as compliance activities tied to the research mission). It is also interesting to note that the range of values is relatively similar across sectors at the lower enrollment levels—the interquartile range between the least and greatest reported levels of spending on institutional support is approximately $1,500 in all three sectors.

Applying the concepts and the proposed assignments of funding responsibility presented in the framework, we looked for states and institutions where the level of public funding support falls below the minimum level of support necessary to cover the core costs of operating a public institution in each sector. To do so, we subtracted institutional support expenditures per FTE from state and local appropriations per FTE. Negative numbers suggest that public funding levels are falling short of the institution's minimum needs. That is, public funding is fully expended before foundational administrative costs are met, which generally means that revenue from tuition is directly supporting some of those costs, as well as all the other education-related costs incurred by the institution. Figure 9 reports the number of public institutions by state and sector that have greater expenditures in institutional support than they receive in state and local appropriations on a per FTE basis. There are 19 states with at least one public institution that fits this description and a total of 41 institutions. Of these, four are public research institutions (or 2.2 percent of the institutions in the sector after the filters we applied, e.g., excluding institutions with hospitals, etc.), 16 are public comprehensive four-year institutions (4.9 percent), and 21 are public two-year institutions (2.2 percent). If the foundational costs include expenses

estimated for the operation and maintenance of physical facilities related to instruction, student services, and academic support, the number of states and institutions rises to 33 and 104, respectively. By sector, these accounted for 10.5 percent of public research universities, 12.2 percent of public comprehensive institutions, and 4.7 percent of public community colleges. In both cases, two-year institutions accounted for the largest number of institutions having costs unsupported by public funds, followed by public comprehensive institutions, while the latter sector had a heavier concentration of poorly funded institutions. (Appendix B reports the institutions that are represented in this table.)

Figure 9. Count of Institutions with Expenses Exceeding State & Local Appropriations

	Institutional Support > State & Local Appropriations			Institutional Support + O&M for Instruction, Student Services, & Academic Support > State & Local Appropriations		
State	Public Research	Public Comprehensive	Public Two-Year	Public Research	Public Comprehensive	Public Two-Year
United States	**4**	**16**	**21**	**19**	**40**	**45**
Alabama	0	0	0	1	3	0
Alaska	0	0	0	0	0	0
Arizona	0	0	0	1	0	0
Arkansas	0	0	0	0	0	0
California	0	0	1	0	0	2
Colorado	1	1	3	3	2	3
Connecticut	0	1	1	0	1	1
Florida	0	0	0	0	0	1
Georgia	0	0	1	1	0	2
Hawaii	0	0	0	0	0	0
Idaho	0	0	0	0	0	0
Illinois	0	0	1	0	0	2
Indiana	0	0	0	0	0	0
Iowa	0	0	0	0	0	1
Kansas	0	0	0	0	0	0
Kentucky	0	0	0	1	0	0
Louisiana	0	2	1	1	4	3
Maine	0	1	0	0	1	0
Maryland	0	0	0	0	0	0
Massachusetts	0	0	1	0	0	1
Michigan	1	0	0	2	2	0
Minnesota	0	0	0	0	0	0
Mississippi	0	0	0	1	0	0
Missouri	0	0	0	0	0	2
Montana	0	0	0	0	0	0
Nebraska	0	0	0	0	1	0
Nevada	0	0	0	0	0	0
New Hampshire	0	2	2	1	4	4

State	Institutional Support > State & Local Appropriations			Institutional Support + O&M for Instruction, Student Services, & Academic Support > State & Local Appropriations		
	Public Research	Public Comprehensive	Public Two-Year	Public Research	Public Comprehensive	Public Two-Year
New Jersey	0	0	5	1	0	11
New Mexico	0	0	1	0	0	1
New York	0	0	0	0	0	0
North Carolina	0	0	1	0	0	1
North Dakota	0	0	0	0	0	0
Ohio	0	1	0	1	3	1
Oklahoma	0	1	0	0	1	0
Oregon	1	0	0	1	0	0
Pennsylvania	0	1	0	1	3	2
Rhode Island	0	0	0	1	0	0
South Carolina	0	4	1	0	8	1
South Dakota	0	1	1	0	2	1
Tennessee	0	0	0	1	0	0
Texas	0	0	0	0	1	1
Utah	0	0	0	0	0	0
Vermont	1	1	1	1	2	2
Virginia	0	0	0	0	0	0
Washington	0	0	0	0	0	0
West Virginia	0	0	0	0	1	2
Wisconsin	0	0	0	0	1	0

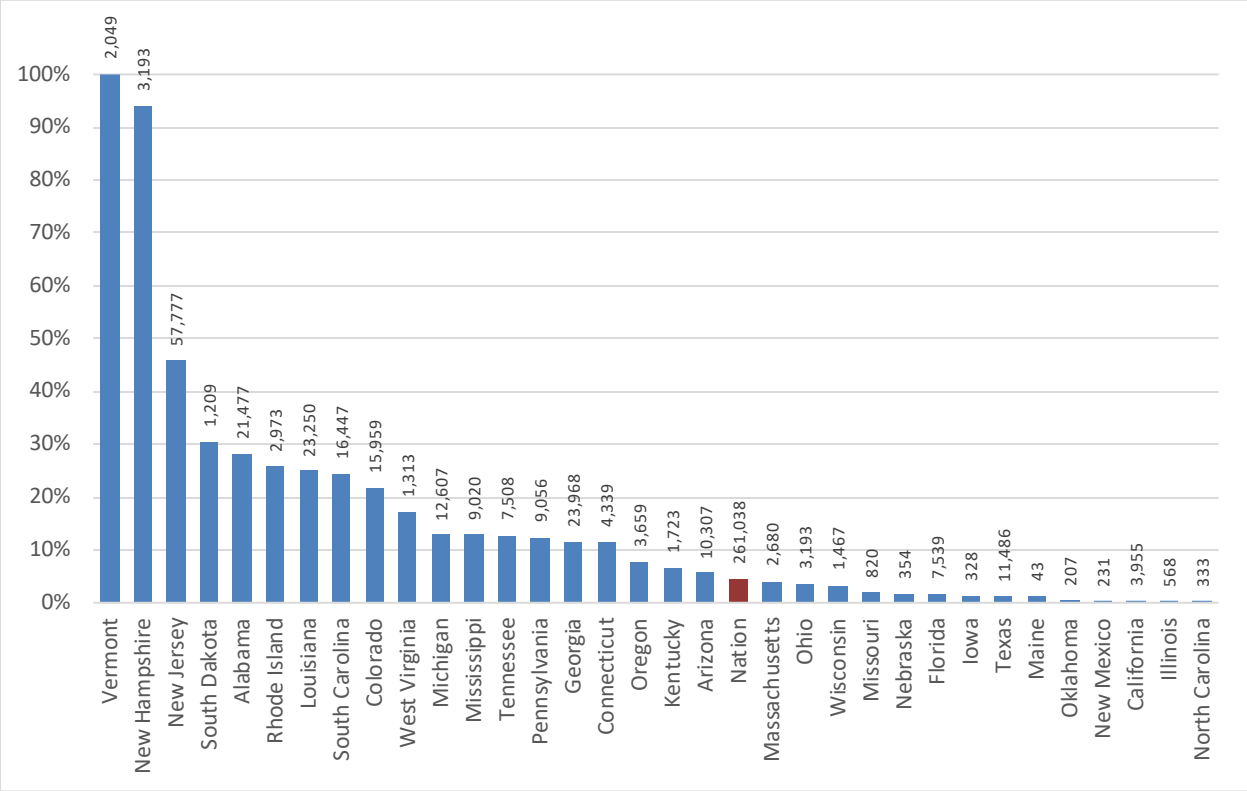
The above figure compares state and local appropriations to the actual expenditures of an institution, but it may be that some of those institutions get counted because their expenditures are unusually high. What happens if we hold institutions to a higher standard for efficiency? Rerunning the numbers assuming that state and local appropriations must cover only a specified level of expenditures on institutional support or on the sum of institutional support plus the upkeep for physical spaces we used above, we still find institutions that have to obtain some revenue from other sources besides public funds to cover their foundational costs. Figure 10 shows the effect that such a hypothetical cap on expenditures spent on the foundational core (identified in the figure as "maximum budget") has on the number of institutions that would still need to find revenue beyond public funding. Bearing in mind that these expenditure categories are not able to capture many of the maintenance/renewal costs outlined in the framework as foundational institutional costs (e.g., professional development of core employees), these two figures underestimate the number of institutions for which public funding levels fall short those foundational costs.

Figure 10. Imposing a Cap on Institutional Core Expenditures

	Maximum Budget for Institutional Support < State & Local Appropriations			Maximum Budget for Institutional Support + O&M for Instruction, Student Services, & Academic Support < State & Local Appropriations		
	Public Research	Public Comprehensive	Public Two-Year	Public Research	Public Comprehensive	Public Two-Year
Sector-Wide Average	$3,032	$2,979	$2,499	$4,282	$4,219	$3,401
Maximum Budget	$2,500	$2,750	$2,250	$4,000	$3,750	$3,000
Count of Institutions	0	3	5	3	13	11

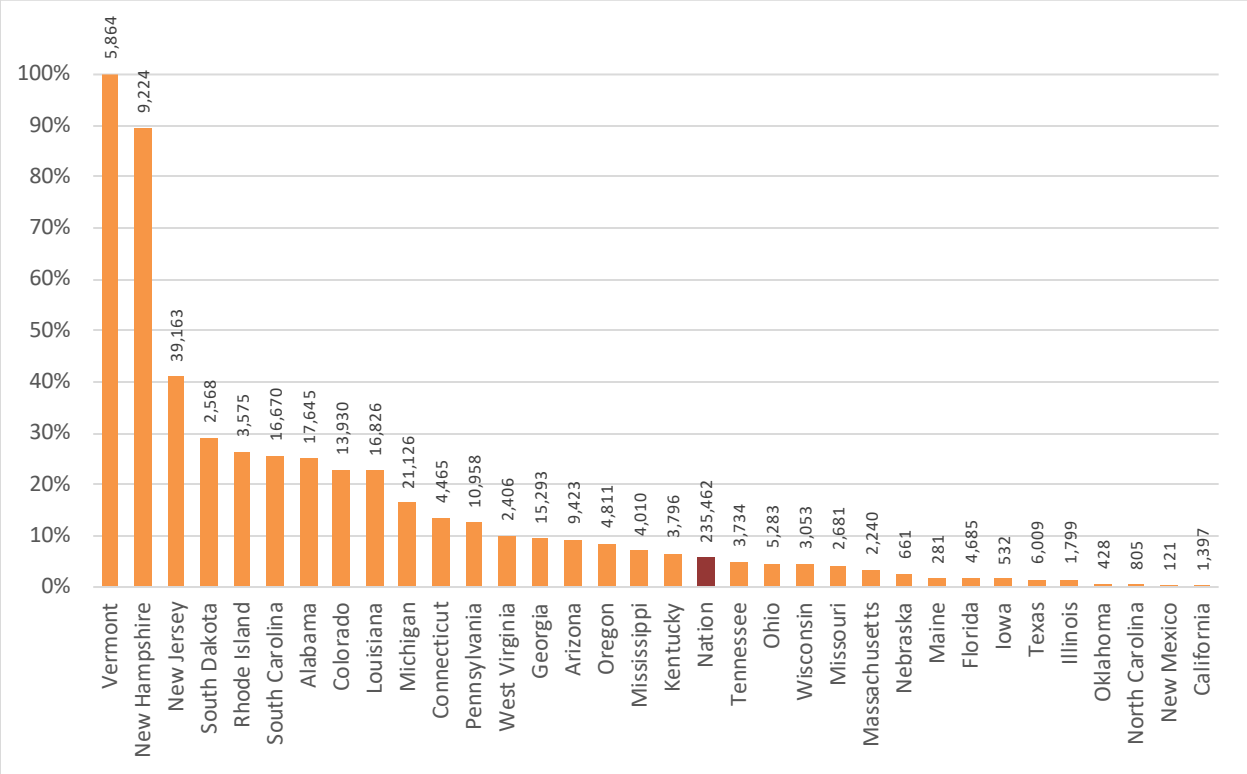
These patterns of funding inadequacy impact a larger number of public comprehensive and two-year institutions—those that are generally broad- or open-access institutions. Fewer research universities find it necessary to tap other sources of support for foundational institutional costs. This raises the question of whether the patterns of underfunding disproportionately affect institutions that enroll relatively large numbers of students from at-risk populations. To address this question, we counted the number of underrepresented minorities (in this case, American Indian/Alaska Native, Blacks, Latinx, and Native Hawaiian/Pacific Islanders), as well as Pell recipients, and their shares of enrollment in "underfunded" institutions. Underfunded institutions in this discussion uses the more expansive measure of foundational expenditures (i.e., institutional support and allocated operations and maintenance costs). For underrepresented minorities, the 20 public research universities that do not collect enough in state and local appropriations to cover those basic costs collectively enroll 8.1 percent of the underrepresented minorities who are enrolled in that sector. The corresponding proportion for public comprehensive four-year institutions is 8.8 percent and, for public two-year institutions, 2.5 percent. Figure 11 shows the proportion of all underrepresented minorities studying in each state who are enrolled in institutions that receive public funds at a level too low to support their foundational expenditures. The number of such students is given at the top of each bar. (States with no institutions meeting the criteria are excluded.)

Figure 11. URM Enrollment in "Underfunded" Institutions, by State



A similar picture emerges when looking at Pell recipients (Figure 12). Nationally, 5.7 percent of all Pell recipients were enrolled in "underfunded" institutions. By sector, the numbers were 8.2 percent for public research universities, 8.9 percent for public comprehensive institutions, and 3.2 percent for public two-year institutions. The slightly higher proportions, for each sector and overall, for Pell recipients relative to underrepresented minorities may reflect the particular funding challenges at rural institutions.

Figure 12. Pell Enrollment in "Underfunded" Institutions, by State



This analysis suggests that there are public institutions in a diverse group of states that may not be receiving sufficient public funding to support foundational operations; according to the institutional adequacy framework, the state (and, in some cases, local government) may not be holding up its end of the responsibility for assuring adequate funding to maintain a state asset. These are institutions that are, or are close to, having to dip into other revenue sources in order to pay for purely administrative costs before any of those funds can be used to address expenses more central to its mission. For most institutions, these revenues will come from tuition. As these figures show, though relatively few in number, these institutions nevertheless enroll substantial numbers of low-income and underrepresented populations.

Conclusion

This paper argues for the development of a conceptual framework to help policymakers better understand institutional funding requirements. It is particularly concerned with identifying a standard for defining a reasonable minimum funding level that public institutions require as a state asset, even if all the costs to actually produce postsecondary awards will be borne by students through their tuition payments. Such a standard grows more necessary as state funding levels approach or fall below that minimum level. Some institutions will struggle to successfully raise enough tuition revenue from a dwindling pool of prospective students to remain viable if those funds also have to support the foundational funding needs of the enterprise. Their financial weakness is especially problematic if they

serve large proportions of traditionally underrepresented minorities, low-income, or rural students. The need for this framework and associated standard is no longer academic: there are public institutions in some states where cuts to public funding support are deep enough that they threaten the institution's financial viability, especially in combination with unfavorable demographic conditions. This may lead to institutional closures or consolidations that, at a minimum, will be disruptive. The institutions most likely to be affected are those that disproportionately serve low-income or underrepresented students (or both), and may also be located in communities that can ill afford the loss of a major economic engine.

The available research and analyses in this paper support the design of key components in the conceptual framework—namely that there are economies of scale in higher education, and that fixed effects appear to be greater for institutional support expenditures than for other cost categories, suggests that a set of foundational expenses are unavoidable for postsecondary institutions to "open the doors." The effort to develop an empirically based expression of that standard encountered some obstacles that are worth further investigation. First among them is a misalignment between the accounting standards used by IPEDS and their application to this conceptual framework. While IPEDS is the only national source for relevant data, additional research may be able to tap more detailed data held by states and systems that can be developed to identify foundational costs more precisely. Such costs would include the replacement value of physical facilities, estimated costs of deferred maintenance, and spending on professional development expenses, among other basic institutional needs. These data could be mined to further develop the empirical basis for a standard minimum funding level.

Finally, there are (at least) two additional possible lines of further inquiry. One is for researchers to look for the cost-minimizing level of enrollments (or completions) for specific expenditure categories, especially institutional support. A second interesting prospective area is to employ an approach like quantile regression, which may have promise for selecting a reasonable standard of efficiency applicable to all institutions within a sector. Traditional ordinary least squares regression can highlight which institutions may be more inefficient than others within the same sector. But the goal embedded in the institutional adequacy framework is not to reduce inefficiency in core operational requirements just to reach the average of a set of similar institutions. It is rather to identify an efficient frontier, but such a frontier would need to be reasonable—leaving room for legitimate variation in the real operating costs of different institutions—not simply determined by identifying the lowest expenditures level. Rather than specify the slope of the regression line at the mean of the available data, quantile regression gives a regression line that keeps the specified percentage of cases underneath it. In simple terms, it is akin to the height versus weight percentile measures anyone with a growing child is likely to be familiar with. With appropriate covariates selected to address institutional differences in mission, curriculum, location, student characteristics, and other factors, this approach can potentially provide the basis for identifying a reasonable and empirically-derived standard for the foundational funding needs of public institutions. An initial attempt to use quantile regression at the 25th and 50th percentiles is included in Appendix A.

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Appendix A. Regressions

REGRESSION ON INSTITUTIONAL SUPPORT EXPENDITURES

- Data are split into 3 datasets by sector, and an OLS regression is ran on all 3, without dummy variables for sector since they are split out.
- Y = Institutional Support $
- Model: $Y = \beta_0 + \beta_1 * FTE + \beta_2 * FTE^2 + \beta_3 * \%STEM + \beta_4 * X + \varepsilon$
- X is a vector of state dummy variables
- Results: (***99.9% significance; **99% significance, *95% significance, "90%)

Variable	**Research Universities** Coefficient (Robust std error)	**Public Comp. 4-year** Coefficient (Robust std error)	**Public 2-year** Coefficient (Robust std error)
FTE	2,801.524" (1,427.533)	1,641.59*** (213.123)	1,871.530*** (70.387)
FTE^2	0.0176 (0.02613)	0.008 (0.007)	-0.002 (0.002)
% STEM	27,791,176.934 (32,574,908.422)	5,134,259.116" (2,961,558.071)	2,489,164.693" (1,352,072.198)
Constant	-13,702,383.479 (33,314,786.678)	-1,273,373.701 (3,010,359.393)	-556,531.098 (1,388,897.983)
Descriptive	*R^2=0.50 F-Stat = 2.54 on 51 and 129 DF p-val < 0.00002 n= 181*	*R^2=0.77 F-stat=18.46 on 51 and 284 DF p-val < 0.00001 n=336*	*R^2=0.79 F-stat=68.11 on 51 and 907 DF p-val <0.00001 n=959*

REGRESSION ON INSTRUCTION EXPENDITURES

- Data are split into 3 datasets by sector, and an OLS regression is ran on all 3, without dummy variables for sector since they are split out. Same as above with new Y variable.
- Y = Instruction $
- Model: $Y = \beta_0 + \beta_1 * FTE + \beta_2 * FTE^2 + \beta_3 * \%STEM + \beta_4 * X + \varepsilon$
- X is a vector of state dummy variables
- Results: (***99.9% significance; **99% significance, *95% significance, "90%)

Variable	**Research Universities** Coefficient (Robust std error)	**Public Comp. 4-year** Coefficient (Robust std error)	**Public 2-year** Coefficient (Robust std error)
FTE	11,123.79*** (2,372.33)	8,515.76*** (319.98)	6,500.27*** (141.43)
FTE^2	0.063 (0.043)	-0.034** (0.011)	-0.046*** (0.0042)

% STEM	117,532,491.89* (54,134,338.81)	-102,879.5 (4,380,106.7)	8,307,060.72** (2,716,818.95)
Constant	-28,030,541.74 (55,363,899.3)	-8,334,837.86" (4,604,350)	-2,601,022.57 (2,790,815.74)
Descriptive	*R^2=0.83* *F-Stat = 12.34 on 51 and 129 DF* *p-val < 0.00001* *n= 181*	*R^2=0.95* *F-stat=111.3 on 51 and 277 DF* *p-val < 0.00001* *n=329*	*R^2=0.88* *F-stat=135.11 on 51 and 907 DF* *p-val <0.00001* *n=959*

QUANTILE REGRESSION

- Data are split into 3 datasets by sector, and a quantile regression is run at tau=0.25 and tau=0.5 (25th percentile and median) for each sector.
- Y = Institutional Support $
- Model: $Y = \beta_0 + \beta_1 * FTE + \beta_2 * FTE^2 + \beta_3 * \%STEM + \varepsilon$
- State dummy variables could not be run with the split out data for quantile regression because of singularities in the matrices associated with too many identical values per column.
- Results: (***99.9% significance; **99% significance, *95% significance, "90%)

Variable	Research Universities Coefficient (Robust std error) Tau=0.25	Research Universities Coefficient (Robust std error) Tau=0.5	Public Comp. 4-year Coefficient (Robust std error) Tau=0.25	Public Comp. 4-year Coefficient (Robust std error) Tau=0.5	Public 2-year Coefficient (Robust std error) Tau=0.25	Public 2-year Coefficient (Robust std error) Tau=0.5
FTE	2,037.173*** (308.960)	2,693.736*** (499.996)	1,735.283*** (103.772)	2,473.760*** (111.497)	1,297.133*** (30.590)	1,761.71*** (31.02)
FTE^2	-0.003 (0.006)	-0.006 (0.009)	-0.001 (0.004)	-0.026*** (0.004)	0.002" (0.0009)	-0.0002 (0.0009)
% STEM	19,480,128.262** (5,958,206.324)	28,719,780.213** (9,642,264.563)	-290,282.118 (1,319,874.29)	486,261.208 (1,418,129.15)	810,730.271 (552,706.42)	-124,902.49 (560,394.7)
Constant	-6,524,059.542 (4,873,626.937)	-10,341,333.957 (7,887,071.671)	742,752.489 (619,719.404)	1,145,524.795" (665,852.918)	556,059.9** (233,674.7)	1,021,873.4*** (236,925.140)

Appendix B. "Underfunded" Institutions

The following table displays the institutions for which state and local appropriations per FTE were not sufficient to cover their foundational costs, as measured by their institutional support expenditures per FTE student in FY 2018.

Public Research	Public Comprehensive	Public Two-Year
The University of Alabama	Alabama State University	Asnuntuck Community College (CT)
Northern Arizona University	Jacksonville State University (AL)	Tallahassee Community College (FL)
University of Colorado Colorado Springs	Troy University (AL)	Atlanta Technical College
University of Colorado Boulder	Colorado State University-Pueblo	Carl Sandburg College (IL)
Colorado School of Mines	Western State Colorado University	John Wood Community College (IL)
University of Delaware	Central Connecticut State University	Iowa Lakes Community College
Georgia Southern University	Grambling State University (LA)	Louisiana State University-Eunice
Northern Kentucky University	Louisiana State University-Alexandria	Southern University at Shreveport (LA)
University of Louisiana at Lafayette	Louisiana State University-Shreveport	Quincy College (MA)
Michigan State University	Southern University at New Orleans	State Fair Community College (MO)
University of Michigan-Flint	Maine Maritime Academy	North Central Missouri College
Jackson State University (MS)	Grand Valley State University (MI)	NHTI-Concord's Community College (NH)
University of New Hampshire-Main Campus	University of Michigan-Dearborn	Manchester Community College (NH)
Montclair State University (NJ)	Peru State College (NE)	Nashua Community College (NH)
Miami University-Oxford (OH)	Keene State College (NH)	Great Bay Community College (NH)
University of Oregon	University of New Hampshire at Manchester	Bergen Community College (NJ)
University of Pittsburgh-Pittsburgh Campus	Plymouth State University (NH)	Rowan College at Burlington County (NJ)
University of Rhode Island	Granite State College (NH)	Camden County College (NJ)
Tennessee State University	Miami University-Hamilton (OH)	Essex County College (NJ)
University of Vermont	Miami University-Middletown (OH)	Hudson County Community College (NJ)
	Ohio State University-Marion Campus	Mercer County Community College (NJ)
	University of Science and Arts of Oklahoma	Passaic County Community College (NJ)
	Lincoln University (PA)	Salem Community College (NJ)
	West Chester University of Pennsylvania	Raritan Valley Community College (NJ)
	College of Charleston (SC)	New Mexico Military Institute
	Citadel Military College of South Carolina	Western Piedmont Community College (NC)
	Francis Marion University (SC)	Kent State University at Stark (OH)
	Lander University (SC)	University of Pittsburgh-Titusville
	Coastal Carolina University	Denmark Technical College (SC)
	South Carolina State University	Southeast Technical Institute (SD)
	University of South Carolina-Upstate	Community College of Vermont
	Winthrop University (SC)	Vermont Technical College
	Black Hills State University (SD)	Warren County Community College (NJ)
	Dakota State University (SD)	Sussex County Community College (NJ)
	University of Houston-Downtown	Southwest Collegiate Institute for the Deaf (TX)
	Castleton University (VT)	East San Gabriel Valley Regional Occupational Program (CA)

	Northern Vermont University Shepherd University (WV) University of Wisconsin-Whitewater Pennsylvania College of Technology	Pennsylvania Highlands Community College Eastern West Virginia Community and Technical College Blue Ridge Community and Technical College (WV) Louisiana Delta Community College Georgia Military College