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Consequences of State Disinvestment in Public Higher Education:

Lessons for the New England States

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EXECUTIVE SUMMARY

Public higher education produces many benefits that are vital to the New England economy, but it is increasingly at risk following years of state budget cuts. In 2017 in New England, real per-student state funding for higher education was lower than it was in 2008, with a double-digit decline in each of the region's states except Maine. States have reduced funding for higher education to address short-term budget gaps caused by recessions and long-term budget gaps attributed to the growing costs of Medicaid and public pensions.

Research in this report shows that reductions in state appropriations have resulted in higher tuition and fees, greater student loan debt, decreased resources for education and research, and fewer graduates and approved patent applications from public colleges and universities. If the New England states wish to better meet the educational needs of the region's students and the workforce requirements of employers, policymakers will need to restore some of the reduced appropriations and safeguard public higher education against future budget cuts.

Among the findings highlighted in this report are that when other factors are held constant, each dollar of reduced state appropriations leads, on average, to a 17 cent increase in net tuition and fees and a 30 cent decrease in instructional expenditures at public doctoral institutions. At community colleges, $1 in lost state appropriations leads, on average, to a 56 cent cut in instructional expenditures. These cuts seriously diminish students' opportunities to pursue and earn academic degrees. Estimates in this report suggest that due to state funding cuts, community colleges in New England collectively granted about 21,388 fewer associate's degrees during the 2002–2012 period than they would have granted if they had received per-student state appropriations at the 2001 level (after inflation adjustments) each year since the 2001 recession. Because community colleges have a higher concentration of racial minorities and low-income students, these students are more likely to be affected and miss the opportunity to use a community-college education as a stepping stone for moving up the career and income ladder or transitioning to a four-year college.

State funding cuts also have implications for employers and the vitality of New England's economy. When the region's public institutions grant fewer degrees, it becomes harder to address the demand by its employers for skilled workers. In addition, state funding cuts hurt public institutions' ability to produce high-quality research that generates large social and economic benefits. Estimates in this report suggest that due to state funding cuts, the six public doctoral institutions in New England together produced 117 to 369 fewer approved patent applications during the 2002–2012 period than they would have produced if they had received per-student state appropriations at the 2001 level (after inflation adjustments) each year since the 2001 recession.

This report recommends that policymakers provide robust financial support for public higher education, particularly community colleges, which are the most vulnerable to the negative consequences of state disinvestment. To reduce the chances of having to make state funding cuts, or to at least mitigate future cuts, policymakers should consider both short-term and long-term solutions such as strengthening state budget stabilization funds and addressing long-term state budget gaps. If states need to raise more revenues to safeguard public colleges and universities, the social, economic, and fiscal benefits associated with public higher education likely will justify the additional costs to taxpayers.

I. Introduction

Governments support public higher education because it produces many public benefits that would be undersupplied if only private institutions provided opportunities to pursue and earn postsecondary degrees. Some of these benefits are particularly valuable to society. For example, college graduates share their knowledge and skills with coworkers, which increases those coworkers' productivity and wages (Glaeser and Saez 2004; Moretti 2004a; Moretti 2004b; Rosenthal and Strange 2008). Researchers also find that, because human capital is a critical determinant of long-term economic growth, cities with a larger share of college-educated people experience greater employment growth (Simon 1998; Simon and Nardinelli 2002; Shapiro 2006). Furthermore, university-based research spurs innovations in private industry (Mansfield 1995). Businesses located near universities especially benefit from these positive spillovers, because the proximity makes it easier for them to collaborate with university researchers (Jaffe 1989; Bania, Eberts, and Fogarty 1993; Mansfield and Lee 1996; Anselin, Varga, and Acs 1997; Adams 2002; Zheng and Slaper 2016).

From a pure investment perspective, public higher education can generate a positive net return for governments (Trostel 2010). On average, people with higher educational attainment earn higher incomes and pay more taxes than do people with lower educational attainment. People with higher educational attainment also are less likely to rely on public assistance or to commit violent crimes and therefore cause fewer government expenditures on welfare and corrections. Trostel (2010) estimates that the direct extra tax revenues from college graduates plus the direct savings in post-college government expenditures are greater than the gross government cost on public higher education per college degree.

In addition, supporting public higher education helps governments address social and economic inequality. Many low- and moderate-income students cannot afford to attend private colleges and universities, but governments can lower access barriers facing these students by supporting lower-cost public institutions.[1]

For these reasons and others, most people value public higher education. In WGBH News's 2018 National Higher Education Poll, 76 percent of the respondents expressed a positive opinion of public colleges and universities, while only 59 percent had a positive view of private colleges and universities. Furthermore, 78 percent of the respondents said they would be concerned if their state cut funding for public higher education.[2]

Nevertheless, state appropriations for higher education have declined over the past several decades in the United States (Long 2016). The New England region is no exception. After inflation adjustments, state funding for higher education per student in 2017 was lower than it was

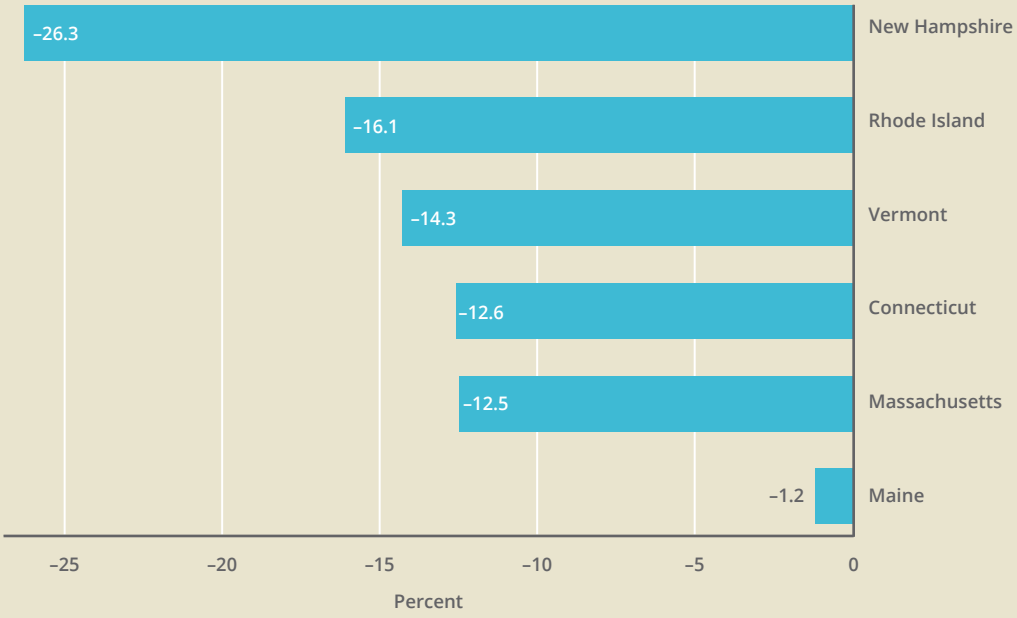
1 Some voters and policymakers are concerned that many students of public institutions will leave their home states after graduation. If so, the home states would not receive many of the social and fiscal benefits from these students after investing in their education. In reality, public institutions' students are less likely than private institutions' students to leave their states after graduation. According to national surveys, 76.5 percent, 71.1 percent, and 65.4 percent of undergraduates who graduated from public four-year institutions in 1993 still lived in the state where they received their bachelor's degrees in 1994, 1997, and 2003, respectively (Perry 2001; Bradburn, Nevill, Cataldi, and Perry 2006). In comparison, 63.1 percent, 57.6 percent, and 53.4 percent of undergraduates who graduated from private nonprofit four-year institutions in 1993 still lived in the state where they received their bachelor's degrees in 1994, 1997, and 2003, respectively.

2 WGBH News, "WGBH News Higher Education Poll: Top Line Data," *WGBH News*, September 16, 2018.

Figure 1

State Funding for Higher Education Remains Below Pre-Great Recession Levels in the New England States

Percent Change in Inflation-adjusted State Spending on Higher Education per Student between 2008 and 2017



Source: Center on Budget and Policy Priorities.

a decade ago in each of the six New England states (Figure 1). All but Maine saw double-digit declines.

One reason for the decreasing state support of higher education is that states often cut higher education funding deeply to help close budget gaps caused by economic recessions. During and in the aftermath of the two recent recessions (2001 and 2007–2009), states faced large and unprecedented revenue shortfalls. To solve the severe fiscal crises, state governments across the country made deep cuts in higher education funding (Mitchell and Leachman 2015; Mitchell, Leachman, and Masterson 2016). Although the US unemployment rate is at a historically low level, states have not raised their appropriations for higher education back to the pre-recession levels (Mitchell, Leachman, and Masterson 2016; State Higher Education Executive Officers Association 2017).

Another reason for the decreasing state support of higher education is that states have had to allocate more resources to the large and growing Medicaid and unfunded public pension liabilities, which have crowded out state funding for public higher education in the long run (Kane, Orszag, and Gunter 2003; Okunade 2004; Kane, Orszag, and Apostolov 2005; Novy-Marx and Rauh 2014). Since fiscal year 2009, Medicaid has surpassed elementary and secondary education to become the largest state spending category (National Association of State Budget Officers 2015). Furthermore, Novy-Marx and Rauh (2009) estimate that unfunded liabilities for state-administered pension plans in the United States were about $3 trillion as of the end of 2008. If no policy changes are made, government contributions to these plans would have to increase to an equivalence of 14.1 percent of state and local governments' total own-source revenue to fully fund the public pension systems over the next 30 years (Novy-Marx and Rauh 2014).

Many public university administrators, students and families, advocacy groups, and news outlets have expressed concern about the negative consequences of "state disinvestment in higher education" (Dewitt 2017[3]; Lambeck 2017[4]; Mitchell, Leachman, and Masterson 2017; Lannan 2018[5]). For example, a recent descriptive analysis by the Massachusetts Budget and Policy Center suggests that deep cuts to state funding played a major role in driving up tuition and fees across public colleges and universities in Massachusetts, and consequently, students and families have had to take out more student loans (Thompson 2018). To cope with recent reductions in state funding, the University of Massachusetts system imposed a hiring freeze, increased the student-to-faculty ratio, and reduced program offerings (Lannan 2017[6]).

These negative consequences have even broader implications. For example, greater student loan debt is found to lower the homeownership rate for the borrowers (Cooper and Wang 2014; Mezza et al. 2016). Also, when higher-education funding is cut, public college students receive less support to help them graduate and therefore face a higher risk of dropping out. Data show that student-loan borrowers who do not graduate have significantly higher default rates than borrowers who graduate (Baum et al. 2018). Perhaps more important, students who leave school without a degree, especially racial-minority and low-income students, miss the opportunity to use higher education as a stepping stone for career advancement and upward income mobility.

State disinvestment in higher education also has negative implications for employers. Across the country, employers are facing a tight labor market and having difficulty filling open positions, especially those requiring skills and training. A decline in public institution graduates due to state funding cuts will likely exacerbate the shortage of skilled workers. In addition, if the trend in state funding of higher education persists, it will likely be hard to meet employers' demand for middle-skill and high-skill workers in the long term. The Bureau of Labor Statistics (2013) projects that occupations requiring postsecondary education will grow by 14.0 percent between 2012 and 2022 and occupations requiring a high school diploma or less will grow by only 9.1 percent during the same period.

Community colleges are particularly vulnerable to the negative consequences of state funding cuts.

This report aims to gain a deeper understanding of the consequences of decreasing state support for higher education, with a special focus on New England. It first reviews the role of public institutions in the higher education sector and the evolution of state funding for higher education both in New England and across the country. Then, it systematically examines the effects of changes in state appropriations on public institutions and their students and discusses the broader implications.

The results of the analysis indicate that a reduction in state appropriations generally leads to an increase in tuition and fees and a decrease in school expenditures, and it ultimately hurts degree completion rates and research productivity at public institutions. Among the different types of public institutions, community colleges are more likely to serve non-traditional and socioeconomically disadvantaged students, and these institutions are found to be particularly vulnerable to the negative consequences of state funding cuts. This report recommends that policymakers consider protecting the appropriations for community colleges, strengthening state budget stabilization funds, and addressing long-term state budget gaps.

3 Dewitt, Ethan, "Since Recession, N.H. Tuition Is Up, While Support for Public Higher Ed Is Down," *Concord Monitor*, August 30, 2017.

4 Lambeck, Linda C., "School Funding Trimmed for Most, Not All, Districts under Legislative Budget," *Connecticut Post,* October 26, 2017.

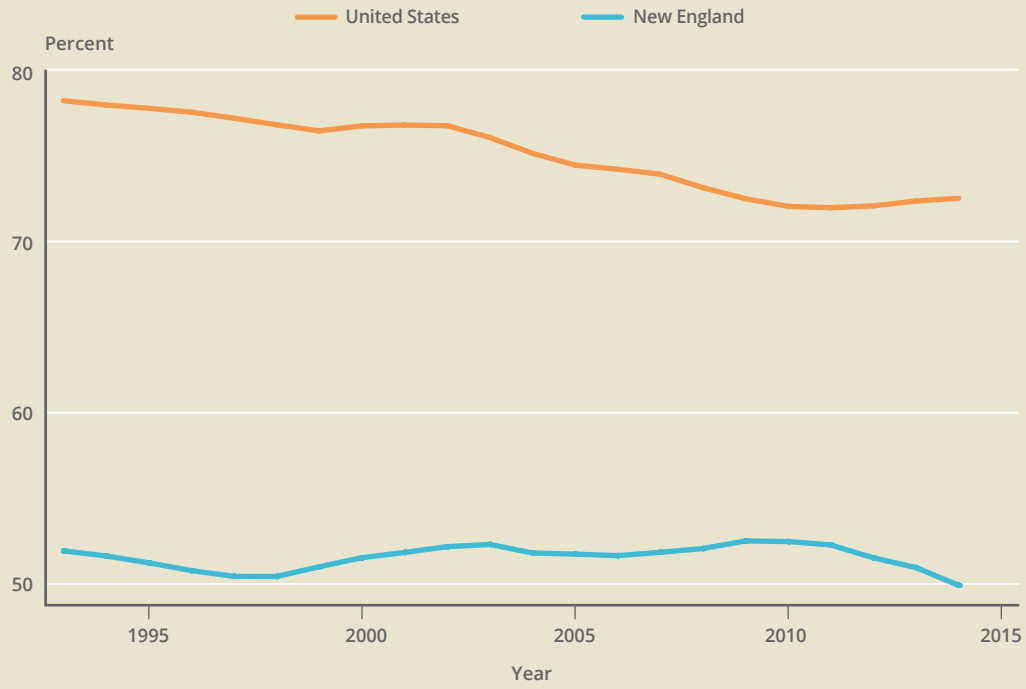
5 Lannan, Katie, "Students Pay More as Mass. Cuts Support for Higher Education," *State House News Service*, March 1, 2018.

6 Lannan, Katie, "Students in Mass. May Be Facing Higher Public Ed Costs," *State House News Service*, March 1, 2017.

Figure 2

Half of Higher Education Students in New England Were Enrolled in Public Institutions

The Percent Shares of Fall Enrollment in Public Institutions, 1993–2014



Source: National Center for Education Statistics, Digest of Education Statistics.

II. The Role of Public Institutions in the Higher Education Sector

Public institutions play an important role in the higher education sector. In New England, they enroll about half of the postsecondary student population, and community colleges are virtually the only providers of a two-year postsecondary education in the region. Community colleges also are more likely than other types of public institutions to serve older, minority, and low-income students.

Figure 2 shows the share of the fall enrollment in public institutions for New England and the United States from 1993 through 2014. Over this period, the share for New England was significantly and consistently lower than that for the United States. New England, in fact, had the lowest share among the nine census divisions. This is because this region has a high concentration of private institutions (especially elite ones) and relies on these types of colleges and universities to provide postsecondary education services more than other parts of the country do.[7]

7 The online Appendix Table 1 shows the ratios of the postsecondary enrollment to the college-age population (aged 18 to 24) by institution type in 2014. New England had a higher ratio of the total (combined public and private) postsecondary enrollment to the college-age population than did the United States. However, the region had a lower ratio of the public four-year and two-year enrollment to the college-age population than did the nation, which is similar to what Table 1 shows.

Table 1

Some New England States Are Particularly Reliant on Public Four-year Institutions

The Percent Shares of Fall Enrollment by Institution Type, 2014

	Public		Private			
	Four-year	Two-year	Four-year		Two-year	
			Nonprofit	For-profit	Nonprofit	For-profit
United States	40.9	31.7	19.6	6.3	0.2	1.4
New England	29.0	20.9	48.1	1.7	0.1	0.2
Connecticut	33.3	27.3	34.9	4.6	0.0	0.0
Maine	42.5	25.2	29.2	2.2	0.4	0.6
Massachusetts	24.4	19.9	54.6	0.7	0.2	0.2
New Hampshire	26.4	14.1	57.3	2.1	0.1	0.0
Rhode Island	30.2	21.0	48.8	0.0	0.0	0.0
Vermont	44.6	13.7	40.7	1.0	0.0	0.0

Source: National Center for Education Statistics, Digest of Education Statistics.

However, the gap between the shares for the region and the nation shrunk by almost 4 percentage points over the past two decades, largely because the share for the nation dropped more substantially than the share for the region. The national decline was driven by the rapid growth of private for-profit institutions in the 2000s. Enrollment in private for-profit institutions accounted for only 1.7 percent of the total enrollment in the United States in 1993, but it climbed to almost 10 percent in 2010 before dropping to 7.7 percent in 2014.[8]

While not as dominant as the public institutions in other regions, New England public institutions still enroll about half of the higher education students in the region. In addition, some New England states rely more on public institutions than do other states in the region. In 2014, the public four-year institutions in Maine and Vermont had even higher shares of total enrollments than did the public four-year institutions across the United States (Table 1).

Community colleges now play a more prominent role in providing two-year postsecondary education in New England than they do in the United States as a whole. They enrolled nearly 99 percent of students attending two-year institutions in the region in 2014 (Figure 3). In comparison, across the nation, 95 percent of students attending two-year institutions went to community colleges that year.[9]

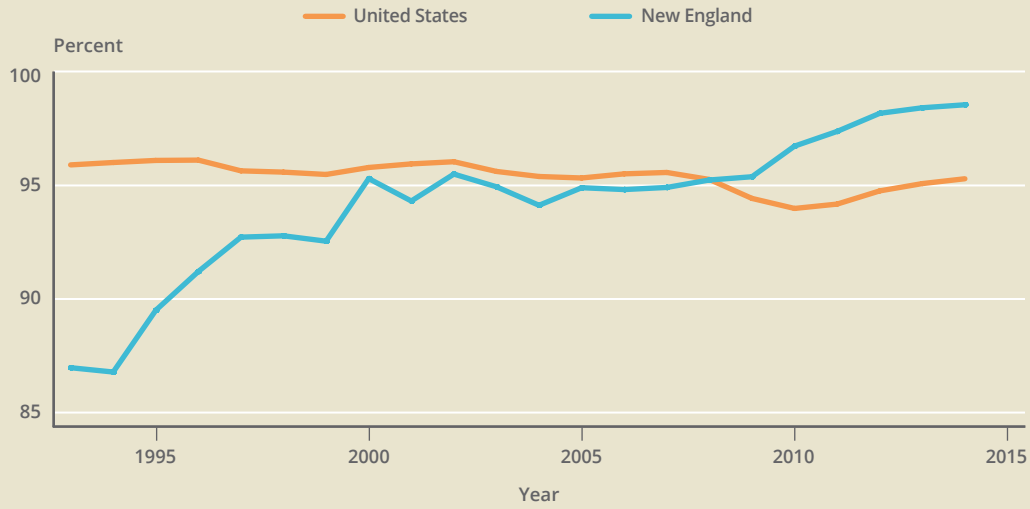
8 Goodman and Henriques (2015) suggests that state funding cuts contributed to a shift in student enrollment from public institutions to private for-profit institutions.

9 New England has a relatively smaller two-year postsecondary sub-sector than the United States. Only about a fifth of postsecondary students went to two-year institutions (public and private combined) in the region in 2014, compared with nearly a third of postsecondary students enrolled in two-year institutions across the United States that year (Table 1).

Figure 3

Community Colleges Have Been Playing an Increasingly Important Role in the Two-year Postsecondary Sub-sector in New England

Fall Enrollment in Community Colleges as a Share of Enrollment in Public and Private Two-year Institutions, 1993–2014



Source: National Center for Education Statistics, Digest of Education Statistics.

Community colleges are more likely to serve non-traditional and socioeconomically disadvantaged students than are public and private nonprofit four-year institutions—two other major players in the higher education sector (Table 2). Sixty percent of community-college students in New England were enrolled as part-time students in 2012, while most undergraduates in public and private nonprofit four-year institutions were enrolled as full-time students (Panel A). Community colleges also had a much higher percentage of older students—aged 25 and older—among full-time undergraduates than did four-year institutions (Panel B). In addition, community-college students were more likely to be black or Hispanic (Panels C and D), and they were more likely than students at four-year institutions to come from low-income families and receive federal grants—mostly need-based Pell Grants (Panels E and F).[10]

III. The Role of State Appropriations in Public Higher Education Finance

Public institutions critically depend on state funding. However, state appropriations for public higher education have declined substantially in recent decades, both in New England and across the nation. States have reduced funding for higher education to address short-term budget gaps caused by recessions and long-term budget gaps attributed to the growing costs of Medicaid and public pensions.

Public institutions' revenues come from three sources: state appropriations, tuition and fees, and other funding sources. Other funding sources include federal appropriations; local appropriations; investment return; federal grants and contracts; and private gifts, grants, and contracts. Each of these other funding sources is generally much smaller than state appropriations or tuition and fees and is often earmarked for specific purposes. In contrast, state appropriations are general-purpose revenue and essentially support all expenditure categories in each public university.

10 Private nonprofit four-year institutions in Maine and New Hampshire had a higher share of black or Hispanic students than did community colleges in their states, likely because these four-year institutions enrolled some out-of-state minority students.

Table 2 Community College Students Compared with Students at Four-year Institutions

Panel A	Percent of Part-time Students among Undergraduates (2012)		
	Public Two-year	Public Four-year	Private Nonprofit Four-year
United States	54.3	20.6	18.6
New England	60.1	21.2	13.7
Connecticut	65.2	28.1	14.8
Maine	51.8	18.8	15.3
Massachusetts	58.7	17.4	14.5
New Hampshire	61.6	8.8	13.8
Rhode Island	65.9	18.5	7.7
Vermont	-	30.8	9.8

Panel B	Percent of Students Aged 25 and Older among Full-time Undergraduates (2012)		
	Public Two-year	Public Four-year	Private Nonprofit Four-year
United States	33.4	16.3	19.3
New England	26.3	11.2	11.0
Connecticut	25.1	17.7	9.4
Maine	36.1	13.1	3.9
Massachusetts	25.3	8.0	13.2
New Hampshire	22.1	5.4	7.6
Rhode Island	18.9	8.6	6.6
Vermont	-	7.9	12.9

Panel C	Percent of Students Who Are Black (2012)		
	Public Two-year	Public Four-year	Private Nonprofit Four-year
United States	14.4	14.0	12.3
New England	9.3	5.3	6.3
Connecticut	11.3	8.5	7.3
Maine	1.2	1.0	3.4
Massachusetts	12.6	4.9	7.9
New Hampshire	1.5	1.2	2.4
Rhode Island	9.2	5.9	4.5
Vermont	-	1.7	2.9

Source: National Center for Education Statistics, Delta Cost Project.
Note: There are no reported data on public two-year institutions in Vermont for 2008 or 2012. Therefore, the data on public two-year institutions in the New England region do not include Vermont.

Table 2 Community College Students Compared with Students at Four-year Institutions

Panel D	Percent of Students Who Are Hispanic (2012)		
	Public Two-year	Public Four-year	Private Nonprofit Four-year
United States	11.7	8.7	8.3
New England	11.5	5.7	5.6
Connecticut	15.9	8.8	5.8
Maine	1.1	1.0	3.6
Massachusetts	13.6	5.1	6.4
New Hampshire	2.4	2.2	4.0
Rhode Island	15.4	7.5	6.2
Vermont	-	2.8	3.3

Panel E	Percent of Students Whose Total Family Income Is Less than $15,000 (2008)		
	Public Two-year	Public Four-year	Private Nonprofit Four-year
United States	27.2	15.1	14.0
New England	24.1	9.7	10.2
Connecticut	22.9	8.0	8.2
Maine	23.2	10.6	9.6
Massachusetts	27.9	10.7	11.0
New Hampshire	11.9	6.4	6.7
Rhode Island	30.6	10.0	7.3
Vermont	-	8.8	13.7

Note: Data include only dependent undergraduates who applied for federal financial aid.

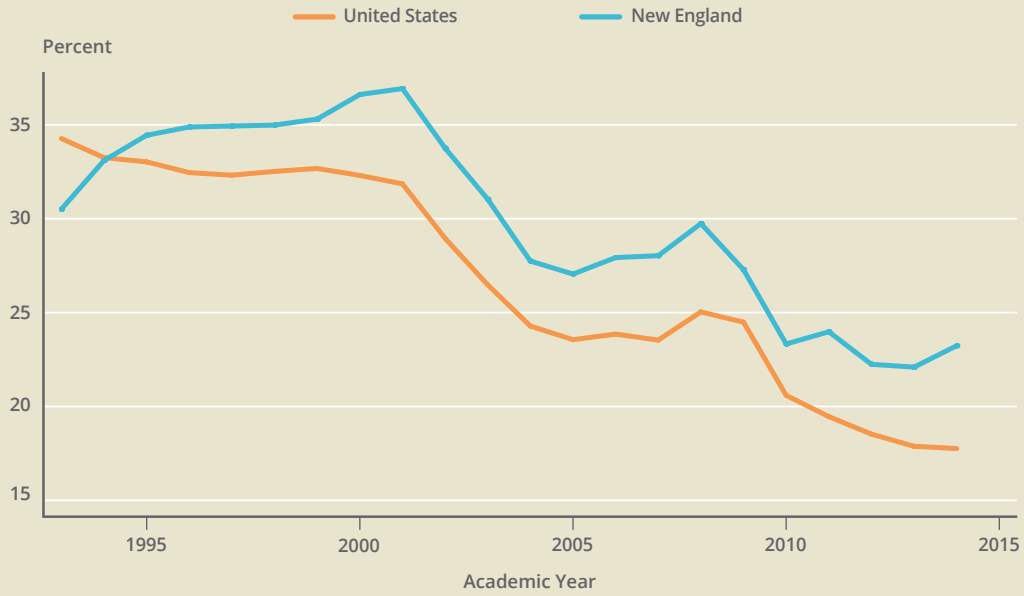
Panel F	Percent of Full-time, First-time Undergraduate Students Receiving Federal Grants (2012)		
	Public Two-year	Public Four-year	Private Nonprofit Four-year
United States	60.6	44.6	44.3
New England	55.4	33.9	32.3
Connecticut	50.5	31.8	25.8
Maine	71.3	45.0	32.6
Massachusetts	56.0	33.4	33.8
New Hampshire	46.0	24.0	33.9
Rhode Island	56.0	36.0	25.6
Vermont	-	33.0	36.3

Source: National Center for Education Statistics, Delta Cost Project.
Note: There are no reported data on public two-year institutions in Vermont for 2008 or 2012. Therefore, the data on public two-year institutions in the New England region do not include Vermont.

Figure 4

State Appropriations Have Been Playing a Decreasing Role in Financing Public Institutions

State Appropriations as a Share of Total Revenues of Public Institutions, 1993–2014



Source: National Center for Education Statistics, Digest of Education Statistics.

Note: Total revenues for 2002 and 2003 and state appropriations for 2002 are missing and are estimated using interpolation.

State appropriations have played an important but decreasing role in financing public institutions. As a share of public institutions' total revenues, they have trended downward both in New England and across the United States over the past two decades (Figure 4). Long (2016) shows that all states and all types of public institutions have experienced reductions in state appropriations. Due to this long-run decline, state appropriations have recently become less important than tuition and fees in financing public institutions. They were a larger revenue source than tuition and fees in the 1990s and 2000s, but that changed in the 2010s.

Figure 4 also shows that the state appropriations' share of the total revenues of public institutions fell further and earlier in the nation as a whole than in New England. As a result, the region and the nation have reversed positions. In the early 1990s, when New England experienced a severe economic and fiscal crisis, the region's state appropriations represented a lower share of public institutions' total revenues compared with the United States as a whole. Since then, New England's state appropriations have made up a greater share of the total revenues.

The extent of public institutions' reliance on state appropriations varies across the New England states. In New Hampshire and Vermont, state appropriations make up a much smaller percentage of total revenues of public institutions than in other New England states and across the United States. In 2014, New Hampshire and Vermont appropriated only 8.1 percent and 10.0 percent, respectively, of total revenues of public institutions, compared with 17.8 percent across the United States.

IV. The Consequences of Decreasing State Appropriations for Higher Education

Net tuition and fees at public doctoral institutions increase by 17 cents in response to a $1 decrease in state appropriations.

Using large national datasets and advanced statistical methods, two new Federal Reserve Bank of Boston working papers examine the impact of reductions in state appropriations on public higher education institutions and their students (Zhao 2018; Zhao forthcoming). This report builds on these papers and highlights the experiences of the New England states.

The working papers and this report find that when states reduce funding for higher education, many public institutions raise tuition and fees—especially for out-of-state undergraduates—to only *partially* offset state revenue loss in the United States. Public institutions also have to cut their spending, especially in the areas of instruction and research. These actions ultimately hurt schools' ability to help students complete their degrees and to help university researchers produce more high-quality research.

The analysis also reveals that community colleges are more vulnerable than other types of public institutions to the negative impact of state funding cuts. Unlike public doctoral institutions, community colleges often are unable to raise tuition and fees and therefore have no cushion against state funding reductions. They also have to trim educational expenditures more dramatically in the event of state funding cuts, and so they experience a larger decline in degree completion rates than do other types of public institutions.

TYPES OF PUBLIC INSTITUTIONS

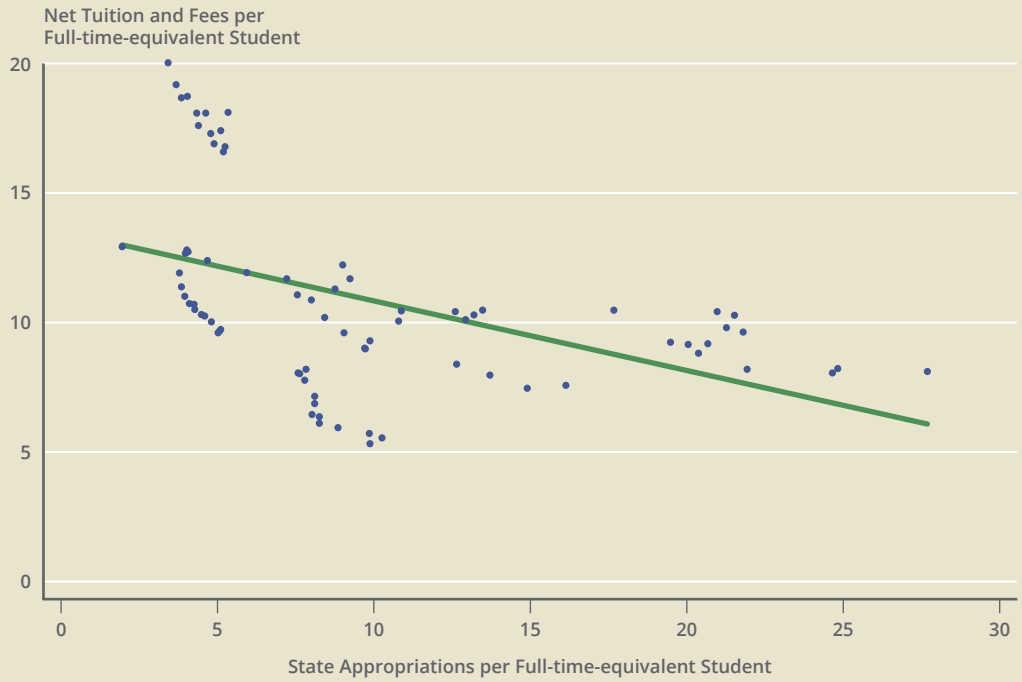
The Carnegie Commission on Higher Education classifies public institutions into the following four categories based on the type and number of degrees they award each year.

- **Public doctoral/research institution:** A public institution that awards at least 20 research/scholarship doctoral degrees a year. The state university systems in the six New England states—University of Connecticut, University of Maine, University of Massachusetts, University of New Hampshire, University of Rhode Island, and University of Vermont—are all public doctoral institutions.
- **Public master's institution:** A public institution that awards at least 50 master's degrees and fewer than 20 doctoral degrees a year. New England examples include Bridgewater State University in Massachusetts, Central Connecticut State University, and Rhode Island College.
- **Public bachelor's institution:** A public institution where baccalaureate or higher degrees account for at least half of the total degrees awarded and fewer than 50 (if any) master's degrees a year are awarded. New England examples include Charter Oak State College in Connecticut and Massachusetts College of Liberal Arts.
- **Public associate's institution (commonly called community college):** A public two-year institution that awards degrees no higher than an associate's degree. New England examples include Quinsigamond Community College in Massachusetts and Eastern Maine Community College.

Figure 5

Public Doctoral Institutions Tend to Raise Tuition and Fees When States Reduce Appropriations

State Appropriations versus Net Tuition and Fees among Public Doctoral Institutions, 2000–2012



Sources: National Center for Education Statistics, Delta Cost Project; author's calculations.

Note: The figure is based on the data of six New England public doctoral institutions for 2000–2012. The straight line is generated from a univariate regression, which describes a simple linear relationship between the two variables in question. Net tuition and fees are defined as gross tuition and fees net of scholarships and fellowships that institutions award to students. All financial variables are in thousands of 2012 dollars.

The Impact on Tuition and Fees

Many public institutions need to raise tuition and fees to address state funding cuts. Figure 5 shows that net tuition and fees at public doctoral institutions in New England tend to increase when state appropriations decrease.[11] Using advanced statistical methods to analyze a national data sample, Zhao (2018) finds that net tuition and fees at public doctoral institutions increase by 17 cents, on average, in response to a $1 decrease in state appropriations.[12]

Furthermore, the increase in tuition and fees is much greater for out-of-state students than for in-state students.[13] For a $1 decrease per full-time-equivalent (FTE) student in state appropriations, out-of-state full-time undergraduates at public doctoral institutions face an average increase of 26 cents in sticker price, while the average increase for in-state full-time undergraduates is 14 cents.[14] One reason for the difference in price increases is that public doctoral institutions are less constrained in raising out-of-state tuition than in raising in-state tuition. Individual institutions have full autonomy over setting out-of-state tuition, but they often need to obtain the approval of the

11 Public doctoral institutions are selected for illustration purposes. Net tuition and fees are defined as gross tuition and fees net of scholarships and fellowships that institutions award to students.

12 See the online Appendix Table 2, Panel A for the related regression coefficients.

13 Knight and Schiff (2016) show that public universities' charging residents and nonresidents a different amount of tuition results in economic inefficiencies from a national perspective.

14 The sticker price is a fixed amount of money that an institution charges a full-time student to cover tuition and required fees for an academic year before any discounts. It is also called the published price, because schools often list it in their brochures.

state legislature or a state- or system-wide governing board to raise in-state tuition (Jaquette and Curs 2015). It is also politically less risky to increase out-of-state tuition, because doing so exports more of the cost burden to non-residents.

Nevertheless, the increases in tuition and fees do not *fully* offset the reductions in state appropriations for several reasons. First, public institutions in many states have only limited control over setting in-state tuition. In these states, the state legislature or some centralized agencies or boards possess the primary tuition-setting authority, and their members have political incentive to keep tuition down. According to a 2010–2011 survey conducted by the State Higher Education Executive Officers Association, the primary tuition-setting authority belongs to the state legislature or the statewide coordinating governing agency in 14 states and to the coordinating/governing boards for institutional systems in 19 states (Bell, Carnahan, and L'Orange 2011). Second, states sometimes impose ad hoc tuition caps, curbs, or freezes (Boatman and L'Orange 2006; Kim and Ko 2015). For example, Massachusetts implemented a two-year tuition freeze at state colleges and universities in the mid-2010s (Murray 2017[15]). Third, public institutions limit their tuition and fees increases in order to remain competitive in recruiting and retaining students (Povich 2015[16]). The University of Massachusetts system cited the need for maintaining competitiveness relative to other institutions in the state as a reason for implementing a lower tuition increase in 2018 than in previous years (Murray 2017).

In contrast to public doctoral institutions, community colleges, on average, show no changes in tuition and fees after experiencing reductions in state appropriations (Zhao 2018). The lack of price response from community colleges is likely because they are mandated to be accessible for everyone, and their intended student population tends to be low income and sensitive to tuition increases.

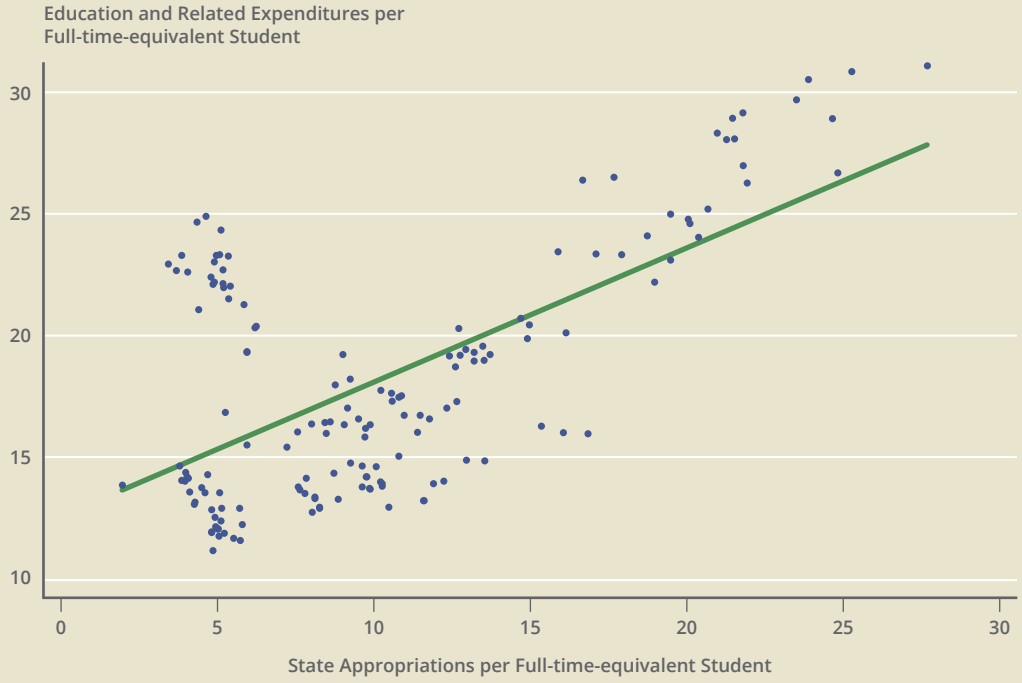
One direct implication of increases in tuition and fees at public institutions is that many students have to take out more student loans to pay for their education. The Massachusetts Budget and Policy Center shows that the share of graduates from Massachusetts public four-year institutions who borrowed student loans jumped from 58 percent in 2004 to 73 percent in 2016, and the average amount of the inflation-adjusted student loan debt among borrowers increased 77 percent during this period (Thompson 2018). In comparison, the nationwide share of graduates from public four-year institutions who borrowed student loans increased from 54 percent in 2004 to 59 percent in 2016, and the nationwide average amount of the inflation-adjusted student loan debt among borrowers increased 30 percent during this period. Furthermore, Clifford (2016) finds that borrowers from neighborhoods with lower average incomes, higher minority shares, or lower average educational attainment levels had a harder time keeping up with their student loan payment schedule and had higher delinquency rates. Subsequently, the delinquency likely damaged these students' credit histories and credit scores, making it more difficult for them to rent an apartment, receive a mortgage to buy a home, or even find a job, since many employers conduct a credit background check of job applicants.

15 Murray, Stephanie, "Cost of Attending UMass Likely to Go Up 2–3%, Meehan Says," *State House News Service*, June 20, 2017.
16 Povich, Elaine S., "To Balance Budgets, Governors Seek Higher Education Cuts," *Stateline*, March 27, 2015.

Figure 6

Public Doctoral Institutions Tend to Cut Spending When States Reduce Appropriations

State Appropriations versus Education and Related Expenditures among Public Doctoral Institutions, 1987–2012



Sources: National Center for Education Statistics, Delta Cost Project; author's calculations.

Note: The figure is based on the data of six New England public doctoral institutions for 1987–2012. The straight line is generated from a univariate regression, which describes a simple linear relationship between the two variables in question. All financial variables are in thousands of 2012 dollars.

The Impact on School Expenditures

Because increases in tuition and fees, if there are any, are not enough to replace lost revenues from the states, public institutions have to cut spending to balance their budgets. Figure 6 shows, for example, that when state appropriations are reduced, education and related expenditures tend to decrease among public doctoral institutions in New England.[17] Furthermore, Zhao (2018) estimates that a $1 cut in state appropriations results, on average, in a drop of almost 50 cents in education and related expenditures—including nearly 30 cents in instructional expenditures—for public doctoral institutions across the country.[18] Reducing instructional expenditures then leads to a lower instructional-faculty-to-student ratio, which likely reduces the quality of education that students receive.

For community colleges, a $1 cut in state appropriations results in a reduction of 56 cents in instructional expenditures.

In addition, Zhao (2018) estimates that a $1 cut in state appropriations results, on average, in a reduction of 7 cents in public service expenditures for public doctoral institutions. Public institutions often provide free community services, such as assistance at hospitals and tutoring for K–12 students. Many also actively engage in local economic development. Therefore, reductions in school expenditures on public service are likely to have a negative impact on public institutions' surrounding communities.

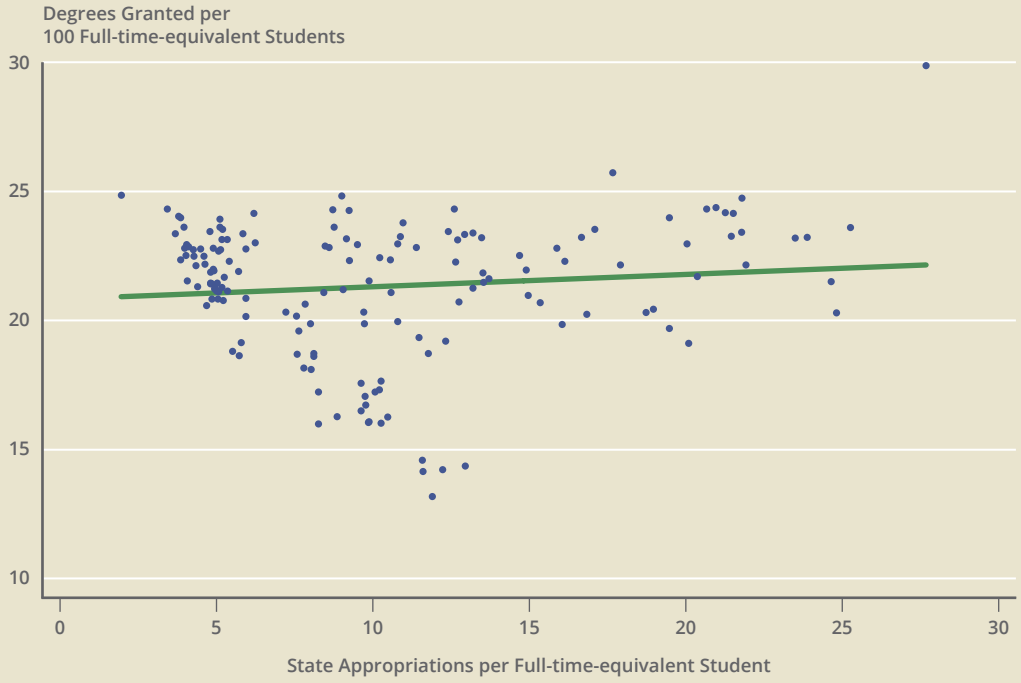
17 Education and related expenditures refer to total spending on direct educational costs, including spending on instruction, student services, and the education share of spending on central academic and administrative support, operations, and maintenance.

18 See the online Appendix Table 2, Panel B for the related regression coefficients.

Figure 7

Degree Completion Tends to Decline When States Reduce Appropriations

State Appropriations versus Degrees Granted among Public Doctoral Institutions, 1987–2012



Sources: National Center for Education Statistics, Delta Cost Project; author's calculations.

Note: The figure is based on the data of six New England public doctoral institutions for 1987–2012. The straight line is generated from a univariate regression, which describes a simple linear relationship between the two variables in question. All financial variables are in thousands of 2012 dollars. Degrees granted include bachelor's and graduate degrees.

In addition to public doctoral institutions, other types of public institutions have to implement spending cuts in response to state funding reductions. In particular, community colleges cut more spending than other types of public institutions, because, as noted earlier, they are unable to raise tuition and fees as a cushion against state funding reductions. Zhao (2018) estimates that for community colleges, a $1 cut in state appropriations results, on average, in about a $1 reduction in education and related expenditures, including a reduction of roughly 56 cents in instructional expenditures.

The Impact on Degree Completion

Cuts in school expenditures leave fewer school resources available to help students complete their degrees. For example, reducing instructional expenditures often leads to fewer classes and larger classes, and lower quality and quantity of teaching faculty and staff (Korn and McWhirter 2017[19]; Lannan 2017). Reducing research spending also hinders graduate students' ability to complete their degrees, because many rely on research assistantships, and their theses and dissertations are often tied to their advisors' research projects.

Figure 7 shows that when state appropriations are reduced, the number of degrees granted

19 Korn, Melissa, and Cameron McWhirter, "Public Universities Become Prime Targets for State Budget Cuts," *Wall Street Journal*, February 10, 2017.

relative to the enrollment tends to decrease slightly among public doctoral institutions in New England. Zhao (2018) further estimates that a decrease of $10 million in state appropriations results, on average, in about 10 fewer graduate degrees granted by public doctoral institutions.[20] Estimates in this report suggest that due to state funding cuts, the six public doctoral institutions in New England collectively granted about 462 fewer graduate degrees during the 2002–2012 period than they would have granted if they had received per-student state appropriations at the 2001 level (after inflation adjustments) each year since the 2001 recession.[21]

Community colleges suffer an even larger drop in degree completion rates, because they have to make deeper cuts in educational expenditures to cope with state funding reductions. For a $10 million decline in state appropriations, the number of associate's degrees granted by community colleges decreases, on average, by about 57 (Zhao 2018). Estimates in this report suggest that due to state funding cuts, community colleges in New England collectively granted 21,388 fewer associate's degrees during the 2002–2012 period than they would have granted if they had received per-student state appropriations at the 2001 level (after inflation adjustments) each year since the 2001 recession.[22]

Due to state funding cuts, New England's community colleges granted 21,388 fewer degrees during the 2002–2012 period.

Appropriation cuts and public institutions' responses to them likely have a disproportionate impact on low-income and minority students, because they are more likely to attend community colleges than public four-year institutions. Many labor scholars and other experts suggest that receiving an associate's degree opens a promising pathway to a well-paying middle-skill job (for example, Holzer and Lerman 2007). However, state funding cuts make it more difficult for socioeconomically disadvantaged students to complete their associate's degrees and get on this pathway.

The Impact on Research Productivity

Part of the core mission of public doctoral institutions is to produce high-quality research that generates large social and economic benefits. The National Science Board (2018) reports that in 2016, all US colleges and universities together spent $71.8 billion on research and development (R&D), which was about 15 percent of the total R&D expenditures in the United States that year. While their share of the financial resources for the US R&D system is relatively small, colleges and universities have played an outsized role in the country's R&D activities, accounting for 49 percent of its basic research performance in 2015 (National Science Board 2018). Lendel (2010) shows that

20 See the online Appendix Table 2, Panel C for the related regression coefficients.

21 This calculation is done under the assumption that the effect of state appropriations on the number of graduate degrees granted by public doctoral institutions in New England is the same as the national average.

22 This calculation is done under the assumption that the effect of state appropriations on the number of associate's degrees granted by community colleges in New England is the same as the national average. Vermont is not included in the calculation because there is no information on public associate's institutions in Vermont in our data source (the Delta Cost Project database).

universities with more R&D expenditures have a stronger impact on their regional economies. Furthermore, the American Academy of Arts and Sciences (2016) reports that in 2012 and 2013 US public universities filed 13,322 patent applications, received 3,278 granted patents, issued 3,094 licenses, and created 522 start-ups.

Licensing patents can generate additional revenue for academic institutions but also make broad economic contributions to the society. The Association of University Technology Managers (AUTM) reports that the 193 academic institutions that responded to the 2017 AUTM US Licensing Activity Survey collected $3.14 billion in gross licensing income, or an average of $153,111 per license, in that year (AUTM 2017). Pressman et al. (2017) estimate that during the 1996–2015 period, academic licensing from the AUTM survey respondents contributed $148 billion to $591 billion (in 2009 US dollars) to the US GDP, and their licensed-product sales supported 1.27 million to 4.27 million person years of employment. In addition, Rothwell et al. (2013) find that patents play an important role in driving long-run regional economic growth in the United States.

Due to state funding cuts, New England's public doctoral institutions produced 117 to 369 fewer approved patent applications.

In New England, some public universities have indeed created influential patented technologies. For example, researchers at the University of Massachusetts Amherst invented Geckskin, a super-strong adhesive product inspired by the footpads of geckos. An index-card size of Geckskin can hold up to 700 pounds against a smooth surface and can be easily released without leaving any residues. Scientists believe that this invention has huge potential for military, medical, industrial, clothing, and home applications. It was named as a top-5 science breakthrough of 2012 by *CNN Money*, a top-10 textile innovation for 2013–14 by the FabricLink Network, and one of 14 smart, nature-inspired inventions by *Bloomberg News*.[23]

University-based research needs financial support from the schools. However, Zhao (forthcoming) finds that reducing state appropriations leads to cuts in research spending at public doctoral institutions that are among the top 250 US research universities. The study estimates that a $1 decrease in state appropriations results, on average, in a decrease of 15 cents to 21 cents in research expenditures for public doctoral institutions.[24] These expenditure cuts are concentrated on salaries and wages paid to researchers. For a $1 decrease in state appropriations, school spending on researchers' salaries and wages drops by 11 cents to 15 cents.

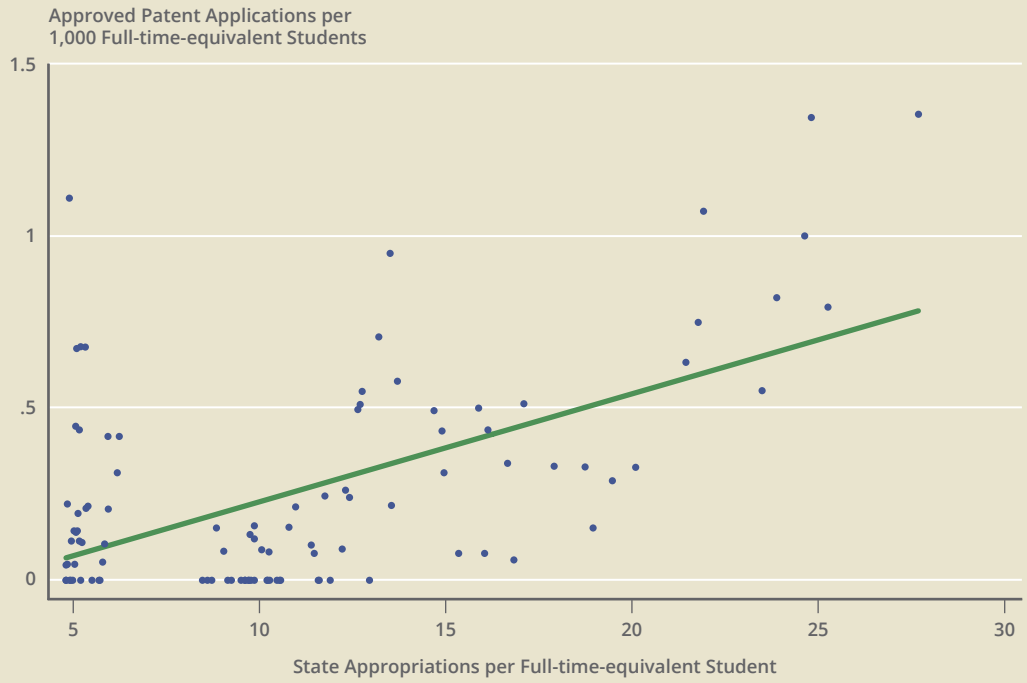
23 See https://geckskin.umass.edu/.

24 See the online Appendix Table 2, Panel D for the related regression coefficients.

Figure 8

The Number of Approved Patent Applications Tends to Decline When States Reduce Appropriations

State Appropriations versus Approved Patent Applications among Public Doctoral Institutions, 1987–2003



Sources: National Center for Education Statistics, Delta Cost Project; United States Patent and Trademark Office; author's calculations.

Note: The figure is based on the data of six New England public doctoral institutions for 1987–2003. The straight line is generated from a univariate regression, which describes a simple linear relationship between the two variables in question. All financial variables are in thousands of 2012 dollars.

Reductions in research expenditures also hurt research production. Using the number of approved patent applications as a measure of research production, Figure 8 shows that when state appropriations are reduced, research productivity among public doctoral institutions in New England tends to decrease. Furthermore, Zhao (forthcoming) estimates that, while student enrollment is held constant, a decrease of $13 million to $42 million in state appropriations results, on average, in one less approved patent application from public doctoral institutions. Estimates in this report suggest that due to state funding cuts, the six public doctoral institutions in New England collectively produced 117 to 369 fewer approved patent applications during the 2002–2012 period than they would have produced if they had received per-student state appropriations at the 2001 level (after inflation adjustments) each year since the 2001 recession.[25]

25 This calculation is done under the assumption that the effect of state appropriations on the number of approved patent applications from public doctoral institutions in New England is the same as the national average.

V. Conclusion and Policy Recommendations

State appropriations are an important revenue source for public institutions, but they have declined significantly both in New England and across the United States over the past several decades. This report and other related research articles from the Federal Reserve Bank of Boston suggest that decreases in state appropriations have negative consequences for public institutions and students. These cuts tend to lead to higher tuition and fees and lower school spending on classroom instruction, research and development, and community service. As a result, they hinder public institutions from fulfilling their missions of educating students, producing research, and providing public service. Furthermore, reductions in state appropriations likely contribute to higher student loan debt and the shortage of skilled workers that employers are experiencing.

The research also reveals that the negative consequences of state funding cuts are more pronounced for community colleges than for other types of public institutions. Students at community colleges are more likely to be racial or ethnic minorities and come from low-income families than are students at other types of public institutions. Therefore, socioeconomically disadvantaged students are more likely to be affected than other members of the population, even though these students are the ones who need the most help climbing the career and income ladder. Taking these findings into account, states should consider providing more protection to community colleges in future budget crises.

States should also pursue policy options that reduce the chances and severity of state funding cuts for higher education. They need to consider both short-term and long-term solutions, since the declining state support for higher education is due to both economic recessions and the long-run growth of Medicaid and public pension costs. First, they should consider building larger budget stabilization funds—commonly known as rainy day funds—during economic booms. In principle, money should be deposited into budget stabilization funds during the good times and be withdrawn during the bad times to offset revenue shortfalls and avoid budget cuts and tax increases. However, Zhao (2016) shows that most states, including the New England states, have not had large enough budget stabilization funds to address revenue shortfalls in the last 25 years. In addition, to improve the effectiveness of budget stabilization funds, states should consider increasing or eliminating the size caps and reforming the deposit, withdrawal, and replenishment rules governing these funds (Sobel and Holcombe 1996; Hou 2004; Wagner and Elder 2005; McNichol and Boadi 2011; Zhao 2016).

Second, it is perhaps more important and necessary for states to take actions to close the long-term budget gaps. On the spending side, reforms are likely needed to address the rapid growth of Medicaid and unfunded pension liabilities, which in the past have crowded out state funding for higher education. If policymakers and voters do not wish to curb spending on Medicaid and public pensions, states will need to raise more revenues. While new taxes and fees impose costs on taxpayers, the social, economic, and fiscal benefits associated with public higher education will likely justify those costs.[26]

It will not be easy to make these changes, as policymakers face trade offs. But as this report shows, public higher education institutions need robust state support to fulfill their missions, help their students graduate, produce skilled workers for employers, and generate the positive social and fiscal benefits we all need.

26 Recall that public higher education can generate a positive net investment return for governments, because governments can collect more taxes and spend less on welfare and corrections when a higher percentage of the workforce is college-educated (Trostel 2010). Supporting public higher education also helps governments address social and economic inequality.

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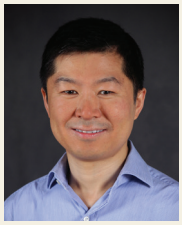

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