Cutting state support hurts public universities and their students

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June 23, 2017

Summary

Two recent reports, Delisle (2017) and Cooper (2017), claim to find only a weak relationship ("pennies on the dollar") between decreases in state appropriations for public higher education per student and increases in tuition. But these reports misinterpret previous findings, selectively report results, use non-standard definitions of tuition and state support, and overemphasize the experience of three states with high fossil-fuel revenues. A reanalysis of several datasets supports the consensus finding that $1,000 in the state appropriation per student tends to increase tuition by roughly $350. The evidence is strong that declining state appropriations are met with tuition increases. The discussion of state support for public higher education cannot focus exclusively on tuition and affordability. Quality is jeopardized as well. Deming and Walters (2017) suggests that the impact of cuts in state support for public higher education also exacts a significant toll on quality.

In a recent Brookings Report entitled "The Disinvestment Hypothesis: Don't blame state budget cuts for rising tuition at public universities", Delisle (2017) criticizes the quality of evidence in recent studies that show a strong relationship between decreases in state appropriations for public higher education and increases in tuition, in particular, Webber (2016) and the U.S. Department of Education National Center for Education Statistics (NCES; Cunningham et al. 2002). However, Delisle reports results selectively and misinterprets findings. The studies that Delisle (2017) reports as finding a weak relationship

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are selectively reported or have methodological difficulties. A report (Cooper, 2017) from the American Enterprise Institute (AEI) released the same week claims to demonstrate that the relationship is between tuition and state support for public higher education is weak. A close inspection of the AEI data indicates that the AEI result is driven entirely by three states with high fossil-fuel revenues and a non-standard definition of state support that erroneously classifies states with substantial cuts to higher education as having had increases.

A central issue in the accessibility discussion is the relationship between expenditures on public higher education and prices, what students and their families must pay in tuition.[1] The difference between the cost that has exceeded the price was historically covered by state subsidies for public higher education. Many commentators, e.g., Folbre (2011), Rampell (2012), Webber (2016), and Leonhardt (2017) have observed that state appropriations for public higher education have fallen sharply over time across most states while tuition has increased.[2] By some measures, it is not the cost of public higher education that has increased but the distribution of the cost between the state appropriation paid by taxpayers and the tuition paid by students and their families.

Both Delisle and Cooper (2017) imply that anything short of a one-for-one relationship between changes in state support for public higher education and changes in public tuition negates the role of state appropriations. In addition to their serious empirical mistakes and errors in interpreting the literature, both essays also mistakenly operate from the expectation that changes in state support for public higher education would be met one-for-one by changes in tuition. Even if the relationship is far less than one-for-one, there is a crucial role for states in maintaining the affordability of public higher education. The existing studies and analysis based on their data strongly indicate that declining state appropriations are substantially offset by tuition increases and are a major cause of recent increases in tuition.

Both Delisle (2017) and Cooper (2017) entirely ignore the issue of quality in relation to reduced public support for higher education. States will choose the level of resources and, hence, quality to provide in public higher education and the distribution of costs between taxpayers and students. Faced with a cut in state support, public colleges can increase

[1] Prices, rather than price, is operative because as tuition has increased, there has been a proliferation of tailored packages, with few students paying the same price.

[2] The changes in state appropriation since 2008, by state, from Leonhardt (2017) are reprinted in Figure 4.

tuition or cut spending per student.

Although the goals of this briefing paper are to highlight the empirical shortcomings of Delisle (2017) and Cooper (2017) and to provide better estimates of the recent relationship between state appropriations for public higher education and students, I also briefly summarize concerns regarding deterioration of educational quality. Deming and Walters (2017) expands on how the quality of public higher education must join financial accessibility at the core of the discussion.

1 Delisle misses the scatterplot in Webber (2016)

Delisle (2017) dismisses a widely cited study by Webber (2016), complaining both illogically and erroneously that in the Webber study, changes in state appropriation explain too much of the increase in tuition. Delisle's criticism rests on a poor definition of the share of tuition hikes explained by cuts and a failure to examine the data with a scatterplot.

Figure 1 shows a scatterplot of the Webber data on the change in tuition versus the change in state funding per student, both in $1,000s, for 2000–2014. The states are labeled; for example, Georgia (GA) decreased its state appropriation per student by $5,100 and increased tuition by $3,500 during this period.

The solid line in Figure 1 is the regression line for the scatterplot of change in tuition versus change in state appropriation. The slope indicates an increase of $330 of tuition for each lost $1,000 of state appropriation per student; the adjusted R-squared for the bivariate regression is 0.36, meaning that more than one third of the variation in tuition changes is explained by state appropriation changes, making state appropriation a powerful single explanation of the change in tuition.[3]

Both Delisle and Webber (2016) compute the what they call the "share of tuition hike explained by cuts" as the change in state appropriation divided by the change in tuition in each state. The change in state appropriation divided by the change in tuition is the wrong computation because the relationship of interest is the change in tuition for a change in

[3] Alaska (AK), North Dakota (ND), and Wyoming (WY) are all fossil-fuel-producing states in which fuel royalties play a significant role in the funding of higher education, and they are all influential points for the regression line in Figure 1. If these three fossil-fuel-producing states, with a total population around 2 million persons, are excluded from the regression, the regression coefficient increases to an increase of $440 of tuition for each lost $1,000 of state appropriation per student.

appropriation rather than vice versa. That is, the inverse, or change in tuition divided by the change in the state appropriation, is the correct computation. The corrected term is really a state-specific, reduced-form summary of the tuition change per change in the state appropriation.

There can clearly be other factors that might contribute to tuition changes or intervene in the relationship between appropriation cuts and tuition increases. For example, a university might raise tuition independent of changes in the state appropriation if the university is seeking to improve quality. (Compare, for example, the technological needs of a 2017 frosh biology lab with its 1987 counterpart.) Even if the state and tuition shares of expenditure remain the same, the total expenditure may need to increase to provide a higher quality education. Thus, a baseline of "no tuition increase" is not realistic, and hence I include an intercept term in the regression of tuition change on change in state appropriation per student.

The regression relationship illustrated by the solid line permits other factors to play a role while focusing on the systematic relationship between changes in the state appropriation for public higher education per student and tuition. The regression is the most useful way to summarize the extent to which tuition hikes are explained by cuts.[4]

2 Delisle ignores the NCES study (Cunningham et al., 2002)

Although Delisle (2017) cites the "Study of College Cost and Prices" undertaken by Cunningham et al. (2002) for the U.S. Department of Education's National Center for Education Statistics (NCES), Delisle omits a key finding from the NCES report, explained in the detailed model results in Chapters III and V,

> Over the whole period, the most "important" variable associated with the change

[4] Although the regression line is the most useful estimate, we can also examine the possibility of a one-for-one relationship that Delisle and Webber consider. In Figure 5, the dotted line is for reference $1,000 of tuition for each lost $1,000 of state appropriation per student. The dashed line is a regression with the restriction y-intercept $\equiv 0$, that is, a state with no appropriation change is restricted to have no tuition change. The slope of the dashed line indicates an increase of $890 dollars of tuition for each lost $1,000 of state appropriation per student. Although R-squared is difficult to interpret in a regression without an intercept, the adjusted R-squared for the regression with y-intercept $\equiv 0$ is 0.68, indicating a strong fit. This regression closely matches the dotted line would indicate a perfect one-for-one tradeoff between state appropriations and tuition. The hypothesis that state appropriations are offset one-for-one by tuition changes is in fact a reasonable description of the relationship between state appropriations and tuition.

> in tuition was change in revenue from government appropriations. Institutions that experienced the greatest declines in appropriations (from all government sources) per FTE student typically had larger increases in tuition... Larger increases in tuition were associated with larger decreases in the revenue from state appropriations.

and repeated several times as a "major conclusion" of Cunningham et al. (2002, pp. vi, 132),

> For public 4-year institutions, revenue from state appropriations remains the largest source of revenue and is the single most important factor associated with changes in tuition.

For public institutions offering bachelors' degrees, an increase of $240 and $410 dollars of in-state tuition for each lost $1,000 of state appropriation per student, depending on the exact type of institution (See Tables 13–15, pp. 43–50 of Cunningham et al. (2002).) These results obtain in regressions with many other controls that are quite possibly correlated with the reduction in state appropriations and may well understate the magnitude of the effect of state appropriations on tuition.[5]

Delisle (2017) criticizes the use of "sticker price" rather than individually tailored prices (with aid and scholarships). The use of sticker price, which is in fact a reasonable measure of the public goal for the cost of attendance, is apparently the basis of the Delisle dismissal of the National Center for Education Statistics report as less robust than those of the other studies that Delisle summarizes. But sticker price is probably the price of greatest interest to typical middle-class families and state policy makers. Indeed, the proliferation of tailored tuition, which makes families face fragmented and noncomparable packages, disrupts rational family and public decisionmaking. The NCES study, while now fifteen years old, represents high quality empirical analysis with clear documentation of procedures. There is no evidence that the study is less robust than any other study Delisle cites.

[5] In response to Cooper (2017), Webber observes the pitfall of including state revenue and the state business cycle as explanatory variables in addition to the change in the state appropriation (Webber, personal correspondence).

3 Delisle ignores time-series evidence from Kim and Ko (2015)

Delisle (2017) cites a result in Kim and Ko (2015) as evidence for a weak relationship between changes in state appropriations per student and changes in tuition. Kim and Ko (2015), which treats state and university tuition-control policies and includes the effect of state appropriations on tuition only as a tangential matter, has a substantive problem: the "change in percent of revenue from tuition" is included as an explanatory variable for tuition. The regression results, which Delisle (2017) considers to be a robust study, cannot be meaningfully interpreted with change in tuition included as an explanation for change in tuition. But Figure 2 reprinted from Kim and Ko (2015) shows — and Delisle (2017) does not include — a time-series plot of aggregate changes in state appropriations and tuition. As can be seen in the time series of percent changes in appropriation and percent changes in tuition in Figure 2, the two variables are strongly negatively correlated ($r = -0.60$) in the aggregate, which strongly suggest a negative relationship between changes in state appropriations and changes in tuition.[6]

4 Delisle selectively reports Rizzo and Ehrenberg (2004)

Delisle (2017) reports a finding of low responsiveness of in-state tuition to state appropriations from Rizzo and Ehrenberg (2004). The Rizzo and Ehrenberg (2004) coefficient indicating an increase of only \$60 dollars of in-state tuition for each lost \$1,000 of state appropriation per student is smaller than the responsiveness estimated by the Webber (2016) and Cunningham et al. (2002) by a factor of four to eight. As in Cunningham et al. (2002), the Rizzo and Ehrenberg (2004) regression includes many controls, of which some are potentially highly correlated and might bias the coefficient on state appropriation. For example, state tax revenues is included as well as state appropriations for higher education. If cuts in state appropriations in higher education are frequently associated with decreases

[6] Although there are only 23 observations in the aggregated data, the bivariate regression coefficient implies an elasticity of 0.450 (with an adjusted R-squared of 0.33). Suppose that initial state appropriation was \$5,000 per student and initial tuition was \$10,000. A 20 percent decrease in the appropriation, i.e., a decrease of \$1,000 in state appropriation per student, would be associated with a 9 percent increase in tuition, i.e., an increase of \$900 in tuition, which makes Kim and Ko (2015) one of the larger response estimates in the literature. Again, the highly aggregated data and the small number of observations make this a merely illustrative calculation.

in state tax revenues, as they have been recently, then the latter may mask the effect of the former.

There are some surprising results in Rizzo and Ehrenberg (2004). Out-of-state tuition is much more responsive to state appropriations than is in-state tuition, with an increase of $220 dollars of tuition for each lost $1,000 of state appropriation per student in their preferred specification. The Rizzo and Ehrenberg (2004) simulations in their Table 7.10 are based on the lowest magnitude estimate in the paper (a fixed-effect reduced-form elasticity of -0.18). All of the other elasticity estimates are higher, as large as -0.32 in the fixed-effect structural specification, which is equivalent to the bivariate regression estimate derived from the Webber (2016) data.

The reliance of the main Rizzo and Ehrenberg (2004) results on cross-sectional time-series data with identification from changes over time within-state also mean that the Rizzo and Ehrenberg (2004) data may be subject to bias if the data are serially correlated or if there are lags in adjustment. For example, institutions of public higher education may temporarily buffer the effect of state appropriations from having an impact on tuition because they need political approval to raise tuition, because they seek to limit the impact on current vulnerable students, or simply because the information about the appropriation cut has arrived too late in the budget season for a tuition response. Learning the relationship between tuition and state appropriations from year to year changes would miss changes in tuition that arrive one or more years after the change in state appropriations, and this would bias the coefficient downwards. In contrast, the Webber (2016) analysis accumulates fifteen-year changes in tuition and state appropriations that address the problem posed for year-to-year analysis by the presence of long and variable lags. The Webber (2016) result that effectively accumulates potentially long and variable lags finds a substantially stronger relationship between changes in state appropriation per student and changes in tuition.

5 Cooper: data issues and a missing scatterplot

Cooper (2017) covers 2004–2015, a time period similar to the 2000–2014 period covered in Webber (2016) but draws a very different conclusion, namely that the relationship between state support for public higher education implies an increase of only $50 dollars of tuition for each lost $1,000 of state appropriation per student. Unfortunately, Cooper (2017) does not

present a scatterplot, which would clarify the source of the discrepancy. Figure 3 presents a scatterplot of Cooper's data.

As in Webber (2016), the fossil-fuel producing states of Alaska (AK), North Dakota (ND), and Wyoming (WY) are significant influence points for the regression line based on their substantial increase in state funding for public higher education. Cooper (2017) also identifies Connecticut and New Jersey as having large increases in public funding. Cooper's reported increases in Connecticut and New Jersey appear in neither Webber (2016) (see Figure 1) nor in Leonhardt (2017), both of which show sizeable decreases in state support for public higher education in Connecticut and New Jersey. In Cooper (2017) Connecticut and New Jersey stand out clearly as outliers, which may result from Cooper's nonstandard operationalization of "direct subsidy" per student rather than state appropriation per student.[7]

When these five states, Connecticut, New Jersey are omitted from Cooper, we focus on the great majority of states that experienced decreases in the state direct subsidy per student. The slope of the regression line increases in magnitude from an increase of $120 of tuition for each lost $1,000 of state appropriations per student (the solid line in Figure 3 with an adjusted R-squared of 0.02) to an increase of $370 of tuition for each lost $1,000 of state appropriation per student (the dashed line in Figure 3 with an adjusted R-squared of 0.09). (If Arizona (AZ), which had a large increase in tuition accompanying a moderate decrease in state support and might be considered an influential point, is also excluded, the regression line indicates an increase of $270 of tuition for each lost $1,000 of state appropriation per student with an adjusted R-squared of 0.06.)

Cooper's "pennies" results depends entirely on a definition of support for public higher education funding that turns Connecticut and New Jersey into significant outliers that massively increased their public support for public higher education despite indications

[7]Cooper also transforms Colorado (CO) from having a large decrease in the state appropriation to a relatively small decrease in state support, with no support from Leonhardt (2017) or Webber (2016). Illinois (IL) shows a dramatic decrease in support uniquely in Cooper, but this appears to be largely attributable to a rapid decline that begin in 2015 (and continued into 2016) shown Leonhardt (2017) and occurring after the end of the Webber (2016) analysis. Cooper's "net tuition" change variable has a correlation of only $r = 0.69$ with Webber's tuition change. Cooper's "direct subsidy" change variable has a correlation of only $r = 0.64$ with Webber's change in appropriation per student. The years of coverage vary, from 2000–2014 in Webber to 2004–2015 in Cooper, but these are nonetheless low correlations for pairs of variables that are intended to measure essentially the same thing. Scatterplots comparing the data values from the two sources are presented in Figures 6 and 7.

elsewhere (Leonhardt, 2017; Webber, 2016) that this is not the case.

The Cooper (2017) approach has other problems. As I noted above, sticker price tuition is actually a more salient measure of access than "net tuition", which Cooper uses. Direct subsidy per student includes government contracts and grants, which are probably not terribly important but muddy the water with respect to state support for the public higher education of undergraduate students. However, the key issue, made clear by the scatterplot, is that the accounting of the direct subsidy in a small number of cases substantially distorts the characterization of the relationship between tuition and state support for public higher education. When the outliers are taken into account, the estimated relationship is nearly identical to that found elsewhere in the literature, with a decrease of $1,000 of state support for public higher education per student being met by an increase on the order of $350.

6 Public Support for Quality and Affordability

Contrary to the assertions in Delisle (2017) and Cooper (2017), the negative relationship between the State appropriations and tuitions for public higher education appears well established in the literature and in the data.

Much of the learning about the relationship in these studies has occurred in a context of reduced state support for public higher education with the prospect of further reductions. But cuts and increases may not have the same effect and the timing and lags may differ.

Presented with occasional increases in public support, universities may seek to remediate reductions in quality from earlier cuts or to undertake deferred maintenance. These potentials also give insight into why the relationship between state appropriations for higher education and tuition are less than one-for-one. Cuts in public support may be offset by phased-in increases in tuition to avoid putting degree completion out of reach of vulnerable current students. Increases in state appropriations may go to remediate the impact on quality of long-standing cuts, for example, trying to rebuild a dedicated faculty that both teaches and researches, whose numbers have been squeezed by unreplaced retirements or who have been replaced by high-turnover adjuncts. Or increases in state support may go to educational improvements, such as, building twenty-first century biology labs that enable undergraduates to learn modern genetic methods.

Facing cuts in state support, which have been far more common in recent years, public

universities may seek to buffer the immediate impact on students, for example, by tapping reserve funds or by eroding quality rather passing on insurmountable tuition increases to students in the middle of their studies. Or universities may face political and public challenges to tuition increases even if quality is at stake. Erosion of quality, for example, increasing reliance on often-exploited temporary adjuncts in lieu of research-active teaching faculty, can dodge the immediate tuition increase but can long run damage to student success and career trajectories.

Reductions in state support can also interfere with the fundamental mission of state colleges and universities, which may divert resources to fund raising, to attracting out-of-state or international students who typically pay higher tuitions, to managing a patched-together temporary teaching workforces, and to the development of revenue-generating programs. These perverse non-tuition responses to reduced state appropriations are entirely unaccounted in Delisle (2017) and Cooper (2017).

Colleges may be reluctant to pass along increased State support as decreased tuition if the tuition reduction seems likely to be unsustainable, as has recently been the case. Recent years have seen only brief and punctuated periods of increased public support (as evident in Figure 2). So little is known about how sustained public support would affect tuition.

Future research might examine asymmetry in the effect and timing of increased or decreased state support on tuition. Additional research on the quality impact of changes in state support, along the lines of Deming and Walters (2017) is also critical. Introducing quality to the analysis is essential to understand why the large estimated impact of state support on tuition, on the order of $350 of tuition increase for each decrease $1,000 of state support for public higher education per student, only tells a piece of the story. It is time to acknowledge the strength of this relationship and then to move beyond the simplistic yo-yo accounting of public support and tuition.

Accessibility of public higher education for students and families of limited means is a key and contentious policy issue. Sustained public support, if it comes, may put substantial pressure on the public higher education system to reduce or eliminate tuition, which would return us to an era of robust public support for public higher education. Several candidates for President in the 2016 campaign presented plans for more public assumption of responsibility for financing public higher education. New York State has eliminated

tuition at public institutions of higher education for students from households with limited means.

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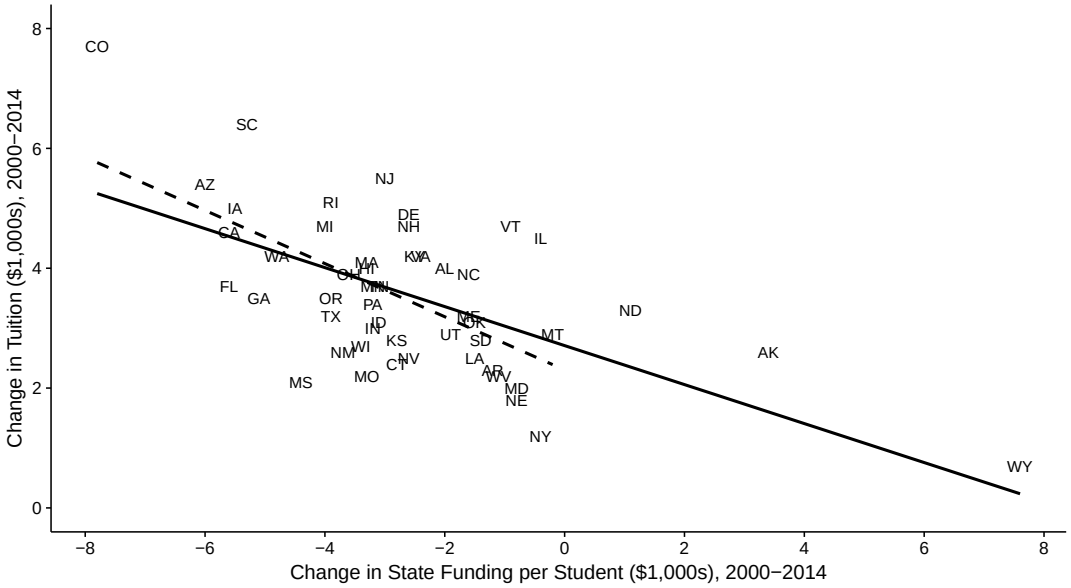
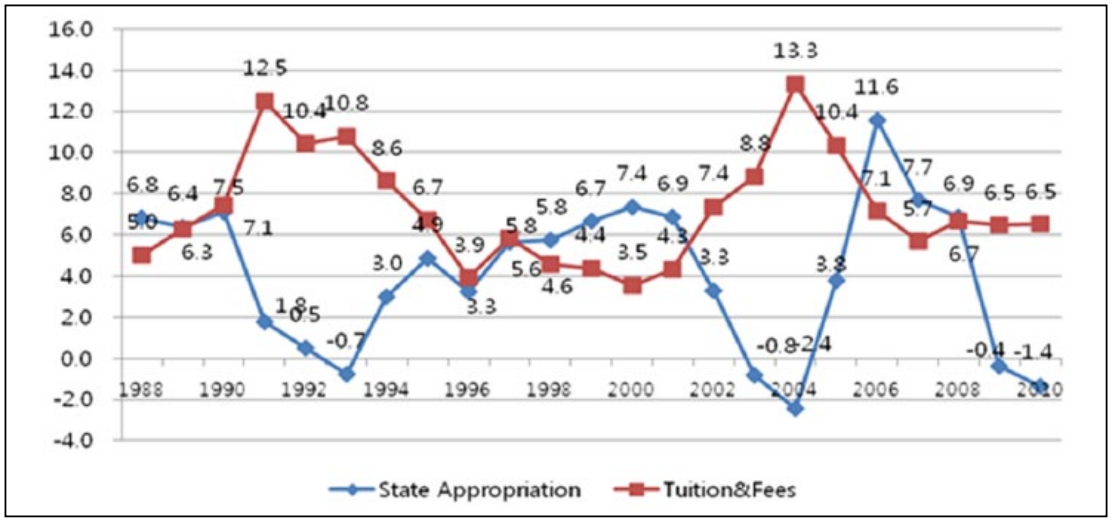
Figure 1: *Webber: Change in tuition versus change in state appropriation, 2000–2014*



The figure presents the change in tuition versus the change in state appropriations per student, both in $1,000s, for 2000–2014. The solid line represents a linear regression of change in tuition per $1,000 change in state appropriation per student. The slope indicates an increase of $330 of tuition for each lost $1,000 of state appropriation per student; the adjusted R-squared for the bivariate regression is 0.36. Dashed line shows the same specification excluding the fossil-fuel-producing states of Alaska (AK), North Dakota (ND), and Wyoming (WY); the slope implies an increase of $370 of tuition for each lost $1,000 of state appropriation per student; the adjusted R-squared for the bivariate regression is 0.33.
Source: Author's analysis of data from Webber (2016).

Figure 2: *Kim and Ko: Time series of changes in tuition and state appropriations, 1988–2010*

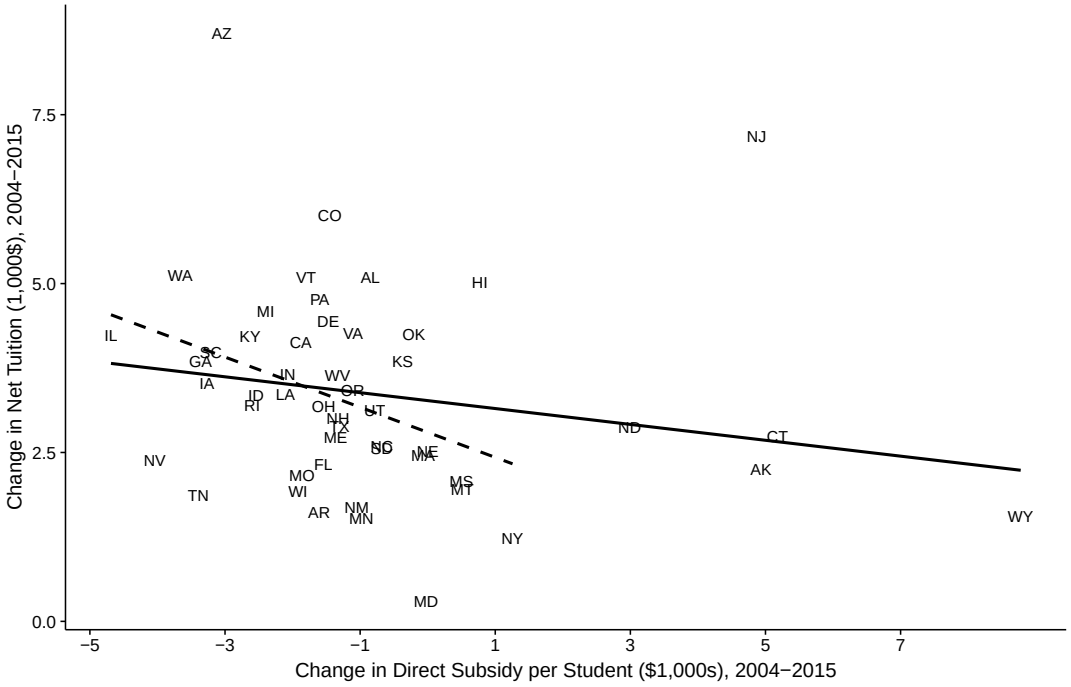


Percentage of Change in 4-Year Public Institution Tuition and State Appropriation, 1988-2010.

Source. Integrated Postsecondary Education Data System.

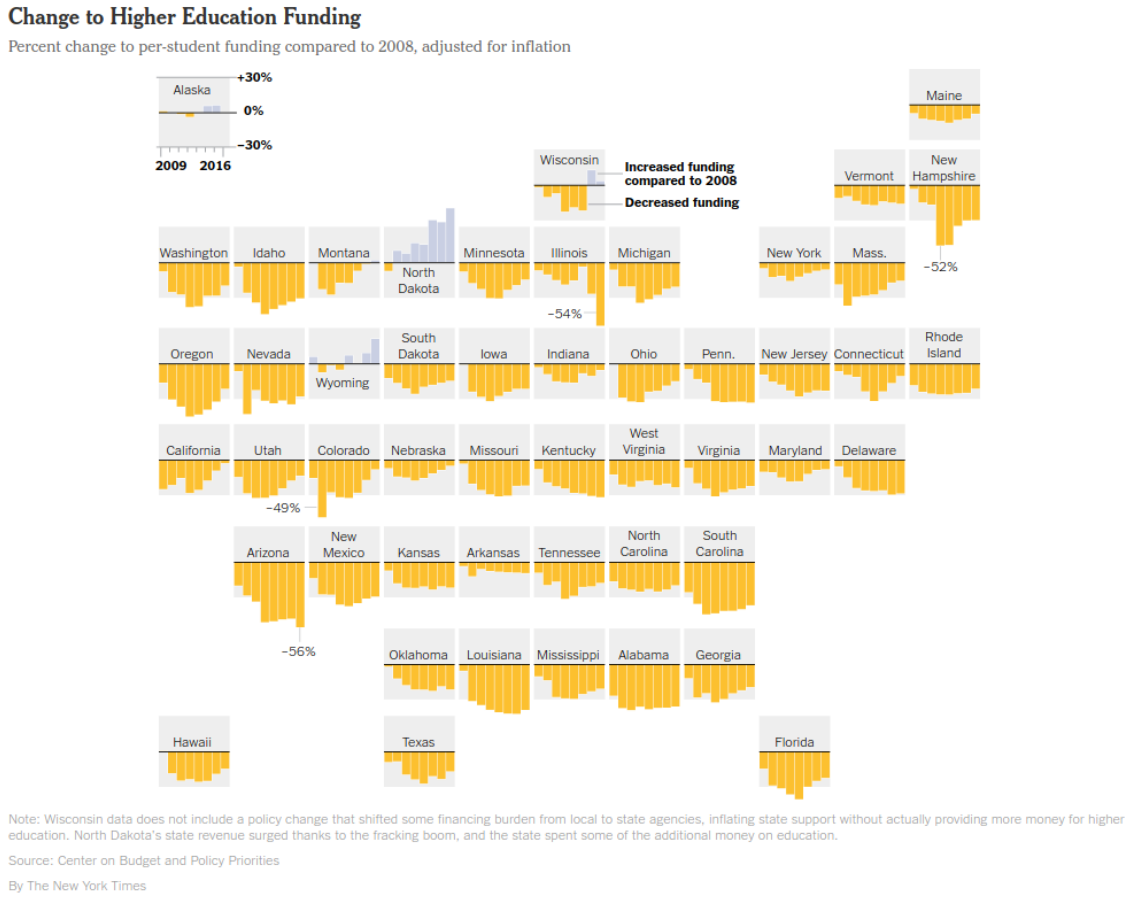
The figure presents time series of percent changes in state appropriations and tuition and fees 1988–2010. The correlation between the two series is $r = -0.60$. The bivariate regression coefficient implies an elasticity of 0.450 (with an adjusted R-squared of 0.33). Suppose that initial state appropriation was \$5,000 per student and initial tuition was \$10,000. A 20 percent decrease in the appropriation, i.e., a decrease of \$1,000 in state appropriation per student, would be associated with a 9 percent increase in tuition, i.e., an increase of \$900 in tuition.
Source: Kim and Ko (2015).

Figure 3: *Cooper: Change in net tuition versus change in direct subsidy per student, 2004–2015*



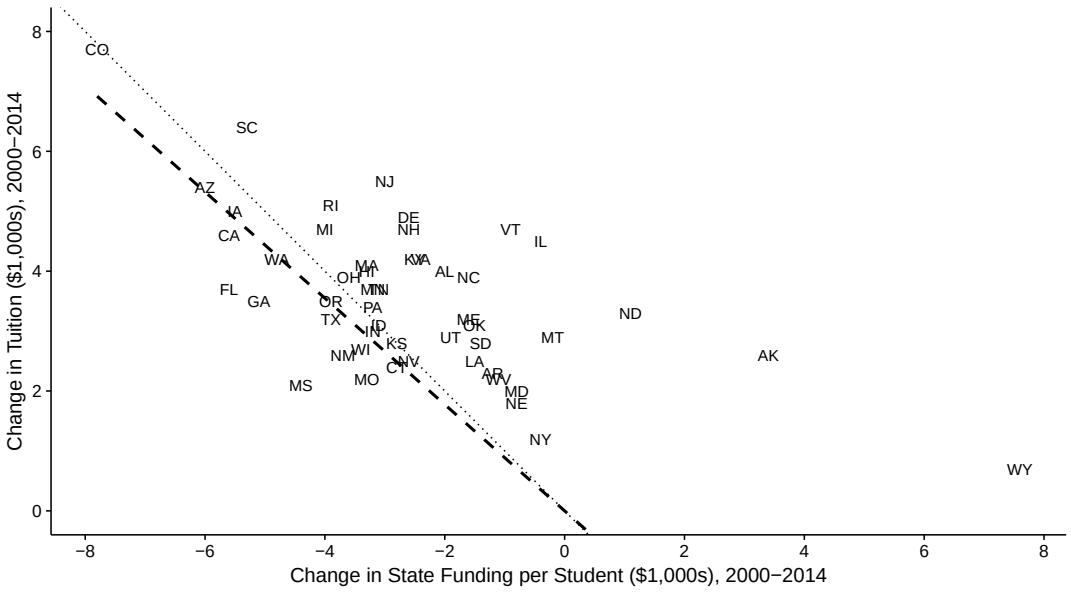
The figure presents the change in "net tuition" versus the change in the state "direct subsidy" per student, both in $1,000s, for 2004–2015. The solid line represents linear regression of change in net tuition versus change in direct subsidy per student with all data points; the slope implies an increase of $120 of tuition for each lost $1,000 of state appropriations per student (Adjusted R-squared is 0.02). The dashed line shows the same specification excluding Alaska (AK), North Dakota (ND), Wyoming (WY), Connecticut (CT), and New Jersey (NJ); the slope implies an increase of $370 of tuition for each lost $1,000 of state appropriation per student (Adjusted R-squared is 0.09).
Source: Author's analysis of data from Cooper (2017).

Figure 4: *Percent change to per-student funding compared to 2008*



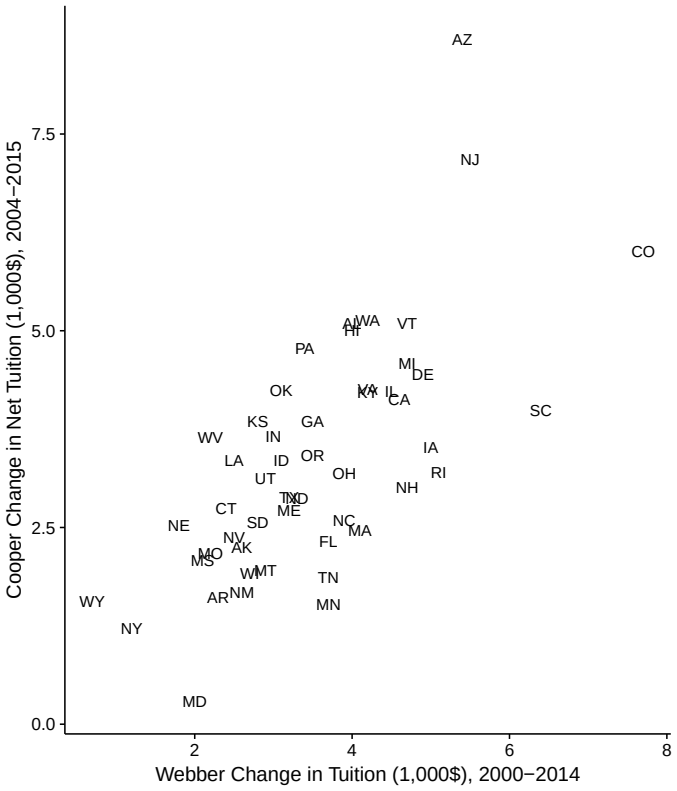
Source: Leonhardt (2017).

Figure 5: *Sole cause? Change in tuition versus change in state appropriation, 2000–2014*



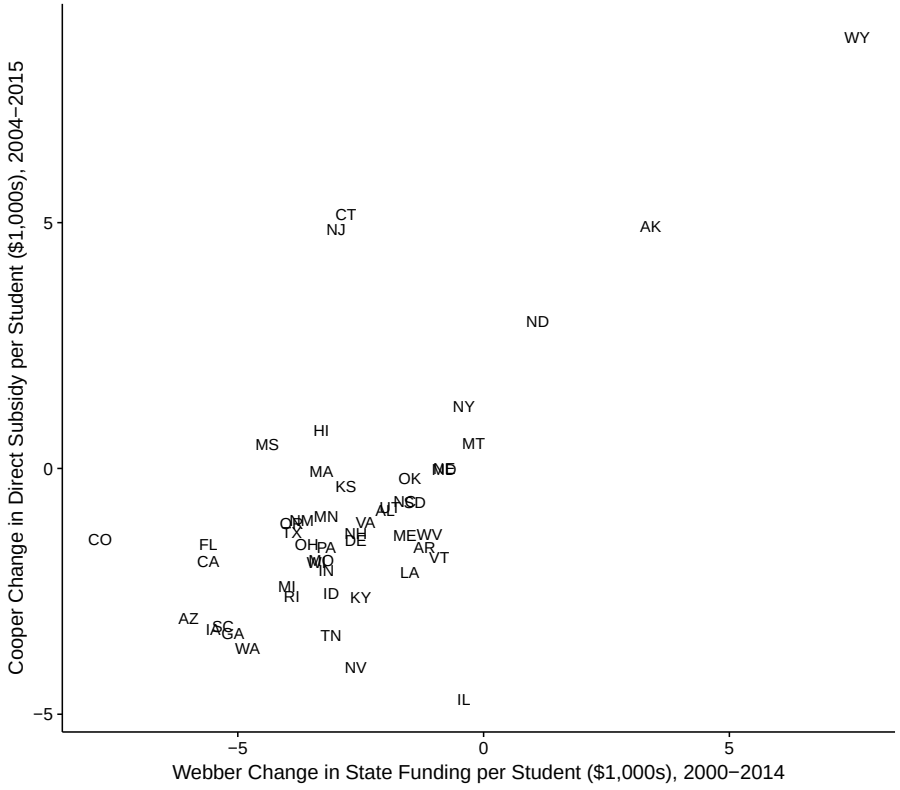
The figure presents the change in tuition versus the change in state appropriations per student, both in $1,000s, for 2000–2014. The dashed line represents linear regression of change in tuition versus change in state appropriation per student with the restriction y-intercept $\equiv 0$, that is, a state with no appropriation change is restricted to have no tuition change. The slope of the dashed line indicates an increase of $890 dollars of tuition for each lost $1,000 of state appropriation per student. The dotted line, for reference, represents a hypothetical loss of $1,000 of tuition for each lost $1,000 of state appropriation per student.
Source: Author's analysis of data from Webber (2016).

Figure 6: *Change in Tuition: Cooper (2004–2015) vs. Webber (2000–2014)*



The figure presents the change in "net tuition" in \$1,000s as reported by Cooper (2017) for 2004–2015 versus the change in tuition as reported by Webber (2016) for 2000–2014. The correlation is $r = 0.69$. Source: Author's analysis of data from Webber (2016) and Cooper (2017).

Figure 7: *Change in State Support: Cooper (2004–2015) vs. Webber (2000–2014)*



The figure presents the change in "direct subsidy" in $1,000s per student as reported by Cooper (2017) for 2004–2015 versus the change in state appropriation per student reported by Webber (2016) for 2000–2014. The correlation is $r = 0.64$.
Source: Author's analysis of data from Webber (2016) and Cooper (2017).